Operation and Maintenance Manual

Project Name: Plant 1 PS Screens

Project Location: Wichita, KS

Vulcan Multi-Rake Screens, Shaftless Screw Conveyors & Washing Presses
Model No. VMR-48, TF-240 & EWP 300/600

Contractor:
Wildcat Construction
3219 West May Street
Wichita, KS 67213
316-945-9408

Engineer:
Professional Engineering Consultants
303 South Topeka
Wichita, KS 67202
316-262-2691

Manufacturer:
Vulcan Industries, Inc.
212 S. Kirlin St.
Missouri Valley, IA 51555
712-642-2755, FAX 712-642-4256

Manufacturer's Representative:
Ray Lindsey Company
17221 Bel Ray Place
Belton, MO 64012
816-388-7440

Vulcan Job No. 19177

Prepared by: Joel Fredericksen
joel@vulcanindustries.com

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1 General Safety Instructions

1.1 Operator's Responsibilities

This machine was designed and built to operate within all applicable safety guidelines. In practice, however, this safety can only be achieved if all the necessary measures are taken. It is the responsibility of the owner and/or operator to ensure that these measures are taken and to monitor their performance.

The operator must ensure the following:

- The machine is used only as directed in this manual.
- The machine is in good working condition and the safety devices are checked regularly for their operability.
- The required personal safety gear for operating, maintenance and repair is available and is used.
- The operating instructions are available in legible condition and in complete form.
- Only adequately qualified and authorized personnel operate, maintain and repair the machine.
- All the safety and warning signs attached to the machine are in place and remain legible.
- All doors, panels, covers, and guards are closed or secured in place.

1.2 Safety Measures

A. Keep Information Available

Keep these operating instructions in an easily accessible location. Ensure that everyone working on the machine can access the operating instructions at all times.

Keep all safety signs and instruction plates on the machine in legible condition. Immediately replace signs that have become damaged or unreadable.

B. Biohazardous Materials

When operating the machine, especially when performing maintenance and upkeep, it is imperative that you comply with applicable instructions and guidelines on safety, occupational medicine and hygiene. The medium processed by the machine falls under the category of:

"Biologically Hazardous Material"!

C. **Before Turning the Machine on,** familiarize yourself with the following:

- The operating and control elements of the machine.
- Machine equipment.
- The mode of operation of the machine.
- The immediate surroundings of the machine.
- The safety devices on the machine.
- Emergency measures.

Before the machine is turned on, perform the following:

- Check and ensure that all safety devices are attached and functioning.
- Check the machine for visible damage. Immediately rectify defects or report them to supervising personnel. Operate the machine only when it is in good working condition.
- Ensure that only authorized personnel remain the in the area of the machine and no one might be injured when the machine is activated.

Caution: Automatic Equipment! When the machine is activated it can run in automatic mode, and can start automatically at any time.

D. During Normal Operation

Do not remove or deactivate any safety device while the machine is running.

Do not operate the machine with guards, doors, panels or covers removed.

E. During Maintenance

Perform the maintenance work prescribed in the operating instructions – adjustment, cleaning, lubrication, upkeep and inspection – within the suggested maintenance schedule.

Take note of special requirements for individual components in these operating instructions.

Before performing maintenance work:

- Disconnect the power supply. Follow all Lock-Out Tag-Out procedures in place for the worksite. Note that control panels may have more than one source of power.
- Ensure that all parts of the drive have cooled down to room temperature.
- Ensure that appropriate hoisting gear and load suspension devices are available when large machine parts have to be replaced.
- Bar access to the work area of the machine and ensure that no unauthorized people remain in it.
- Replace machine parts that are not in good working condition
- Use only genuine replacement parts from the manufacturer.
- Ensure that suitable collection containers are available for all substances that are hazardous to groundwater (oils, coolants, etc.).

After maintenance work is completed and before switching on the machine:

- Check that all bolted joints previously loosened are securely fastened.
- Check whether all safeguards and covers previously removed are properly installed.
- Ensure that all tools, materials, and other equipment used have been removed from the work area.
- Clean the work area and remove liquids that might have spilled.
- Ensure that all safety devices of the machine are functioning properly.

F. Working on Electrical Equipment

Only trained electricians should perform work on electrical equipment of the machine.

Regularly check electrical equipment:

- Reattach loose connections.
- Immediately replace damaged wires or cables.

Always keep the control panel and all electrical supply units closed. Access is allowed only by authorized personnel.

Never clean electrical equipment with water or similar liquids.

G. Environmental Protection

When performing work on the machine, follow the protocol for waste prevention and proper recycling or waste disposal.

Ensure that hazardous substances such as grease, oils, coolants, solvent-containing cleaning fluids, etc. are collected and disposed of in a safe manor and as prescribed by environmental laws.

H. Equipment Modifications

For safety reasons do not perform any unauthorized modifications to the machine. This also applies to welding work on load-bearing parts.

Vulcan Industries, Inc. must approve all modifications in writing.

Use only genuine replacement parts from the manufacturer. Parts manufactured from a third-party do not conform to the manufacturers design standards.

The use of third-party parts and special equipment on the machine could result in catastrophic failures and void the warranty.

1.3 Requirements for Operating Personnel

Warning: All operating and maintenance personnel must read and understand these operating instructions before operating and/or performing maintenance to this machine.

A. Operating Personnel

Only personnel who are trained, instructed, and authorized to operate the machine may do so. These personnel must be familiar with the operating instructions.

The following qualifications are needed for the following activities:

- Only electricians may perform work on electrical equipment.
- Only trained personnel may perform maintenance, upkeep, and repair work.

1.4 Other Dangers

A. Risk of Injury

Do not impede the operating sequence of the machine. Injury from the moving components can occur. Lock-out the machine before performing any kind of inspection or maintenance activities.

Warning: Do not reach into automatic equipment without first shutting down the machine! The machinery can start at any time.

B. Build-up of Hazardous Gasses

Because of the nature of the treatment process, hazardous gasses may form and lead to a deadly atmosphere. Always take appropriate precautions when operating and/or maintaining equipment in a classified area.

Warning: There is risk of explosion or detonation.

1.5 Safety Symbols

The following are pictures and explanations of all the safety stickers that are used on Vulcan equipment. Some of these may or may not pertain to your particular machine.

A spreader bar must be used when lifting this machine.

Contractor, make sure the seal off fitting is potted before you close out the job.

Be careful of moving parts when working on the machine. Use proper Lock-out procedures.

This part of the machine is not meant to be used as a step. Injury to persons or damage to machinery can result.

Section 1
General Safety Instructions

Grease point for maintenance reference.

Grease point for maintenance reference.

Watch for an open pit.

Equipment in Automatic mode may start if sensors are triggered. Make sure the machine is properly locked-out

Section 1
General Safety Instructions

Do not operate the machine with covers removed.

Take care in not getting caught in the exposed screw or other moving parts.

2 Receiving, Storage & Transporting

2.1 Receiving

A. Suggested Receiving Practices

Upon receipt of the equipment, locate the packing slip and verify completeness of the shipment. The packing list will clearly indicate the items that have shipped, contents of containers and component weights. Contact Vulcan Industries, Inc. immediately if the received items are not as indicated on the packing slip.

No claims for missing components will be honored if not identified at the time of receipt of the shipment.

Upon receipt of the shipment, carefully check the contents of the delivery against the packing list to insure that the delivery is complete, and all components are accounted for.

Components are generally shipped on skids or pallets though occasionally they are shipped loose inside the equipment. Do not remove the equipment from the shipping skids or pallets, except as required to inspect the components, and check the scope of supply. Inventory all loose items identified on the packing list.

The skids must be placed on a smooth, level surface. When stored outside, suitable cribbing must be arranged to support the skids and their associated weight.

Care must be taken when unloading the equipment from the carrier. Prior to attempting to off-load the equipment:

- Inspect lifting points, rigging, and equipment.
- Confirm lifting capacities for all rigging and equipment.

Before unloading and accepting any equipment from the shipping company, thoroughly inspect the equipment and/or packaging for signs of damage. If damage to the packaging is discovered, immediately check the contents for damage.

If visual damage is evident, do not accept delivery until directed to do so by an authorized Vulcan Industries, Inc. representative.

Warranties are only valid if equipment is delivered and stored without damage.

2.2 Storage

A. Short Term Storage

The equipment, if possible, should be stored inside in a climate controlled environment.

The major pieces of equipment are shipped on skids or pallets. Do not remove the equipment from the shipping skids or pallets, except as required to inspect the components, and check the scope of supply.

The skids must be placed on a smooth, level surface. If stored outside, a suitable cribbing must be arranged to support the skids and their associated weight.

The equipment should be covered with a tarp to protect it from moisture, dust, or other harmful elements.

B. Long Term Storage

If the equipment is to be stored outside for more than one month, the following “lay up” procedures must be followed:

- Drain gear cases completely, and refill completely full with a compatible gear oil. Lubrication recommendations may be found in Section 5 of the Operation and Maintenance manual. The gear is normally shipped with a plug installed in the breather port. Make sure the plug is installed and not the breather. Tag the gear “Check oil level before operating”.
- Coat the chains and sprockets with a heavy duty Penetrant/Demoisturant/Rust Preventative (alphasourceintl.com) product number S00710 or equal.
- After lay- up and before installing the equipment, the following procedures must be followed:
    - Unbag all electrical components and inspect for corrosion.
    - Use a suitable solvent to remove all protectant from chains, sprockets, etc.
    - The equipment should be washed down completely and thoroughly dried. Inspect for any signs of corrosion.
    - Drain the gear cases down to the normal fill level. (Note: Some equipment may need to be installed prior to performing this step).
    - Follow all lubrication instructions as outlined in Section 5 of the Operation and Maintenance manual.

Follow the normal installation procedures as outlined in Section 3 of the Operation and Maintenance manual.

Figure 2.2 below is the preferred method of storing the machine.

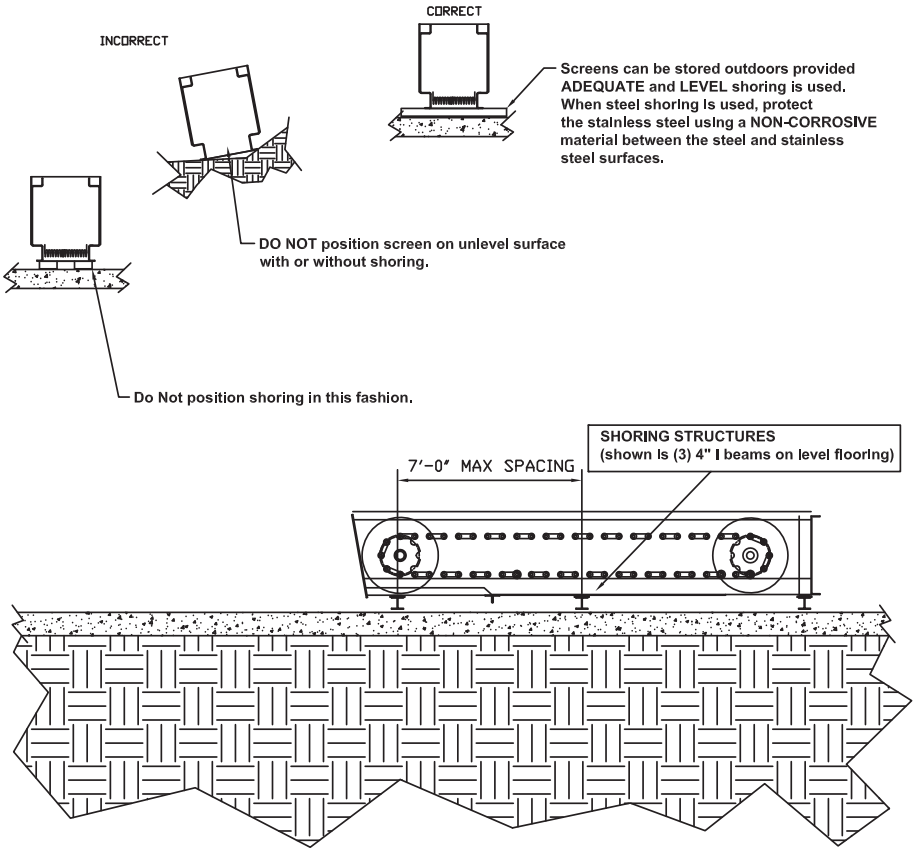

INCORRECT
CORRECT
Screens can be stored outdoors provided ADEQUATE and LEVEL shoring is used. When steel shoring is used, protect the stainless steel using a NON-CORROSIVE material between the steel and stainless steel surfaces.
DO NOT position screen on unlevel surface with or without shoring.
Do Not position shoring in this fashion.
SHORING STRUCTURES (shown is (3) 4" I beams on level flooring)
7'-0" MAX SPACING

Figure 2.2

2.3 Transporting the Equipment

A. Safety Precautions for Transportation

When transporting the machine, the following precautions must be taken into account:

- Protruding edges may lead to cuts.
- Suspended loads may fall, causing mortal danger.

Caution: Never stand under suspended loads!

- Parts that have been stacked too high may fall.
- Using load suspension devices other than those indicated here could severely damage the machine.

B. Ground Transportation

Transport the machine only in the original packaging, and using suitable ground transportation designed for the load and size of the machine. Refer to the packing slip for actual shipping weights of the equipment.

Do not place any objects on the machine while it is being transported.

During transport protect the machine against:

- Overturning.
- Violent action from the outside.
- Mechanical jolts and vibrations.
- Humidity.
- Effects of heat.

C. Suspended Transportation

Transport the machine only in the original packaging using suitable hoisting equipment designed for the load and size of the machine. Refer to the packing slip for actual shipping weights of the equipment.

The use of lifting trucks / forklifts to maneuver screens being stored indoors is acceptable. Use caution when lifting and turning. Attempting to turn the screen at sharp angles can damage the screen.

The use of chokers and slings is strictly prohibited!

When lifting lugs / devices are not used, a spreader bar positioned over the component as shown in Figure 2.3 is required. The strap / cable must not create a squeezing effect on the equipment being raised.

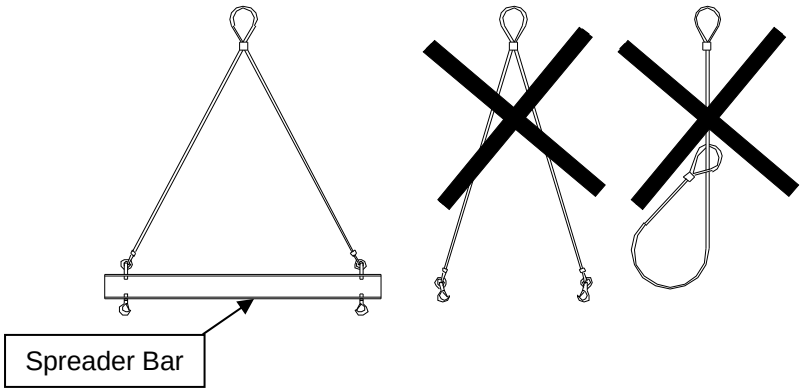


Fig. 2.3

3 Installation & Start-up

3.1 Pre-Installation Instructions

Experienced personnel trained in the installation and operation of this type of equipment must be employed to perform the installation of this equipment. Any questions regarding the installation should be directed to Vulcan Industries, Inc.'s, Installation and Service department. The following steps must be performed in order:

- Check the channel
- Inspect and identify components
- Machine placement
- Fitting the channel side seals
- Mounting the gearbox housing vent
- Transition to post-screening equipment
- Start-up

A. Standard Erecting Practices

All fabricated equipment manufactured by Vulcan Industries, Inc. is shop assembled and tested prior to shipping and should not present any abnormal erection problems. Due to varying field conditions, a reasonable amount of fit-up is considered standard erection practice. The use of such tools as "come-a-longs", jacks, drifts, and reamers is to be expected. The equipment should be assembled and installed according to the AISC "Code of Standard Practice". Section 7.12 of that code states:

> "Normal erection operations include the correction of minor misfits by moderate amounts of reaming, chipping, welding, or cutting, and the drawing of elements into line through the use of drift pins. Errors which cannot be corrected by the foregoing means or which require major changes in member configuration are reported immediately to the owner and fabricator by the erector, to enable whoever is responsible either to correct the error or to approve the most efficient and economic means of correction to be used by others."

If an erection problem is traceable to Vulcan Industries, Inc.'s, Fabrication or Engineering departments, we will work to resolve the problem. If field modifications are done by others to correct the problem, they must be approved in writing by Vulcan Industries, Inc. No back charges will be accepted by Vulcan Industries, Inc. unless the deficiencies are documented and the remedy is approved in writing by Vulcan Industries, Inc.

B. "As Built" Drawings

Vulcan Industries, Inc. provides detailed "AS-BUILT" installation drawings. Drawings should be thoroughly reviewed prior to installing any Vulcan equipment.

IMPORTANT! Always verify the detailed drawing is marked "AS-BUILT". Drawings not marked "AS-BUILT" may not reflect contract

changes to the approved shop drawings required during manufacturing and therefore may be incorrect.

3.2 Check the Channel

- After locating the channel center, use a plumb bob to measure the wall plumb in relation to the string as shown. Measurements should be equal.
- The channel width if slightly wide is not a problem. However, the **channel cannot be narrow.**
- Verify the channel floor is free of debris and is level. The area where the screens frames will sit should be leveled. (When required, Vulcan Industries, Inc. recommends using stainless shims and a transit).

Figure 3.2 shows proper channel configuration.

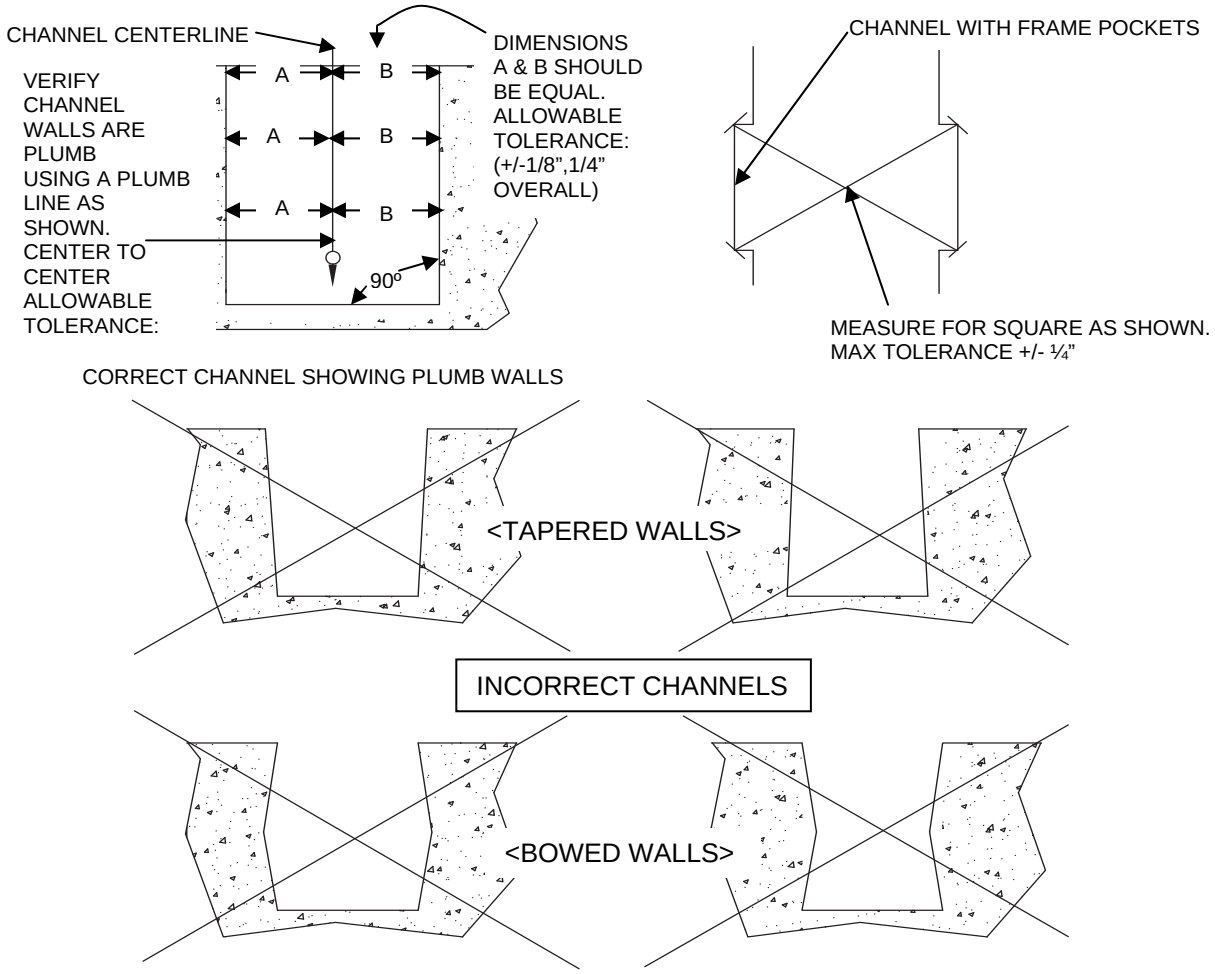
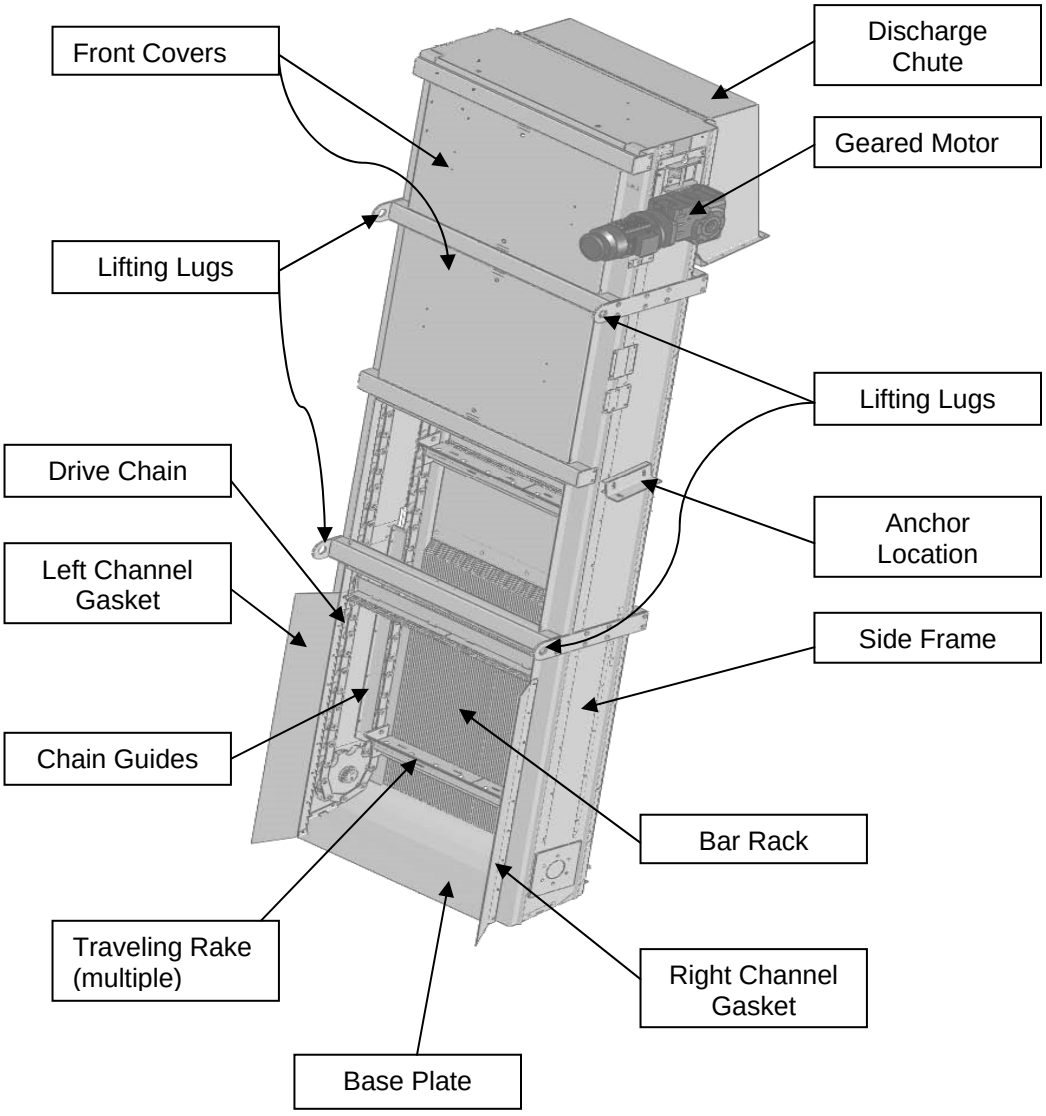


Figure 3.2

3.3 Inspect and Identify Components

A filter screen VMR Multi-Rake Screen consists of the following standard components: Please check the packing list against the shipment, then identify these parts.



3.4 Machine Placement

Upon satisfactory inspection of the channel and machine components, the screen is ready to be installed in the channel.
Take these precautions when placing the machine:

- Never apply excessive side loads to the frame. Side loads may cause the frame to bow or twist.
- While installing equipment, avoid pinching the frame between the channel walls when lowering. If binding and/or wedging of any part of the screen occurs, remove the screen and widen the channel opening. DO NOT FORCE THE SCREEN INTO POSITION!
- Never anchor the base plate and then pull or push on the frame to make it square with the channel. Doing so will twist the frame and cause misalignment and wear of the chain and rake assembly.

A. Positioning the Machine

- Position the upper level anchor assemblies (refer to the as-built drawings for component identification and match marking) around/against the screen.
- Carefully relax the lifting device but do not remove the lifting cables/chains. (Temporary shoring may be required.)
- Using a plumb bob, transit and levels, confirm the screen is installed as follows: (refer to Figure 3.4 and the General Arrangement drawing in Section 8.2)

  Level: Place a level across the top-most corner of the top cover and frame.

  Frame Sides: Can be used to check vertical. Use of a plumb bob is recommended.

  Plumb: Using a plumb bob on each frame leg, the measured difference tolerance is ± 1/8" over 20'.

  Square: The frame should be positioned as square to the channel opening as possible and the frame should be checked as shown on Figure 3.4

Note: Variances in the channel bottom may necessitate shimming the base plate to bring the frame into full plumb and square. Use stainless steel shims compatible with frame material, if required. Place shims only along the sides of the base plate so that the side frame is directly over the shim.

Figure 3.4 shows how to measure for machine level and square.

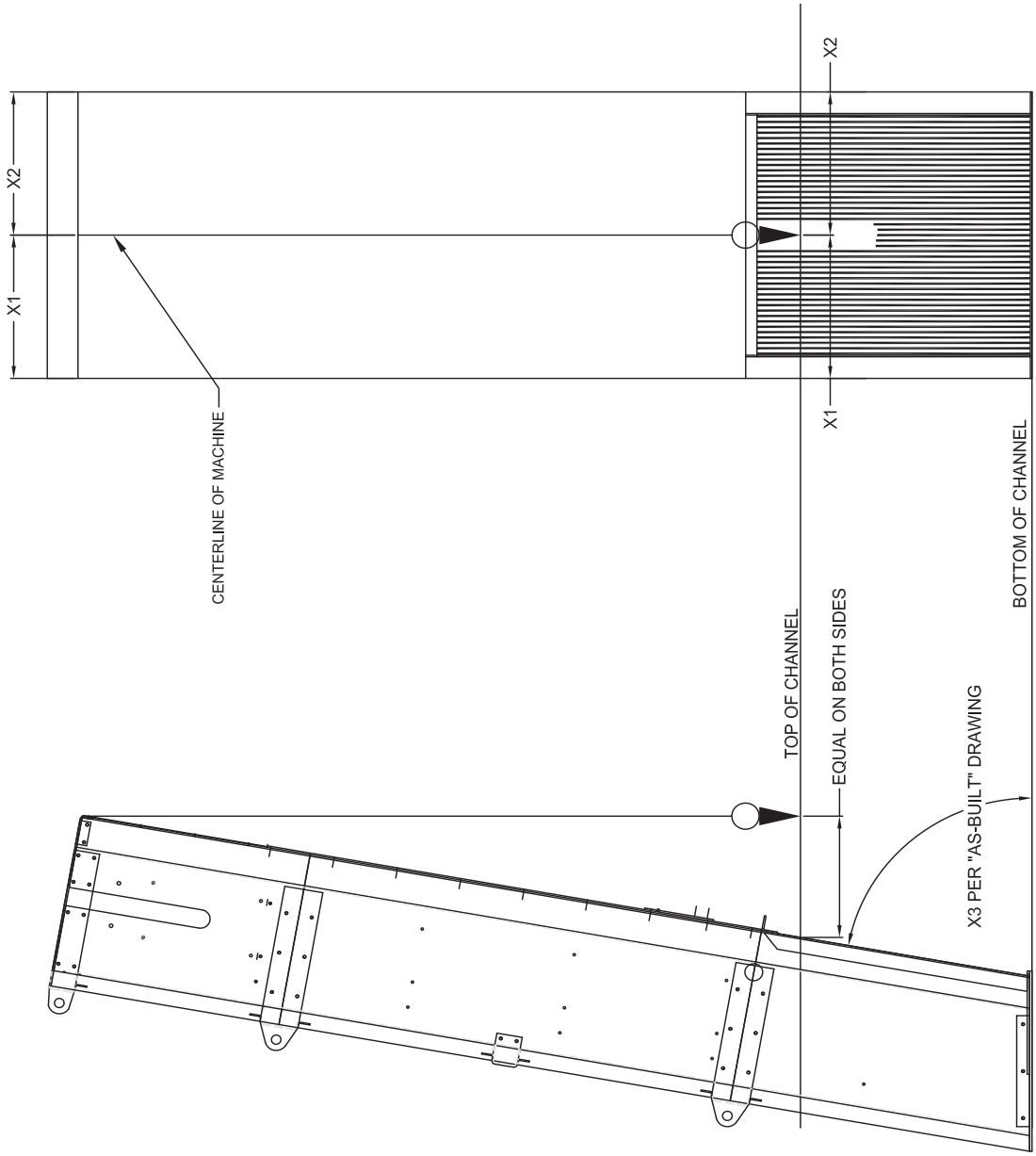


Figure 3.4

A. Anchoring

The following is a typical anchor connection for the VMR. When placing the anchors, a minimum edge distance in the flooring of 4" must be held to prevent breaking or blowing-out the flooring material. Refer to SECTION 8- PROJECT DATA for the machine and anchor positions as well as anchor types and instructions.

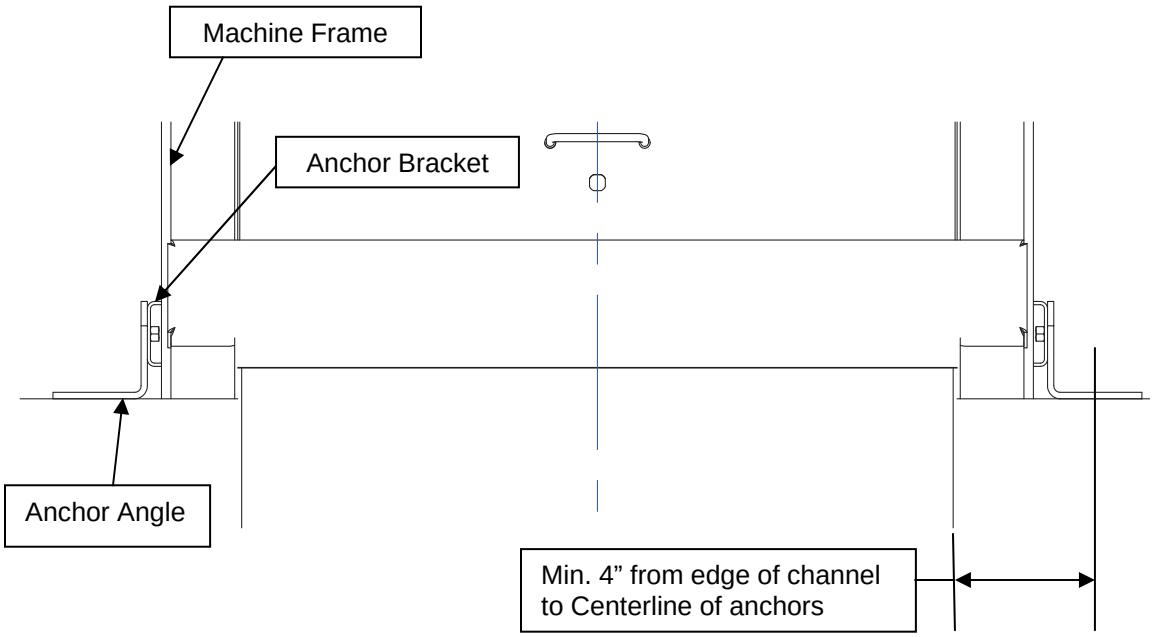


Figure 3.6 Typical Anchor Detail

B. Adjusting and Anchoring the Support Legs

Support legs are installed if rotation of the machine has been specified for the project. Support legs are installed and adjusted after the screen has been set to the correct angle and location according to the Approved General Arrangement Drawings.

For easier installation of the support legs, square up and level the machine first and then attach the support legs.

Refer to SECTION 8- PROJECT DATA for anchor bolt information on sizes and installation.

Install the support legs in the following manner:

- Slip the support leg assembly over the pivot pin.

- Set the support legs. Make sure that the anchors are a minimum of 4” away from any finished floor edge to prevent breaking or blow-outs.
- Drill anchors through the holes in the foot plate and adjust the bearing assembly as necessary.
- Tighten all hardware and set the foot plates approximately 1-1/2” off the finished floor for grouting.

Figure 3.7 details the support leg assembly.

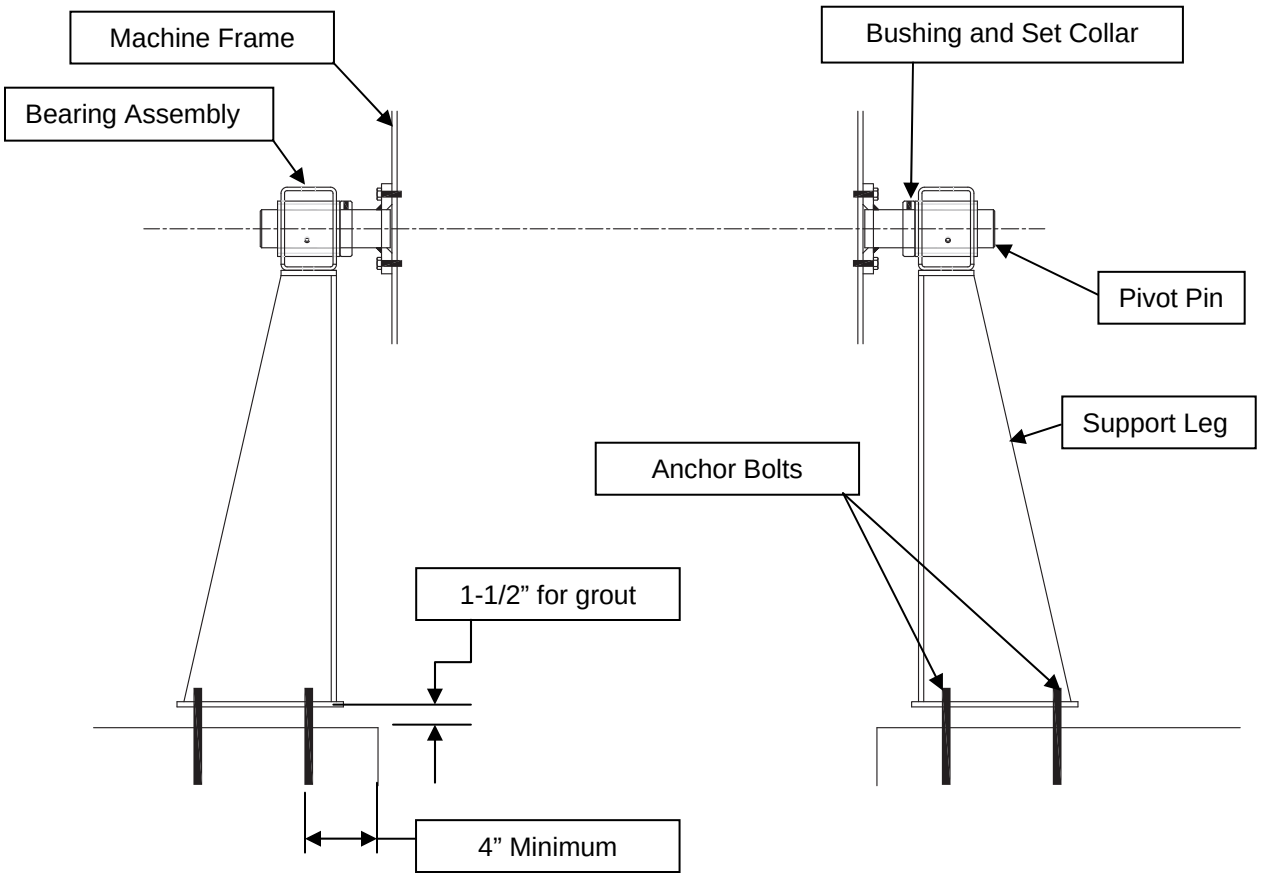


Figure 3.7 Support Legs

To prevent side movement, set screws are provided to screw into the set collar and prevent shifting.

Important! Vulcan Industries, Inc. uses all stainless steel hardware and anchor bolts for the assembly and anchoring of the equipment. Vulcan strongly recommends the use of an anti-seize lubricant specifically formulated for use with stainless steel on assembly hardware. Unlubricated hardware has a tendency to seize and cannot be properly tightened. Seized bolts must be replaced.

Bolt Torque:
3/8” 15 Ft. Lb.
1/2" 35 Ft. Lb.
5/8” 50 Ft. Lb.
3/4" 80 Ft. Lb

CAUTION: <u>DO NOT GROUT AROUND SIDE FRAMES</u> without consulting the factory or factory representative. This may cause warping of side frame. This equipment will not operate properly if side frames are not plumb.

C. Transducer Positioning

Figure 3.5 shows the proper transducer locations when being placed in the channel.

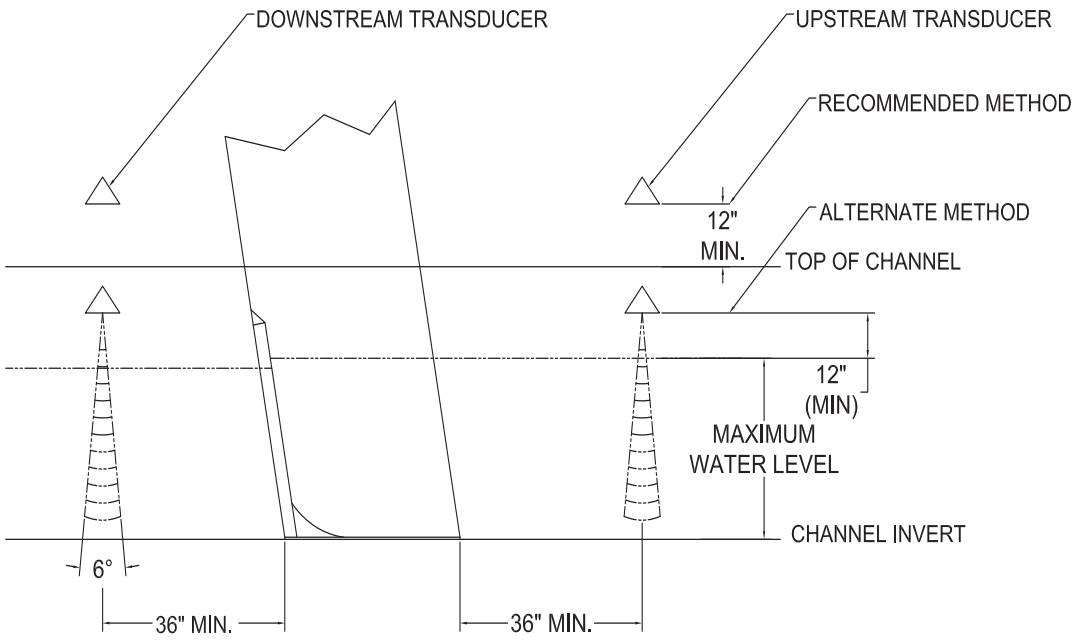


Figure 3.5 Transducer Position

Notes:

1. The upstream and downstream transducers should be mounted at the same elevation.

2. Dimensions shown are minimum recommendations. Consult factory if other installations constraints must be considered.

3.Transducers should be mounted above the top of the channel if possible, but must be a minimum of 12” above the maximum water level.

4. Transducers should be mounted over center of channel if possible, and must have no obstructions to the beam angle as shown above.

In deep channel installation, ensure that the beam angle does not come in proximity of the channel sidewalls.

3.5 Fitting the Channel Side Seals

Channels made of concrete generally have greater tolerances than fabricated channels. Accordingly the screen width is made smaller than the channel width. Two rubber side seals are provided with the screen to close the gap between the screen frame and the concrete channel. The side seals are held in place by a stainless steel flat bar which is bolted to the front of the frame.

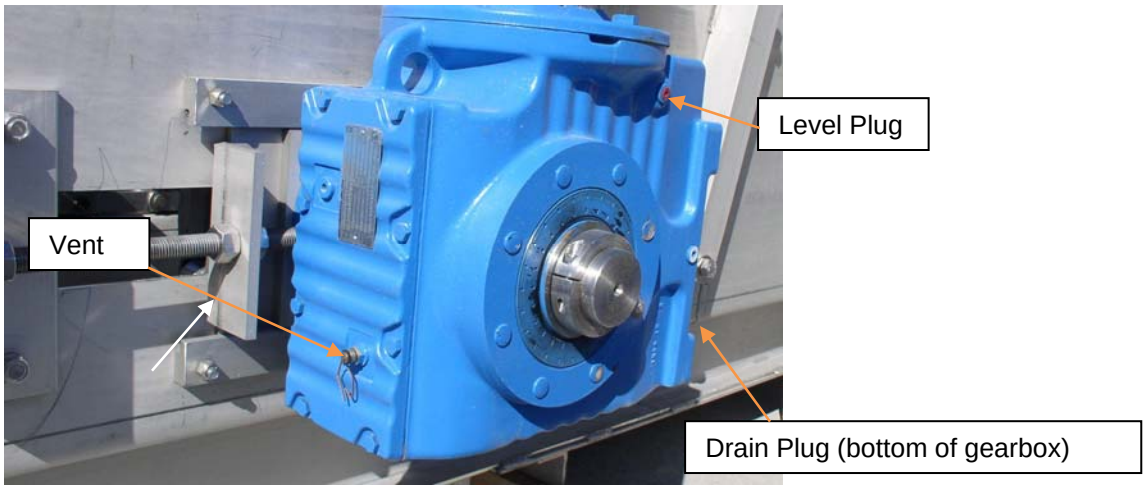
Water pressure forces the gasket against the channel wall to make a seal.
The gasket and flat bars should be cut to the length of the screen frame from the bottom to the top of the channel. Be sure the gasket contacts the channel invert to avoid short circuiting.

If the space between the screen and the channel is more than 1-1/2” on either side, a baffle plate must be anchored to the channel wall over the total length of the seal. If baffle plates are required and they are not contained in the delivery, please contact **Vulcan Industries, Inc.**

3.6 Mounting the Gearbox Housing Vent

The gearbox of the driving unit is filled with oil at the factory. To be sure the oil does not leak during transportation, the vent plug is removed from the gearbox housing and the tapped hole is closed with a plug.

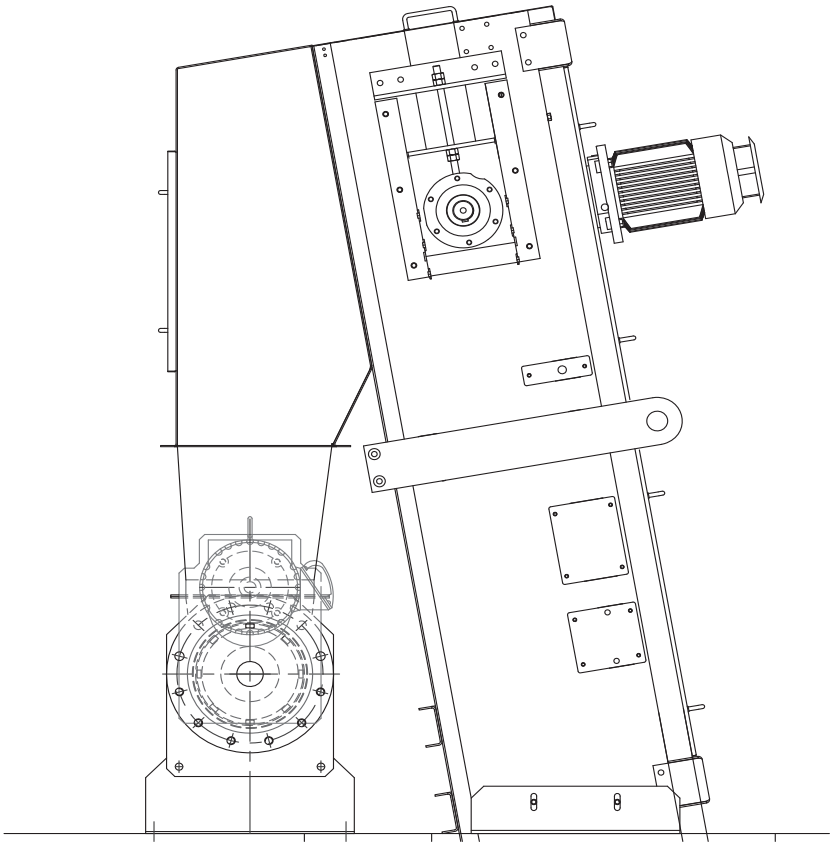
After the screen is set in its final installed position, the plug must be removed and the vent plug must be installed. Please save the removed plug for future use. Check the gearbox for proper oil level. See the following diagram.



3.7 Transition to Post-Screening Handling Equipment

The following design criteria for screening hoppers must be observed:

- Side walls of hoppers must be inclined to at least 60º from horizontal.
- Hopper width must be at least as wide as the free discharge width of the screen.
- Screen handling units must be of adequate capacity to fully remove all screenings.



Receiving hoppers manufactured by Vulcan Industries, when properly installed, will mate up with the discharge chute on the backside of the VMR machine. This interface is meant to bolt together and form a sealed connection. Check the Approved “As Built” General Arrangement drawings for location and interface of this equipment.

3.8 Start-up

The instructions in this section are an overview of basic operating functions of this machine. More detailed step-by-step functions and programmed operations are described in SECTION 7-ELECTRICAL CONTROLS. Refer to that section for more details.

Section 3
Installation & Start-up

A. Pre Start-up Check

Initial start-up is only to be performed by a trained factory technician. The technician must inspect the installation and provide the client with a certificate of proper installation. Only after the client has such a certificate in hand, may the equipment be started.

Starting the machine for a functional check, test run or commissioning is only to be carried out or arranged by a factory-trained technician.

The field connection between the control panel and the multi-rake machine must be made in accordance with local, state, and federal electric codes. Consult the Electrical Drawings in SECTION 7 of this manual for inner-connecting wiring requirements.

Licensed electricians must make the electrical connections.

The following steps must be observed when commissioning for the first time:

- Check all fasteners for tightness.
- Install all protective covers and guards.
- Check that all electrical protection devices (fuses, motor starter relay, smooth-starting device and current relay) are adjusted and activated.
- Check the direction of rotation of the drive motor. If the direction of rotation is correct, the upper drive chain rotates counter-clockwise (looking downstream). If the direction of rotation is wrong, the motor leads must be changed to achieve proper rotation.

B. Initial Start-up / Long Dormancy Cycle Start-up

Prior to initial start-up and following long shutdown periods, the following must be checked and verified for safety reasons.

- Make sure all tools, rags and other loose items have been removed from the machine.
- Perform all lubrication tasks as described under SECTION 5- MAINTENANCE.
- Prior to energizing the VMR, all electrical work and related mechanical work must be completed. Check that all mechanical and electrical lock-outs have been cleared.
- Verify that all electrical safeties operate properly.
- Close circuit breaker at the electrical control panel to energize the system.
- Using the local "Hand-Off-Auto" control switch, place unit in "Hand". Use the "Forward-Off-Reverse" switch to "jog" the drive motor to verify rotation. If rotating improperly, reverse two motor leads. If operating properly, test the reverse mode.

NOTE: The reverse switch is always spring loaded to prevent unattended operation.

- If system operates freely, then place mode controller in "Forward" position and allow the rake to travel to the bottom of the screen.
- Stop the rake near the bottom of travel and begin jogging the rake forward until the teeth engage the base plate and bar rack. The rake teeth should clear the base plate by ¼" and enter the bar rack without binding or shifting position. Removable rake tooth sections are slotted for adjustment. If necessary, loosen the teeth attachment bolts and center the teeth on the bar rack spaces. Refer to SECTION 5- MAINTENANCE for instructions on adjusting the rake.
- Continue to jog forward until the rake passes over the dead plate. Ensure that the rake teeth do not contact the dead plate. Teeth should clear the dead plate by 1/4 inch.
- If the rake teeth drag along the base plate, the rake will require adjustment. Refer to SECTION 5- MAINTENANCE for instructions on adjusting the rake.
- Operate the rake upwards through the bars and dead plate, stopping prior to reaching the wiper. Jog the rake forward until the rake shelf contacts the wiper blade. Make any adjustments necessary to ensure the wiper blade does not jam on the rake itself. Refer to SECTION 5-MAINTENANCE for instructions on adjusting the rake.
- Once the rakes and wiper have been properly aligned (See SECTION 5-MAINTENANCE for alignment instructions), place the rake in the forward direction and visually observe operation through three (3) complete cycles. The rake should travel freely with no signs of binding or jamming.
- Mode of operation may now be set at desired position (Hand-Off-Auto).

4 Operating Procedure

4.1 Normal Operation

Starting

- Insure power is available to control panel.
- Verify power to drive unit.
- Make certain there are no other personnel working on this unit.
- Establish sewage flow.
- Place mode controller (usually a Hand-Off-Automatic or HOA for short) into desired position.

Stopping

- Shut down sewage flow.
- Place HOA controller to "OFF" position.

If sewage is not stopped, the screen may become blocked and require manual cleaning prior to restart.

A. Hand Operation

Hand operation should mainly be used for maintenance purposes. The rakes can be operated in the forward or reverse direction by setting the HOA controller to “HAND”, then selecting either “FWD” (forward) or “REV” (reverse) at the local control panel. The “REV” (reverse) position is a spring return to off-switch that prevents the machine from running unattended in the reverse direction.

Quick Manual Start-up

The VMR can be run manually in forward or reverse by:

- At main control panel, set disconnect to “on”.
- At main control panel, set control power to “on”.
- At local control panel, switch for-off-rev to “off”.
- At local control panel, switch hand-off-auto to “hand”.
- At local control panel, pull out emergency stop switch.
- At local control panel, switch for-off-rev to “for” for forward, or “rev” for reverse.
  Note: Local control switches may be incorporated into the main control panel. See Device Functions in SECTION 7.2 for complete electrical sequenced operation and switch locations.

Shut-down

- The multi-rake can be stopped at any time by pressing the emergency stop button at the local control panel, or by turning the HOA to “off”.

B. Automatic Operation

Automatic operation is used as the primary operating mode. The “START” signal will be from a repeat cycle timer, float switch, differential level input and/or a remote start signal (depending on the design specifications). (Reference SECTION 7-ELECTRICAL CONTROLS for more information.)

Quick Automatic Start-up

The multi-rake can be run through a complete cycle by:

- At main control panel, set disconnect to “on”.
- At main control panel, set control power to “on”.
- Automatic control device programmed or enabled.
- At local control panel, switch for-off-rev to “off”.
- At local control panel, switch hand-off-auto to “auto”.
- At local control panel, pull out emergency stop switch.
  Note: Local control switches may be incorporated into the main control panel. See Device Functions in SECTION 7.2 for complete electrical sequenced operation and switch locations.

Shut-down

- The multi-rake can be stopped at any time by pressing the emergency stop button at the local control panel or by turning the HOA to “off”.

4.2 Protective Devices

- High Torque Protection:
  The circuitry within the variable frequency drive (VFD) is used to monitor the three-phase motor circuit. When the motor has exceeded the VFD set point, the VFD will de-energize the motor. The VFD is calibrated at the factory.
- Motor Thermals (if present):
  The motor has heat sensing thermals imbedded in the windings. When any of the thermals overheat the motor starter is de-energized, stopping the equipment.
- Fuses and Breakers:
  Used to provide short circuit protection.
- Emergency Stop Push Buttons:
  E-stop push buttons are located on the local control panel and/ or the main control panel. Pushing the button in will shut down the equipment, whether in hand or auto mode. To reset the E-stop, the button must be manually pulled out.

4.3 Emergency Stop / Restart

Activate the E-Stop during an emergency situation to immediately stop the machine from operating. Restart the machine by:

- Pulling the E-Stop button out.
- Restart the machine in the desired operating mode.

4.4 Forced Operation

If the drive system has not been activated by the transducer level differential within the period of one hour, the machine will automatically cycle one for a preset adjustable amount of time.

5 Machine Maintenance

5.1 Safety Precautions

Vulcan Industries, Inc. will not be responsible for any harm or injury that may result from the improper operation of this equipment. Furthermore, Vulcan Industries, Inc. will not guarantee this equipment if improperly operated or operated without the designed safety features. For your safety when working on this machine, please follow these suggested precautions:

- Only fully trained and authorized personnel should be permitted to enter owner defined boundaries around, within or on any equipment or components that present a potential for injury through a lack of knowledge concerning proper safety precautions.
- Warning signs and labels shall not be removed or obscured at any time.
- Material handled by this equipment may come under the scope of materials classified as "**Bio-Hazardous Material**". Appropriate precautions must be taken to protect personnel from exposure.
- Protective guards and covers must be in place before operating this equipment.
- Control panels may have more than one source of power. Make sure all potential power sources are locked out prior to performing any maintenance or repair.
- Before attempting removal or repair of the rake assemblies or motor, the drive assembly must be secured against possible movement.

5.2 Inspections and Preventative Maintenance Schedule

DANGER! To prevent injury or death, do not perform any maintenance functions that require reaching into the machine while the machine is under power. Follow proper lock-out tag-out procedures first. Then perform maintenance functions.

A. Daily

Check the machine operability. Always look out for damaged parts. Damaged components can jeopardize the safety of personnel and equipment. Replace any damaged parts immediately!

During operation try to observe the following:

- Any unusual noises heard as the machine is running.
- Oil leakage from the gearbox.
- Motor runs abnormally hot.

Check for jammed solids and deposits. Any jammed solids or objects that are considered uncharacteristic for screenings must be removed as these can damage the rakes.

- Follow the Emergency Shut-Down Procedure as described in SECTION 4: OPERATION.
- Remove residual solids from between the bars with a suitable tool.
- Restart the system as described in SECTION 4: OPERATION.

Check the rakes for damage. Check to see if the teeth on the rakes are functional.

- Rakes with broken or bent teeth should be replaced with new tooth sections.

B. Weekly or After 30 Operating Hours

Check the wiper. The wiper should continuously clear the rakes in an unimpeded manner. Check the wiper operation for:

- Any materials that have adhered to the wiper blade. These need to be removed.
- Warped or gouged wipers should be replaced.

Clean and remove deposits from the chains. Avoid cleaning electrical components with a water jet to reduce the risk of electrical shock.

- Wash off the outside of the machine with a suitable cleaning device. Avoid spraying directly or excessive overspray onto the electric motor.
- Remove deposits from the wiper and discharge chute.

C. Monthly or Every 100 Operating Hours

Check the safety devices. Never operate the machine with faulty safety devices. Fix all defective safety devices immediately!

- Place the machine in manual mode (see SECTION 4: OPERATION for instructions).
- Begin the machine cycle.
- Activate the E-stop. The machine should come to a full stop.
- Pull out the E-stop button and cycle the machine again.
- Do this with all safety devices on the machine.

Check protective motor switches and overload relays. Refer to SECTION 7: ELECTRICAL and SECTION 6: DRIVE DATA for instructions and information on testing these components.

Check sprockets, drive chain, bearings and gearbox.

DANGER! The examination of these items requires observing the machine within as it is running. DO NOT attempt to reach or extend yourself into the machine as it is running!

When checking the chain drive system:

- Put the machine into an E-stop condition and remove the front covers so you can see the chain, sprockets and drive system.
- Reset the machine. Start the cycle in manual mode as described in SECTION 4: OPERATION.
- Visually inspect the sprockets and drive chains for damage and excessive wear.
- Check the drive shaft and bearings for concentricity and smooth turning.

- Check the gearbox for leakage.
- Check the gearbox temperature for excessive heat.
- After the check, replace the covers and place the machine back to normal operation.

Lubricate:

- With a grease gun, lubricate the machine grease points (called out later in this section) with petroleum grease, Allied Mega Blue LC 500 or equivalent.

D. Semi-annually or Every 600 Operating Hours

Check the fasteners. Perform the following maintenance items:

- Check all fasteners for tightness.
- Check all electrical connections for cleanliness and secure fits.
- Secure or tighten any loose connections.

Check the chain tension. When setting the tension do not over-tighten the chain.

- Drain the channel and wash the lower bearings with a high-pressure wash in order to remove any debris in the lower bearing area.
- Rotate the rake heads so that none are pivoting around the lower bearing.
- Lock-out the machine.
- With a feeler gauge, measure the gap between the bearing ring on the lower journal and the chain rollers. The gap should measure 1/32 or .032 inches. The gap should not exceed 1/16 or .063 inches and the rollers should only touch the bearing ring on the upward rotation.
- If the tension needs to be adjusted, follow the adjustment instructions detailed later in this section.
- After inspection, return the machine to normal operation.

Check gearbox oil level and consistency

- Lock-out the machine.
- Open the drain plug as shown in figure 5.2 and check the oil for consistency. The oil should smell fresh and not burnt or dirty. The oil should look clear or transparent and not black or gray.
- Remove the oil level plug as shown in figure 5.2.
- Observe the oil level; it should be even with the bottom of the view-hole and readily visible. If oil is not visible from the view-hole the machine is low and oil needs to be added. Refer to SECTION 6- DRIVE DATA for prescribed oils to use. If oil seeps from the view-hole, there is too much and oil must be drained. Allow the excess oil to drain from the view-hole into an appropriate waste oil container until it is level with the view-hole.

Clean the drive and gearbox ventilation. Remove the gearbox vent as shown in figure 5.2 and clean with air or cleaning solvent. Replace the vent when cleaned.

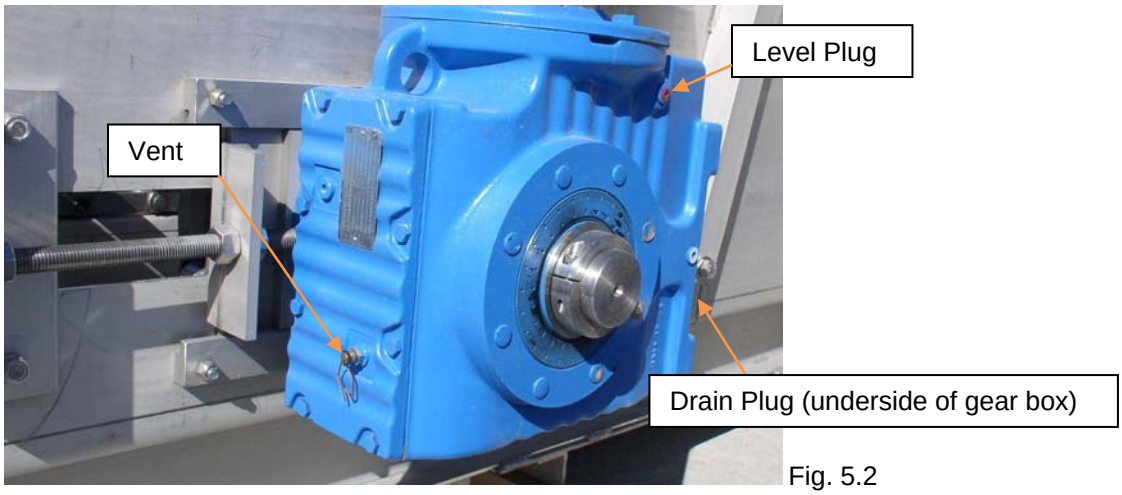


Fig. 5.2

E. Annual Inspection

Check the drive unit:

- Check the motor and gearbox for damage and excessive wear.
- Check that all fasteners are secure and tight.

F. 2 Year Inspection

Replace gearbox oil. Replace the gearbox oil by:

- Lock-out the machine.
- Remove the drain plug as shown in figure 5.2 and drain the oil into a proper waste oil container.
- Replace the drain plug.
- Through the vent hole add new oil into the gearbox. Use oil as prescribed in SECTION 5.5 and quantities as listed on the data sheets in SECTION 6.
- Check the oil level as detailed in 5.2.
- Replace the vent cap and oil level plug when properly full.

5.3 Maintenance /Lubrication Schedule

Occurrence	Inspection	Activity
Daily	Entire Machine	Check operability
	Screen	Check for jammed solids and deposits
	Clearing Rake	Check for broken teeth
Weekly (30 hrs)	Wiper	Clean
		Check operability
		Check for wear
	Entire Machine	Clean the outside
	Discharge Hopper	Clean
Monthly (100 hrs)	Safety Devices	Check operability
	Protective motor switch and overload relay	Check reference variables
	Sprockets and chain	Visual inspection for defects
	Bearings and Shaft	Check for concentricity and smooth running
	Gearbox housing	Check for leaks and high temperature
	Bearing mount, drive shaft	Lubricate all grease points
Semi-annually (600 hrs)	Fastener connections	Check for secure fit, tighten loose connections
	Electric connections	Check for secure fit, tighten loose connections
	Chain	Check tension, adjust if necessary
	Drive unit	Clean ventilation
	Gearbox	Check oil quality
		Clean vents
Annually (1200 hrs)	Drive unit	Check for leaks and damage
		Check fasteners
2 years	Gearbox	Change oil

5.4 Required Tools

The following is a categorized list of tools to have available when working on this machinery.
Hand Tools:

- Standard maintenance tools (i.e. screwdrivers, allen wrenches, socket, open-end and box-end wrenches up to 1-1/2" and if possible, metric up to 32mm, punches, etc.)
- 18" crescent wrench
- Channel lock pliers
- Tape measure
- Feeler gauge set
- Metric allen wrench set
- Torque wrench with a minimum rating of 100 ft/lbs.
- Voltage / Amp meter

Lifting Devices:

- Lifting device sufficient enough to lift the machine from the channel
- Heavy duty ¼" cable come-along
- Nylon or cable lifting straps

Safety Devices:

- Lock-out Tag-out as required by local policy
- Hazardous gas detector
- Appropriate work attire and gloves

5.5 Recommended Lubricant Types

These recommendations are not intended to be the only types/brands of lubricants that may be used on this type of equipment. (Lubricants of the same characteristics may be supplemented.)

Manufacturer / Brand	
GEAR REDUCER OILS:	
❑ Mobil SHC-634 (provided with units, recommended by mfg.)	Synthetic
❑ Shell Omala 460 HD	Synthetic
❑ Shell Omala 680	Petroleum
❑ Mobil gear 600 XP 680	Petroleum
GREASES (multi-purpose)	
❑ Mega Blue LC-500, EP-2 (used by Vulcan Industries)	Petroleum
❑ Mobil Mobilith AW-2	Petroleum
❑ Or equivalent AW-2 or EP-2	Petroleum
❑ Mobil FM-102	Food grade

5.6 Lubrication Points

Fig. 5.6 Wiper Pivot: 2x grease lines (one on each side of the frame for each bearing).

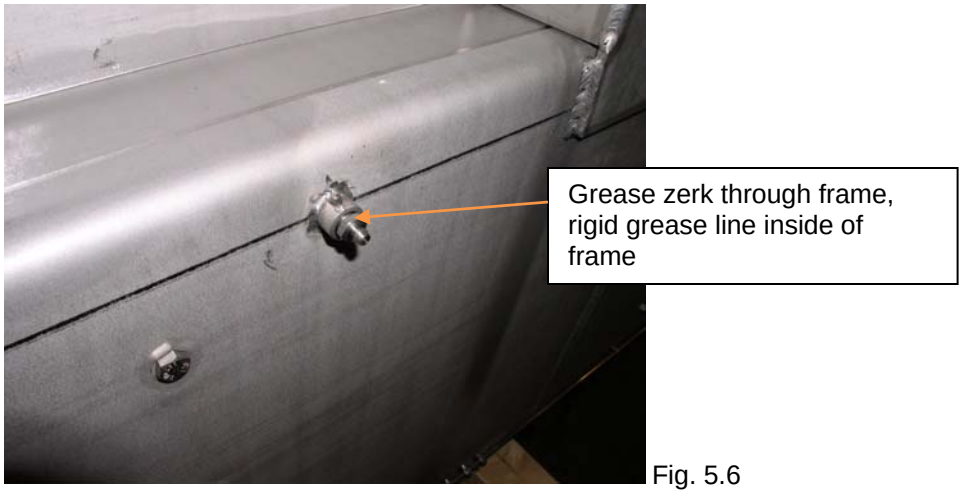


Fig. 5.6

Fig.5.6.A Drive Shaft: Flange block grease line (on opposite side of motor and gear box).

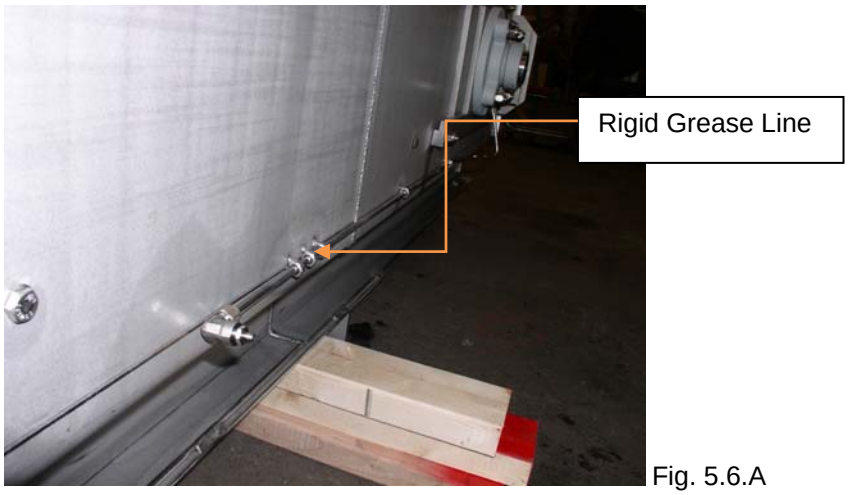


Fig. 5.6.A

5.7 Machine Adjustments

A. Rake Adjustment

The rake adjustment is set at the factory and should not need any adjustment prior to start-up. However, over time the rake may need to be realigned or adjusted for proper depth setting.

There are two bolts on each end of the rake assembly that allow for setting the depth and alignment.

- Loosen both bolts on the inside of the rake pan as shown in figure 5.7 (one on each side of the screen).
- Measure ¼" of clearance between the rake teeth and the dead plate. Check that the rake assembly is level across the width of the screen.
- Retighten the bolts.
- In manual mode, run the rake cautiously through the wiper to ensure that there is no interference or jamming with the wiper.
- If all is satisfactory, replace all access panels and switch the machine into automatic mode for normal operation.

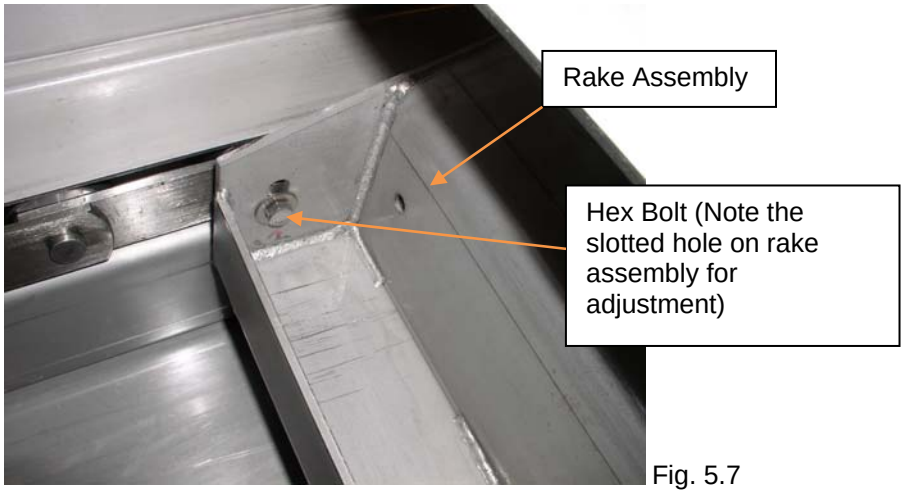


Fig. 5.7

B. Chain Drive Tension Adjustment

The drive chain for the rakes can be adjusted for tension. This should be checked regularly as a slack chain indicates worn components.

The tension system consists of two adjustment brackets, sliders, an adjustment screw and nuts. There are two of these tension systems, one on each side of the frame and all adjustments must be made equally on both sides. (See figure 5.7.A for details.)

Adjust the chain tension by:

- Using a feeler gauge, measure the gap between the bearing ring on the lower journal and the chain rollers. The gap should measure 1/32 or .032 inches. The gap should not

exceed 1/16 or .063 inches and the rollers should only touch the bearing ring on the upward rotation.

- Loosen the nuts on the adjustment screw and the lock nuts on the sliders.
- Rotate the adjusting nuts to slacken or tighten the tension on the chain.
- Retighten all the nuts when the proper tension is set.

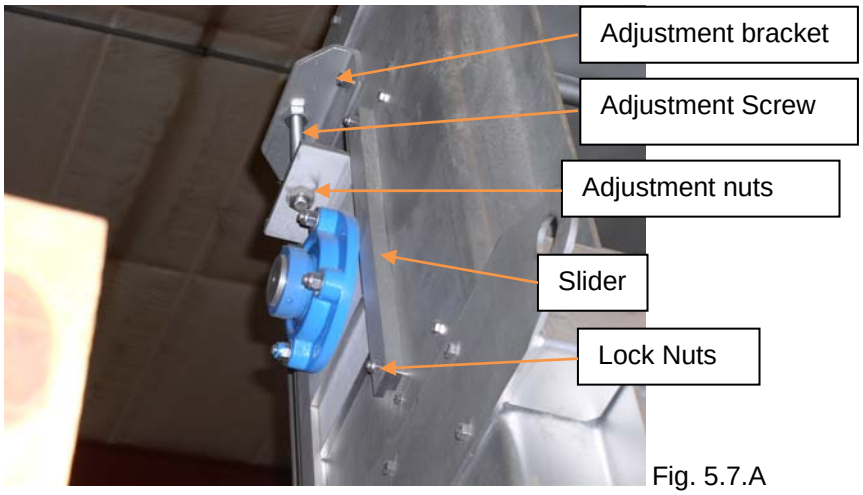


Fig. 5.7.A

C. Wiper Assembly Stop Adjustment

The wiper is cushioned to the stop position by a pair of adjustable stop bolts (See Fig. 5.7.B). The position of these bolts determines the wiper's "stop" point. To adjust the stop, loosen the nuts and rotate the bolt until the wiper assembly has the proper range of motion that does not allow the wiper to bind with the rake.

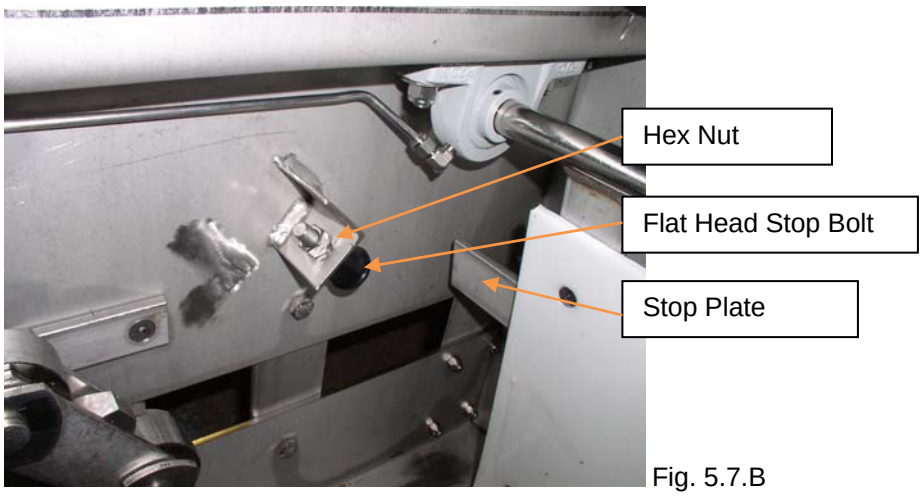


Fig. 5.7.B

5.8 Component Replacement

A. Wiper Replacement

Over time the wiper plates wear and need replacing. To replace the wiper plates:

- Position the rakes so there is easy access to the wiper plate and blade.
- Remove the flat head screws that hold the wiper plate. (See Fig 5.8.A1)
- Remove the flat head screws that hold the wiper blade. (See Fig. 5.8.A2)
- Replace the old plates with new ones and replace the flat head screws.
- Run one manual cycle to check for proper operation and adjust the stops if necessary.

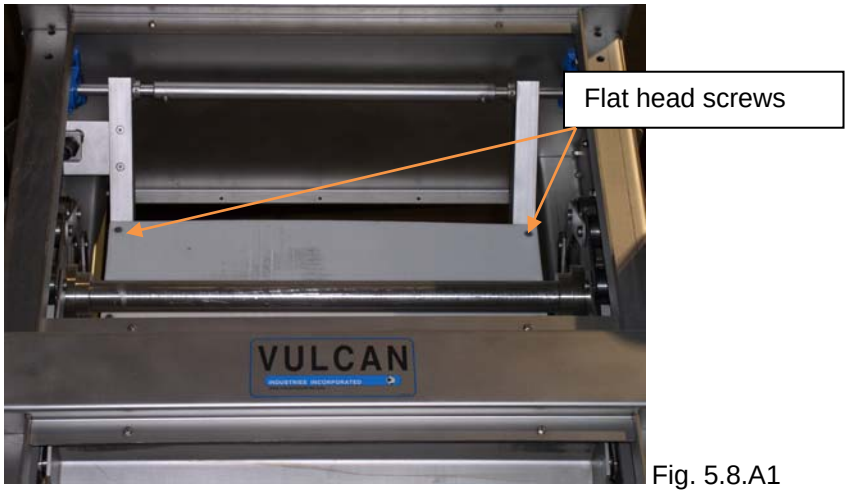


Fig. 5.8.A1

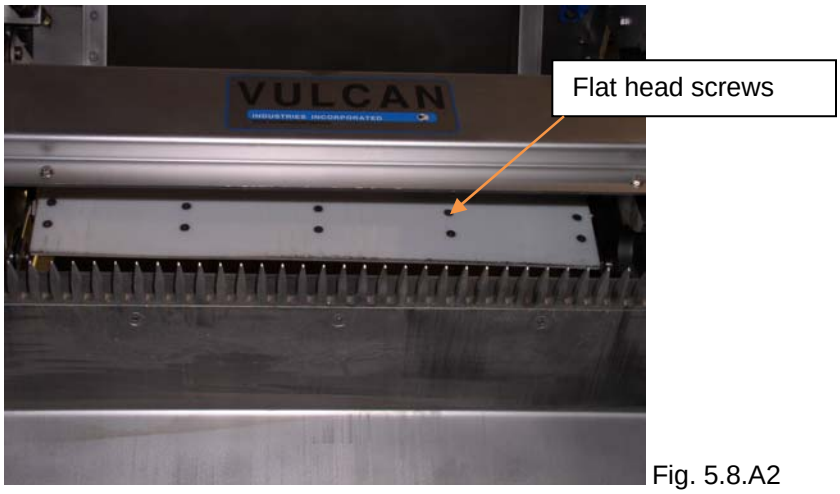


Fig. 5.8.A2

B. Rake Replacement

Through wear and time some rake teeth may break off and need replacing. To replace a section of rake teeth, position the rake assembly in the center of the access hatches. Remove the access hatches to properly work on the rake head. Remove the flat head screws (see Fig. 5.8.B) used to mount the rake teeth to the rake assembly. Replace the old teeth with the new ones and replace the flat head screws.

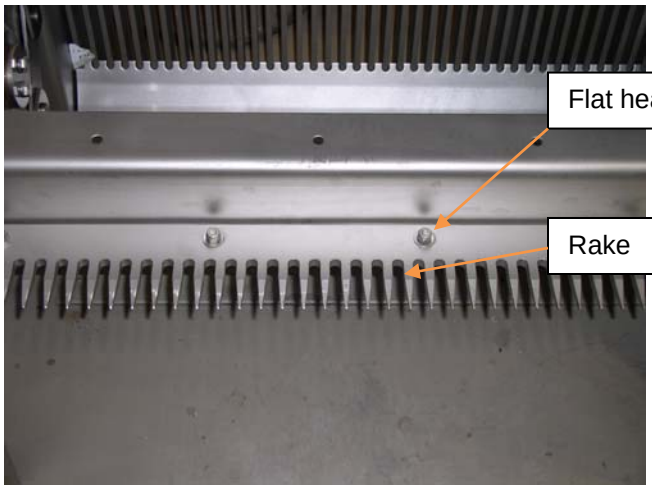


Fig. 5.8.B

C. Chain Replacement

DANGER! REPLACE ONLY ONE CHAIN SECTION AT A TIME! To avoid damage to the machine and fatal injury to personnel, only one chain should ever be disconnected at one time.

DANGER! CHAINS ARE HEAVY! Always use a mechanical lifting device to assist in lifting and supporting the chains. Make sure the chains are supported properly before any master links are loosened. Always use the lock pins provided to support the chains from falling.

Items to note before working on the drive chains:

- Chains weigh 7 lbs. per foot. Provide supports accordingly to handle this load.
- Replace chains when the tension adjuster has topped out and cannot be adjusted any further.
- Small parts may fall into the channel. Make sure all master link pieces and supporting hardware are properly handled to avoid losing them. Use mechanical support devices to assist in supporting heavier components in order to allow for free hands when working.

The following detail shows all the loose components to the master link.

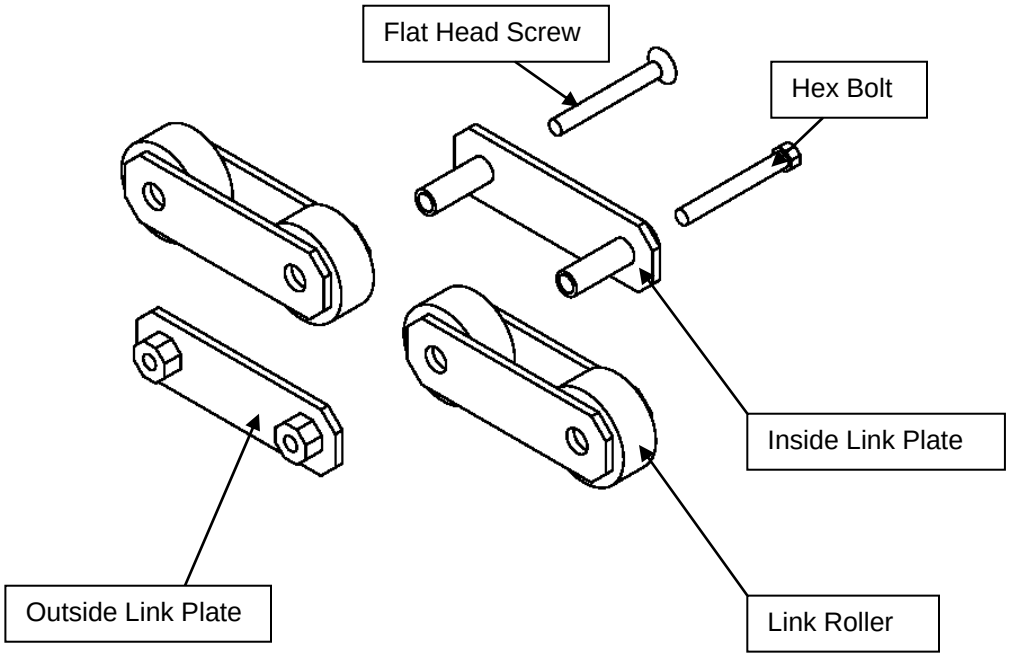


Fig. 5.8.C

- If possible, rotate the machine horizontally up out of the channel to provide easier maintenance on the machine.

Over time the drive chain may need to be replaced. Perform the following steps in order to replace the chain:

- Remove both access hatches on each side of the machine frame.
- Position one of the rake assemblies so that the rake heads are centered within the access hatch openings. (See Fig. 5.8.C1 for the access hatch). Note that the rake heads are attached to the drive chain by the master links.


Fig. 5.8.C1

- Place the ¾" lock pins into the pin holes on the frame of the machine. These holes can be found just a few inches below the access hatches. (See Fig 5.8.C2)

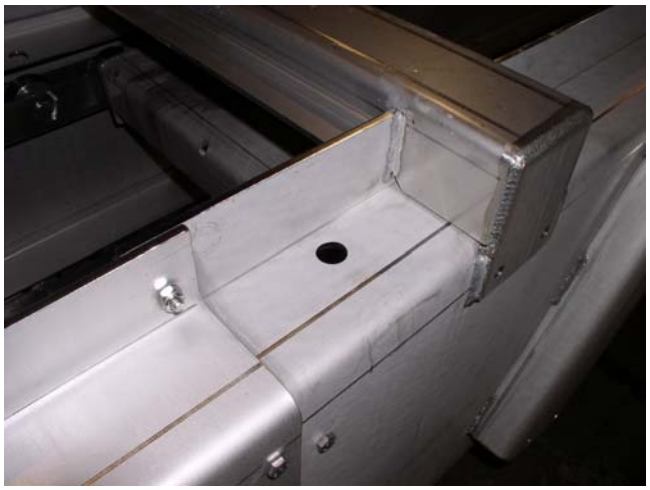
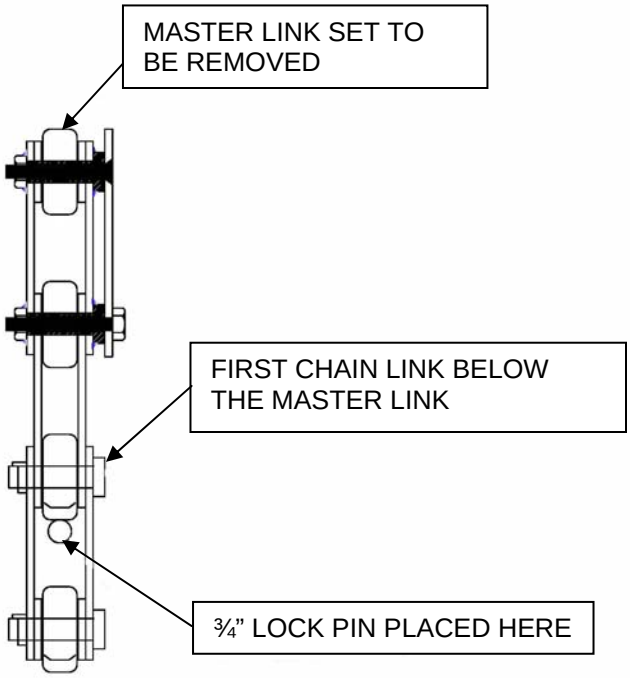


Fig. 5.8.C2

- Refer to the diagram below. The lock pin must be placed in the link just immediately below the master link. The pin must fit between the two rollers in the link. Failure to do so will result in the chain falling into the channel.



- Remove the flat head bolts and hex head bolts that hold the master link and rake head assembly together. (See Fig. 5.8.C3 AND 5.8.C4.) REMOVE ONE SIDE OF THE RAKE HEAD AT A TIME!

  Disconnect the rake head from the chain that is not being maintenanced first. Replace the bolts back into the master link; then remove the rake head from the chain that is receiving maintenance. Failure to follow this step closely will result in the chain and sprocket back-spinning and damage to the machine or death may result!

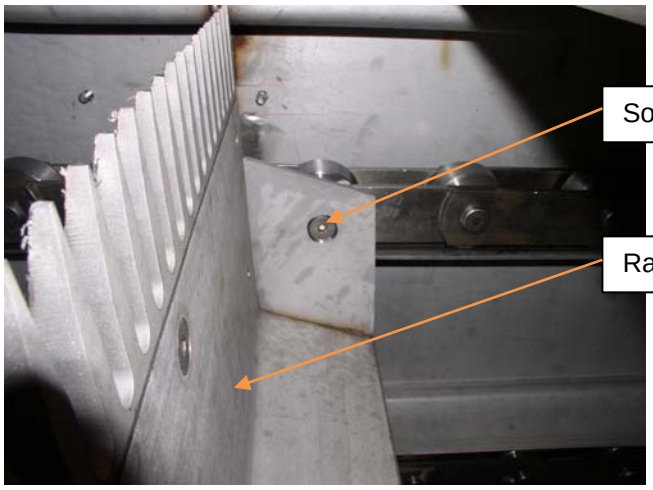


Fig. 5.8.C3

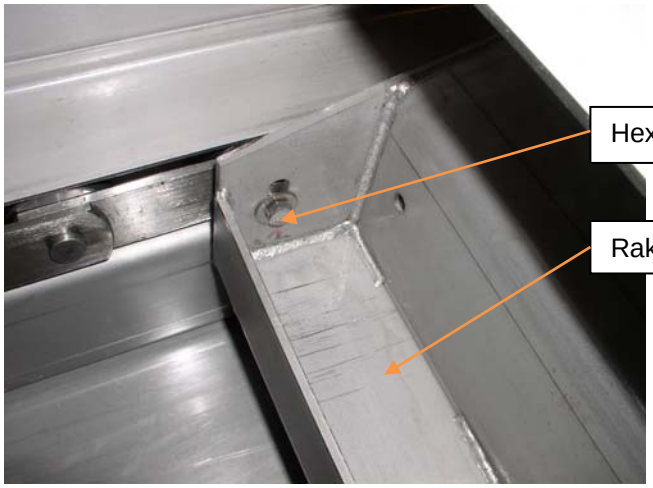


Fig. 5.8.C4

- On the chain being maintenanced, pull the master link apart and keep these pieces with the rake assembly. Take care not to drop these pieces! (Refer to Fig. 5.8.C for details.)
- Attach the new chain to the existing lower chain section (See Fig. 5.8.C5). Reattach the rake head to the chain.

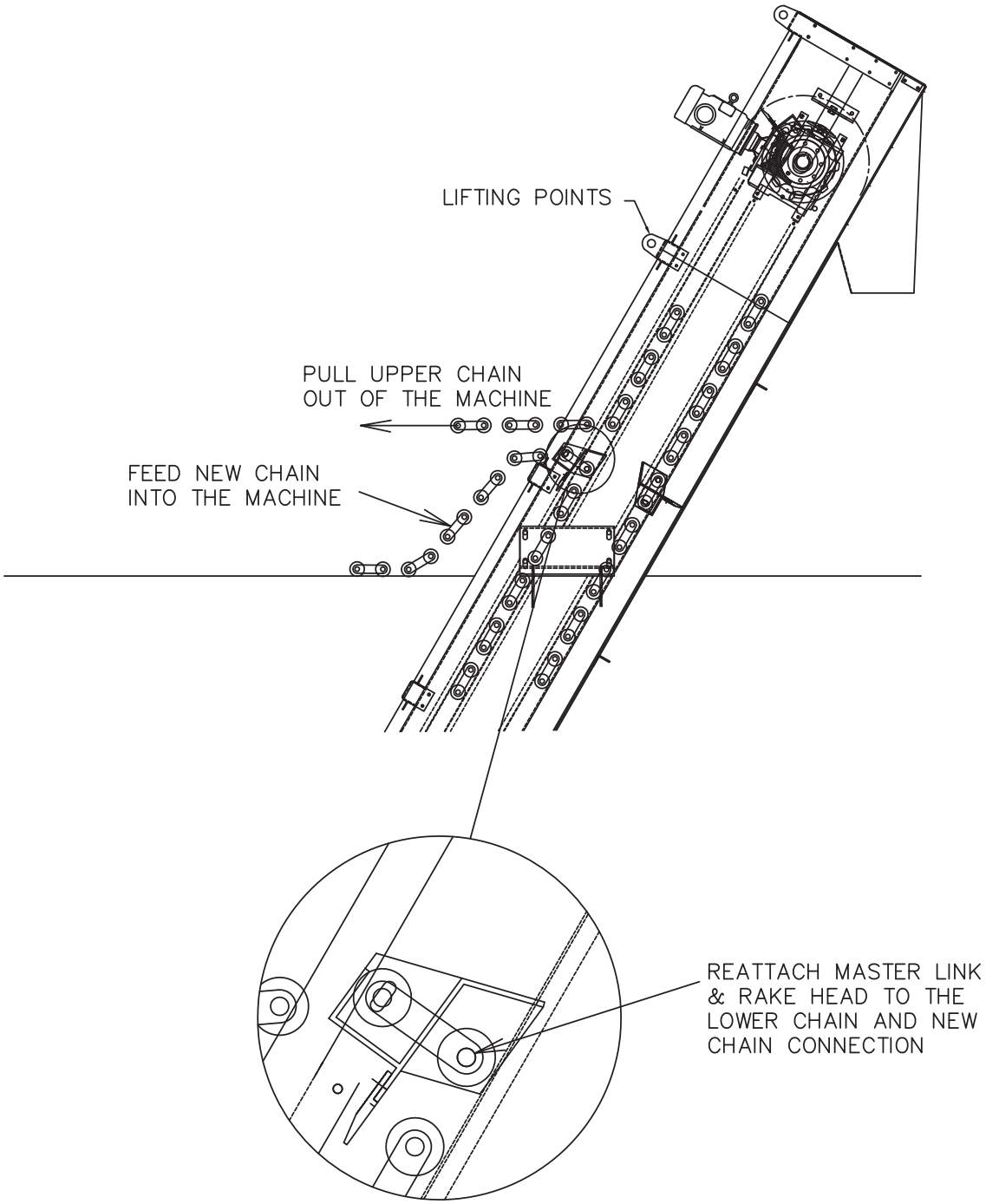

LIFTING POINTS
PULL UPPER CHAIN
OUT OF THE MACHINE
FEED NEW CHAIN
INTO THE MACHINE
REATTACH MASTER LINK
& RAKE HEAD TO THE
LOWER CHAIN AND NEW
CHAIN CONNECTION

Fig. 5.8.C5

- Connect a controlled descent device onto the lifting lugs above the access hatch opening then strap this device onto the rake head assembly. (See Fig. 5.8.C6).

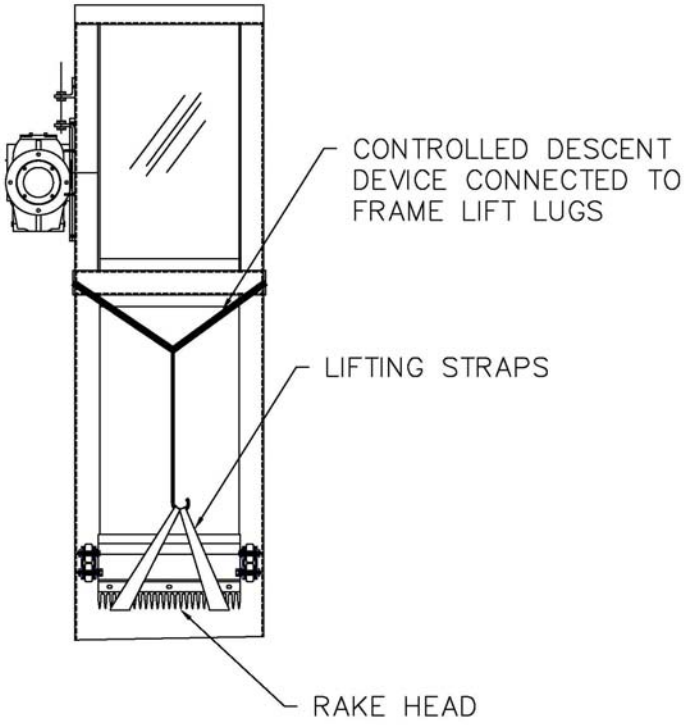


Fig. 5.8.C6

- Tension the upper chain.
- Pull the lock pins.
- Using a combination of the controlled descent device and short motor pulses, lower the new chain section into the machine while pulling the upper chain section out of the machine. (See Fig 5.8.C5).
- Keep rotating the chain until the next master link connection is centered in the access hatch.
- Put the lock pins in place.
- Remove the rake head from the chain.
- Remove the old chain section. (Keep hold of all the loose master link pieces.)
- Reattach the new chain section and rake head to the master link.
- Repeat the process of connecting a new chain over again until the entire drive chain has been replaced.
- Perform these steps for the drive chain on the opposite side when finished.
- When finished replacing both chains, set the tension back to the factory tension setting as shown in SECTION 8.4. The marking on the slider plate must align with the mark on the frame. From there, measure the gap between the bearing ring on the journal and the chain rollers. This gap should be .032 inches. Adjust the chains accordingly.

D. Upper Sprocket Maintenance

Contact Vulcan Industries, Inc. should any maintenance issues arise in regards to the upper sprockets. The sprockets need to be factory assembled and require a complete dismantling of the chains and drive system.

E. Replacing the Motor

Remove the motor by disconnecting all power to the motor and then unbolt it from the gear box. Make sure the new motor configuration completely matches that of the old motor.

F. Replacing the Outer Shaft Bearing

Perform the following steps when replacing the outer shaft bearing: (Refer to Fig. 5.8.G1)

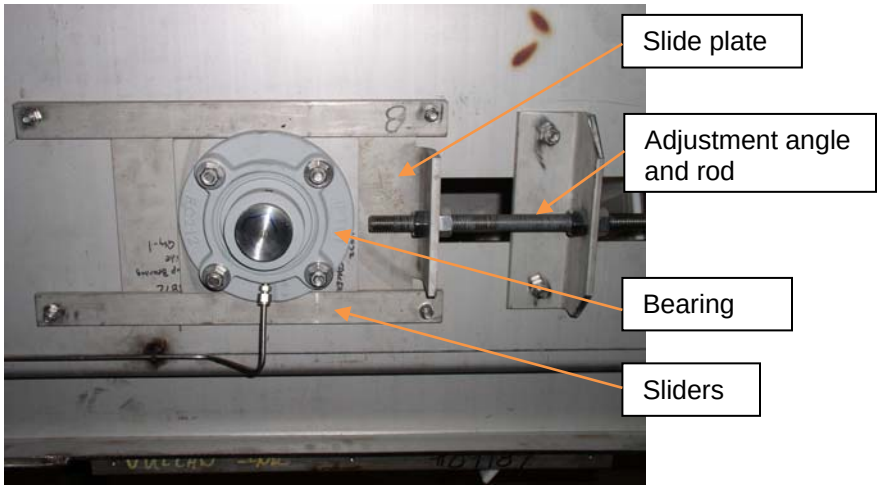


Fig. 5.8.G1

- Support the drive shaft from inside the machine to prevent it from falling.
- Separate the tension slide plate from the adjustment angle by unbolting the adjustment rod.
- Remove the slide plate from the frame by unbolting the sliders. Make sure to disconnect the grease line in the process.
- Remove the set collar from the drive shaft and slide the bearing assembly off the shaft. (See fig. 5.8.G2).

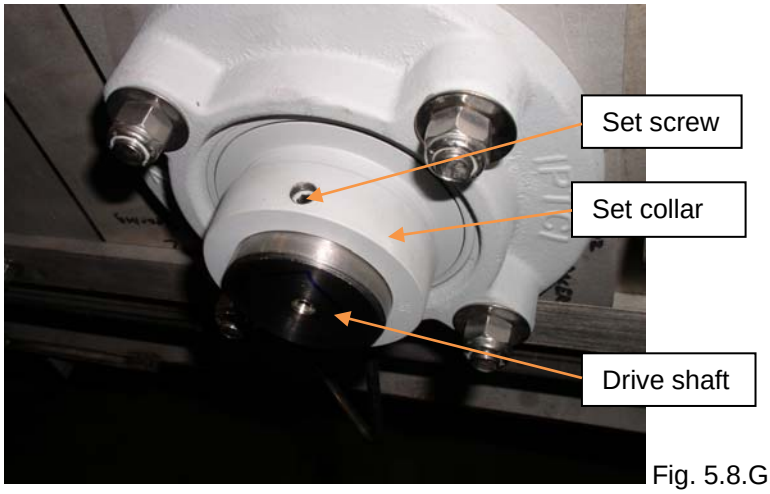


Fig. 5.8.G2

- Remove the bearing from the slide plate and replace with a new bearing.
- Mount the new bearing by performing these steps in reverse order.
- Check the chain tension after removing the supports.

G. Replacing the Gear Reducer

Perform the following steps to replace the gear reducer: (See Fig. 5.8.H1)

- Support the drive shaft from inside the machine to prevent it from falling.
- Separate the tension slide plate from the adjustment angle by unbolting the adjustment rod.
- Remove the motor from the gear box. Make sure power is disconnected from the motor.
- Remove the slide plate from the frame by unbolting the sliders.

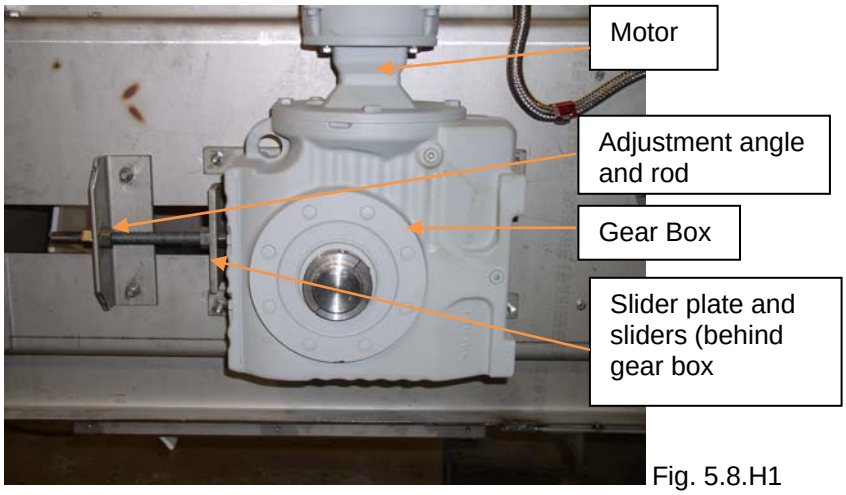


Fig. 5.8.H1

- Remove the set collar from the drive shaft and slide the gear box off the shaft. (See Fig. 5.8.H2).

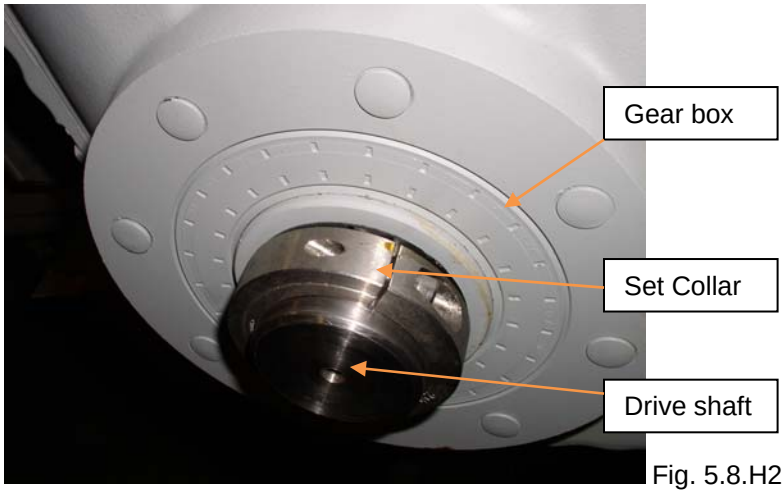


Fig. 5.8.H2

- Remove the gear box from the slide plate and replace with a new gear reducer.
- Mount the new gear reducer by performing these steps in reverse order.

H. Removing the Lower Journal

To replace the Lower Journal, perform the following steps:

- Release the chain tension as described in 5.7.B of this section.
- Slip the chain off of the journal.
- Remove the bolts that hold the cover plate to the journal and the bolts that hold the journal to the frame and backup flange. (See Fig. 5.8.J)

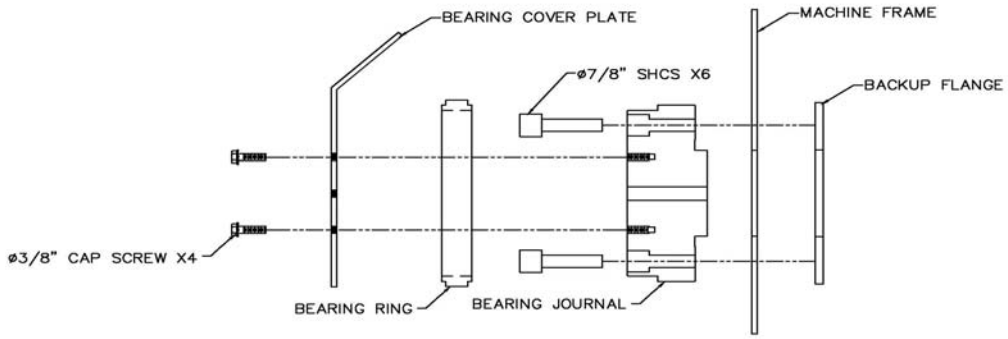


Fig. 5.8.J

I. Replacing the Bearing Ring

- Remove the journal as described previously.
- Using a mallet and punch, carefully remove the bearing ring without damaging the journal.
- Thoroughly degrease and sanitize the journals. Make sure the mating surface for the bearing is clean and dry.
- Heat the new bearing rings in hot water. Bring the water to 140º F and then add the rings to the water for 10 to 15 minutes.

DANGER! Extreme heat is being used. The parts will be very hot to touch. Use proper protection when handling the bearing rings.

- While the rings are still hot and malleable, place them on the journal. The rings should easily slide onto the journal and upon cooling, tighten around the journal.
- Replace the journal onto the frame and reattach the chain and cover plate.
- Perform a few test runs of the system before reinstating the machine back to service.

J. Replacing the Lower Sprocket

To replace the bearings and the lower sprockets, perform the following steps:

- Release the chain tension as described in 5.7.B of this section.
- Slip the chain off of the sprocket.
- Remove the bolts that hold the center cap to the spindle and the bolts that hold the spindle to the machine frame. (See Fig. 5.8.L)
- Slip the bearings, bushing and sprocket off of the spindle.
- Inspect the bearings and bushing and replace worn parts.
- Lubricate and reassemble as shown in Fig 5.8.L

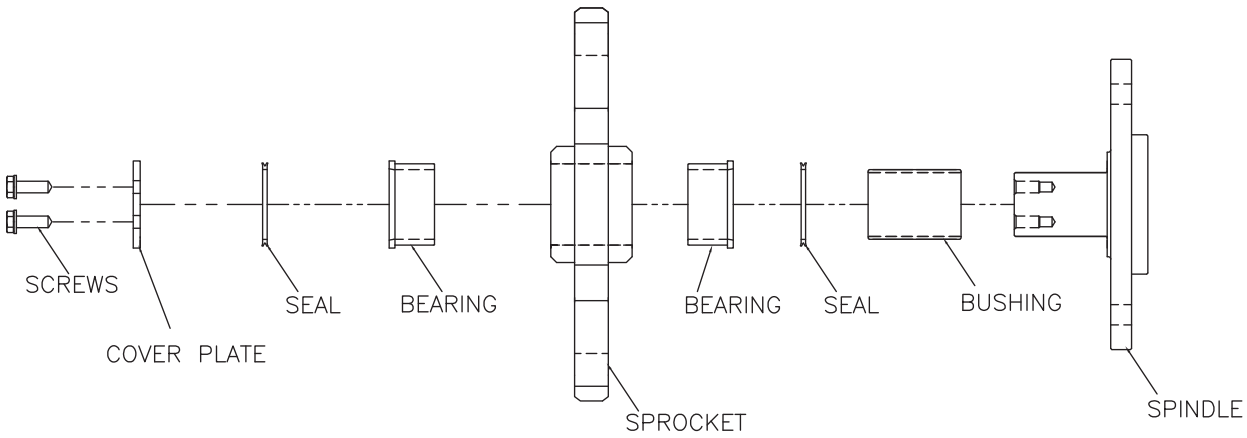


Fig. 5.8.L

- Mount the spindle onto the frame.

- Replace the chain onto the sprocket and reset the chain tension.

5.9 Mechanical Troubleshooting Reference

The following table is a list of possible common machine faults, symptoms and remedies for fixing. These items listed here are only for mechanical issues. For issues with the control system or electrical malfunctions refer to SECTION 7: Electrical Controls.

Problem	Possible Causes	Solutions
Multi-rake screen does not start	No power to the motor*	Check all contacts and connections on terminal boxes, junction boxes and main control panel
	Faulty motor	Replace the motor
	Control malfunction	Check control settings
		check signal to drive unit
	Downstream units not operational	Make sure units are operational
Noises	Bulky material jammed between screen bars	Remove objects
	Bulky material jammed in the vicinity of discharge hopper	Remove objects
	Rake teeth bent	Replace teeth
	Damaged bearings in gearbox	Inspect gearbox for damage and replace or repair if needed
	Worn or damaged bearings on the drive shaft	Inspect drive system and replace or repair as needed
Overload relay has deactivated the drive motor	Bulky material jammed between screen bars	Deactivate entire system and remove objects
	Obstruction at bottom of channel	Remove obstruction
Screenings are not being fully scraped away	Wiper has solids stuck on it	Clean wiper
	Wiper plate is worn or damaged	Replace wipers
	Bulky material is jammed in discharge area and prevents wiper assembly from full motion	Remove objects

*Refer to SETCTION 7: Electrical Controls for more detailed information on this subject.

6 Parts Lists & Vendor Data

At Vulcan Industries we do our best to service all our machinery in the most expedited manner. If you require replacement parts for your machine, you can contact our service department at:

Vulcan Industries
212 S. Kirlin St.
Missouri Valley, IA 51555
712-642-2755

Or email at service@vulcanindustries.com

Normal hours of operation are Monday-Friday 8 A.M. to 5 P.M. central.

Make sure to provide the following information located on the cover page of this manual:

- The Vulcan Job Number.
- The project or facility name.
- The project or facility location (city & state).
- Machine Model Number.

Also provide any drawing numbers that you are referencing for your part numbers. If you are using the assembly drawings provided on the following pages, use the drawing numbers listed in the upper right corner of the drawing for reference.

All of this information will help us expedite the correct replacement parts for your machine. Thank you.

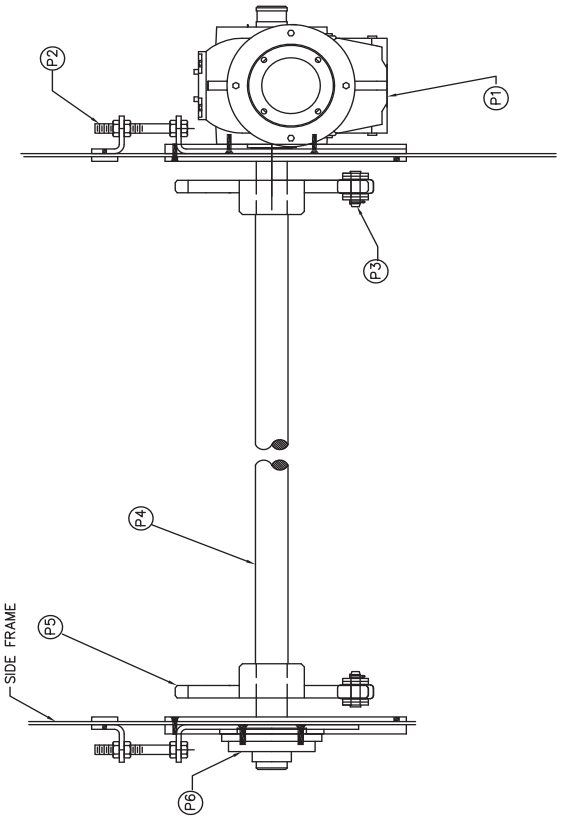
6.1 Assembly Drawings

The following drawings reference the working components of the multi-rake machine and are to be used when ordering replacement parts.

Section 6
Parts Lists & Vendor Data

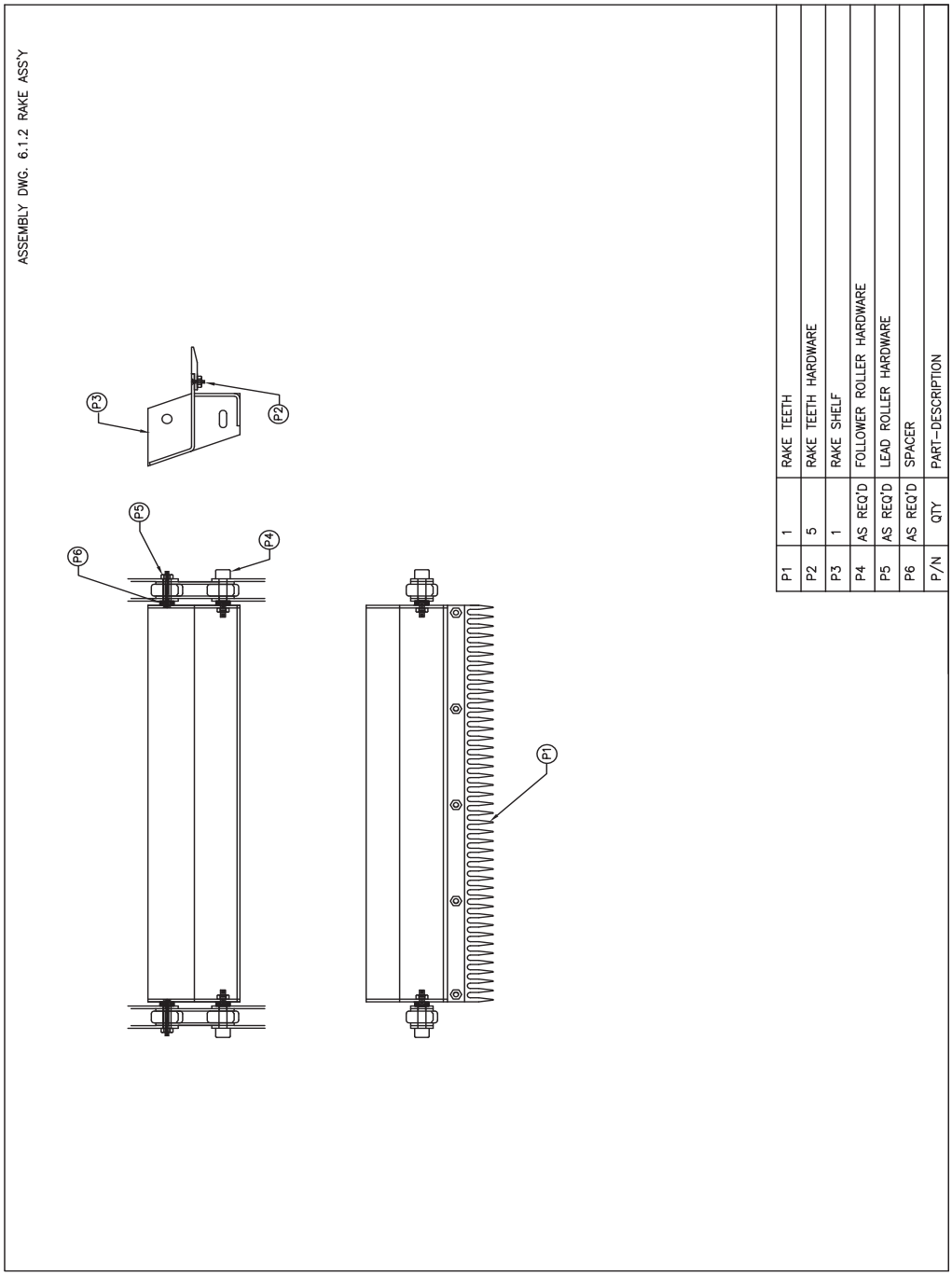
A. Drive System

ASSEMBLY DWG. 6.1.1 DRIVE SYSTEM



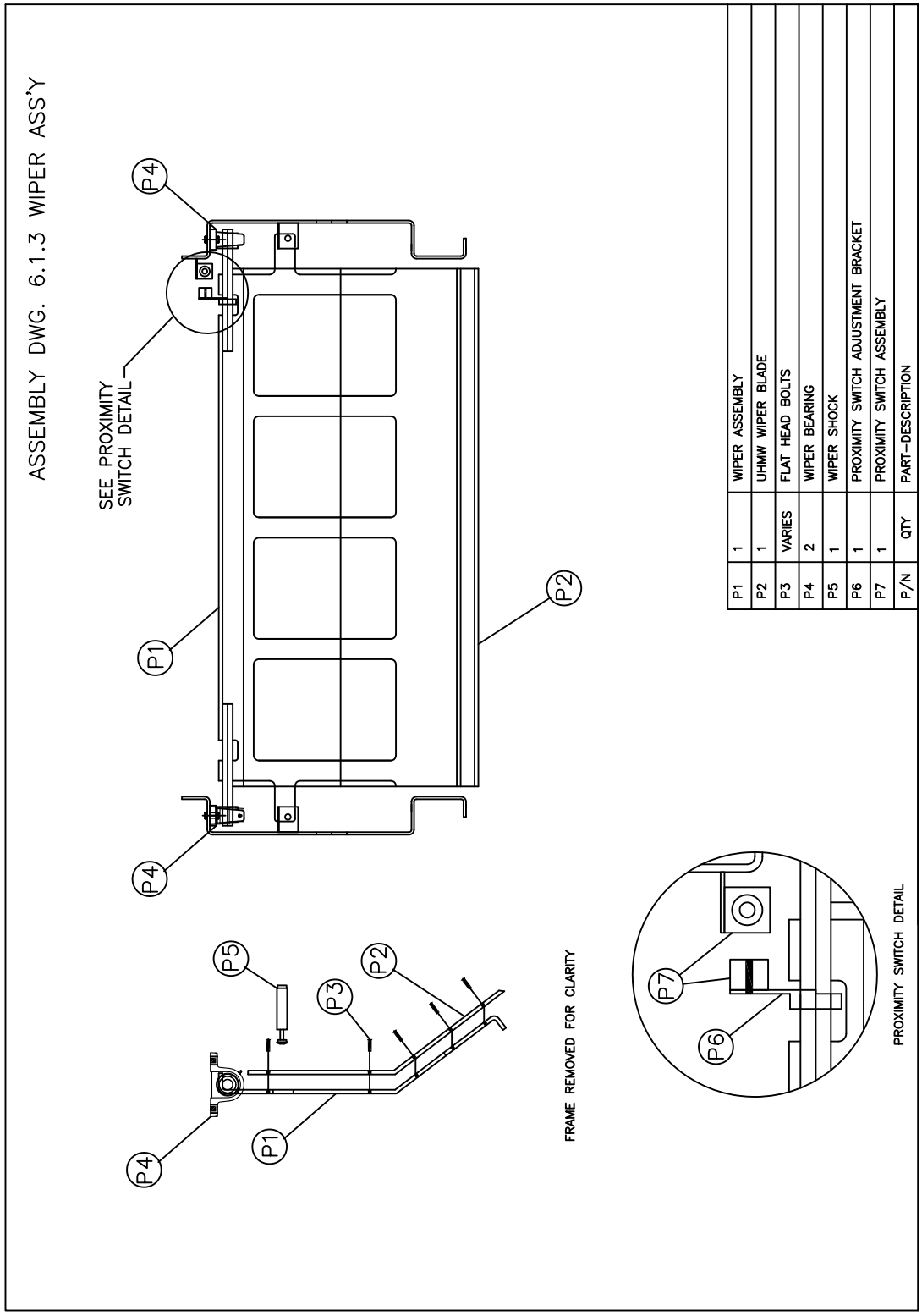
P/N	QTY	PART-DESCRIPTION
P1	1	DRIVE MOTOR & GEARBOX
P2	2	CHAIN TENSION SYSTEM
P3	AS REQ'D	DRIVE CHAIN
P4	1	DRIVE SHAFT
P5	2	UPPER DRIVE SPROCKET
P6	1	FLANGE BEARING W/ SET SCREW LOCK

B. Rake Assembly



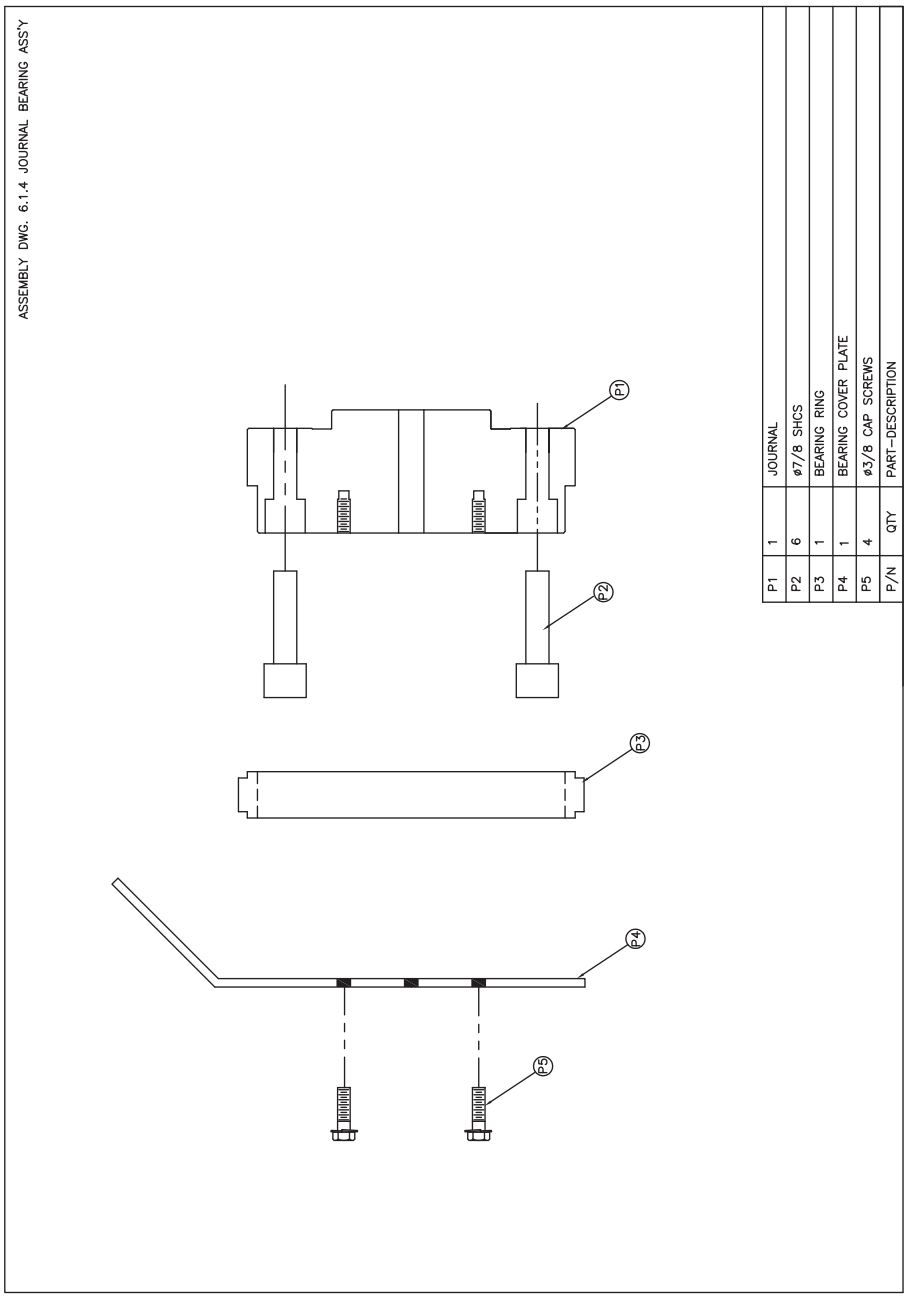
P/N	QTY	PART-DESCRIPTION
P1	1	RAKE TEETH
P2	5	RAKE TEETH HARDWARE
P3	1	RAKE SHELF
P4	AS REQ'D	FOLLOWER ROLLER HARDWARE
P5	AS REQ'D	LEAD ROLLER HARDWARE
P6	AS REQ'D	SPACER

C. Wiper Assembly



P/N	QTY	PART-DESCRIPTION
P1	1	WIPER ASSEMBLY
P2	1	UHMW WIPER BLADE
P3	VARIES	FLAT HEAD BOLTS
P4	2	WIPER BEARING
P5	1	WIPER SHOCK
P6	1	PROXIMITY SWITCH ADJUSTMENT BRACKET
P7	1	PROXIMITY SWITCH ASSEMBLY

D. Journal Bearing Assembly



E. Recommended Spare Parts per Screen

Part Description	Quantity
Wiper blades	Four (4)
5 Foot sections of drive chain	Four (4)
Proximity switches	Four (4)

For a list of spare parts included with your contract refer to Section 8: Project Data, 8.2 Project Specifications, 2.17 of your VMR O & M manual.

6.2 Drive Motor and Gear Data

VULCAN INDUSTRIES, INC.

Quality Control Document

Form #: 4.4.11

Device 1

Job No.	**19177**
Job Name	**Wichita KS.**
Equipment Type	**VMR-48**
Equipment Serial No.	**19177-450-1**
	Tagged BSC-1

Date of test: **1/3/2020**

Description of test: **In Shop Factory Test**

Motor Nameplate Data

Mfg.	**Baldor-Reliance**			
Serial No.	**F1903071530**			
CAT No.	**1DXM7542T**			
Spec. #	**06J010X181G2**			
No.	**D10140742**			
Frame	Type	Code	Design	Class
182TC	**C1/D1**	**T2B**	**B**	**F**
Encl.	H.P.	PH.	HZ	RPM
	3	**3**	**60**	**1755**
S.F.	VOLTS		AMPS	
1	**230 / 460**		**8.2 / 4.1**	
DE brg				
ODE brg				

Reducer Nameplate Data

Mfg.	**SEW-Eurodrive**
Serial No.	**87.7803639201.0003.19.50**
Type	**SA97/TAM182**
Mount	**M1A**
Oil Capacity	**7.0 liter**
T_2 =	**35,400**
N_2 =	
I (ratio) =	**262.22**
SF	

Brake Nameplate Data

Mfg.	
Serial No.	
Model No.	
Ft lbs torque	
Voltage	

Testing Equipment:

Test Device 1:	Serial No.	Date of Calibration
Fluke 333 Clamp Meter	79610273	7/24/2020
Test Device 2:	Serial No.	Date of Calibration
Fluke 65 Thermometer	95600311	7/13/2020

Voltage Reading Phase to Phase:

L1-L2	L1-L3	L2-L3
482	**476**	**486**
Motor Amp Reading		
T1	T2	T3
2.2	**2.1**	**2.2**

Motor Temp. Rise		Reducer Temp. Rise
66	**at start up**	**66**
72	**15 min.**	**70**
76	**30 min**	**76**
81	**1 hr.**	**87**
83	**2 hr.**	**93**
83	**3 hr.**	**97**
84	**4 hr.**	**98**
84	**5 hr.**	**103**
84	**6 hr**	**104**
85	**7 hr.**	**105**
85	**8 hr.**	**105**

Test Remarks			
	Reducer vent plug installed	**Y**	N
	Oil level confirmed	**Y**	N
	All lubrication completed	**Y**	N
	Adjustment required	Y	**N**
	Operated with designed controls	**Y**	N
	Video taped operation	Y	**N**
	Control panel verified	**Y**	N
	8 hr run test completed	**Y**	N
	Screen hour meter start / finish	**0.5**	**8.5**

TEST REMARKS:

Went over control panel operation with technician, verifying complete operation.
Connected control panel to equipment and verified operation between the two pieces of equipment
Ran equipment for period of 8 hours monitoring amps, voltage, and temperature of both motor and gear box.

VULCAN INDUSTRIES, INC.

Quality Control Document

Form #: 4.4.11

Device 1

Job No.	**19177**
Job Name	**Wichita KS.**
Equipment Type	**VMR-48**
Equipment Serial No.	**19177-435-2**
	Tagged BSC-2

Date of test: **1/3/2020**

Description of test: **In Shop Factory Test**

Motor Nameplate Data

Mfg.	**Baldor-Reliance**			
Serial No.	**F1906073400**			
CAT No.	**1DXM7542T**			
Spec. #	**06J010X181G2**			
No.	**D48513888**			
Frame	Type	Code	Design	Class
182TC	**C1/D1**	**T2B**	**B**	**F**
Encl.	H.P.	PH.	HZ	RPM
	3	**3**	**60**	**1755**
S.F.	VOLTS		AMPS	
1	**230 / 460**		**8.2 / 4.1**	
DE brg				
ODE brg				

Reducer Nameplate Data

Mfg.	**SEW-Eurodrive**
Serial No.	**87.7803639201.0004.19.50**
Type	**SA97/TAM182**
Mount	**M1A**
Oil Capacity	**7.0 liter**
T_2 =	**35,400**
N_2 =	
I (ratio) =	**262.22**
SF	

Brake Nameplate Data

Mfg.	
Serial No.	
Model No.	
Ft lbs torque	
Voltage	

Testing Equipment:

Test Device 1:	Serial No.	Date of Calibration
Fluke 333 Clamp Meter	79610273	7/24/2020
Test Device 2:	Serial No.	Date of Calibration
Fluke 65 Thermometer	95600311	7/13/2020

Voltage Reading Phase to Phase:

L1-L2	L1-L3	L2-L3
482	**473**	**486**
Motor Amp Reading		
T1	T2	T3
2.2	**2.2**	**2.2**

Motor Temp. Rise		Reducer Temp. Rise
66	**at start up**	**66**
72	**15 min.**	**70**
77	**30 min**	**76**
81	**1 hr.**	**85**
83	**2 hr.**	**94**
84	**3 hr.**	**99**
85	**4 hr.**	**103**
84	**5 hr.**	**104**
84	**6 hr**	**106**
84	**7 hr.**	**106**
84	**8 hr.**	**106**

Test Remarks			
	Reducer vent plug installed	**Y**	N
	Oil level confirmed	**Y**	N
	All lubrication completed	**Y**	N
	Adjustment required	Y	**N**
	Operated with designed controls	**Y**	N
	Video taped operation	Y	**N**
	Control panel verified	**Y**	N
	8 hr run test completed	**Y**	N
	Screen hour meter start / finish	**0.9**	**9**

TEST REMARKS:

Went over control panel operation with technician, verifying complete operation.
Connected control panel to equipment and verified operation between the two pieces of equipment
Ran equipment for period of 8 hours monitoring amps, voltage, and temperature of both motor and gear box.

VULCAN INDUSTRIES, INC.

Quality Control Document

Form #: 4.4.11

Device 1

Job No.	**19177**
Job Name	**Wichita KS.**
Equipment Type	**VMR-48**
Equipment Serial No.	**19177-450-3**
	Tagged BSC-3

Date of test: **1/21/2020**

Description of test: **In Shop Factory Test**

Motor Nameplate Data

Mfg.	**Baldor-Reliance**			
Serial No.	**F1903071535**			
CAT No.	**1DXM7542T**			
Spec. #	**06J010X181G2**			
No.	**D10140743**			
Frame	Type	Code	Design	Class
182TC	**C1/D1**	**T2B**	**B**	**F**
Encl.	H.P.	PH.	HZ	RPM
	3	**3**	**60**	**1755**
S.F.	VOLTS		AMPS	
1	**230 / 460**		**8.2 / 4.1**	
DE brg				
ODE brg				

Reducer Nameplate Data

Mfg.	**SEW-Eurodrive**
Serial No.	**87.7803639201.0001.19.50**
Type	**SA97/TAM182**
Mount	**M1A**
Oil Capacity	**7.0 liter**
T_2 =	**35,400**
N_2 =	
I (ratio) =	**262.22**
SF	

Brake Nameplate Data

Mfg.	
Serial No.	
Model No.	
Ft lbs torque	
Voltage	

Test Remarks			
	Reducer vent plug installed	**Y**	N
	Oil level confirmed	**Y**	N
	All lubrication completed	**Y**	N
	Adjustment required	Y	**N**
	Operated with designed controls	**Y**	N
	Video taped operation	Y	**N**
	Control panel verified	**Y**	N
	8 hr run test completed	**Y**	N
	Screen hour meter start / finish	**0.5**	**8.6**

Testing Equipment:

Test Device 1:	Serial No.	Date of Calibration
Fluke 333 Clamp Meter	79610273	7/24/2020
Test Device 2:	Serial No.	Date of Calibration
Fluke 65 Thermometer	95600311	7/13/2020

Voltage Reading Phase to Phase:

L1-L2	L1-L3	L2-L3
478	**490**	**491**

Motor Amp Reading

T1	T2	T3
2.1	**2**	**2.1**

Motor Temp. Rise		Reducer Temp. Rise
68	**at start up**	**66**
76	**15 min.**	**71**
79	**30 min**	**74**
83	**1 hr.**	**79**
86	**2 hr.**	**87**
85	**3 hr.**	**91**
85	**4 hr.**	**92**
84	**5 hr.**	**92**
84	**6 hr**	**94**
84	**7 hr.**	**95**
84	**8 hr.**	**95**

TEST REMARKS:

Went over control panel operation with technician, verifying complete operation.
Connected control panel to equipment and verified operation between the two pieces of equipment
Ran equipment for period of 8 hours monitoring amps, voltage, and temperature of both motor and gear box.

VULCAN INDUSTRIES, INC.

Quality Control Document

Form #: 4.4.11

Device 1

Job No.	**19177**
Job Name	**Wichita KS.**
Equipment Type	**VMR-48**
Equipment Serial No.	**19177-435-4**
	Tagged BSC-4

Date of test: **1/21/2020**

Description of test: **In Shop Factory Test**

Motor Nameplate Data

Mfg.	**Baldor-Reliance**			
Serial No.	**F1903071560**			
CAT No.	**1DXM7542T**			
Spec. #	**06J010X181G2**			
No.	**D10140748**			
Frame	Type	Code	Design	Class
182TC	**C1/D1**	**T2B**	**B**	**F**
Encl.	H.P.	PH.	HZ	RPM
	3	**3**	**60**	**1755**
S.F.	VOLTS		AMPS	
1	**230 / 460**		**8.2 / 4.1**	
DE brg				
ODE brg				

Reducer Nameplate Data

Mfg.	**SEW-Eurodrive**
Serial No.	**87.7803639201.0002.19.50**
Type	**SA97/TAM182**
Mount	**M1A**
Oil Capacity	**7.0 liter**
T_2 =	**35,400**
N_2 =	
I (ratio) =	**262.22**
SF	

Brake Nameplate Data

Mfg.	
Serial No.	
Model No.	
Ft lbs torque	
Voltage	

Test Remarks			
	Reducer vent plug installed	**Y**	N
	Oil level confirmed	**Y**	N
	All lubrication completed	**Y**	N
	Adjustment required	Y	**N**
	Operated with designed controls	**Y**	N
	Video taped operation	Y	**N**
	Control panel verified	**Y**	N
	8 hr run test completed	**Y**	N
	Screen hour meter start / finish	**0.5**	**8.6**

Testing Equipment:

Test Device 1:	Serial No.	Date of Calibration
Fluke 333 Clamp Meter	79610273	7/24/2020
Test Device 2:	Serial No.	Date of Calibration
Fluke 65 Thermometer	95600311	7/13/2020

Voltage Reading Phase to Phase:

L1-L2	L1-L3	L2-L3
478	**489**	**492**

Motor Amp Reading

T1	T2	T3
2.2	**2.2**	**2.2**

Motor Temp. Rise		Reducer Temp. Rise
68	**at start up**	**66**
75	**15 min.**	**73**
80	**30 min**	**81**
84	**1 hr.**	**87**
87	**2 hr.**	**98**
87	**3 hr.**	**102**
87	**4 hr.**	**104**
86	**5 hr.**	**105**
86	**6 hr**	**105**
86	**7 hr.**	**106**
86	**8 hr.**	**107**

TEST REMARKS:

Went over control panel operation with technician, verifying complete operation.
Connected control panel to equipment and verified operation between the two pieces of equipment
Ran equipment for period of 8 hours monitoring amps, voltage, and temperature of both motor and gear box.

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Product Information Packet

DXP INDUSTRIES

IDXM7542T

3HP,1755RPM,3PH,60HZ,182TC,0632M,XPFC,F1

Part Detail

Revision:	E	**Status:**	PRD/A	**Change #:**		**Proprietary:**	No
Type:	AC	**Prod. Type:**	0632M	**Elec. Spec:**	06WGX181	**CD Diagram:**	CD0005
Enclosure:	XPFC	**Mfg Plant:**		**Mech. Spec:**	06J010	**Layout:**	06LYJ010
Frame:	182TC	**Mounting:**	F1	**Poles:**	04	**Created Date:**	12-21-2011
Base:	RG	**Rotation:**	R	**Insulation:**	F	**Eff. Date:**	08-19-2013
Leads:	9#16					**Replaced By:**	
Literature:		**Elec. Diagram:**					

Nameplate NP0890XPSL

NO.		**CC**	010A				
S/N		**TEMP CODE**	T2B				
SPEC.	06J010X181G2	**INV.TYPE**	PWM				
CAT.NO.	IDXM7542T	**C HP FR**	60	**C HP TO**	90		
HP	3	**CT HZ FROM**	6	**CT HZ TO**	60		
VOLTS	230/460	**VT HZ FROM**	6	**VT HZ TO**	60		
AMPS	8.2/4.1	**MAG CUR**	4.2/2.1				
RPM	1755	**MX RPM**	2700				
HZ	60	**PH**	3	**CL**	F	**NOM.EFF.**	89.5
SER.F.	1.00	**DES**	B	**SL HZ**	1.5	**WK2**	0.3
FRAME	182TC	**RATING**	40C AMB-CONT				
	75C RISE						

Parts List

Part Number	Description	Quantity
SA236472	SA 06J010X181G2	1.000 EA
RA223419	RA 06J010X181G2	1.000 EA
36FN3000C01SP	EXFN, PLASTIC, 5.25 OD, .912 ID	1.000 EA
HW3201A05	3/8-16 EYEBOLT	1.000 EA
07CB1000A02	CONDUIT BOX, MODEL 306,EXP. PROOF	1.000 EA
10XN2520A12	O1/4-20X 3/4 HEX HEAD CAP	4.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	4.000 EA
WD1000B17	T&B CX35TN TERMINAL	1.000 EA
11XW1032G06	10-32 X .38, TAPTITE II, HEX WSHR SLTD U	1.000 EA
HW4500A19	1/4-28X1/4 SLOTTED PLUG F/S	2.000 EA
06EP1706A01	SPECIAL FRONT ENDPLATE X06M - TEFC	1.000 EA
10XN3118K20	5/16-18 X 1 1/4 GRADE 5 STEEL ZC PLATED	4.000 EA
HW1001A31	LOCKWASHER 5/16, ZINC PLT.591 OD, .319 I	4.000 EA
HW5100A05	WVY WSHR F/205 & 304 BRGS	1.000 EA
06EP1707A01	STD XP PU EP 182-4TC 206 BRG 306M	1.000 EA
51XN1032A20	10-32 X 1 1/4 HX WS SL SR	2.000 EA
HW4001A01	1/4 HX SOC PIPE PLG (F/S) ALLOY STEEL W/	2.000 EA
60XN1032A07	10-32 X 1/2 TRUSS HEAD, TORX SERRATED ZN	2.000 EA
10XN3118K20	5/16-18 X 1 1/4 GRADE 5 STEEL ZC PLATED	4.000 EA
HW1001A31	LOCKWASHER 5/16, ZINC PLT.591 OD, .319 I	4.000 EA
06FH1003A01	FAN COVER, CAST X-PROOF--MACHINING	1.000 EA
51XN1032A14	10-32 X 0.875 HX WS SL SR	4.000 EA
07CB1500A01	CONDUIT BOX LID MACH	1.000 EA
10XN2520A16	1/4-20 X 1 HEX HEAD CAP SCR, ZINC PLATED	4.000 EA

Parts List (continued)

Part Number	Description	Quantity
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	4.000 EA
HW2501E16	3KEY, 1/4 SQ X 1.750	1.000 EA
HA7000A02	KEY RETAINER RING, 1 1/8 DIA, 1 3/8 DIA	1.000 EA
LB1081	ALUM XP CAUTION LABEL	1.000 EA
LB1115	LABEL,LIFTING DEVICE	1.000 EA
85XU0407S04	4X1/4 U DRIVE PIN STAINLESS	6.000 EA
MJ1000A75	GREASE, POLYREX EM EXXON (USe 4824-15A)	0.050 LB
51XB1214A16	12-14X1.00 HXWSSLD SERTYB	1.000 EA
MG1025G29	MUNSELL 4.5Y 5.3/0.7 DARK CHARCOAL GREY	0.028 GA
MG1025Z20	ACTIVATOR WILKOFAST 060.32	0.010 GA
LB1119	WARNING LABEL	1.000 EA
LB1125C01	STD (STOCK) CARTON LABEL BALDOR WITH FLA	1.000 EA
LC0145B01	CONNECTION LABEL	1.000 EA
NP0890XPSL	SS XP INV UL CSA CC CL-I GP-D	1.000 EA
G0PA1000	SPCL PACKAGING	1.000 EA
LB1506	LABEL "AMERICAN MADE" 1.50 X 1.00	1.000 EA
MN416A01	TAG-INSTAL-MAINT no wire. (100/bx) 8/12	1.000 EA

AC Induction Motor Performance Data

Record # 36483

Typical performance - not guaranteed values

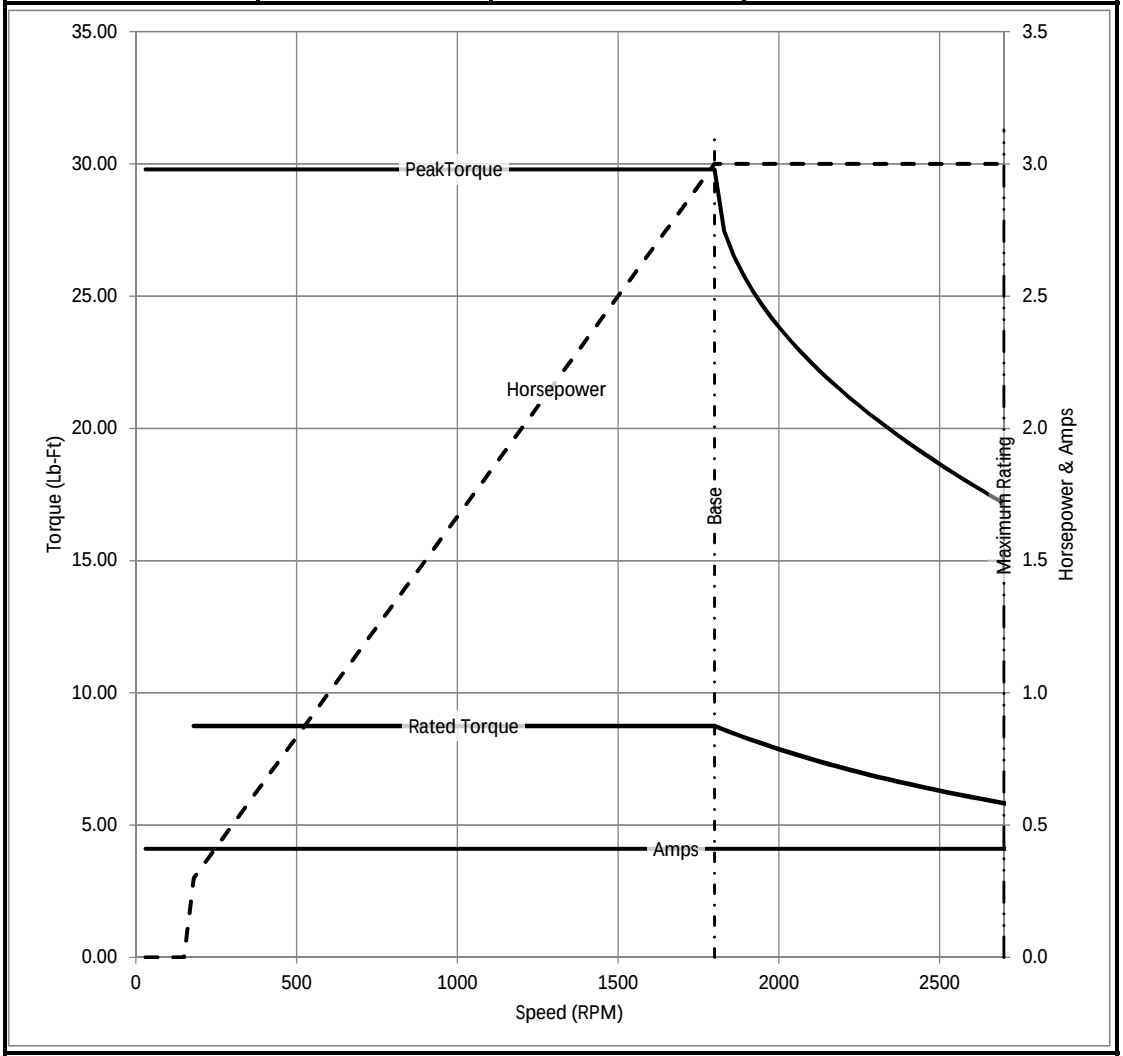
Winding: 06WGX181	**Type:** 0632M	**Enclosure:** TEBC

Nameplate Data				General Characteristics at 460 V, 60 Hz: High Volt Connection	
Rated Output (HP)	3			Full Load Torque	9.06 LB-FT
Volts	230/460			Start Configuration	DOL
Full Load Amps	8.2/4.1			Break Down Torque	33.1 LB-FT
R.P.M.	1755			Pull-Up Torque	18.2 LB-FT
Hz	60	Phase	3	Locked-rotor Torque	20.4 LB-FT
NEMA Design Code	B	KVA Code	J	Starting Current	29.8 Amps
Service Factor	1			No-load Current	2.14 Amps
NEMA Nom. Eff.	89.5	P.F.	77	Line-line Res. @ 25°C.	3.94 Ohms
Rating - Duty	40C AMB-CONT			Temp. Rise @ Rated Load	35°C
S.F. Amps				Temp. Rise @ S.F. Load	

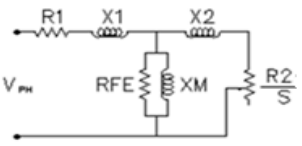
Load Characteristics at 460 Volts, 60 Hz, 3 HP

% of Rated Load	25	50	75	100	125	150	S.F.
Power Factor	38	58	70	77	81	83	
Efficiency	83.2	88.3	89.8	89.7	89.1	87.7	
Speed	1790	1779	1769	1757	1744	1730	
Line Amperes	2.34	2.79	3.39	4.1	4.91	5.86	

Catalog	IDXM7542T	NP VOLTS	230/460	ENCLOSURE	XPFC	WYE CONN EQ CKT OHMS PER PHASE (BASE RATING, 20C)			
FRAME	182TC	NP AMPS	8.2/4.1	Base Volts	460	R1	1.930	X1	5.490
HP	3 HP	DUTY	Cont	Base AMPS	4.1	R2	1.370	X2	4.581
BASE SPEED	1800	MAX SAFE RPM	2700	Slip Hz	1.43			XM	119.333
PHASE/HZ	3/60	AMB^{0}C/INSUL	40/F	WK^2 (lb-ft^2)	0.298				



Remarks: Calculated Data



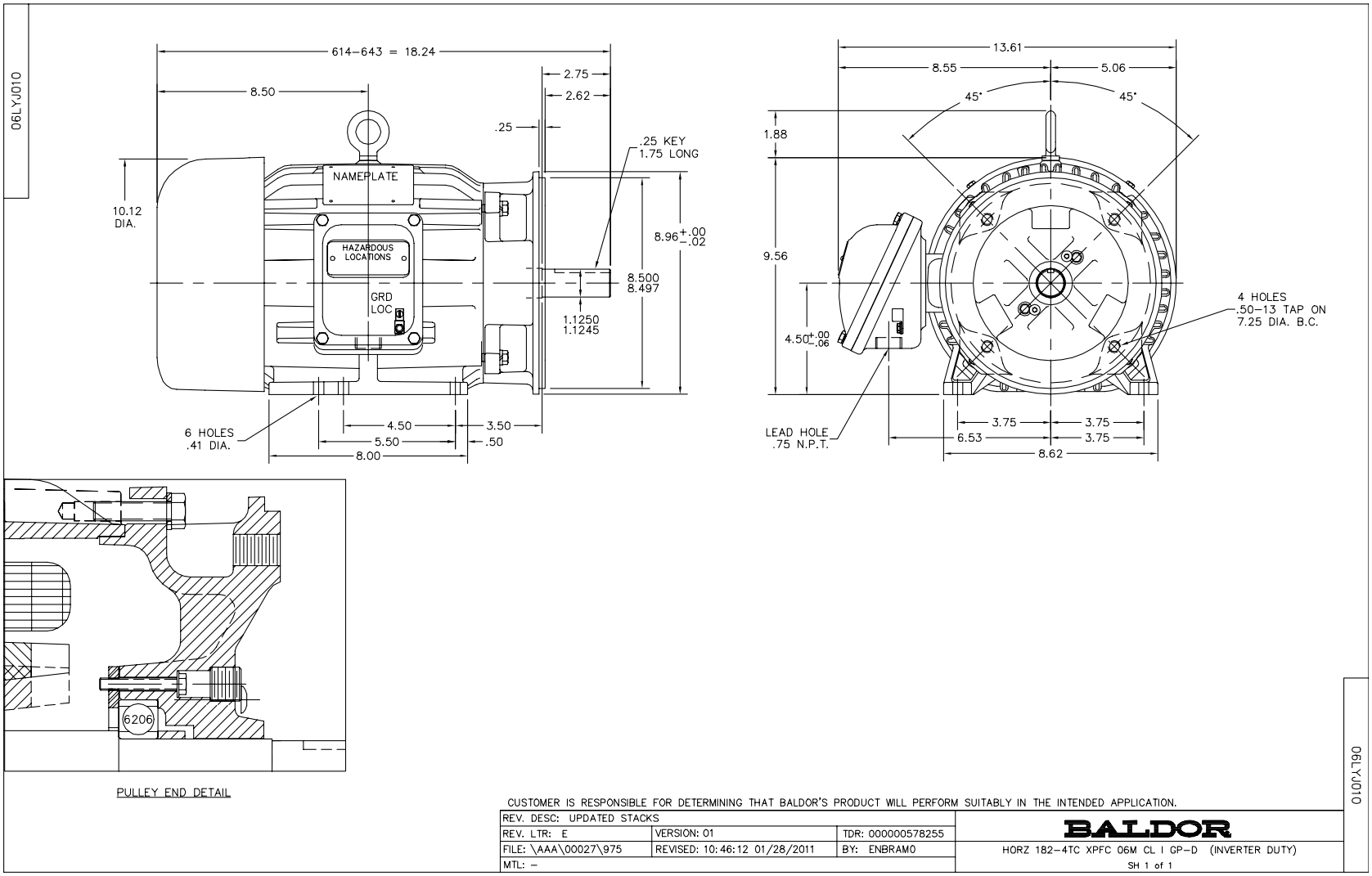
BALDOR
A MEMBER OF THE ABB GROUP

DR BY ENR
CK BY
APP BY ENR
DATE 2/27/2013

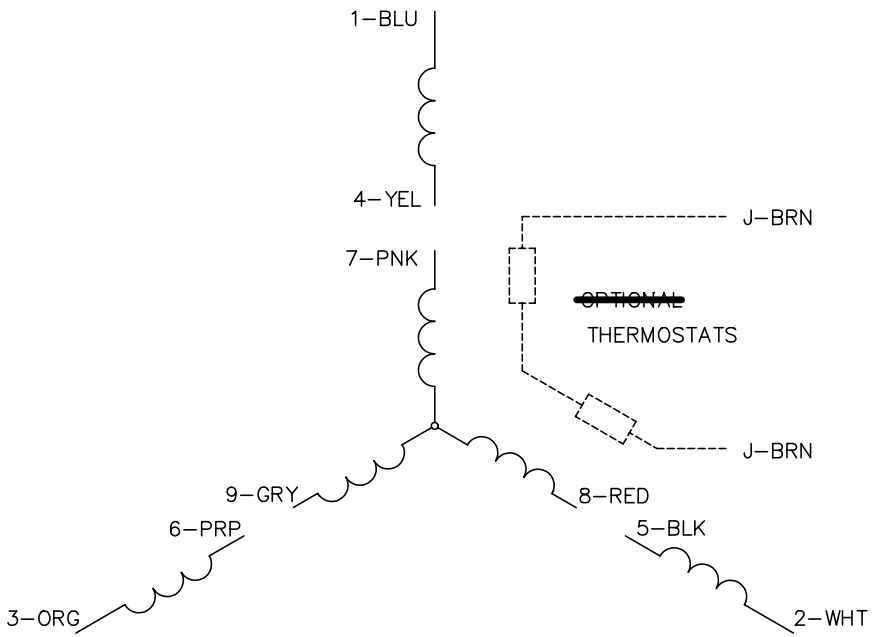
A-C MOTOR
PERFORMANCE CURVES

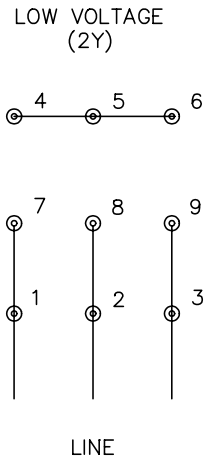
06J010X181G2

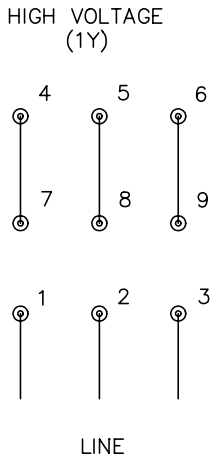
ISSUE DATE 2/27/2013



CD0005







NOTES:

1. INTERCHANGE ANY TWO LINE LEADS TO REVERSE ROTATION.
2. OPTIONAL THERMOSTATS ARE PROVIDED WHEN SPECIFIED.
3. ACTUAL NUMBER OF INTERNAL PARALLEL CIRCUITS MAY BE A MULTIPLE OF THOSE SHOWN ABOVE.
4. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

CD0005

REV. DESC: REVISE TO SHOW OPTIONAL COLORS			BALDOR ELECTRIC Co.
REV. LTR: E	BY: JLP	REVISED: 01/19/99 10:15	TDR: 0171435
CD0005		FILE: AAA00005140	MDL: –
		MTL: –	3PH, DV, 9 LEADS

S..AD..

SA..AD..

General Information

Introduction

The SEW-Eurodrive Helical-Worm Gear Units are designed for continuous duty under difficult operating conditions. Only materials of the highest quality are used in the manufacture of the units. These units have the following standard construction features:

Gearcase and flanges of high strength gray cast iron SAE Class 30.

Double seals on output shafts with additional inner seal made of Viton®.

Captured keys on input and output shafts.

Foot mounted, flange mounted, flange mounted with hollowshaft, or shaft mounted.

Efficiency

The efficiency of the gear units is mostly determined by the gearing and bearing friction, and ranges up to approximately 92%. However, due to the sliding friction of the worm gearing, the actual efficiency depends upon the gear ratio of the worm stage and the input speed.

The helical-worm gear units have an input helical gear stage which reduces the ratio of the worm gear stage and as a result improves the overall efficiency as compared to a gear unit with a worm gear only.

The rated efficiencies are achieved if the gear unit has been correctly run in, has achieved its nominal operating temperature, has the proper lubrication, and is operating within its torque rating.

Backdriving

With respect to torque driving back from the output shaft, the backdriving efficiency 2 $\frac{1}{}$ is far less favorable than the forward efficiency and may need to be taken into account.

The low backdriving efficiency may provide some braking effect in certain instances but since the actual efficiency is dependent on many factors including ambient temperature and worm speed, we request you submit full details to our engineering department if this braking effect is required.

Since the SEW-Eurodrive Helical-Worm gear units have fairly high efficiency, they can not be considered as self-locking, and should not be used if the self-locking effect is required.

Input Power, Output Torque, and Speed

The details on power, torque, and speed given in the selection tables always refer to the mounting position B3 or similar mounting position with standard features, standard ambient conditions, and standard lubricants. Depending upon ratio, increased output power ratings may be achieved through the use of special lubricants. Please consult your SEW-Eurodrive representative.

The output speeds have been rounded up or down. The actual output speed may vary slightly due to the motor frame size, the loading, or the supply voltage.

Design Variations

In addition to the versions shown in the accompanying pages, the Helical-Worm Gear Units are also available with the combination of double shaft, double flange or flange opposite shaft mount.

Additional features available for the Helical-Worm Gear units are:

Adapters for IEC or NEMA C-Face motors.

Motor mounting platforms and scoops.

Adapters for torque limiting couplings.

Corrosion protection.

Torque arm attachment.

Shrink disc shaft mounting.

Please contact your SEW-Eurodrive representative for additional information.

Abbreviations

The following abbreviations are used in the selection tables:

f_B	Service Factor
F_{Ra}	Permissible output overhung load (lb) at the midpoint of the output shaft extension
F_{Re}	Permissible input overhung load (lb) at the midpoint of the input shaft extension
i	Gear unit ratio
i_w	Worm gear stage ratio
	Efficiency
n_a	Output speed in rpm
n_e	Input speed in rpm
P_a	Rated output power (Hp)
P_e	Calculated power input into the gear unit (Hp) P_e is calculated from $T_{a\,max}$ by taking into account the gear units' efficiency under standard operating conditions. For calculated P_e less than .2Hp, a dash (—) is shown in the respective selection tables since the actual values are subject to large variations.
P_n	Motor rated power (HP)
T_a	Output torque (lb-in.) with reference to the driving motor
$T_{a\,max}$	Maximum permissible output torque (lb-in.) at $f_B = 1.0$

Dimension Page Notes

The dimension sheets are valid for standard units with various basic features. In particular, accessories such as platforms, scoops, etc. will alter the basic dimensions. Please refer to the respective accessory dimension pages for additional dimensions.

Certified dimension sheets are available from your SEW-Eurodrive Assembly Center.

Viton® is a registered trademark of DuPont Dow Elastomers

Service Factoring

Unit Selection

In order to select the most suitable gear unit it is essential that a thorough knowledge of the characteristics of the driven machine are known. The gear units are normally designed for constant torque load and only a few starts/stops. If these conditions do not exist, it is necessary to determine a service factor, $f_{B\ TOTAL}$, where $f_{B\ TOTAL} = f_B \times f_{B1} \times f_{B2}$

- f_B Is determined by the start/stop frequency, Load Class, and the daily operating time.
- f_{B1} Is determined by the ambient temperature.
- f_{B2} Is determined by the cyclic duration factor.

f_B, f_{B1}, f_{B2} service factors are shown in the diagrams that follow.
For gearmotors, the appropriate service factor taken from the diagram is then compared with the service factor given with each speed/power combination listed in the gearmotor selection tables. To ensure a long, trouble free service life it is essential that the unit selected has a service factor equal to, or greater than, that determined from the diagram.

Load Classification

I = Uniform load. Permissible inertia acceleration factor 0.2

II = Moderate shock load. Permissible inertia acceleration factor 3.0

III= Heavy shock load. Permissible inertia acceleration factor 10

For inertia acceleration factor > 10, please contact your nearest SEW-Eurodrive representative.

Inertia acceleration factor = $\frac{J_L}{J_m}$

Where: J_L = Reflected Load Inertia
J_m = Motor Inertia

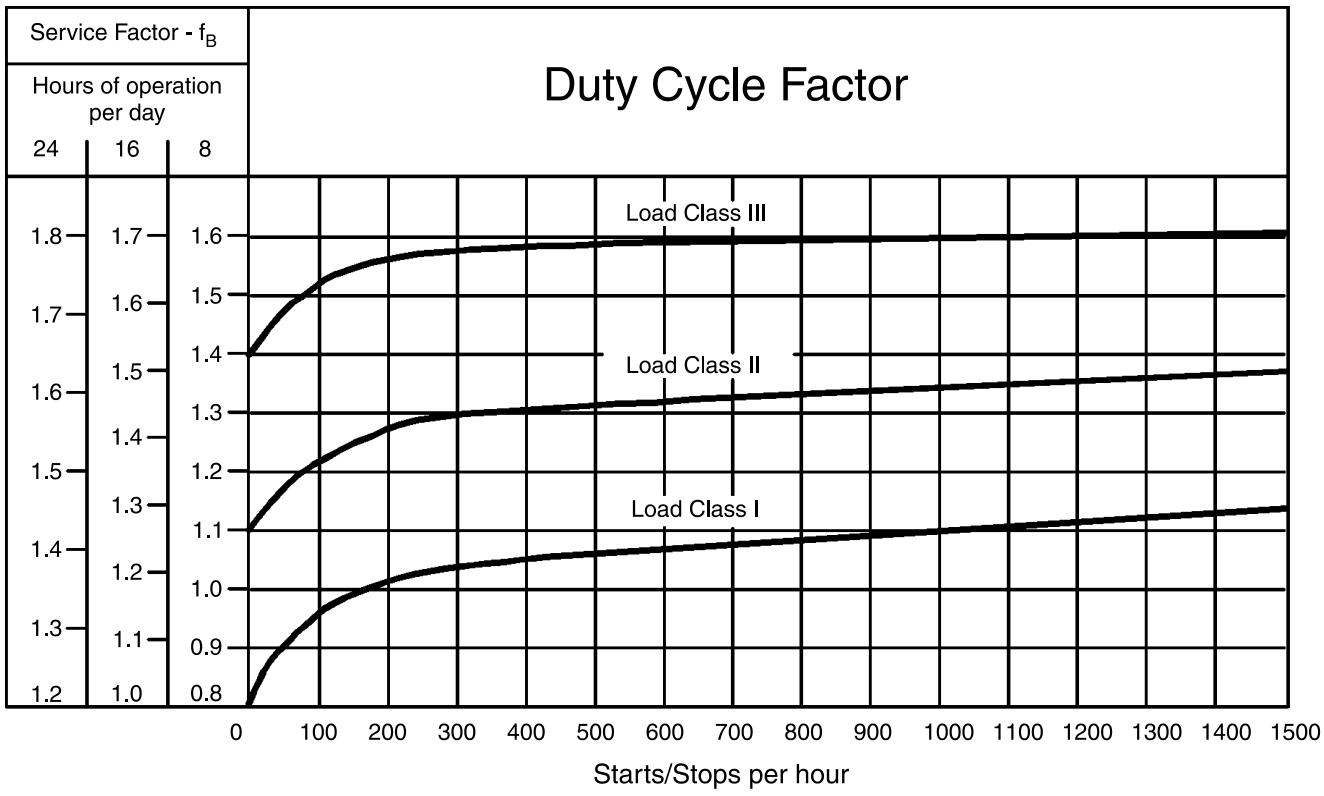
All external load inertias, J, must be reflected back to the input side of the gear unit.

Example: $J_L \quad J \quad \frac{1}{(Gear\ Ratio)^2}$

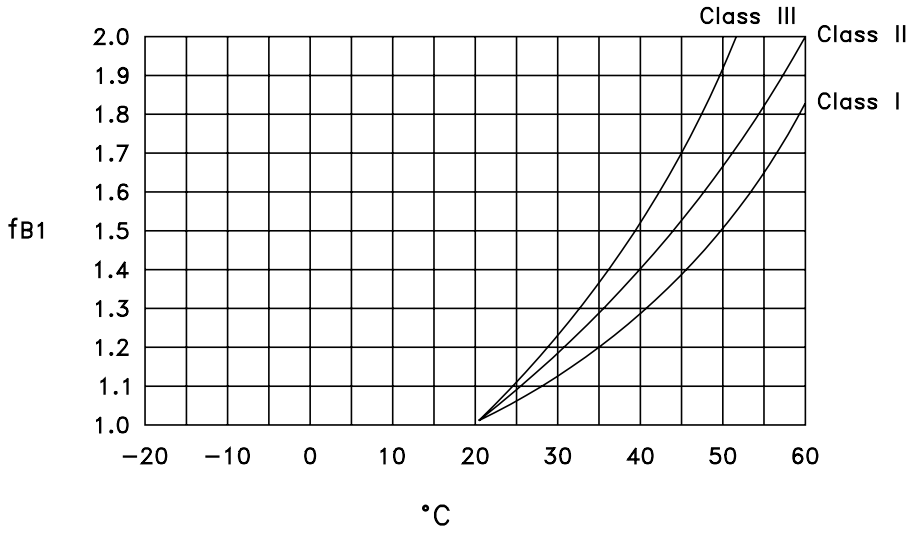
Included in the number of starts and stops per hour must be all regenerative brake actions and the speed changes from high to low speed as experienced with multi-speed motors.
Example: Load Class I with 200 starts and stops per hour and operating time of 24 hours per day gives $f_B = 1.36$.

AGMA

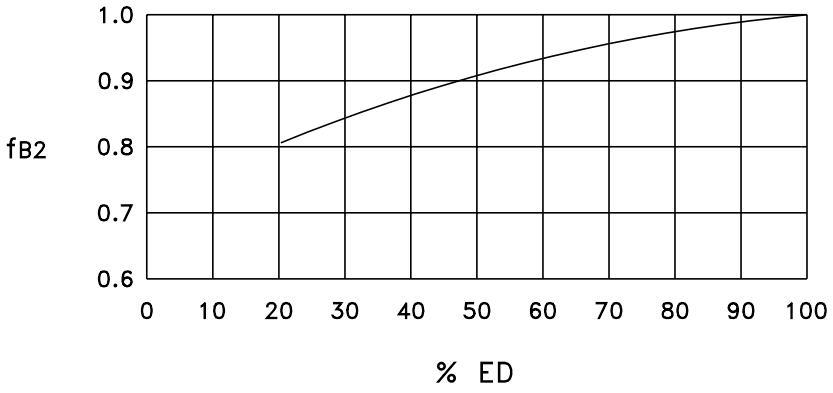
For Service Factors using AGMA criteria, please refer to the guidelines on page 4.



Service Factor for Increased Ambient Temperatures

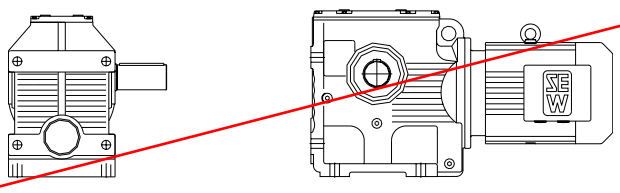


Service Factor for Intermittent Duty



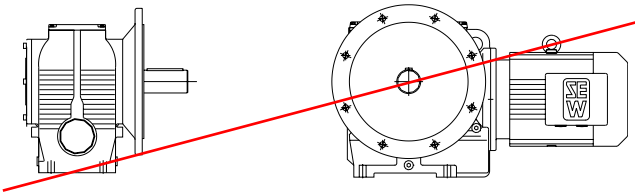
$$\%ED \quad \frac{\text{Running Time in Minutes}}{\text{60 Minutes}} \quad 100$$

Mounting Options



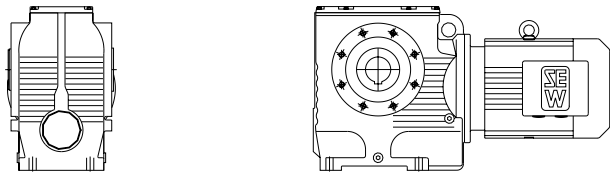
S

Solid shaft
Foot mount



SF

Solid shaft
Flange mount (D & B5 style flange with through holes)

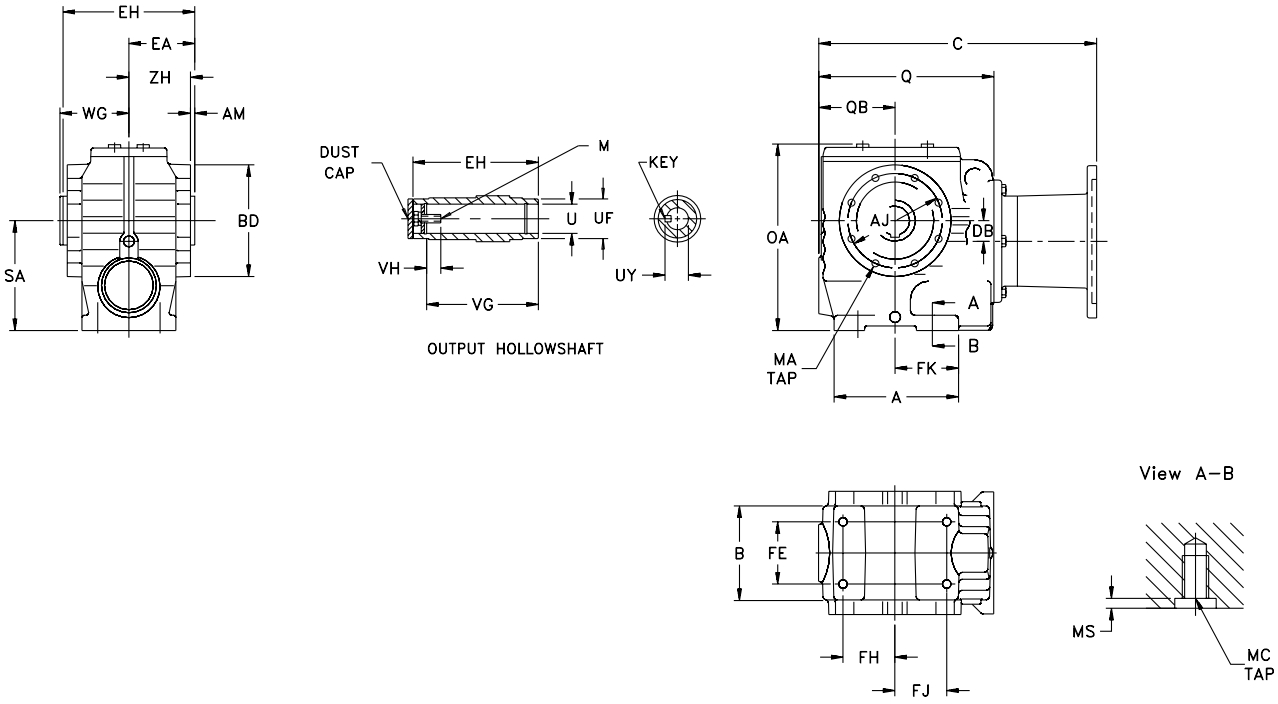


SA

Hollowshaft with key
Shaft mount

S97						AM182			AM184			AM213			AM215		
Ratio i	Output Speed n_a rpm	Input Power P_{emax} HP	Output Torque T_{amax} lb-in	Stages Pri.	Stages Sec.	Input Power P_e HP	Output Torque T_a lb-in	Output OHL F_{Ra} lb	Input Power P_e HP	Output Torque T_a lb-in	Output OHL F_{Ra} lb	Input Power P_e HP	Output Torque T_a lb-in	Output OHL F_{Ra} lb	Input Power P_e HP	Output Torque T_a lb-in	Output OHL F_{Ra} lb
286.40	6.10	4.79	35400	2	-	3	20800	8060	4.79	35400	7470	-	-	-	-	-	-
262.22	6.70	5.19	35400	2	-	3	19000	8100	5	33200	7580	-	-	-	-	-	-
231.67	7.50	5.85	35000	2	-	3	16800	8170	5	29400	7760	5.85	35000	7490	5.85	35000	7490
196.52	8.90	6.65	34000	2	-	3	14200	8210	5	25000	7920	6.65	34000	7540	6.65	34000	7540
180.95	9.70	7.05	33400	2	-	3	13000	8240	5	23000	7990	7.05	33400	7580	7.05	33400	7580
161.74	11	7.58	32300	2	-	3	11600	8260	5	20500	8060	7.50	31900	7650	7.58	32300	7630
145.60	12	8.11	31400	2	-	3	10400	8280	5	18500	8120	7.50	28800	7790	8.11	31400	7670
131.85	13	8.65	30400	2	-	3	9290	8300	5	16600	8170	7.50	26000	7880	8.65	30400	7720
116.92	15	9.44	29600	2	-	3	8050	8300	5	14700	8210	7.50	23100	7990	9.44	29600	7740
105.71	17	9.98	28400	2	-	3	7260	8330	5	13300	8240	7.50	20800	8060	10	28400	7790
89.60	20	11.04	26700	2	-	3	5970	8330	5	11200	8260	7.50	17600	8150	10	24100	7940
80.85	22	11.31	28900	2	-	3	7040	8330	5	12200	8260	-	-	-	-	-	-
78.26	22	11.97	25400	2	-	-	-	-	-	-	-	7.50	15300	8190	10	21000	8060
71.43	25	12.90	29200	2	-	3	6150	8330	5	10800	8280	7.50	16600	8170	10	22400	8010
65.45	27	13.03	23500	2	-	-	-	-	-	-	-	7.50	12700	8240	10	17500	8150
60.59	29	15.16	29200	2	-	3	5180	8330	5	9120	8300	7.50	14100	8210	10	19000	8100
55.79	31	16.36	29200	2	-	3	4730	8330	5	8320	8300	7.50	12900	8240	10	17500	8150
49.87	35	18.35	29200	2	-	3	4160	8350	5	7430	8300	7.50	11500	8260	10	15700	8190
44.89	39	20.35	29200	2	-	3	3720	8350	5	6640	8330	7.50	10400	8280	10	14100	8210
40.65	43	21.81	28600	2	-	3	3320	8350	5	5970	8330	7.50	9380	8300	10	12700	8080
36.05	49	23.67	27500	2	-	3	2880	8350	5	5270	8330	7.50	8230	8100	10	11200	7880
32.60	54	25.27	26400	2	-	3	2570	8280	5	4730	8120	7.50	7430	7900	10	10200	7700
26.39	66	26.60	23000	2	-	3	2300	7700	5	4120	7490	7.50	6370	7250	10	8580	6980
23.59	74	29.26	23000	2	-	3	2040	7470	5	3630	7290	7.50	5660	7070	10	7700	6820
21.23	82	31.92	22700	2	-	3	1810	7270	5	3270	7090	7.50	5090	6890	10	6900	6680
19.23	91	34.58	22100	2	-	3	1630	7070	5	2920	6910	7.50	4600	6730	10	6240	6530
17.05	103	37.24	21200	2	-	3	1420	6840	5	2570	6710	7.50	4030	6530	10	5490	6370
15.42	114	39.90	20400	2	-	3	1260	6640	5	2300	6530	7.50	3630	6370	10	4960	6210
13.07	134	43.89	19200	2	-	3	1040	6350	5	1950	6230	7.50	3050	6100	10	4160	5990
11.41	153	46.55	17700	2	-	-	-	-	-	-	-	7.50	2660	5900	10	3630	5780
9.55	183	46.55	14800	2	-	-	-	-	-	-	-	7.50	2170	5630	10	3010	5540
8.26	212	46.55	12700	2	-	-	-	-	-	-	-	7.50	1860	5420	10	2570	5330

Please consult your SEW-Eurodrive Assembly Center for additional speed (RPM) selections and dimension pages not listed.



Gearcase

Model	A	AJ	AM	B	BD	DB	EA	FE	FH	FJ	FK	MA	MC	MS	OA
SA87	10.24	7.09	0.20	7.64	8.46	1.48	4.92	4.65	4.53	4.33	4.92	M16 x 1.02	M16 x 1.26	0.24	14.49
	260	180	5	194	215	37.5	125	118	115	110	125	M16 x 26	M16 x 32	6	368
SA97	11.85	8.66	0.20	9.29	10.24	2.05	5.71	6.30	5.31	4.45	5.51	M16 x 1.02	M20 x 1.42	0.24	17.91
	301	220	5	236	260	52	145	160	135	113	140	M16 x 26	M20 x 36	6	455

Gearcase

Model	Q	QB	SA	WG	ZH
SA87	13.39	5.91	8.86	5.04	4.72
	340	150	225	128	120
SA97	16.54	7.09	11.02	5.87	5.51
	420	180	280	149	140

Output Shaft Inch Series/*Optional Metric Series* **For solid shaft design, see page 544.**

EH	UF	U	UY	VG	VH	Key	M
9.84	3.74	2.375 $^{+.001}_{-0}$	2.65	8.66	1.37	5/8 5/8 3 1/4	3/4 10 2
250	*95*	*70* $^{+.030}_{-0}$	*74.9*	*220*	*34*	*20 x 12 x 110*	*M20 x 50*
11.42	4.72	2.750 $^{+.001}_{-0}$	3.03	10.23	1.24	5/8 5/8 3 1/4	3/4 10 2
290	*120*	*90* $^{+.035}_{-0}$	*95.4*	*255*	*41*	*25 x 14 x 140*	*M24 x 60*

Motor Compatibility - NEMA

Model		NEMA LP 143TC 145TC	182TC 184TC	213TC 215TC	254TC 256TC	284TC 286TC
SA87	C	18.07	20.67	20.67	23.78	—
		459	525	525	604	—
SA97	C	—	23.62	23.62	26.73	28.78
		—	600	600	679	731

Motor Compatibility - IEC

Model		IEC LP 80	90	100	112	132ML	132S/M	160	180
SA87	C	17.20	17.80	19.65	19.65	23.19	20.67	24.37	—
		437	452	499	499	589	525	619	—
SA97	C	—	—	22.60	22.60	26.14	23.62	27.32	28.74
		—	—	574	574	664	600	694	730

Dimensions are inch / *mm*

Dimension C is to motor mounting surface

For the selected LP adapter size the pinion bore must be available in the desired gear ratio for the reducer. Please see the compatibility tables beginning on page 496.

Refer to page 556 for standard NEMA C-Face dimensions.

See page 543 for available output shaft sizes.

6.3 Anchor Bolt Data

Attached are page(s) from the 2014 Hilti North American Product Tech Guide. For complete details on this product, including data development, product specifications, general suitability, installation, corrosion, and spacing and edge distance guidelines, please refer to the Technical Guide, or contact Hilti.

Hilti, Inc.
5400 South 122nd East Avenue
Tulsa, OK 74146

1-800-879-8000
www.hilti.com

3.2.3 HIT-HY 200 Adhesive Anchoring System

HIT-HY 200-A

HIT-HY 200-R

Listings/Approvals

ICC-ES (International code council)
ESR-3187

Independent code evaluation

IBC®/IRC® 2009
IBC®/IRC® 2006
IBC®/IRC® 2003

LEED® Credit 4.1-Low Emitting Materials

The Leadership in Energy and Environmental Design (LEED®) Green Building Rating system™ is the nationally accepted benchmark for the design, construction and operation of high performance green buildings.

3.2.3.1 Product description

Hilti HIT-HY 200 adhesive is an injectable, two-component, hybrid adhesive. The two components are separated by means of a dual-cylinder foil pack attached to a manifold. The two components combine and react when dispensed through a static mixing nozzle attached to the manifold.

Hilti HIT-HY 200 adhesive is available in two options, Hilti HIT-HY 200-A, and Hilti HIT-HY 200-R. Both options utilize the same technical data. Hilti HIT-HY 200-A will have shorter working times and curing times than Hilti HIT-HY 200-R. The packaging for each is different which helps the user distinguish between the two adhesives.

Hilti HIT-HY 200 adhesive comes with three hole cleaning options:

- The traditional hole cleaning method uses steel wire brushes and compressed air
- The self-cleaning method uses the Hilti TE-CD or TE-YD Hollow Drill Bits in conjunction with a Hilti vacuum to remove the dust as you drill. The hole is clean and ready for anchor installation.
- The no-cleaning method requires the use of Hilti HIT-Z and HIT-Z-R threaded anchor rods. If the base material temperature is less than 41° F (5° C) or if diamond core drilling is used, then the drilled hole must be cleaned.

Elements that are suitable for use with this system are threaded steel rods, Hilti HIS-(R)N steel internally threaded inserts, steel reinforcing bars and Hilti HIT-Z and HIT-Z-R threaded rods.

Product features

- Two great products with equal performance data
- User can select product gel time suitability based on temperature of the base material and jobsite time requirements
- No hole cleaning requirement when installed SafeSet™ hollow drill bit technology
- No hole cleaning requirement when installing HIT-Z rods in dry conditions
- ICC-ES approved for cracked concrete and seismic service
- May be installed in diamond cored holes when addition cleaning steps are employed

Guide specifications

Injectable adhesive shall be used for installation of threaded rods (rebar) (inserts) into existing concrete. Adhesive shall be furnished in containers which keep component A and component B separate. Containers shall be designed to accept static mixing nozzle which thoroughly blends component A and component B and allows injection of the mixed adhesive directly into the drilled hole. Only injection tools and static mixing nozzles supplied by the manufacturer may be used. Injection adhesive shall be formulated to include the resin and hardener to provide optimal curing speed, high strength and stiffness. Injection adhesive anchor system shall be Hilti HIT-HY 200 installed using Hilti Safe Set™ Technology. HIT-HY 200 System shall be supplied by Hilti.

3.2.3.3 Hilti HIT-HY 200-AR Adhesive with Hilti HAS threaded rod

Figure 9 -HAS threaded rod installation conditions

Permissible concrete conditions		Permissible drilling method	
Uncracked concrete	Dry concrete	Hammer drilling with carbide tipped drill bit	
Cracked concrete	Water saturated concrete	Hilti TE-CD or TE-YD Hollow Drill Bit	

Table 38 - HAS threaded rod specifications

Setting information		Symbol	Units	Nominal rod diameter						
				3/8	1/2	5/8	3/4	7/8	1	1-1/4
Nominal bit diameter		d_o	in.	7/16	9/16	3/4	7/8	1	1-1/8	1-3/8
Standard effective embedment		$h_{ef,std}$	in.	3-3/8	4-1/2	5-5/8	6-3/4	7-7/8	9	11-1/4
			(mm)	(86)	(114)	(143)	(171)	(200)	(229)	(286)
Effective embedment	minimum	$h_{ef,min}$	in.	2-3/8	2-3/4	3-1/8	3-1/2	3-1/2	4	5
			(mm)	(60)	(70)	(79)	(89)	(89)	(102)	(127)
	maximum	$h_{ef,max}$	in.	7-1/2	10	12-1/2	15	17-1/2	20	25
			(mm)	(191)	(254)	(318)	(381)	(445)	(508)	(635)
Fixture hole diameter	through-set		in.	1/2	5/8	13/16[1]	15/16[1]	1-1/8[1]	1-1/4[1]	1-1/2[1]
Fixture hole diameter	preset		in.	7/16	9/16	11/16	13/16	15/16	1-1/8	1-3/8
Installation torque		T_{inst}	ft-lb	15	30	60	100	125	150	200
			(Nm)	(20)	(40)	(80)	(136)	(169)	(203)	(271)

1 Install using (2) washers. See Figure 11.

Figure 10 - HAS threaded rods

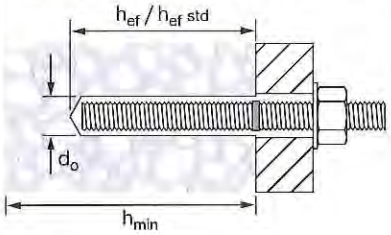


Figure 11 - Installation with (2) washers

HAS-E carbon steel threaded rod specifications

Carbon steel rods conform to ISO 898 class 5.8 with a minimum tensile strength of 72.5 ksi (500 MPa) and a minimum yield strength of 58 ksi (400 MPa).

HAS-E nuts conform to SAE J995 Grade 5.

HAS-E washers conform to ASTM F884, HV, and ANSI B18.22.1 Type A Plain.

HAS-E rod, nut and washer has an electroplated zinc coating conforming to ASTM B633, SC 1.

HAS Super high strength threaded rod specifications

Carbon steel rods manufactured from ASTM A193, Grade B7, with a minimum tensile strength of 125 ksi (862 MPa) and a minimum yield strength of 105 ksi (724 MPa).

HAS Super nuts conform to SAE J995 Grade 5.

HAS Super washers conform to ASTM F884, HV, and ANSI B18.22.1 Type A Plain.

HAS Super rods, nuts and washers, except the 7/8-in. diameter, have an electroplated zinc coating conforming to ASTM B633, SC1.

7/8-in. HAS Super rods, nuts and washers are hot-dip galvanized in accordance with ASTM A153.

HAS-R 304 stainless steel

3/8-, 1/2- and 5/8-in. rods manufactured from AISI Type 304 stainless steel with a minimum tensile strength of 100 ksi (689 MPa) and a minimum yield strength of 65 ksi (448 MPa).

3/4-, 1- and 1 1/4-in. rods are manufactured from AISI Type 304 stainless steel conforming to ASTM F593 Condition CW or cold worked.

AISI Type 304 stainless steel nuts conform to ASTM F594.

AISI Type 304 stainless steel washers conform to ASTM A240 and ANSI B18.22.1 Type A Plain.

HAS-R 316 stainless steel

3/8-, 1/2- and 5/8-in. rods manufactured from AISI Type 316 stainless steel with a minimum tensile strength of 100 ksi (689 MPa) and a minimum yield strength of 65 ksi (448 MPa).

3/4-, 1- and 1 1/4-in. rods are manufactured from AISI Type 316 stainless steel conforming to ASTM F593 Condition CW.

AISI Type 316 stainless steel nuts conform to ASTM F594.

AISI Type 316 stainless steel washers conform to ASTM A240 and ANSI B18.22.1 Type A Plain.

3.2.3 HIT-HY 200 Adhesive Anchoring System

Table 39 - Hilti HIT-HY 200 adhesive design strength with concrete / bond failure for threaded rod in uncracked concrete [1,2,3,4,5,6,7,8]

Nominal anchor diameter in.	Effective embedment in. (mm)	Tension — ΦN_n or N_r				Shear — ΦV_n or V_r			
		f'_c = 2500 psi (17.2 Mpa) lb (kN)	f'_c = 3000 psi (20.7 Mpa) lb (kN)	f'_c = 4000 psi (27.6 Mpa) lb (kN)	f'_c = 6000 psi (41.4 Mpa) lb (kN)	f'_c = 2500 psi (17.2 Mpa) lb (kN)	f'_c = 3000 psi (20.7 Mpa) lb (kN)	f'_c = 4000 psi (27.6 Mpa) lb (kN)	f'_c = 6000 psi (41.4 Mpa) lb (kN)
3/8	2-3/8 (60)	2,855 (12.7)	3,125 (13.9)	3,415 (15.2)	3,620 (16.1)	3,075 (13.7)	3,370 (15.0)	3,680 (16.4)	3,900 (17.3)
	3-3/8 (86)	4,835 (21.5)	4,855 (21.6)	4,855 (21.6)	5,150 (22.9)	10,415 (46.3)	10,460 (46.5)	10,460 (46.5)	11,085 (49.3)
	4-1/2 (114)	6,475 (28.8)	6,475 (28.8)	6,475 (28.8)	6,865 (30.5)	13,945 (62.0)	13,945 (62.0)	13,945 (62.0)	14,785 (65.8)
	7-1/2 (191)	10,790 (48.0)	10,790 (48.0)	10,790 (48.0)	11,440 (50.9)	23,245 (103.4)	23,245 (103.4)	23,245 (103.4)	24,640 (109.6)
1/2	2-3/4 (70)	3,555 (15.8)	3,895 (17.3)	4,500 (20.0)	5,510 (24.5)	7,660 (34.1)	8,395 (37.3)	9,690 (43.1)	11,870 (52.8)
	4-1/2 (114)	7,445 (33.1)	8,155 (36.3)	8,635 (38.4)	9,150 (40.7)	16,035 (71.3)	17,570 (78.2)	18,595 (82.7)	19,710 (87.7)
	6 (152)	11,465 (51.0)	11,510 (51.2)	11,510 (51.2)	12,200 (54.3)	24,690 (109.8)	24,795 (110.3)	24,795 (110.3)	26,280 (116.9)
	10 (254)	19,185 (85.3)	19,185 (85.3)	19,185 (85.3)	20,335 (90.5)	41,320 (183.8)	41,320 (183.8)	41,320 (183.8)	43,800 (194.8)
5/8	3-1/8 (79)	4,310 (19.2)	4,720 (21.0)	5,450 (24.2)	6,675 (29.7)	9,280 (41.3)	10,165 (45.2)	11,740 (52.2)	14,380 (64.0)
	5-5/8 (143)	10,405 (46.3)	11,400 (50.7)	13,165 (58.6)	14,300 (63.6)	22,415 (99.7)	24,550 (109.2)	28,350 (126.1)	30,795 (137.0)
	7-1/2 (191)	16,020 (71.3)	17,550 (78.1)	17,985 (80.0)	19,065 (84.8)	34,505 (153.5)	37,800 (168.1)	38,740 (172.3)	41,065 (182.7)
	12-1/2 (318)	29,975 (133.3)	29,975 (133.3)	29,975 (133.3)	31,775 (141.3)	64,565 (287.2)	64,565 (287.2)	64,565 (287.2)	68,440 (304.4)
3/4	3-1/2 (89)	5,105 (22.7)	5,595 (24.9)	6,460 (28.7)	7,910 (35.2)	11,000 (48.9)	12,050 (53.6)	13,915 (61.9)	17,040 (75.8)
	6-3/4 (171)	13,680 (60.9)	14,985 (66.7)	17,305 (77.0)	20,590 (91.6)	29,460 (131.0)	32,275 (143.6)	37,265 (165.8)	44,350 (197.3)
	9 (229)	21,060 (93.7)	23,070 (102.6)	25,900 (115.2)	27,455 (122.1)	45,360 (201.8)	49,690 (221.0)	55,785 (248.1)	59,130 (263.0)
	15 (381)	43,165 (192.0)	43,165 (192.0)	43,165 (192.0)	45,755 (203.5)	92,975 (413.6)	92,975 (413.6)	92,975 (413.6)	98,550 (438.4)
7/8	3-1/2 (89)	5,105 (22.7)	5,595 (24.9)	6,460 (28.7)	7,910 (35.2)	11,000 (48.9)	12,050 (53.6)	13,915 (61.9)	17,040 (75.8)
	7-7/8 (200)	17,235 (76.7)	18,885 (84.0)	21,805 (97.0)	26,705 (118.8)	37,125 (165.1)	40,670 (180.9)	46,960 (208.9)	57,515 (255.8)
	10-1/2 (267)	26,540 (118.1)	29,070 (129.3)	33,570 (149.3)	37,365 (166.2)	57,160 (254.3)	62,615 (278.5)	72,300 (321.6)	80,485 (358.0)
	17-1/2 (445)	57,100 (254.0)	58,755 (261.4)	58,755 (261.4)	62,280 (277.0)	122,990 (547.1)	126,545 (562.9)	126,545 (562.9)	134,140 (596.7)
1	4 (102)	6,240 (27.8)	6,835 (30.4)	7,895 (35.1)	9,665 (43.0)	13,440 (59.8)	14,725 (65.5)	17,000 (75.6)	20,820 (92.6)
	9 (229)	21,060 (93.7)	23,070 (102.6)	26,640 (118.5)	32,625 (145.1)	45,360 (201.8)	49,690 (221.0)	57,375 (255.2)	70,270 (312.6)
	12 (305)	32,425 (144.2)	35,520 (158.0)	41,015 (182.4)	48,805 (217.1)	69,835 (310.6)	76,500 (340.3)	88,335 (392.9)	105,120 (467.6)
	20 (508)	69,765 (310.3)	76,425 (340.0)	76,740 (341.4)	81,345 (361.8)	150,265 (668.4)	164,605 (732.2)	165,285 (735.2)	175,205 (779.3)
1-1/4	5 (127)	8,720 (38.8)	9,555 (42.5)	11,030 (49.1)	13,510 (60.1)	18,785 (83.6)	20,575 (91.5)	23,760 (105.7)	29,100 (129.4)
	11-1/4 (286)	29,430 (130.9)	32,240 (143.4)	37,230 (165.6)	45,595 (202.8)	63,395 (282.0)	69,445 (308.9)	80,185 (356.7)	98,205 (436.8)
	15 (381)	45,315 (201.6)	49,640 (220.8)	57,320 (255.0)	70,200 (312.3)	97,600 (434.1)	106,915 (475.6)	123,455 (549.2)	151,200 (672.6)
	25 (635)	97,500 (433.7)	106,805 (475.1)	119,905 (533.4)	127,100 (565.4)	210,000 (934.1)	230,045 (1023.3)	258,260 (1148.8)	273,755 (1217.7)

1 See section 3.1.7 for explanation on development of load values.
2 See section 3.1.7.3 to convert design strength (factored resistance) value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 42 - 55 as necessary. Compare to the steel values in table 41. The lesser of the values is to be used for the design.
5 Data is for temperature range A: Max. short term temperature = 104° F (40° C), max. long term temperature = 75° F (24° C).
For temperature range B: Max. short term temperature = 176° F (80° C), max. long term temperature = 122° F (50° C) multiply above value by 0.80.
For temperature range C: Max. short term temperature = 248° F (120° C), max. long term temperature = 162° F (72° C) multiply above value by 0.70.
Short term elevated concrete temperatures are those that occur over brief intervals, e.g., as a result of diurnal cycling. Long term concrete temperatures are roughly constant over significant periods of time.
6 Tabular values are for dry concrete conditions. For water saturated concrete multiply design strength (factored resistance) by 0.85.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see section 3.1.7.5.
8 Tabular values are for normal weight concrete only. For lightweight concrete, multiply design strength (factored resistance) by λ_a as follows:
For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_a = 0.45.

HIT-HY 200 Adhesive Anchoring System 3.2.3

Table 40 - Hilti HIT-HY 200 adhesive design strength with concrete / bond failure for threaded rod in cracked concrete [1,2,3,4,5,6,7,8,9]

Nominal anchor diameter in.	Effective embedment in. (mm)	Tension — ΦN_n or N_r				Shear — ΦV_n or V_r			
		f'_c = 2500 psi (17.2 Mpa) lb (kN)	f'_c = 3000 psi (20.7 Mpa) lb (kN)	f'_c = 4000 psi (27.6 Mpa) lb (kN)	f'_c = 6000 psi (41.4 Mpa) lb (kN)	f'_c = 2500 psi (17.2 Mpa) lb (kN)	f'_c = 3000 psi (20.7 Mpa) lb (kN)	f'_c = 4000 psi (27.6 Mpa) lb (kN)	f'_c = 6000 psi (41.4 Mpa) lb (kN)
3/8	2-3/8 (60)	1,900 (8.5)	1,900 (8.5)	1,900 (8.5)	2,015 (9.0)	2,045 (9.1)	2,045 (9.1)	2,045 (9.1)	2,165 (9.6)
	3-3/8 (86)	2,700 (12.0)	2,700 (12.0)	2,700 (12.0)	2,860 (12.7)	5,810 (25.8)	5,810 (25.8)	5,810 (25.8)	6,160 (27.4)
	4-1/2 (114)	3,600 (16.0)	3,600 (16.0)	3,600 (16.0)	3,815 (17.0)	7,750 (34.5)	7,750 (34.5)	7,750 (34.5)	8,215 (36.5)
	7-1/2 (191)	5,995 (26.7)	5,995 (26.7)	5,995 (26.7)	6,355 (28.3)	12,915 (57.4)	12,915 (57.4)	12,915 (57.4)	13,690 (60.9)
1/2	2-3/4 (70)	2,520 (11.2)	2,760 (12.3)	2,950 (13.1)	3,130 (13.9)	5,425 (24.1)	5,945 (26.4)	6,355 (28.3)	6,735 (30.0)
	4-1/2 (114)	4,830 (21.5)	4,830 (21.5)	4,830 (21.5)	5,120 (22.8)	10,400 (46.3)	10,400 (46.3)	10,400 (46.3)	11,025 (49.0)
	6 (152)	6,440 (28.6)	6,440 (28.6)	6,440 (28.6)	6,825 (30.4)	13,870 (61.7)	13,870 (61.7)	13,870 (61.7)	14,700 (65.4)
	10 (254)	10,730 (47.7)	10,730 (47.7)	10,730 (47.7)	11,375 (50.6)	23,115 (102.8)	23,115 (102.8)	23,115 (102.8)	24,500 (109.0)
5/8	3-1/8 (79)	3,050 (13.6)	3,345 (14.9)	3,860 (17.2)	4,470 (19.9)	6,575 (29.2)	7,200 (32.0)	8,315 (37.0)	9,625 (42.8)
	5-5/8 (143)	7,370 (32.8)	7,590 (33.8)	7,590 (33.8)	8,045 (35.8)	15,875 (70.6)	16,345 (72.7)	16,345 (72.7)	17,325 (77.1)
	7-1/2 (191)	10,120 (45.0)	10,120 (45.0)	10,120 (45.0)	10,725 (47.7)	21,790 (96.9)	21,790 (96.9)	21,790 (96.9)	23,100 (102.8)
	12-1/2 (318)	16,865 (75.0)	16,865 (75.0)	16,865 (75.0)	17,875 (79.5)	36,320 (161.6)	36,320 (161.6)	36,320 (161.6)	38,500 (171.3)
3/4	3-1/2 (89)	3,620 (16.1)	3,965 (17.6)	4,575 (20.4)	5,605 (24.9)	7,790 (34.7)	8,535 (38.0)	9,855 (43.8)	12,070 (53.7)
	6-3/4 (171)	9,690 (43.1)	10,615 (47.2)	10,980 (48.8)	11,635 (51.8)	20,870 (92.8)	22,860 (101.7)	23,645 (105.2)	25,065 (111.5)
	9 (229)	14,640 (65.1)	14,640 (65.1)	14,640 (65.1)	15,515 (69.0)	31,530 (140.3)	31,530 (140.3)	31,530 (140.3)	33,420 (148.7)
	15 (381)	24,395 (108.5)	24,395 (108.5)	24,395 (108.5)	25,860 (115.0)	52,550 (233.8)	52,550 (233.8)	52,550 (233.8)	55,700 (247.8)
7/8	3-1/2 (89)	3,620 (16.1)	3,965 (17.6)	4,575 (20.4)	5,605 (24.9)	7,790 (34.7)	8,535 (38.0)	9,855 (43.8)	12,070 (53.7)
	7-7/8 (200)	12,210 (54.3)	12,665 (56.3)	12,665 (56.3)	13,425 (59.7)	26,300 (117.0)	27,275 (121.3)	27,275 (121.3)	28,910 (128.6)
	10-1/2 (267)	16,885 (75.1)	16,885 (75.1)	16,885 (75.1)	17,900 (79.6)	36,370 (161.8)	36,370 (161.8)	36,370 (161.8)	38,550 (171.5)
	17-1/2 (445)	28,140 (125.2)	28,140 (125.2)	28,140 (125.2)	29,830 (132.7)	60,615 (269.6)	60,615 (269.6)	60,615 (269.6)	64,250 (285.8)
1	4 (102)	4,420 (19.7)	4,840 (21.5)	5,590 (24.9)	6,845 (30.4)	9,520 (42.3)	10,430 (46.4)	12,040 (53.6)	14,750 (65.6)
	9 (229)	14,920 (66.4)	16,340 (72.7)	16,615 (73.9)	17,610 (78.3)	32,130 (142.9)	35,195 (156.6)	35,785 (159.2)	37,930 (168.7)
	12 (305)	22,150 (98.5)	22,150 (98.5)	22,150 (98.5)	23,480 (104.4)	47,710 (212.2)	47,710 (212.2)	47,710 (212.2)	50,575 (225.0)
	20 (508)	36,920 (164.2)	36,920 (164.2)	36,920 (164.2)	39,135 (174.1)	79,520 (353.7)	79,520 (353.7)	79,520 (353.7)	84,290 (374.9)
1-1/4	5 (127)	6,175 (27.5)	6,765 (30.1)	7,815 (34.8)	9,570 (42.6)	13,305 (59.2)	14,575 (64.8)	16,830 (74.9)	20,610 (91.7)
	11-1/4 (286)	20,850 (92.7)	22,840 (101.6)	26,130 (116.2)	27,700 (123.2)	44,905 (199.7)	49,190 (218.8)	56,285 (250.4)	59,660 (265.4)
	15 (381)	32,095 (142.8)	34,840 (155.0)	34,840 (155.0)	36,935 (164.3)	69,135 (307.5)	75,045 (333.8)	75,045 (333.8)	79,545 (353.8)
	25 (635)	58,070 (258.3)	58,070 (258.3)	58,070 (258.3)	61,555 (273.8)	125,075 (556.4)	125,075 (556.4)	125,075 (556.4)	132,580 (589.7)

1 See section 3.1.7 for explanation on development of load values.
2 See section 3.1.7.3 to convert design strength (factored resistance) value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 42 - 55 as necessary. Compare to the steel values in table 41. The lesser of the values is to be used for the design.
5 Data is for temperature range A: Max. short term temperature = 104° F (40° C), max. long term temperature = 75° F (24° C).
For temperature range B: Max. short term temperature = 176° F (80° C), max. long term temperature = 122° F (50° C) multiply above value by 0.80.
For temperature range C: Max. short term temperature = 248° F (120° C), max. long term temperature = 162° F (72° C) multiply above value by 0.70.
Short term elevated concrete temperatures are those that occur over brief intervals, e.g., as a result of diurnal cycling. Long term concrete temperatures are roughly constant over significant periods of time.
6 Tabular values are for dry concrete conditions. For water saturated concrete multiply design strength (factored resistance) by 0.85.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see section 3.1.7.5.
8 Tabular values are for normal weight concrete only. For lightweight concrete, multiply design strength (factored resistance) by λ_a as follows:
For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_a = 0.45.
9 Tabular values are for static loads only. For seismic loads, multiply cracked concrete tabular values by the following reduction factors:
3/8-in to 3/4-in diameter - α_{seis} = 0.60
7/8-in to 1-1/4-in diameter - α_{seis} = 0.75
See section 3.1.7.4 for additional information on seismic applications.

3.2.3 HIT-HY 200 Adhesive Anchoring System

Table 41 - Steel design strength for Hilti HAS threaded rods [3]

Nominal anchor diameter in.	HAS-E[5]			HAS Super ASTM A193 B7[5]			HAS SS AISI 304/316 SS[5]		
	Tensile[1] ϕN_{sa} lb (kN)	Shear[2] ϕV_{sa} lb (kN)	$\alpha_{seis,V}$[4]	Tensile[1] ϕN_{sa} lb (kN)	Shear[2] ϕV_{sa} lb (kN)	$\alpha_{seis,V}$[4]	Tensile[1] ϕN_{sa} lb (kN)	Shear[2] ϕV_{sa} lb (kN)	$\alpha_{seis,V}$[4]
3/8	3,655 (16.3)	1,685 (7.5)	0.7	7,265 (32.3)	3,150 (14.0)	0.7	5,040 (22.4)	2,325 (10.3)	0.7
1/2	6,690 (29.8)	3,705 (16.5)	0.7	13,300 (59.2)	6,915 (30.8)	0.7	9,225 (41.0)	5,110 (22.7)	0.7
5/8	10,650 (47.4)	5,900 (26.2)	0.7	21,190 (94.3)	11,020 (49.0)	0.7	14,690 (65.3)	8,135 (36.2)	0.7
3/4	15,765 (70.1)	8,730 (38.8)	0.7	31,360 (139.5)	16,305 (72.5)	0.7	18,480 (82.2)	10,235 (45.5)	0.7
7/8	21,755 (96.8)	12,050 (53.6)	0.7	43,285 (192.5)	22,505 (100.1)	0.7	25,510 (113.5)	14,125 (62.8)	0.7
1	28,540 (127.0)	15,805 (70.3)	0.7	56,785 (252.6)	29,525 (131.3)	0.7	33,465 (148.9)	18,535 (82.4)	0.7
1-1/4	45,670 (203.1)	25,295 (112.5)	0.7	90,850 (404.1)	47,240 (210.1)	0.7	53,540 (238.2)	29,655 (131.9)	0.7

1 Tensile = $\phi\ A_{se,N}\ f_{uta}$ as noted in ACI 318 Appendix D
2 Shear = $\phi\ 0.60\ A_{se,N}\ f_{uta}$ as noted in ACI 318 Appendix D
3 See section 3.1.7.3 to convert design strength (factored resistance) value to ASD value.
4 Reduction factor for seismic shear only. See section 3.1.7.4 for additional information on seismic applications.
5 HAS Super rods are considered ductile steel elements. HAS standard-E and HAS SS rods are considered brittle steel elements.

3.2.3 HIT-HY 200 Adhesive Anchoring System

Table 44 - Load adjustment factors for 1/2-in. diameter threaded rods in uncracked concrete[1,2,3]

1/2-in. uncracked concrete		Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear[4] f_{AV}				Edge distance in shear: ⊥ Toward edge f_{RV}				Edge distance in shear: ∥ To edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
Embedment h_{ef}	in. (mm)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	1-3/4 (44)	n/a	n/a	n/a	n/a	0.34	0.26	0.20	0.11	n/a	n/a	n/a	n/a	0.10	0.05	0.03	0.02	0.21	0.11	0.07	0.04	n/a	n/a	n/a	n/a
	2-1/2 (64)	0.59	0.59	0.57	0.54	0.40	0.30	0.22	0.13	0.55	0.53	0.53	0.52	0.18	0.09	0.06	0.04	0.35	0.18	0.12	0.07	n/a	n/a	n/a	n/a
	3 (76)	0.61	0.61	0.58	0.55	0.45	0.32	0.24	0.14	0.56	0.54	0.53	0.52	0.23	0.12	0.08	0.05	0.45	0.24	0.15	0.09	n/a	n/a	n/a	n/a
	4 (102)	0.65	0.65	0.61	0.57	0.56	0.38	0.28	0.16	0.58	0.55	0.54	0.53	0.36	0.18	0.12	0.07	0.56	0.37	0.24	0.14	0.58	n/a	n/a	n/a
	5 (127)	0.68	0.68	0.64	0.58	0.69	0.43	0.32	0.19	0.60	0.57	0.55	0.54	0.50	0.26	0.17	0.10	0.69	0.43	0.33	0.20	0.65	n/a	n/a	n/a
	5-3/4 (146)	0.71	0.71	0.66	0.60	0.80	0.48	0.35	0.21	0.62	0.58	0.56	0.54	0.61	0.32	0.21	0.12	0.80	0.48	0.39	0.25	0.69	0.56	n/a	n/a
	6 (152)	0.72	0.72	0.67	0.60	0.83	0.49	0.36	0.21	0.63	0.58	0.56	0.54	0.65	0.34	0.22	0.13	0.83	0.49	0.40	0.26	0.71	0.57	n/a	n/a
	7 (178)	0.76	0.76	0.69	0.62	0.97	0.56	0.41	0.24	0.65	0.59	0.57	0.55	0.82	0.42	0.28	0.16	0.97	0.56	0.44	0.32	0.77	0.61	n/a	n/a
	7-1/4 (184)	0.76	0.76	0.70	0.62	1.00	0.58	0.43	0.25	0.65	0.60	0.57	0.55	0.87	0.45	0.29	0.17	1.00	0.58	0.45	0.32	0.78	0.62	0.54	n/a
	8 (203)	0.79	0.79	0.72	0.63		0.64	0.47	0.27	0.67	0.61	0.58	0.56	1.00	0.52	0.34	0.20		0.64	0.48	0.34	0.82	0.66	0.57	n/a
	9 (229)	0.83	0.83	0.75	0.65		0.72	0.53	0.31	0.69	0.62	0.59	0.56		0.62	0.40	0.24		0.72	0.53	0.36	0.87	0.70	0.60	n/a
	10 (254)	0.86	0.86	0.78	0.67		0.80	0.59	0.34	0.71	0.63	0.60	0.57		0.72	0.47	0.28		0.80	0.59	0.39	0.92	0.73	0.64	n/a
	11-1/4 (286)	0.91	0.91	0.81	0.69		0.90	0.66	0.39	0.74	0.65	0.61	0.58		0.86	0.56	0.34		0.90	0.66	0.42	0.97	0.78	0.67	0.57
	12 (305)	0.94	0.94	0.83	0.70		0.96	0.70	0.41	0.75	0.66	0.62	0.59		0.95	0.62	0.37		0.96	0.70	0.44	1.00	0.80	0.70	0.59
	14 (356)	1.00	1.00	0.89	0.73		1.00	0.82	0.48	0.79	0.69	0.64	0.60		1.00	0.78	0.47		1.00	0.82	0.49		0.87	0.75	0.63
	16 (406)			0.94	0.77			0.94	0.55	0.83	0.72	0.66	0.61			0.95	0.57			0.94	0.55		0.93	0.80	0.68
	18 (457)			1.00	0.80			1.00	0.62	0.88	0.74	0.68	0.63			1.00	0.68			1.00	0.62		0.98	0.85	0.72
	20 (508)				0.83				0.69	0.92	0.77	0.70	0.64				0.80				0.69		1.00	0.90	0.76
	22 (559)				0.87				0.76	0.96	0.80	0.72	0.66				0.92				0.76			0.94	0.79
	24 (610)				0.90				0.82	1.00	0.82	0.74	0.67				1.00				0.82			0.98	0.83
	30 (762)				1.00				1.00		0.90	0.80	0.71								1.00			1.00	0.93
	36 (914)										0.98	0.86	0.76												1.00
	>48 (1219)										1.00	0.98	0.84												

Table 45 - Load adjustment factors for 1/2-in. diameter threaded rods in cracked concrete[1,2,3]

1/2-in. cracked concrete		Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear[4] f_{AV}				Edge distance in shear: ⊥ Toward edge f_{RV}				Edge distance in shear: ∥ To edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
Embedment h_{ef}	in. (mm)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	1-3/4 (44)	n/a	n/a	n/a	n/a	0.49	0.49	0.45	0.41	n/a	n/a	n/a	n/a	0.10	0.06	0.04	0.03	0.21	0.12	0.09	0.05	n/a	n/a	n/a	n/a
	2-1/2 (64)	0.59	0.59	0.57	0.54	0.55	0.55	0.50	0.44	0.55	0.54	0.53	0.52	0.18	0.10	0.07	0.04	0.35	0.20	0.15	0.09	n/a	n/a	n/a	n/a
	3 (76)	0.61	0.61	0.58	0.55	0.60	0.60	0.53	0.46	0.56	0.54	0.54	0.53	0.23	0.13	0.10	0.06	0.47	0.26	0.20	0.12	n/a	n/a	n/a	n/a
	4 (102)	0.65	0.65	0.61	0.57	0.69	0.69	0.60	0.49	0.58	0.56	0.55	0.53	0.36	0.20	0.15	0.09	0.72	0.40	0.30	0.18	0.58	n/a	n/a	n/a
	5 (127)	0.68	0.68	0.64	0.58	0.79	0.79	0.67	0.53	0.61	0.57	0.56	0.54	0.50	0.28	0.21	0.13	1.00	0.56	0.42	0.25	0.65	n/a	n/a	n/a
	5-3/4 (146)	0.71	0.71	0.66	0.60	0.88	0.88	0.73	0.56	0.62	0.58	0.57	0.55	0.62	0.35	0.26	0.16		0.70	0.52	0.31	0.70	0.57	n/a	n/a
	6 (152)	0.72	0.72	0.67	0.60	0.90	0.90	0.75	0.57	0.63	0.59	0.57	0.55	0.66	0.37	0.28	0.17		0.74	0.56	0.33	0.71	0.59	n/a	n/a
	7 (178)	0.76	0.76	0.69	0.62	1.00	1.00	0.83	0.62	0.65	0.60	0.58	0.56	0.83	0.47	0.35	0.21		0.94	0.70	0.42	0.77	0.63	n/a	n/a
	7-1/4 (184)	0.76	0.76	0.70	0.62			0.85	0.63	0.65	0.60	0.59	0.56	0.88	0.49	0.37	0.22		0.99	0.74	0.44	0.78	0.64	0.59	n/a
	8 (203)	0.79	0.79	0.72	0.63			0.91	0.66	0.67	0.61	0.59	0.57	1.00	0.57	0.43	0.26		1.00	0.86	0.51	0.82	0.68	0.62	n/a
	9 (229)	0.83	0.83	0.75	0.65			1.00	0.70	0.69	0.63	0.61	0.58		0.68	0.51	0.31			1.00	0.61	0.87	0.72	0.65	n/a
	10 (254)	0.86	0.86	0.78	0.67				0.75	0.71	0.64	0.62	0.58		0.80	0.60	0.36				0.72	0.92	0.76	0.69	n/a
	11-1/4 (286)	0.91	0.91	0.81	0.69				0.81	0.74	0.66	0.63	0.59		0.95	0.71	0.43				0.81	0.97	0.80	0.73	0.62
	12 (305)	0.94	0.94	0.83	0.70				0.85	0.75	0.67	0.64	0.60		1.00	0.79	0.47				0.85	1.00	0.83	0.75	0.64
	14 (356)	1.00	1.00	0.89	0.73				0.95	0.79	0.70	0.67	0.62			0.99	0.60				0.95		0.90	0.81	0.69
	16 (406)			0.94	0.77				1.00	0.84	0.73	0.69	0.63			1.00	0.73				1.00		0.96	0.87	0.73
	18 (457)			1.00	0.80					0.88	0.76	0.71	0.65				0.87						1.00	0.92	0.78
	20 (508)				0.83					0.92	0.79	0.74	0.67				1.00							0.97	0.82
	22 (559)				0.87					0.96	0.82	0.76	0.69											1.00	0.86
	24 (610)				0.90					1.00	0.84	0.78	0.70												0.90
	30 (762)				1.00						0.93	0.86	0.75												1.00
	36 (914)										1.00	0.93	0.80												
	>48 (1219)											1.00	0.90												

1 Linear interpolation not permitted

2 Shaded area with reduced edge distance is permitted provided the installation torque is reduced to 0.30 T_{max} for 5d ≤ s ≤ 16-in. and to 0.5 T_{max} for s > 16-in.

3 When combining multiple load adjustment factors (e.g. for a four-anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318 Appendix D.

4 Spacing factor reduction in shear, f_{AV}, assumes an influence of a nearby edge. If no edge exists, then $f_{AV} = f_{AN}$.

5 Concrete thickness reduction factor in shear, f_{HV}, assumes an influence of a nearby edge. If no edge exists, then $f_{HV} = 1.0$.

Table 46 - Load adjustment factors for 5/8-in. diameter threaded rods in uncracked concrete[1,2,3]

5/8-in. uncracked concrete		Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear[4] f_{AV}				Edge distance in shear								Concrete thickness factor in shear[5] f_{HV}			
														⊥ Toward edge f_{RV}				∥ To edge f_{RV}							
Embedment h_{ef}	in. (mm)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	1-3/4 (44)	n/a	n/a	n/a	n/a	0.33	0.25	0.18	0.11	n/a	n/a	n/a	n/a	0.09	0.04	0.03	0.01	0.19	0.08	0.06	0.03	n/a	n/a	n/a	n/a
	3-1/8 (79)	0.59	0.59	0.57	0.54	0.44	0.30	0.22	0.13	0.56	0.54	0.53	0.52	0.22	0.10	0.07	0.04	0.44	0.20	0.13	0.07	n/a	n/a	n/a	n/a
	4 (102)	0.62	0.62	0.59	0.55	0.52	0.33	0.25	0.14	0.58	0.55	0.53	0.52	0.32	0.15	0.10	0.05	0.52	0.29	0.19	0.10	n/a	n/a	n/a	n/a
	4-5/8 (117)	0.63	0.63	0.60	0.56	0.59	0.36	0.27	0.16	0.59	0.55	0.54	0.53	0.40	0.18	0.12	0.06	0.59	0.36	0.24	0.13	0.60	n/a	n/a	n/a
	5 (127)	0.65	0.65	0.61	0.57	0.63	0.38	0.28	0.16	0.60	0.56	0.54	0.53	0.45	0.21	0.13	0.07	0.63	0.38	0.27	0.14	0.63	n/a	n/a	n/a
	6 (152)	0.68	0.68	0.63	0.58	0.76	0.42	0.31	0.18	0.62	0.57	0.55	0.53	0.59	0.27	0.18	0.09	0.76	0.42	0.35	0.19	0.69	n/a	n/a	n/a
	7 (178)	0.70	0.70	0.66	0.59	0.86	0.47	0.34	0.20	0.64	0.58	0.56	0.54	0.75	0.34	0.22	0.12	0.88	0.47	0.38	0.24	0.74	n/a	n/a	n/a
	7-1/8 (181)	0.71	0.71	0.66	0.60	0.87	0.47	0.35	0.20	0.64	0.58	0.56	0.54	0.77	0.35	0.23	0.12	0.90	0.47	0.38	0.24	0.75	0.57	n/a	n/a
	8 (203)	0.73	0.73	0.68	0.61	0.95	0.52	0.38	0.22	0.66	0.59	0.57	0.55	0.91	0.41	0.27	0.14	1.00	0.52	0.41	0.29	0.79	0.61	n/a	n/a
	9 (229)	0.76	0.76	0.70	0.62	1.00	0.57	0.42	0.25	0.68	0.60	0.58	0.55	1.00	0.50	0.32	0.17		0.57	0.45	0.32	0.84	0.65	0.56	n/a
	10 (254)	0.79	0.79	0.72	0.63		0.64	0.47	0.27	0.70	0.62	0.59	0.56		0.58	0.38	0.20		0.64	0.48	0.34	0.89	0.68	0.59	n/a
	11 (279)	0.82	0.82	0.74	0.65		0.70	0.52	0.30	0.72	0.63	0.60	0.56		0.67	0.43	0.23		0.70	0.52	0.36	0.93	0.71	0.62	n/a
	12 (305)	0.85	0.85	0.77	0.66		0.77	0.56	0.33	0.74	0.64	0.60	0.57		0.76	0.50	0.26		0.77	0.56	0.38	0.97	0.75	0.65	n/a
	14 (356)	0.91	0.91	0.81	0.69		0.89	0.66	0.38	0.77	0.66	0.62	0.58		0.96	0.62	0.33		0.89	0.66	0.41	1.00	0.81	0.70	0.57
	16 (406)	0.97	0.97	0.86	0.71		1.00	0.75	0.44	0.81	0.69	0.64	0.59		1.00	0.76	0.41		1.00	0.75	0.46		0.86	0.75	0.61
	18 (457)	1.00	1.00	0.90	0.74			0.84	0.49	0.85	0.71	0.66	0.60			0.91	0.49			0.84	0.50		0.91	0.79	0.64
	20 (508)			0.94	0.77			0.94	0.55	0.89	0.73	0.67	0.61			1.00	0.57			0.94	0.55		0.96	0.83	0.68
	22 (559)			0.99	0.79			1.00	0.60	0.93	0.75	0.69	0.63				0.66			1.00	0.60		1.00	0.87	0.71
	24 (610)			1.00	0.82				0.66	0.97	0.78	0.71	0.64				0.75				0.66			0.91	0.74
	26 (660)				0.85				0.71	1.00	0.80	0.73	0.65				0.84				0.71			0.95	0.77
	28 (711)				0.87				0.77		0.82	0.74	0.66				0.94				0.77			0.99	0.80
	30 (762)				0.90				0.82		0.85	0.76	0.67				1.00				0.82			1.00	0.83
	36 (914)				0.98				0.99		0.92	0.81	0.71								0.99				0.91
	>48 (1219)				1.00				1.00		1.00	0.92	0.77								1.00				1.00

Table 47 - Load adjustment factors for 5/8-in. diameter threaded rods in cracked concrete[1,2,3]

5/8-in. cracked concrete		Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear[4] f_{AV}				Edge distance in shear								Concrete thickness factor in shear[5] f_{HV}			
														⊥ Toward edge f_{RV}				∥ To edge f_{RV}							
Embedment h_{ef}	in. (mm)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	1-3/4 (44)	n/a	n/a	n/a	n/a	0.46	0.46	0.43	0.40	n/a	n/a	n/a	n/a	0.09	0.04	0.03	0.02	0.19	0.09	0.08	0.04	n/a	n/a	n/a	n/a
	3-1/8 (79)	0.59	0.59	0.57	0.54	0.55	0.55	0.50	0.44	0.56	0.54	0.53	0.52	0.22	0.10	0.07	0.04	0.45	0.20	0.15	0.09	n/a	n/a	n/a	n/a
	4 (102)	0.62	0.62	0.59	0.55	0.62	0.62	0.55	0.46	0.58	0.55	0.54	0.53	0.33	0.15	0.11	0.06	0.65	0.30	0.22	0.13	n/a	n/a	n/a	n/a
	4-5/8 (117)	0.63	0.63	0.60	0.56	0.66	0.66	0.58	0.48	0.59	0.55	0.54	0.53	0.40	0.18	0.13	0.08	0.81	0.37	0.27	0.16	0.60	n/a	n/a	n/a
	5 (127)	0.65	0.65	0.61	0.57	0.69	0.69	0.60	0.49	0.60	0.56	0.55	0.53	0.45	0.21	0.15	0.09	0.91	0.41	0.30	0.18	0.63	n/a	n/a	n/a
	6 (152)	0.68	0.68	0.63	0.58	0.77	0.77	0.66	0.53	0.62	0.57	0.56	0.54	0.60	0.27	0.20	0.12	1.00	0.54	0.40	0.24	0.69	n/a	n/a	n/a
	7 (178)	0.70	0.70	0.66	0.59	0.86	0.86	0.72	0.56	0.64	0.58	0.57	0.55	0.75	0.34	0.25	0.15		0.68	0.50	0.30	0.74	n/a	n/a	n/a
	7-1/8 (181)	0.71	0.71	0.66	0.60	0.87	0.87	0.73	0.56	0.64	0.58	0.57	0.55	0.77	0.35	0.26	0.15		0.70	0.51	0.31	0.75	0.58	n/a	n/a
	8 (203)	0.73	0.73	0.68	0.61	0.95	0.95	0.78	0.59	0.66	0.59	0.58	0.55	0.92	0.42	0.30	0.18		0.84	0.61	0.37	0.79	0.61	n/a	n/a
	9 (229)	0.76	0.76	0.70	0.62	1.00	1.00	0.85	0.62	0.68	0.60	0.58	0.56	1.00	0.50	0.36	0.22		1.00	0.73	0.44	0.84	0.65	0.58	n/a
	10 (254)	0.79	0.79	0.72	0.63			0.91	0.66	0.70	0.62	0.59	0.57		0.58	0.43	0.26		1.00	0.85	0.51	0.89	0.68	0.61	n/a
	11 (279)	0.82	0.82	0.74	0.65			0.98	0.69	0.72	0.63	0.60	0.57		0.67	0.49	0.29			0.98	0.59	0.93	0.72	0.64	n/a
	12 (305)	0.85	0.85	0.77	0.66			1.00	0.73	0.74	0.64	0.61	0.58		0.77	0.56	0.34			1.00	0.67	0.97	0.75	0.67	n/a
	14 (356)	0.91	0.91	0.81	0.69				0.81	0.78	0.66	0.63	0.59		0.97	0.71	0.42				0.81	1.00	0.81	0.73	0.61
	16 (406)	0.97	0.97	0.86	0.71				0.89	0.82	0.69	0.65	0.61		1.00	0.86	0.52				0.89		0.86	0.78	0.66
	18 (457)	1.00	1.00	0.90	0.74				0.97	0.85	0.71	0.67	0.62			1.00	0.62				0.97		0.92	0.82	0.70
	20 (508)			0.94	0.77				1.00	0.89	0.73	0.69	0.63				0.72				1.00		0.97	0.87	0.73
	22 (559)			0.99	0.79					0.93	0.76	0.71	0.65				0.83						1.00	0.91	0.77
	24 (610)			1.00	0.82					0.97	0.78	0.73	0.66				0.95							0.95	0.80
	26 (660)				0.85					1.00	0.80	0.75	0.67				1.00							0.99	0.84
	28 (711)				0.87						0.83	0.76	0.69											1.00	0.87
	30 (762)				0.90						0.85	0.78	0.70												0.90
	36 (914)				0.98						0.92	0.84	0.74												0.98
	>48 (1219)				1.00						1.00	0.95	0.82												1.00

1 Linear interpolation not permitted

2 Shaded area with reduced edge distance is permitted provided the installation torque is reduced to 0.30 T_{max} for 5d ≤ s ≤ 16-in. and to 0.5 T_{max} for s > 16-in.

3 When combining multiple load adjustment factors (e.g. for a four-anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318 Appendix D.

4 Spacing factor reduction in shear, f_{AV}, assumes an influence of a nearby edge. If no edge exists, then $f_{AV} = f_{AN}$.

5 Concrete thickness reduction factor in shear, f_{HV}, assumes an influence of a nearby edge. If no edge exists, then $f_{HV} = 1.0$.

3.2.3 HIT-HY 200 Adhesive Anchoring System

Table 48 - Load adjustment factors for 3/4-in. diameter threaded rods in uncracked concrete[1,2,3]

3/4-in. uncracked concrete		Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear[4] f_{AV}				Edge distance in shear: ⊥ Toward edge f_{RV}				Edge distance in shear: ∥ To edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
Embedment h_{ef}	in. (mm)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	1-3/4 (44)	n/a	n/a	n/a	n/a	0.33	0.24	0.18	0.10	n/a	n/a	n/a	n/a	0.09	0.03	0.02	0.01	0.17	0.07	0.05	0.02	n/a	n/a	n/a	n/a
	3-3/4 (95)	0.59	0.59	0.57	0.54	0.49	0.30	0.22	0.13	0.57	0.54	0.53	0.52	0.27	0.11	0.07	0.03	0.49	0.22	0.14	0.07	n/a	n/a	n/a	n/a
	4 (102)	0.60	0.60	0.57	0.54	0.51	0.31	0.23	0.13	0.57	0.54	0.53	0.52	0.29	0.12	0.08	0.04	0.51	0.24	0.16	0.08	n/a	n/a	n/a	n/a
	5 (127)	0.62	0.62	0.59	0.56	0.60	0.34	0.25	0.15	0.59	0.55	0.54	0.52	0.41	0.17	0.11	0.05	0.60	0.33	0.22	0.11	n/a	n/a	n/a	n/a
	5-1/4 (133)	0.63	0.63	0.60	0.56	0.63	0.35	0.26	0.15	0.60	0.55	0.54	0.52	0.44	0.18	0.12	0.06	0.63	0.35	0.23	0.11	0.62	n/a	n/a	n/a
	6 (152)	0.65	0.65	0.61	0.57	0.69	0.38	0.28	0.16	0.61	0.56	0.55	0.53	0.54	0.22	0.14	0.07	0.72	0.38	0.29	0.14	0.66	n/a	n/a	n/a
	7 (178)	0.67	0.67	0.63	0.58	0.76	0.41	0.30	0.18	0.63	0.57	0.55	0.53	0.68	0.28	0.18	0.09	0.84	0.41	0.34	0.18	0.72	n/a	n/a	n/a
	8 (203)	0.69	0.69	0.65	0.59	0.83	0.45	0.33	0.19	0.65	0.58	0.56	0.54	0.83	0.34	0.22	0.11	0.96	0.45	0.37	0.21	0.77	n/a	n/a	n/a
	8-1/2 (216)	0.71	0.71	0.66	0.59	0.87	0.47	0.35	0.20	0.66	0.59	0.56	0.54	0.91	0.37	0.24	0.12	1.00	0.47	0.38	0.24	0.79	0.59	n/a	n/a
	9 (229)	0.72	0.72	0.67	0.60	0.90	0.49	0.36	0.21	0.67	0.59	0.57	0.54	0.99	0.40	0.26	0.13		0.49	0.39	0.26	0.81	0.60	n/a	n/a
	10 (254)	0.74	0.74	0.69	0.61	0.98	0.53	0.39	0.23	0.68	0.60	0.58	0.55	1.00	0.47	0.31	0.15		0.53	0.42	0.30	0.86	0.64	n/a	n/a
	10-3/4 (273)	0.76	0.76	0.70	0.62	1.00	0.57	0.42	0.25	0.70	0.61	0.58	0.55		0.53	0.34	0.17		0.57	0.44	0.32	0.89	0.66	0.57	n/a
	12 (305)	0.79	0.79	0.72	0.63		0.64	0.47	0.27	0.72	0.62	0.59	0.56		0.62	0.40	0.20		0.64	0.48	0.34	0.94	0.70	0.60	n/a
	14 (356)	0.84	0.84	0.76	0.66		0.74	0.55	0.32	0.76	0.64	0.61	0.57		0.78	0.51	0.25		0.74	0.55	0.37	1.00	0.75	0.65	n/a
	16 (406)	0.89	0.89	0.80	0.68		0.85	0.62	0.37	0.79	0.66	0.62	0.58		0.96	0.62	0.30		0.85	0.62	0.40		0.80	0.70	n/a
	16-3/4 (425)	0.91	0.91	0.81	0.69		0.89	0.65	0.38	0.81	0.67	0.63	0.58		1.00	0.67	0.33		0.89	0.65	0.41		0.82	0.71	0.56
	18 (457)	0.94	0.94	0.83	0.70		0.95	0.70	0.41	0.83	0.68	0.64	0.58			0.74	0.36		0.95	0.70	0.43		0.85	0.74	0.58
	20 (508)	0.99	0.99	0.87	0.72		1.00	0.78	0.46	0.87	0.70	0.65	0.59			0.87	0.42		1.00	0.78	0.47		0.90	0.78	0.61
	22 (559)	1.00	1.00	0.91	0.74			0.86	0.50	0.91	0.72	0.67	0.60			1.00	0.49			0.86	0.50		0.94	0.82	0.64
	24 (610)			0.94	0.77			0.93	0.55	0.94	0.74	0.68	0.61				0.56			0.93	0.55		0.99	0.85	0.67
	26 (660)			0.98	0.79			1.00	0.59	0.98	0.76	0.70	0.62				0.63			1.00	0.59		1.00	0.89	0.70
	28 (711)			1.00	0.81				0.64	1.00	0.78	0.71	0.63				0.70				0.64			0.92	0.73
	30 (762)				0.83				0.68		0.80	0.73	0.64				0.78				0.68			0.95	0.75
	36 (914)				0.90				0.82		0.86	0.77	0.67				1.00				0.82			1.00	0.82
	>48 (1219)				1.00				1.00		0.99	0.86	0.73								1.00				0.95

Table 49 - Load adjustment factors for 3/4-in. diameter threaded rods in cracked concrete[1,2,3]

3/4-in. cracked concrete		Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear[4] f_{AV}				Edge distance in shear: ⊥ Toward edge f_{RV}				Edge distance in shear: ∥ To edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
Embedment h_{ef}	in. (mm)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	1-3/4 (44)	n/a	n/a	n/a	n/a	0.44	0.44	0.42	0.39	n/a	n/a	n/a	n/a	0.09	0.03	0.02	0.01	0.17	0.07	0.05	0.03	n/a	n/a	n/a	n/a
	3-3/4 (95)	0.59	0.59	0.57	0.54	0.55	0.55	0.50	0.44	0.57	0.54	0.53	0.52	0.27	0.11	0.07	0.04	0.54	0.22	0.15	0.09	n/a	n/a	n/a	n/a
	4 (102)	0.60	0.60	0.57	0.54	0.57	0.57	0.51	0.44	0.57	0.54	0.53	0.52	0.30	0.12	0.08	0.05	0.59	0.24	0.16	0.10	n/a	n/a	n/a	n/a
	5 (127)	0.62	0.62	0.59	0.56	0.63	0.63	0.56	0.47	0.59	0.55	0.54	0.53	0.41	0.17	0.11	0.07	0.83	0.34	0.22	0.13	n/a	n/a	n/a	n/a
	5-1/4 (133)	0.63	0.63	0.60	0.56	0.64	0.64	0.57	0.47	0.60	0.55	0.54	0.53	0.45	0.18	0.12	0.07	0.89	0.36	0.24	0.14	0.62	n/a	n/a	n/a
	6 (152)	0.65	0.65	0.61	0.57	0.69	0.69	0.60	0.49	0.61	0.56	0.55	0.53	0.54	0.22	0.15	0.09	1.00	0.44	0.29	0.18	0.67	n/a	n/a	n/a
	7 (178)	0.67	0.67	0.63	0.58	0.76	0.76	0.65	0.52	0.63	0.57	0.55	0.54	0.69	0.28	0.19	0.11		0.56	0.37	0.22	0.72	n/a	n/a	n/a
	8 (203)	0.69	0.69	0.65	0.59	0.83	0.83	0.70	0.55	0.65	0.58	0.56	0.54	0.84	0.34	0.23	0.14		0.68	0.45	0.27	0.77	n/a	n/a	n/a
	8-1/2 (216)	0.71	0.71	0.66	0.59	0.87	0.87	0.72	0.56	0.66	0.59	0.57	0.55	0.92	0.37	0.25	0.15		0.75	0.50	0.30	0.79	0.59	n/a	n/a
	9 (229)	0.72	0.72	0.67	0.60	0.90	0.90	0.75	0.57	0.67	0.59	0.57	0.55	1.00	0.41	0.27	0.16		0.82	0.54	0.32	0.82	0.61	n/a	n/a
	10 (254)	0.74	0.74	0.69	0.61	0.98	0.98	0.80	0.60	0.69	0.60	0.58	0.55		0.48	0.32	0.19		0.95	0.63	0.38	0.86	0.64	n/a	n/a
	10-3/4 (273)	0.76	0.76	0.70	0.62	1.00	1.00	0.84	0.62	0.70	0.61	0.58	0.56		0.53	0.35	0.21		1.00	0.70	0.42	0.89	0.66	0.58	n/a
	12 (305)	0.79	0.79	0.72	0.63			0.91	0.66	0.72	0.62	0.59	0.57		0.63	0.42	0.25			0.83	0.50	0.94	0.70	0.61	n/a
	14 (356)	0.84	0.84	0.76	0.66			1.00	0.72	0.76	0.64	0.61	0.58		0.79	0.52	0.31			1.00	0.63	1.00	0.76	0.66	n/a
	16 (406)	0.89	0.89	0.80	0.68				0.78	0.80	0.66	0.62	0.59		0.97	0.64	0.38				0.77		0.81	0.70	n/a
	16-3/4 (425)	0.91	0.91	0.81	0.69				0.81	0.81	0.67	0.63	0.59		1.00	0.68	0.41				0.81		0.83	0.72	0.61
	18 (457)	0.94	0.94	0.83	0.70				0.85	0.83	0.68	0.64	0.60			0.76	0.46				0.85		0.86	0.75	0.63
	20 (508)	0.99	0.99	0.87	0.72				0.91	0.87	0.70	0.65	0.61			0.89	0.54				0.91		0.90	0.79	0.66
	22 (559)	1.00	1.00	0.91	0.74				0.98	0.91	0.72	0.67	0.62			1.00	0.62				0.98		0.95	0.82	0.70
	24 (610)			0.94	0.77				1.00	0.94	0.74	0.69	0.63				0.70				1.00		0.99	0.86	0.73
	26 (660)			0.98	0.79					0.98	0.76	0.70	0.64				0.79						1.00	0.90	0.76
	28 (711)			1.00	0.81					1.00	0.79	0.72	0.65				0.89							0.93	0.78
	30 (762)				0.83						0.81	0.73	0.66				0.99							0.96	0.81
	36 (914)				0.90						0.87	0.78	0.70				1.00							1.00	0.89
	>48 (1219)				1.00						0.99	0.87	0.76												1.00

1 Linear interpolation not permitted

2 Shaded area with reduced edge distance is permitted provided the installation torque is reduced to 0.30 T_{max} for 5d ≤ s ≤ 16-in. and to 0.5 T_{max} for s > 16-in.

3 When combining multiple load adjustment factors (e.g. for a four-anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318 Appendix D.

4 Spacing factor reduction in shear, f_{AV}, assumes an influence of a nearby edge. If no edge exists, then $f_{AV} = f_{AN}$.

5 Concrete thickness reduction factor in shear, f_{HV}, assumes an influence of a nearby edge. If no edge exists, then $f_{HV} = 1.0$.

3.2.3.4 Installation instructions

Installation Instructions For Use (IFU) are included with each product package. They can also be viewed or downloaded online at www.us.hilti.com (US) and www.hilti.ca (Canada). Because of the possibility of changes, always verify that downloaded IFU are current when used. Proper installation is critical to achieve full performance. Training is available on request. Contact Hilti Technical Services for applications and conditions not addressed in the IFU.

Figure 14 - HIT-HY 200 adhesive cure time and working time

HIT-HY 200-A

		HAS, HIS-N, Rebar		HIT-Z	
[°C]	[°F]	t_{work}	t_{cure}	t_{work}	t_{cure}
-10...-5	14...23	1.5 h	7 h	-	-
-4...0	24...32	50 min	4 h	-	-
1...5	33...41	25 min	2 h	-	-
6...10	42...50	15 min	1.25 h	15 min	1.25 h
11...20	51...68	7 min	45 min	7 min	45 min
21...30	69...86	4 min	30 min	4 min	30 min
31...40	87...104	3 min	30 min	3 min	30 min

HIT-HY 200-R

		HAS, HIS-N, Rebar		HIT-Z	
[°C]	[°F]	t_{work}	t_{cure}	t_{work}	t_{cure}
-10...-5	14...23	3 h	20 h	-	-
-4...0	24...32	2 h	8 h	-	-
1...5	33...41	1 h	4 h	-	-
6...10	42...50	40 min	2.5 h	40 min	2.5 h
11...20	51...68	15 min	1.5 h	15 min	1.5 h
21...30	69...86	9 min	1 h	9 min	1 h
31...40	87...104	6 min	1 h	6 min	1 h

Resistance of cured Hilti HIT-HY 200 to chemicals

Chemical		Behavior
Acetic acid	10%	+
Acetone		•
Ammonia	5%	+
Benzyl alcohol		-
Chloric acid	10%	•
Chlorinated lime	10%	+
Citric acid	10%	+
Concrete plasticizer		+
De-icing salt (Calcium chloride)		+
Demineralized water		+
Diesel fuel		+
Drilling dust suspension pH 13.2		+
Ethanol	96%	
Ethylacetate		-
Formic acid	10%	+
Formwork oil		+
Gasoline		+
Glycole		•
Hydrogen peroxide	10%	•
Lactic acid	10%	+
Maschinery oil		+
Methylethylketon		•
Nitric acid	10%	•
Phosphoric acid	10%	+
Potassium Hydroxide pH 13.2		+
Sea water		+
Sewage sludge		+
Sodium carbonate 10%	10%	+
Sodium hypochlorite 2%	2%	+
Sulphuric acid	10%	+
	30%	+
Toluene		•
Xylene		•

Key: - non-resistant
+ resistant
• limited resistance

Samples of the HIT-HY 200 adhesive were immersed in the various chemical compounds for up to one year. At the end of the test period, the samples were analyzed. Any samples showing no visible damage and having less than a 25% reduction in bending (flexural) strength were classified as "Resistant." Samples that had slight damage, such as small cracks, chips, etc. or reduction in bending strength of 25% or more were classified as "Limited Resistance" (i.e. exposed for 48 hours or less until chemical is cleaned up). Samples that were heavily damaged or destroyed were classified as "Non-Resistant."

Note: In actual use, the majority of the adhesive is encased in the base material, leaving very little surface area exposed.

3.2.3 HIT-HY 200 Adhesive Anchoring System

3.2.3.5 Ordering information

Hilti HIT-Z anchor rod

Description	Bit dia. (in.)	Min. embed. (in.)	Qty
HIT-Z 3/8 x 4 3/8	7/16	2-3/8	40
HIT-Z 3/8 x 5 1/8	7/16	2-3/8	40
HIT-Z 3/8 x 6 3/8	7/16	2-3/8	40
HIT-Z 1/2 x 4 1/2	9/16	2-3/4	20
HIT-Z 1/2 x 6 ½	9/16	2-3/4	20
HIT-Z 1/2 x 8	9/16	2-3/4	20
HIT-Z 5/8 x 6	3/4	3-3/4	12
HIT-Z 5/8 x 8	3/4	3-3/4	12
HIT-Z 5/8 x 9 1/2	3/4	3-3/4	12
HIT-Z 3/4 x 8 1/2	7/8	4	6
HIT-Z 3/4 x 9 ¾	7/8	4	6

HIT-HY 200-A

HIT-HY 200-R

HIT-HY 200-A (accelerated working time)

Description	Package contents	Qty
HIT-HY 200-A (11.1 fl oz/330 ml)	Includes (1) foil pack with (1) mixer and 3/8 filler tube per pack	1
HIT-HY 200-A Master Carton (11.1 fl oz/330 ml)	Includes (1) master carton containing (25) foil packs with (1) mixer and 3/8 filler tube per pack	25
HIT-HY 200-A Combo (11.1 fl oz/330 ml)	Includes (1) master carton containing (25) foil packs with (1) mixer and 3/8 filler tube per pack and (1) HDM 500 Manual Dispenser	25
HIT-HY 200-A Master Carton (16.9 fl oz/500 ml)	Includes (1) master carton containing (20) foil packs with (1) mixer and 3/8 filler tube per pack	20
HIT-HY 200-A Combo (16.9 fl oz/500 ml)	Includes (2) master cartons containing (20) foil packs each with (1) mixer and 3/8 filler tube per pack and (1) HDM 500 Manual Dispenser	40
HIT-RE-M Static Mixer	For use with HIT-HY 200-A cartridges	1

HIT-HY 200-R (regular working time)

Description	Package contents	Qty
HIT-HY 200-R (11.1 fl oz/330 ml)	Includes (1) foil pack with (1) mixer and 3/8 filler tube per pack	1
HIT-HY 200-R Master Carton (11.1 fl oz/330 ml)	Includes (1) master carton containing (25) foil packs with (1) mixer and 3/8 filler tube per pack	25
HIT-HY 200-R Combo (11.1 fl oz/330 ml)	Includes (1) master carton containing (25) foil packs with (1) mixer and 3/8 filler tube per pack and (1) HDM 500 manual dispenser	25
HIT-HY 200-R Master Carton (16.9 fl oz/500 ml)	Includes (1) master carton containing (20) foil packs with (1) mixer and 3/8 filler tube per pack	20
HIT-HY 200-R Combo (16.9 fl oz/500 ml)	Includes (2) master cartons containing (20) foil packs each with (1) mixer and 3/8 filler tube per pack and (1) HDM 500 manual dispenser	40
HIT-RE-M Static Mixer	For use with HIT-HY 200-R cartridges	1

TE-CD Hollow Drill Bits

Order Description	Working length (in.)
Hollow Drill Bit TE-CD 1/2-13	8
Hollow Drill Bit TE-CD 9/16-14	9-1/2
Hollow Drill Bit TE-CD 5/8-14	9-1/2
Hollow Drill Bit TE-CD 3/4-14	9-1/2
Hollow Drill Bit TE-CD 16-A (Replacement collar)	

TE-YD Hollow Drill Bits

Order Description	Working Length (in.)
Hollow Drill Bit TE-YD 3/4-24	15-1/2
Hollow Drill Bit TE-YD 7/8-24	15-1/2
Hollow Drill Bit TE-YD 1-24	15-1/2
Hollow Drill Bit TE-YD 1 1/8-24	15-1/2
Hollow Drill Bit TE-YD 25-A (Replacement collar)	

HIT-HY 200 Adhesive Anchoring System 3.2.3

Threaded anchors for Hilti chemical anchor systems[1]

HAS-E Rods 5.8 steel			HAS Super A193, B7 high strength steel		HAS-R 304 stainless steel		HAS-R 316 stainless steel	
Description	**Qty**	**Qty**	**Description**	**Qty**	**Description**	**Qty**	**Description**	**Qty**
3/8 x 4-3/8	10	240	-	-	-	-	-	-
3/8x 5-1/8	20	200	**3/8 x 5-1/8**	20	**3/8 x 5-1/8**	20	**3/8 x 5-1/8**	20
3/8 x 8	10	160	-	-	**3/8 x 8**	10	-	-
3/8 x 12	10	90	-	-	-	-	**3/8 x 8**	10
1/2 x 3-1/8	10	240	-	-	-	-	-	-
1/2 x 4-1/2	10	160	-	-	-	-	-	-
1/2 x 6-1/2	20	160	**1/2 x 6-1/2**	20	**1/2 x 6-1/2**	20	**1/2 x 6-1/2**	20
1/2x 8	10	120	-	-	**1/2 x 8**	10	**1/2 x 8**	10
1/2 x 10	10	120	-	-	**1/2 x 10**	10	**1/2 x 11**	10
1/2 x 12	10	80	-	-	-	-	**1/2 x 12**	10
5/8 x 8	20	80	**5/8 x 7-5/8**	20	**5/8 x 7-5/8**	20	**5/8 x 7-5/8**	20
5/8 x 9	10	60	-	-	**5/8 x 10**	10	**5/8 x 9**	10
5/8 x 12	10	60	-	-	-	-	**5/8 x 12**	10
5/8 x 17	10	40	-	-	-	-	-	-
3/4 x 10	10	40	**3/4 x 9-5/8**	10	**3/4 x 9-5/8**	10	**3/4 x 9-5/8**	10
3/4 x 11	10	30	-	-	-	-	**3/4 x 10**	10
3/4 x 12	10	30	-	-	**3/4 x 12**	10	-	-
3/4 x 14	10	30	**3/4 x 14**	10	**3/4 x 14**	10	**3/4 x 16**	10
3/4 x 17	10	20	-	-	**3/4 x 16**	10		
3/4 x 19	10	20	-	-	-	-	-	-
3/4 x 21	10	20	-	-	-	-	-	-
3/4 x 25	10	20	-	-	-	-		
7/8 x 10	10	20	**7/8 x 10 HDG**	5	**7/8 x 10**	10	**7/8 x 10**	10
-	-	-	**7/8 x 12 HDG**	5	-	-	-	-
7/8 x 13	10	20	**7/8 x 16 HDG**	5	-	-	**7/8 x 16**	10
1 x 12	4	16	**1 x 12**	4	**1 x 12**	4	**1 x 12**	4
1 x 14	2	16	**1 x 14**	2	-	-	-	-
1 x 16	2	12	**1 x 16**	2	-	-	**1 x 16**	2
1 x 20	2	12	**1 x 21**	2	-	-	**1 x 20**	2
1-1/4 x 16	4	8	**1-1/4 x 16**	4	-	-	-	-
1-1/4 x 22	4	8	**1-1/4 x 23**	4	-	-	-	-

Hilti Rods are now stamped on the end to show grade of steel and overall anchor length!

E = ISO 898 Class 5.8 Steel

B = ASTM A 193, Grade B7 Steel

R1 = AISI 304 Stainless Steel

R2 = AISI 316 Stainless Steel

HIS-N carbon steel and HIS-RN 316 stainless steel internally threaded inserts[1]

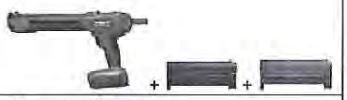
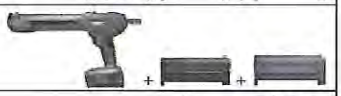
Description	Useable thread length (in)	Qty
3/8 x 4-1/4	1	10
1/2 x 5	1-3/16	5
5/8 x 6-5/8	1-1/2	5
3/4 x 8-1/4	2	5

1 All dimensions in inches.

3.2.3 HIT-HY 200 Adhesive Anchoring System

Accessories — Dispensers

Battery Powered

Description	
HDE 500-A18 Compact Battery Dispenser Kit[1] Includes dispenser, (2) compact B 18 1.6-Ah Li-Ion batteries, C 4/36 battery charger, black and red cartridge holders in a soft bag.	
HDE 500-A18 Industrial Battery Dispenser Kit[1] Includes dispenser, (2) industrial B 18 3.3-Ah Li-Ion batteries, C 4/36 battery charger, black and red cartridge holders in a soft bag.	
HDE 500-A18 Battery Dispenser Tool Body[1] Includes black and red cartridge holders	
Battery Charger C 4/36 Li-Ion 115V Use with all B 14.4, B 18 batteries or B 36 batteries	
Battery Compact 18 1.6-Ah Li-Ion	
Battery Industrial B 18 3.3-Ah Li-Ion	
HDE 500-A18 Hard Case	

Manual

Description	
MD 1000 Manual Dispenser[1] For HIT ICE	
HDM 500 Manual Dispenser with black foil pack holder For use with 11.1 fl oz/330 ml and 16.9 fl oz/500 ml foil packs of HIT-HY 150 MAX, HIT-HY 150 MAX-SD, HIT-RE 500, RE 500-SD, HIT-HY 10 PLUS, HIT-HY 70	
HDM 500 Manual Dispenser with red foil pack holder For use with 11.1 fl oz/330 ml and 16.9 fl oz/500 ml foil pack adhesives HY 200-A and HY 200-R	
HDM 500 Manual Dispenser with black and red foil pack holder For use with 11.1 fl oz/330 ml and 16.9 fl oz/500 ml foil pack adhesives HIT-HY 200-A, HIT-HY 200-R, HIT-HY 150 MAX, HIT-HY 150 MAX-SD, HIT-RE 500, HIT-RE 500-SD, HIT-HY 10 PLUS and HIT-HY 70	
HIT-CB 500 black cartridge (foil pack) holder replacement For use with 11.1 fl oz/330 ml and 16.9 fl oz/500 ml foil packs or HIT-HY 150 MAX, HIT-HY 150 MAX-SD, HIT-RE 500, HIT-RE 500-SD, HIT-HY 10 PLUS and HIT-HY 70	
HIT-CR 500 red cartridge (foil pack) holder replacement For use with 11.1 fl oz/330 ml and 16.9 fl oz/500 ml foil pack adhesives HIT-HY 200-A and HIT-HY 200-R	
HDM 500 Hard Case Only, no tool	

Pneumatic with 1/4 female compressed air coupling

Description	
P 3500 Pneumatic Dispenser[1] For use with HIT 11.1 fl oz/330 ml and 16.9 fl oz/500 ml foil pack	
HIT-P 8000D Pneumatic Dispenser[1] For use with HIT 47.3 fl oz/1400 ml jumbo foil pack	
P 3500 Cartridge (black foil pack) holder replacement For use with the P 3500 Pneumatic Dispenser and HIT-HY 150 MAX-SD, HIT-HY 150 MAX, HIT-RE 500-SD, HIT-RE 500, HIT-HY 70 and HIT-HY 10 PLUS	

1 Dispensers not compatible with HIT-HY 200 Adhesive Anchor System.

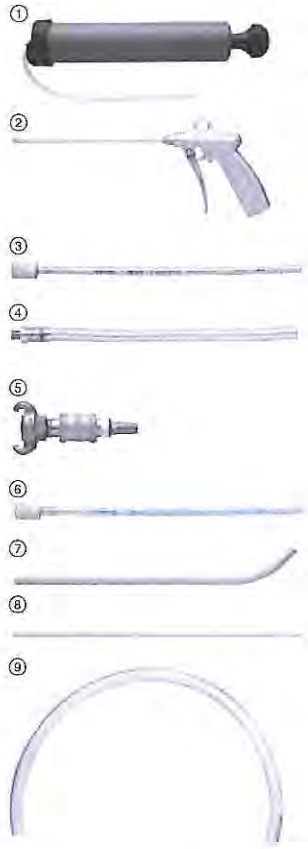
Color coded cartridge holders with the same quality dispenser

With the introduction of HIT-HY 200 and Safe Set™ Technology, Hilti has introduced a new chemistry with a 5:1 ratio. **All other Hilti adhesive anchor system have a 3:1 mix ratio.** The new technology allows for better performance and both the HDM 500 Manual Dispensers and HDE 500-A18 Battery Dispenser can accept both cartridge ratios. Simply change out the cartridge holder and you can use the dispenser on any jobsite with any Hilti foil pack adhesive.

HIT-HY 200 Adhesive Anchoring System 3.2.3

Hilti HIT Profi Accessories for blowing out drilled holes

Description		Diameter in.	Length ft	Qty
Blow-Out Pump For use in holes up to 10 in. deep	①			1
Blow-Out Tool G 1/4 NPT Inlet For use in holes up to 11 in. deep. For holes deeper than 11 in., use Blow-Out Tool plus the following extensions	②			1
Extension hose for blow-out tool HIT-DL 10/0.8	③	0.39	2.6	1
Extension hose for blow-out tool HIT-DL 16/0.8	④	0.71	2.6	1
3/8 Claw-type Quick Connect HIT-DL A	⑤			1
Extension hose for HIT-DL A HIT-DL V10/1	⑥	0.39	3.3	1
Extension tube HIT-DL B (Rigid/bent)	⑦	0.63		5
Extension tube HIT-VL 16/0.7 (Rigid/straight)	⑧	0.63	2.3	10
Coupler for blowing extensions HIT-DL K Metal coupler for splicing 16 mm extension hose		0.63		10
Extension hose HIT-VL 16 (Flexible)	⑨	0.63	33	1
HIT-DRS Dust Removal System with one hole for vacuum attachment and another hole for the Blow-Out Tool. For use with compressed air				1



3.2.3

Air nozzles

Attach to extension end for proper hole cleaning[1]

Description	Qty
HIT-DL 1/2 Use with 10 mm diameter hose	1
HIT-DL 9/16 Use with 10 mm diameter hose	1
HIT-DL 11/16 Use with 10 mm diameter hose	1
HIT-DL 3/4 Use with 16 mm diameter hose/tube	1
HIT-DL 7/8 Use with 16 mm diameter hose/tube	1
HIT-DL 1 Use with 16 mm diameter hose/tube	1
HIT-DL 1-3/8 Use with 16 mm diameter hose/tube	1

1 HIT-DL size determined by the diameter of drilled hole; see Accessory Selection Table below for proper sizing

Also avaliable in metric!

Round brush[2]

Piston plug (10 pack)[3]

Air nozzle

Hole diameter[1]	Description	Description	Use with hose dia.	Description
7/16	**HIT-RB 7/16**	-		-
1/2	**HIT-RB 1/2**	**HIT-IP 1/2**	9 mm	**HIT-DL 1/2**
9/16	**HIT-RB 9/16**	**HIT-IP 9/16**	9 mm	**HIT-DL 9/16**
5/8	**HIT-RB 5/8**	**HIT-IP 5/8**	9 mm	-
11/16	**HIT-RB 11/16**	**HIT-IP 11/16**	9 mm	**HIT-DL 11/16**
3/4	**HIT-RB 3/4**	**HIT-IP 3/4**	16 mm	**HIT-DL 3/4**
7/8	**HIT-RB 7/8**	**HIT-IP 7/8**	16 mm	**HIT-DL 7/8**
1	**HIT-RB 1**	**HIT-IP 1**	16 mm	**HIT-DL 1**
1-1/8	**HIT-RB 1 1/8**	**HIT-IP 1 1/8**	16 mm	-
1-1/4	**HIT-RB 1 1/4**	**HIT-IP 1 1/4**	16 mm	-
1- 3/8	**HIT-RB 1 3/8**	**HIT-IP 1 3/8**	16 mm	**HIT-DL 1 3/8**
1-1/2	**HIT-RB 1 1/2**	**HIT-IP 1 1/2**	16 mm	-
1-3/4	**HIT-RB 1 3/4**	**HIT-IP 1 3/4**	16 mm	-

1 Refer to adhesive anchor system installation instructions to determine the proper hole diameter for the fastening element to be used.
2 Attach brush to HIT-RBH T-handle, HIT-RBS or HIT-RBV extensions.
3 Use piston plugs to help prevent air voids during injection.

3.2.3 HIT-HY 200 Adhesive Anchoring System

Hilti HIT Profi Accessories for brushing drilled holes

Manual brush handle for round steel brush

Description		Qty
HIT-RBH (T-handle) Use to clean holes up to 11 in. deep	①	1

Manual brush extension for round steel brush

Description		Qty
HIT-RBV 11 in. extension for HIT-RBH (T-handle)	②	1

Holders for brush extension RBS

Connects RBS extension to your Hilti drill for use in cleaning holes

Description		Qty
TE-Y SDS Max connection	③	1
TE-C SDS + Connection	④	1

Extensions for round steel brushes

Description		Diameter in	Length ft	Qty
HIT-RBS 10/0.7	⑤	0.39	2.3	1
HIT-RBS-10/0.35	⑤	0.39	1.2	1

Hilti HIT Profi Accessories for adhesive injection

Extension hoses

For use in holes deeper than 10 in.

Description		Diameter in.	Length ft	Qty
HIT-VL 9/1.0 flexible hose	⑥	0.35	3.3	10
HIT-VL 16/0.7 rigid tube	⑦	0.63	2.3	10
HIT-VL 16 flexible hose		0.63	33	1

Coupler for injection extensions

Description		Diameter in.	Qty
HIT-VL K Plastic coupler for connecting 16 mm (0.63 in.) hoses and tubes	⑧	0.63	5

Overhead injection accessories

Description		Hole Diameter in.	Qty
HIT-OHW overhead wedge	⑨	7/16 to 1-1/4	100
HIT-OHC1 overhead drip guard	⑩	7/16 to 5/8	10
HIT-OHC2 overhead drip guard		11/16 to 1-1/4	10

6.4 Additional Vendor Information

This section was intentionally left blank.

7 Electric Controls & Schematics

VMR Screen
Sequence of Operation

(Typical operation for 4 screens.)

1. After the Screen has been properly installed/adjusted and all control panel devices (timer(s), overload, etc.) have been set, automatic operation may proceed. Go to the local control station and make sure the Emergency Stop button is pulled out, place the Hand-Off-Auto switch to the "Auto" position for the automatic circuit to be enabled and all personnel are clear of the equipment.

2. Then go to the Screen control panel, make sure all the selector switches are in the "Off" position. Open the control panel door and place the circuit breaker in the “On” position. Close and secure the control panel door. Then turn on the control panel main disconnect. Then turn the control power selector switch to the "On" position. The white control power indicator light should be on at this time.

3. In AUTO positon at the local control station, the screen shall be controlled by the differential level system, by the high level float switch or by the PLC based frequency and duration timers. Screen operation shall be started when the ultrasonic differential level system senses the operator adjustable differential level across the bar screen. Screen operation shall be stopped after the differential level is below an operator adjustable off set point. The screen will operate at low speed when operation is initiated by differential level or by timer. The screen will operate at high speed when operation is initiated by an operator adjustable high high upstream level ahead of the bar screen or when the high level float switch is closed. When any condition is no longer present the rakes will continue to run for the amount of time set in the off delay timer and park the rakes in the correct positon.

4. Control logic is included to provide overload protection in case of screen blockage that would stall the raking mechanism. If a blockage were encountered, the controls will stop the raking mechanism, reverse direction (low speed in reversal operations) to dislodge the blockage with the preceding rake, and then return to the normal raking direction. Once the blockage is dislodged, the operating sequence continues as normal. If the blockage is not dislodged after three (3) reversals, the screen will stop operation and an alarm signal will be generated. Reset is manually performed after correction of any cause for a trip out.

5. In HAND position at the local control station, the operator shall be able to run the rakes in low speed by selecting the respective FORWARD or REVERSE direction from the FORWARD-OFF-REVERSE selector switch.

6. There is an Ethernet connection available in the control panel for owners use. Ethernet IP addresses will be required for the operator interface and PLC to allow Ethernet communications to function.

VMR Screen
Device Functions

Push Buttons

Screen (X) Fault Reset	This momentary push button resets the VFD after an overcurrent condition. The Hand-Off-Auto selector switch should be placed in the "Off" position before pressing the Screen Fault Reset push button.

Selector Switches

Control Power	This switch is used to turn the control power for the control panel ON and OFF. The control panel will not function when this switch is in the "Off" position.

Pilot Lights

Control Power	This white pilot light will be lit when control power is available at the control panel.
Screen (X) Running	This green pilot light will be lit when the rakes are running.
Screen (X) Fault	This red pilot light will be lit after the current draw on the motor has exceeded the preset of the current sensing relay. This could be due to an exceedingly heavy load or a jam condition.

Automatic Control Devices

Screen (X) Frequency Timer	The frequency timer is located in the PLC and can be accessed by the operator interface on the control panel. The set point of the frequency timer determines how often the VMR Screen is called to run.
Screen (X) Duration Timer	The duration timer is located in the PLC and can be accessed by the operator interface on the control panel. The set point of the duration timer determines how long the VMR Screen will after the frequency timer has timed out.
Screen (X) Differential Level Detector	The differential level detector consists of two transducers, one mounted upstream from the bar screen and one mounted downstream from the bar screen. The transducers are wired to the main control panel. When the differential level reaches the preset/adjustable set point the bar screen will run continuously until the differential level is no longer present. The differential level system is an override to the repeat cycle timer. If a high high upstream level condition is detected, the bar screen will run continuously until the condition is no longer present
Screen (X) Off Delay Timer	The off delay timer is located within the PLC and can be accessed by the operator interface on the control panel. The set point of the off delay timer determines how long the VMR Screen continues to run after the start signals are no longer present.

VMR Screen
Device Functions

Screen (X) Local Control Station

Emergency Stop	This maintained push button would stop the operation of the screen when pushed whether being run in Hand or Auto modes.
Hand/Off/Auto	When this switch is in the “Hand” position, the Forward/Off/Reverse selector switch, in the local control station, is enabled. When in the “Auto” position, the frequency/duration timers, the ultrasonic differential level detector or float switch has control.
Forward/Off/Reverse	This switch is enabled when the Hand/Off/Auto switch is in the “Hand” position. Placing this switch in the “Forward” position will start the rakes in the forward direction. Hold this switch in the “Reverse” position and the rakes will run in the reverse direction at Lo speed. This switch is spring return from the reverse position.

Screw Conveyor
Sequence of Operation

(Typical operation for 2 screw conveyors.)

1. After the Conveyor has been properly installed/adjusted, motor rotation checked and all control panel devices (timer(s), overload(s), current sensing relay, etc.) have been set, automatic operation may proceed. Go to the local control station and make sure the cable-operated Emergency Stop switch is set and make sure all personnel are clear of the equipment.

2. Then go to the main control panel and open the door. Then turn on the circuit breakers for the drive motor. Close the door and place the main disconnect in the “On” position. Then turn the control power selector switch to the "On" position. The white control power indicator light should be on at this time. Place the conveyor Hand/Off/Auto selector switch in the “Auto” position for the automatic circuit to be enabled.

3. The Conveyor will be started when either of the Screens is running and will continue to run for a preset/adjustable amount of time after the Screens have stopped. If the Screens have started a continuous run due to a high level condition the Conveyor will be started and run continuously until the Screens have stopped and will continue to run for a preset/adjustable amount of time.

4. The Conveyor is protected from overtorque by a current sensing relay (CSR1). Should the Conveyor encounter an obstacle the drive motor current increases. Once this increase equals the preset of CSR1 a contact will close giving an input to the PLC. The logic within the PLC will stop the drive. Turn the Hand-Off-Auto selector switch to the "Off" position. Then press the Conveyor Fault Reset push button to reset. The jam must be cleared and the controls again set for automatic operation.

5. In HAND position at the local control station, the operator shall be able to run the rakes in low speed by selecting the respective FORWARD or REVERSE direction from the FORWARD-OFF-REVERSE selector switch.

6. There is an Ethernet connection available in the control panel for owners use. Ethernet IP addresses will be required for the operator interface and PLC to allow Ethernet communications to function.

Screw Conveyor Device Functions

Disconnect

The disconnect removes incoming voltage from the control panel. Voltage is still present at the top of the disconnect. When the disconnect switch is in the "Off" position, the control panel will not function. **This will not remove voltage supplied from other external sources.**

Selector Switches

Control Power

This switch is used to turn the control power for the control panel ON and OFF. The control panel will not function when this switch is in the “Off” position.

Hand-Off-Auto

When this switch is in the “Hand” position, the Forward-Off-Reverse selector switch is enabled. When in the “Auto” position, the automatic circuit within the PLC in the control panel has control.

Forward-Off-Reverse

This switch is enabled when the Hand-Off-Auto switch is in the “Hand” position. Placing this switch in the “Forward” position will run the hollow shaft in the forward direction. Hold this switch in the “Reverse” position and the conveyor will run in the reverse direction. This switch is spring return from the reverse position.

Push Buttons

Conveyor Fault Reset

This push button resets the Conveyor current sensing relay after an overtorque condition. It will also reset the solid-state motor overload. The Hand-Off-Auto selector switch should be placed in the “Off” position before pressing the Conveyor Fault Reset push button.

Pilot Lights

Control Power

This white pilot light will be lit when control power is available at the control panel.

Conveyor Running

This green pilot light will be lit when the Conveyor is running the automatic sequence programmed within the PLC or when run in manual mode.

Conveyor Fault

This red pilot light will be lit after the current draw on the motor has exceeded the preset of the current sensing relay. This could be due to an exceedingly heavy load or a jam condition. It can also be lit after the current draw on the motor has exceeded the preset of the solid-state motor overload. This could be due to a phase loss or short circuit in the three phase motor circuit.

Protective Devices

Current Sensing Relay

This relay monitors the current draw of the drive motor. When the current exceeds the preset of this relay the Conveyor will stop. The cause of the increased current draw must be corrected before automatic operation may continue. Press the Conveyor Fault Reset push button to reset.

Solid State MOL

This device provides phase loss and short circuit protection. It should be adjusted to the full load amp rating of the motor that the starter is controlling. Pressing the Conveyor Fault Reset button to reset the unit.

Screw Conveyor Device Functions

Automatic Control Devices

Off Delay Timer This PLC based off delay timer will allow the Conveyor to run for an adjustable amount of time after the screens have stopped.

Local Control Station Device Functions

Emergency Stop This maintained, cable-operated switch will stop the operation of the Screw Conveyor when pushed.

Compactor
Sequence of Operation

(Typical operation for 2 compactors.)

1. After the compactor has been properly installed/adjusted, motor rotation checked and all control panel devices (timer(s), overload(s), current sensing relay, etc.) have been set, automatic operation may proceed. Make sure all personnel are clear of the equipment. Pull out the Emergency Stop push button and place the Hand-Off-Auto selector switch in the "Auto" position for the automatic sequencing to be enabled.

2. Then go to the main control panel and open the door. Then turn on the circuit breaker for the drive motor. Close the door and place the main disconnect in the “On” position. Then turn the Control Power selector switch to the "On" position. The white Control Power indicator light should be on at this time.

3. The Batch Mode of the compactor will be started by counting the number of times the rake(s) on the bar screen pass through the wiper. This counting is accomplished by a limit switch mounted near the wiper. This limit switch contact will be used to increment a counter within the PLC. When the preset/adjustable count is reached the automatic Batch Mode of operation of the compactor will be initiated. During Batch Mode operation the screw will run alternately in the forward and reverse directions. The solenoid valves will be cycled "On" and "Off" as required by the program within the PLC. When the washing part of the program is complete, the material will be discharged and the dewatering zone and drain pan are flushed. Pressing the Initiate push button located on the local control station will also start a Batch Mode of operation. If a high high upstream level condition is detected by the ultrasonic level detector of if the high level float switch closes the Storm Mode operation of the compactor will begin and continue until the level falls below the operator adjustable set point or until the float switch opens.

4. The compactor is protected from overtorque by the current sensing relay (CSR2). Should the compactor encounter an obstacle the drive motor current increases. Once this increase equals the preset of CSR2 an input will be given to the PLC. At this point the screw will stop, reverse momentarily then run forward again in an attempt to clear the cause of the overtorque condition. After this occurs 3 times the automatic operation will cease and an alarm condition will be generated. Turn the Hand-Off-Auto selector switch to the "Off" position. Then push the Press Fault Reset push button to reset. Place the Hand-Off-Auto selector switch in the "Hand" position and use the Forward-Off-Reverse selector switch to reverse the screw. Once lockout procedures are met, the jam may be cleared and the controls again set for automatic operation.

5. There is an Ethernet connection available in the control panel for owners use. Ethernet IP addresses will be required for the operator interface and PLC to allow Ethernet communications to function.

Compactor
Shaft/Valve Sequencing

Batch Mode Operation

This mode of operation will commence when the hopper level sensor has detected the preset start level OR if the screen cycle counter has reached its preset number of cycles.

When the compactor is called to run the solenoid valves and drive motor will be sequenced as follows:

Step 1- Screw forward, valve 1 (spiral shaft) energized. (5 seconds)

Step 2- Screw stopped, valves 1 & 2 (spiral shaft & washing zone) energized. (5 seconds)**
Adjustment range 5-15 seconds.

Step 3- Screw reverse, valves 1 & 2 (spiral shaft & washing zone) energized. (3 seconds)

Step 4- Screw stopped, valve 2 (washing zone) energized. (5 seconds)**
Adjustment range 5-15 seconds.

Step 5- Screw forward, valve 1 (spiral shaft) energized. (4 seconds)

Steps 2 thru 5 will be repeated for a minimum of 6 cycles. The number of cycles that these steps are repeated can be changed by the operator interface on the front of the control panel. If the discharge from the compactor appears to require further "washing" the number of wash cycles should be increased as required. Washing cycle range should be 6-20 cycles.

Step 6- Screw forward, valve 1 (spiral shaft) energized. (10 seconds)

Step 7- Screw forward, no valves energized. (10 seconds)

Step 8- Screw stopped, valve 3 (flush dewatering zone) energized. (20 seconds)**
Adjustment range 20-120 seconds.

Step 9- Screw stopped, valve 4 (flush drain pan) energized. (20 seconds)**
Adjustment range 20-120 seconds.

(Time setting is operator adjustable via an operator interface)**

Storm Mode Operation

This mode of operation should commence when the screen and screw conveyor are running continuously due to a Storm condition where the material needs to keep moving.

The screw runs in the forward direction, reversing for 3 seconds of every 45 seconds of forward run time. The solenoid valves should be energized continuously during high channel operation. When the high channel condition is no longer present the unit will be ready for Batch Mode operation.

Compactor
Device Functions

Disconnect

The disconnect removes high voltage from the circuit breakers and transformer. Voltage is still present at the top of the disconnect. When the disconnect switch is in the "Off" position, the control panel will not function. **This will not remove voltage supplied from other external sources.**

Selector Switches

Control Power

This switch is used to turn the control power for the control panel ON and OFF. The control panel will not function when this switch is in the “Off” position.

Push Buttons

Compactor Fault Reset

This push button resets the compactor current sensing relay after an overtorque condition. The Hand-Off-Auto selector switch should be placed in the “Off” position before pressing the Fault Reset push button.

Pilot Lights

Compactor Running

This green pilot light will be lit when the compactor is running.

Compactor Fault

This red pilot light will be lit after the current draw on the motor has exceeded the preset of the current sensing relay. This could be due to an exceedingly heavy load or a jam condition.
This pilot light could also be lit if the solid-state motor overload has tripped. This could be due to an exceedingly heavy load or a jam condition.

Protective Devices

Current Sensing Relay

This relay monitors the current draw of the drive motor. When the current exceeds the preset of this relay the compactor will stop. The cause of the increased current draw must be corrected before automatic operation may continue. Press the Compactor Fault Reset push button to reset.

Solid State MOL

This device provides phase loss and short circuit protection. It should be adjusted to the full load amp rating of the motor that the starter is controlling. Press the Compactor Fault Reset push button to reset.

Automatic Control Devices

Screen Cycle Counter

The screen cycle counter programmed within the PLC will count the number of times the rakes pass through the wiper on the screens to initiate the Batch Mode operation. The preset for this counter is operator adjustable via the Operator Interface on the door of the control panel.

Wash Cycle Counter

The wash cycle counter programmed within the PLC will count the number of washing cycles that the compactor will make when it has been started in the Batch Mode. If the discharge from the compactor is not as clean as desired, the wash cycle count should be increased until the desired result is achieved. The preset for this counter is operator adjustable via the Operator Interface on the door of the control panel.

Compactor
Device Functions

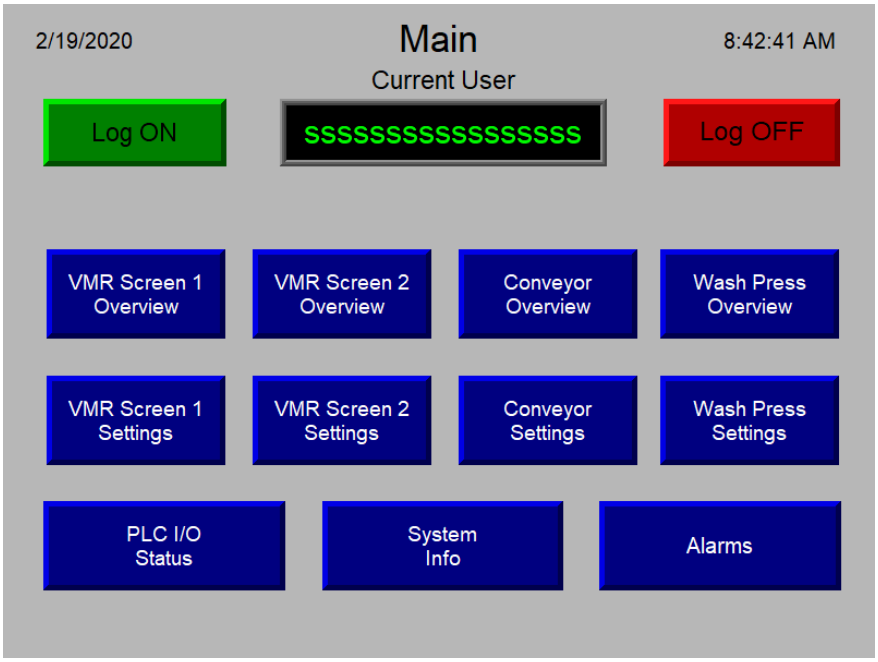
Local Control Station

Hand-Off-Auto	When this switch is in the “Local” position, the Forward-Off-Reverse selector switch is enabled. When in the “Auto” position, the automatic circuit within the PLC in the control panel has control.
Forward-Off-Reverse	This switch is enabled when the Hand-Off-Auto switch is in the “Hand” position. Placing this switch in the “Forward” position will run the hollow shaft in the forward direction. Hold this switch in the “Reverse” position and the rake will run in the reverse direction until the reverse run timer times out. This switch is spring return from the reverse position.
Initiate	The operator may use this momentary push button may be used to start an automatic Batch Mode cycle of the compactor.
Emergency Stop	This maintained push button will stop the operation of the compactor when pushed.

Wichita, KS

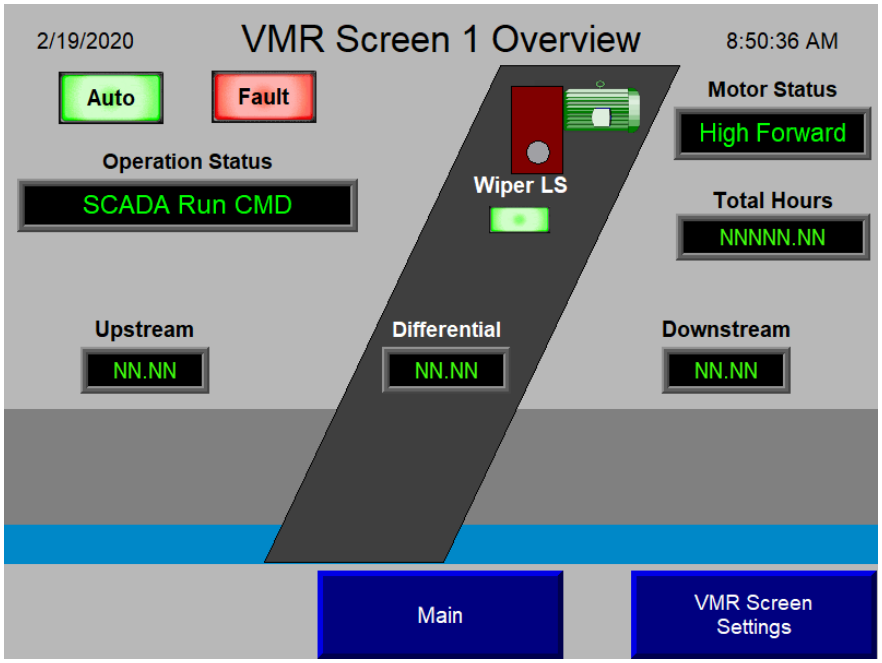
Job #19177

Main Page



Each of the buttons on this page is a link to different page in the Operator Interface Terminal (OIT). The Log On and Log Off buttons are used to log on and off users. The current user that is logged in will be displayed in the Current User window.

VMR Screen Overview



This page gives a graphical overview of the VMR screen. The blue water levels shown ahead and behind the screen will change, simulating the actual levels in the channel. Above these levels are the actual level readouts. The motor is shown red when stopped and green when running. The speed of the motor as well as the current draw is also displayed.

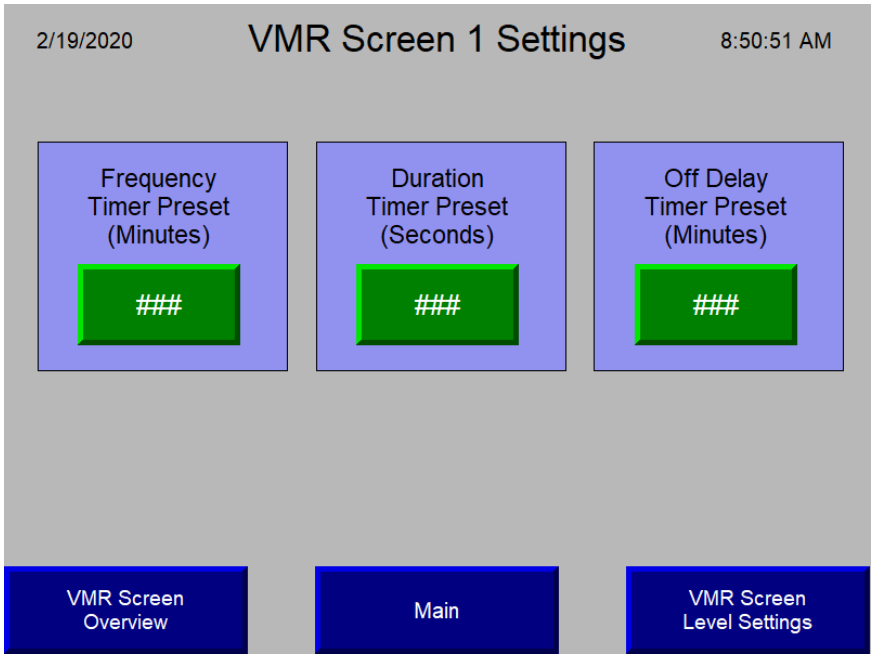
The Auto status indicator will illuminate when the VMR screen is in auto.

The Fault status indicator will illuminate when there is a VMR screen fault.

The Motor Status indicator displays whether the motor is stopped or running.

The Operation Status indicator displays what the VMR screen is currently doing.

VMR Screen Settings



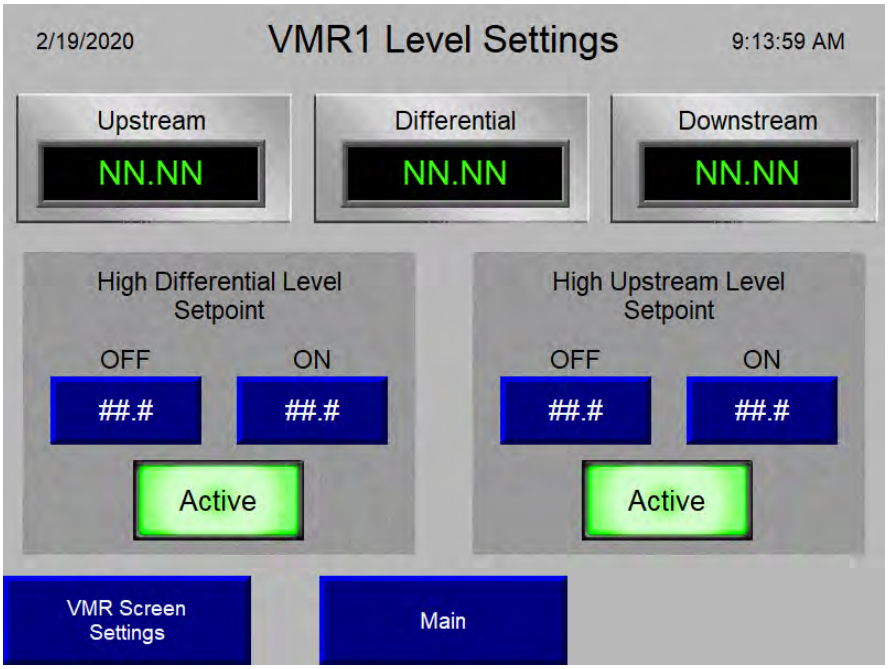
This page is used to adjust the settings of the VMR screen.

The Frequency Timer Preset is how often the screen will make an exercise cycle.

The Duration Timer is how long the screen will run when called by the Frequency Timer.

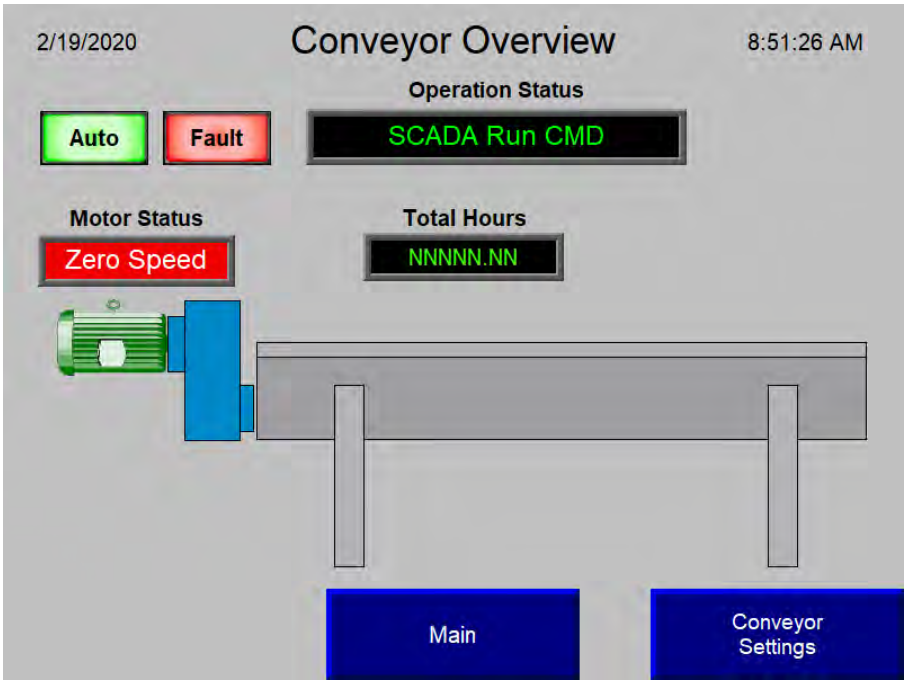
The Off Delay Timer is how long the screen will shut down after a run signal is no longer present.

Level Settings



This page shows the levels at the stair screen. These levels are read from the Milltronics. The buttons are used to adjust the ON and OFF setpoints of the level settings. The indicators will illuminate when the relay is active.

Conveyor Overview



This page gives a graphical overview of the conveyor. The motor is shown red when it is stopped and green when it is running.

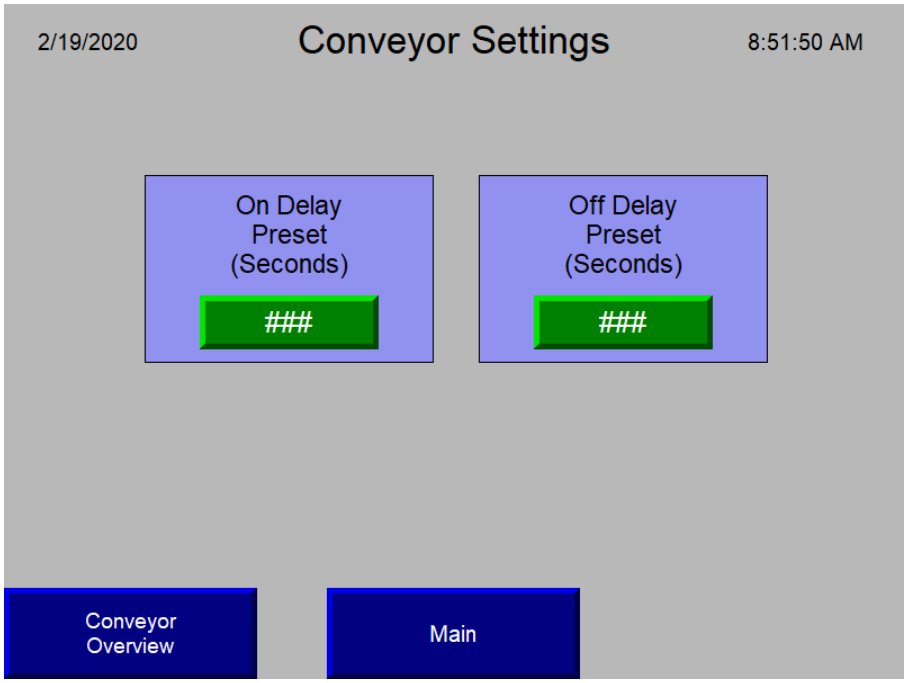
The Auto status indicator will illuminate when the wash press is in auto.

The Fault status indicator will illuminate when there is a conveyor fault.

The Motor Status indicator displays whether the motor is stopped or running.

The Operation Status indicator displays what the conveyor is currently doing.

Conveyor Settings

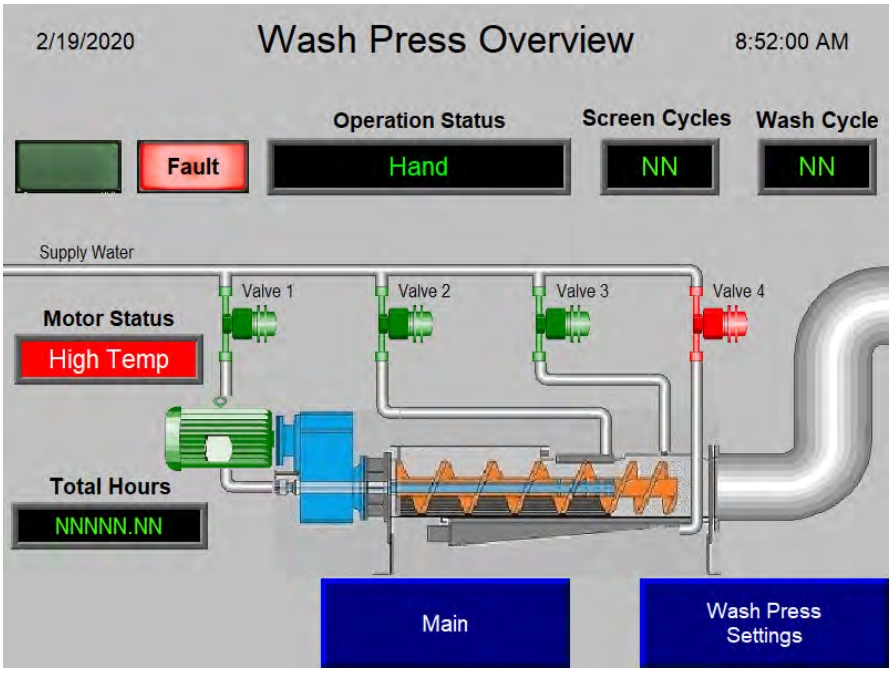


This page is used for setting up the conveyor.

The On Delay Preset is the amount of time that the conveyor will delay starting after a screen has started.

The Off Delay Preset is the amount of time that the conveyor will continue to run after both screens have stopped.

Wash Press Overview



This page gives a graphical overview of the wash press. The motor is shown red when it is stopped and green when it is running. The solenoid valves are shown red when they are closed and green when they are open.

The Auto status indicator will illuminate when the wash press is in auto.

The Fault status indicator will illuminate when there is a Wash Press fault.

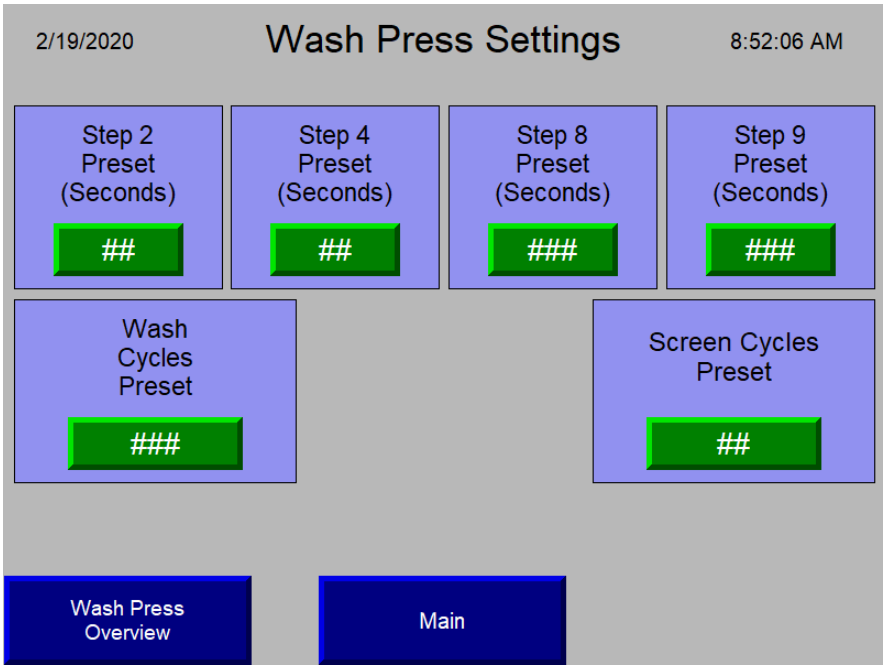
The Motor Status indicator displays whether the motor is stopped or running.

The Operation Status indicator displays what the Wash Press is currently doing.

The Screen Cycles indicator displays how many cycles the screen has made.

The Wash Cycles indicator displays how many wash cycles the wash press has completed in its current batch mode cycle.

Wash Press Settings



This page is used for setting up the Wash Press.

The Step 2 preset lets the user select how long valves 1 and 3 should be on in step 2 of the batch cycle.

The Step 4 preset lets the user select how long valve 3 should be on in step 4 of the batch cycle.

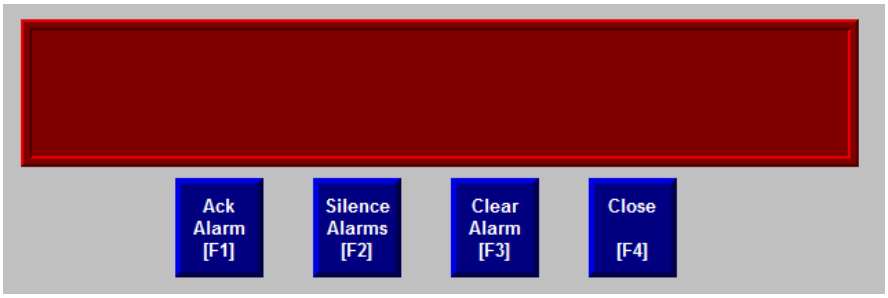
The Dewatering Zone Flush preset lets the user select how long valve 3 is on during step 8.

The Drain Pan Flush preset lets the user select how long valve 4 is on during step 9.

The Wash Cycle Preset lets the user select how many wash cycles the Wash Press needs to complete during a batch cycle.

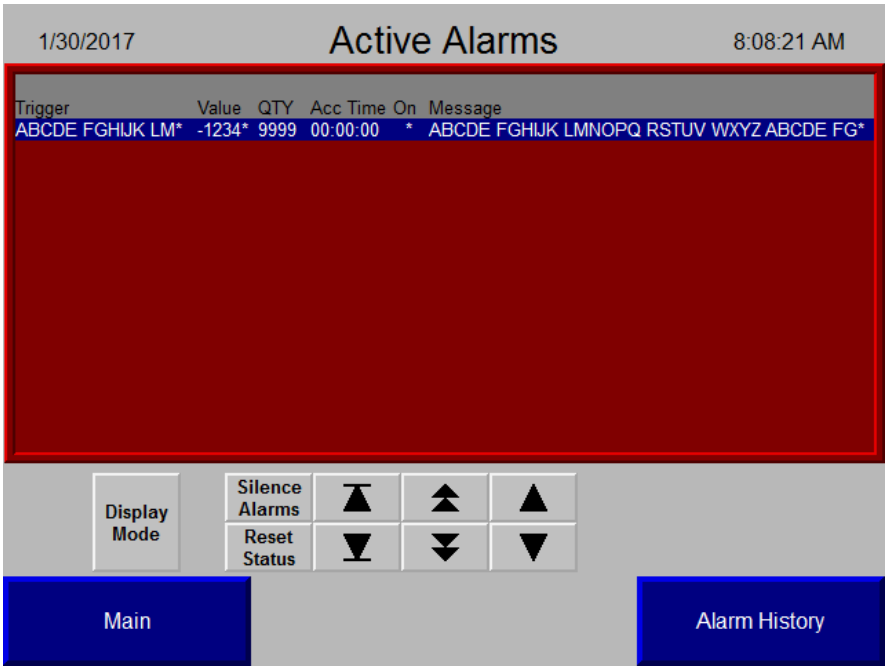
The Screen Cycle Preset is how many cycles the screen will make before a Batch Mode is initiated.

Alarm Banner



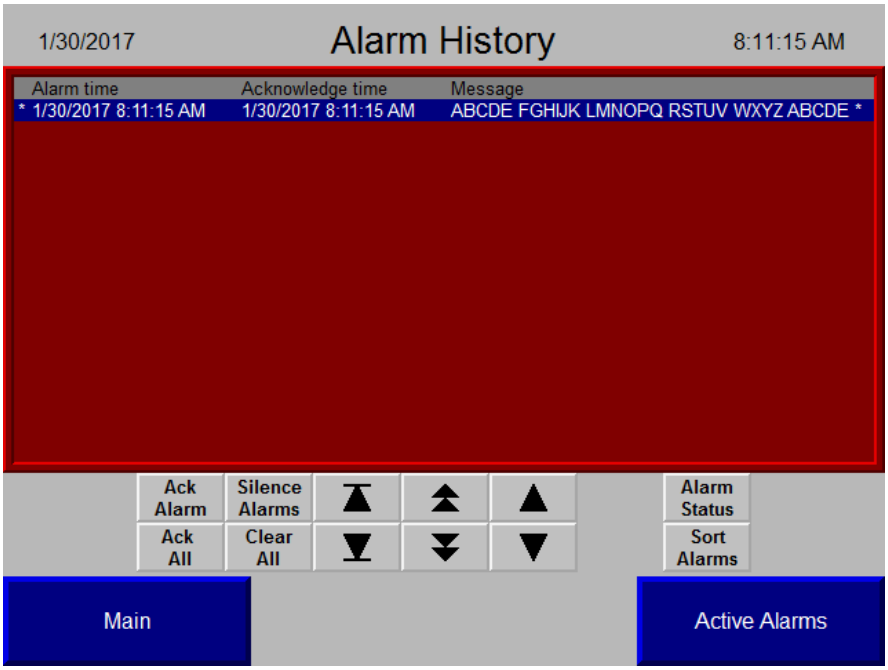
This screen will pop up whenever there is a current alarm and let the user know what the alarm is.

Active Alarms



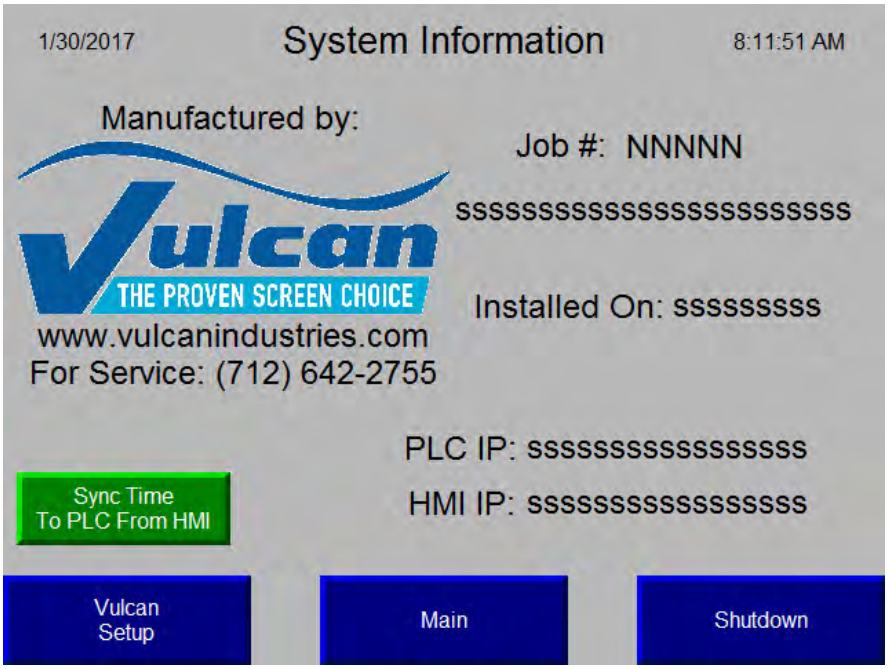
This page displays all of the current alarms.

Alarm History



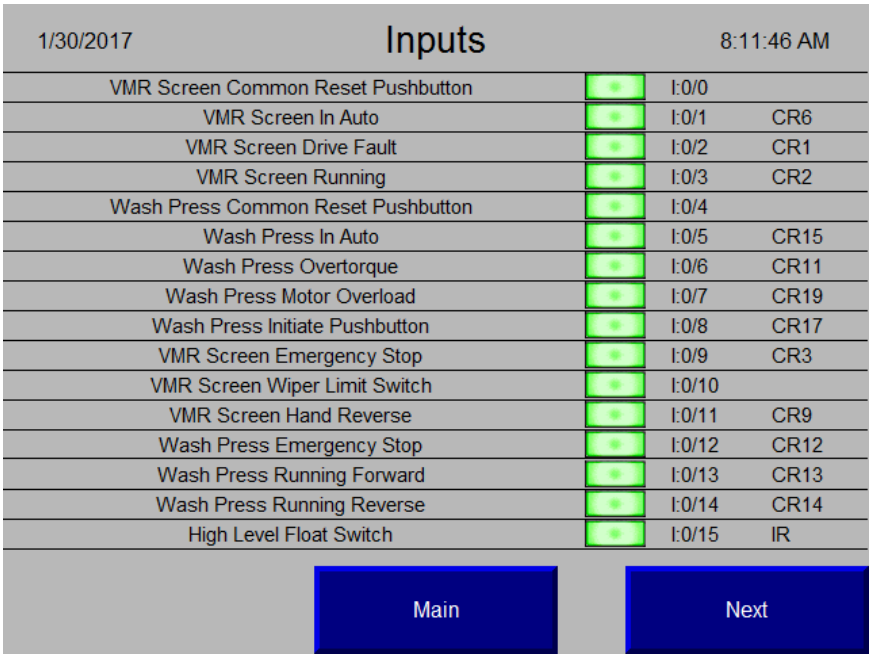
This page is used to display all of the past and present alarms.

System Information



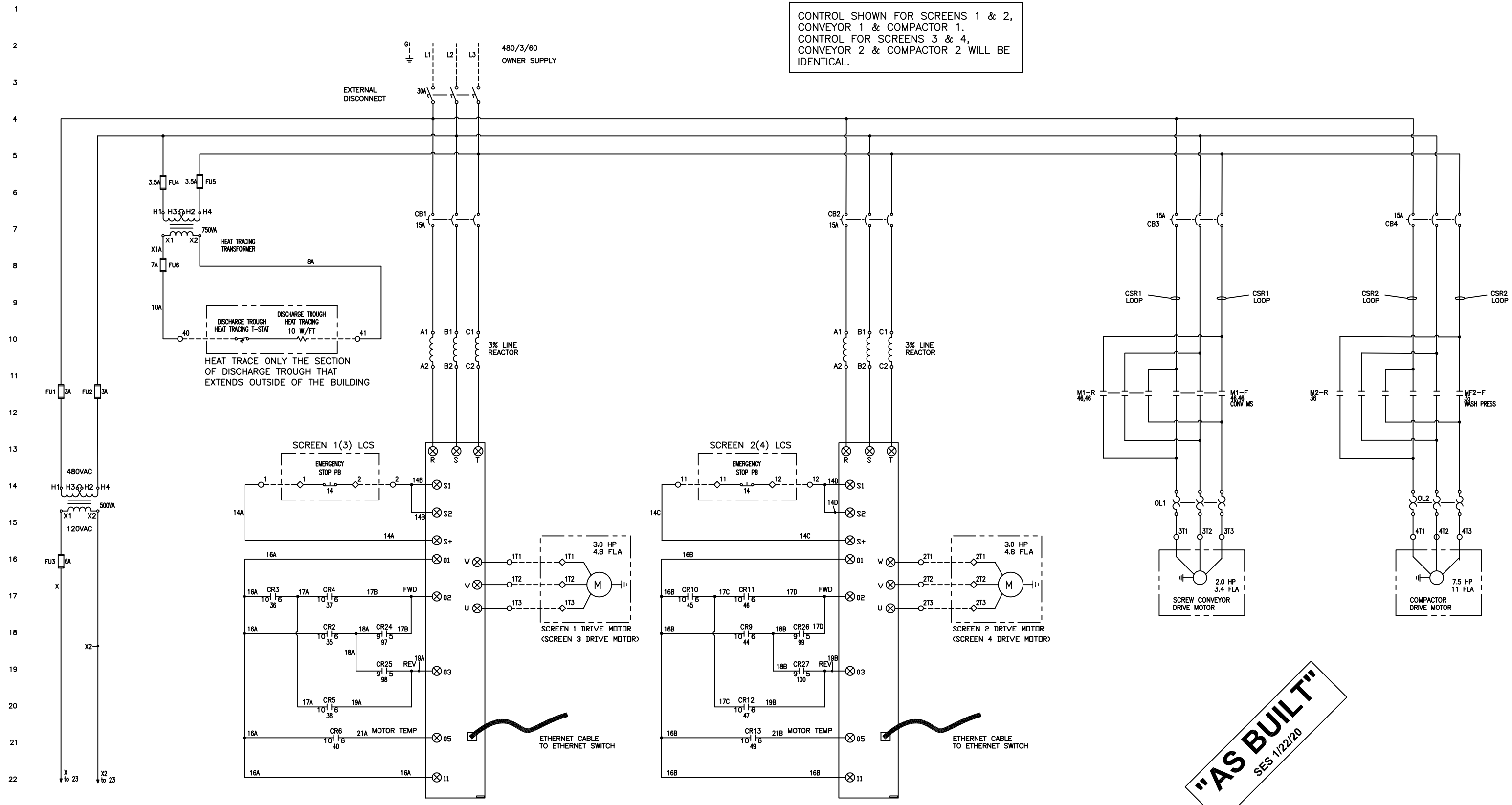
This page displays information about the equipment and offers links for setup purposes. Press the Shutdown button to shut down the runtime and adjust settings of the PanelView such as the date and time. The Vulcan Setup is for Vulcan Service Tech use only.

I/O Status



These pages display the status of the inputs and outputs on the PLC. The lamp is illuminated when the input or output is active.

CONTROL SHOWN FOR SCREENS 1 & 2, CONVEYOR 1 & COMPACTOR 1. CONTROL FOR SCREENS 3 & 4, CONVEYOR 2 & COMPACTOR 2 WILL BE IDENTICAL.



"AS BUILT"
SES 1/22/20

TYPICAL OF TWO CONTROL PANELS

DENOTES EXTERNALLY MOUNTED

DENOTES DOOR MOUNTED

VULCAN INDUSTRIES IS NOT RESPONSIBLE FOR CONDUIT AND WIRING BETWEEN THE CONTROL PANEL AND THE EQUIPMENT.

CAUTION!
THIS CONTROL PANEL IS DESIGNED TO BE MOUNTED IN A NON-EXPLOSIVE ENVIRONMENT. INSTALL PROPER CONDUIT RUNS AND SEALING FITTINGS BETWEEN EXPLOSIVE AND NON-EXPLOSIVE ENVIRONMENTS PER NATIONAL ELECTRIC CODES.

WIRING COLOR CODE
AC NEUTRAL- WHITE
AC HOT-BLACK
GROUND-GREEN
AC CONTROL INTERNAL-RED
AC CONTROL EXTERNAL-YELLOW
DC POS-BLUE
DC NEG-BLUE W/WHITE
DC CONTROL-BLUE

1. CONTROL PANEL NEMA 4X.
2. LOCAL STATION NEMA 7.
3. HEAT SHRINK WIRE MARKERS.
4. CONTROL PANEL UL LISTED 698A.
5. PVC COATED ALUMINUM CONDUIT.

CONTROL WIRING
FIELD WIRING
CONTROL PANEL TERMINAL
SCREEN LCS/J-BOX TERMINAL
PRESS LCS/VALVE STAND TERMINAL

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712-642-2755
www.vulcanindustries.com

SCALE: NONE			DRAWN BY: SES
DATE: 5/14/19	SHEET NUMBER: 1 OF 4		REVIEWED BY: SES
TITLE: 2-VMR,1 TF CONVEYOR & 1-EWP SCHEMATIC			PROJECT NUMBER: 19177
PROJECT: WICHITA WWTP-WICHITA, KS			DRAWING NUMBER: ED-6801-A

CONTROL SHOWN FOR SCREENS 1 & 2, CONVEYOR 1 & COMPACTOR 1. CONTROL FOR SCREENS 3 & 4, CONVEYOR 2 & COMPACTOR 2 WILL BE IDENTICAL.

X from 22 | X2 from 22

SURGE ARRESTOR W/LINE FILTER

CONTROL POWER OFF ON OX

26A

CONTROL POWER INDICATOR

1A FU7

28A

POWER SUPPLY

29A | 29B

OPERATOR INTERFACE

2711P-T10C21D8S

ETHERNET SWITCH

ETHERNET CABLE TO SCADA (BY OTHERS)

ETHERNET CABLE TO SCREEN 1 VFD

ETHERNET CABLE TO SCREEN 2 VFD

ETHERNET CABLE TO PLC

ETHERNET CABLE TO OIT

SCREEN 2(3) LOCAL CONTROL STATION (SCREEN MOUNTED)

EMERGENCY STOP

OFF HAND AUTO OOX

XOO

OFF FOR REV XOO

OOX

SCREEN MOTOR THERMAL

WIPER LIMIT SWITCH NO-HC

CR1	34A	SCREEN 1 (3) EMERGENCY STOP RELAY	NO 94 NC
CR2	35A	SCREEN 1 (3) AUTO RELAY	NO 18,95 NC
CR3	36A	SCREEN 1 (3) HAND RELAY	NO 17,96 NC
CR4	37A	SCREEN 1 (3) RUN FORWARD RELAY	NO 17 NC
CR5	38A	SCREEN 1 (3) RUN REVERSE RELAY	NO 20 NC
CR6	40A	SCREEN 1 (3) MOTOR THERMAL RELAY	NO 21 NC 97
CR7	41A	SCREEN 1 (3) WIPER LIMIT SWITCH RELAY	NO 98 NC

SCREEN 2(4) LOCAL CONTROL STATION (SCREEN MOUNTED)

CR8	43A	SCREEN 2 (4) EMERGENCY STOP RELAY	NO 100 NC
CR9	44A	SCREEN 2 (4) AUTO RELAY	NO 18,101 NC
CR10	45A	SCREEN 2 (4) HAND RELAY	NO 17,102 NC
CR11	46A	SCREEN 2 (4) RUN FORWARD RELAY	NO 17 NC
CR12	47A	SCREEN 2 (4) RUN REVERSE RELAY	NO 20 NC
CR13	49A	SCREEN 2 (4) MOTOR THERMAL RELAY	NO 21 NC 103
CR14	50A	SCREEN 2 (4) WIPER LIMIT SWITCH RELAY	NO 104 NC
CR15	55A	CONVEYOR IN AUTO RELAY	NO 107 NC
CR16	52A	CONVEYOR EMERGENCY STOP SWITCH RELAY	NO 106 NC

MOUNTED TO CONVEYOR

CABLE OPERATED E-STOP SWITCH

CONVEYOR OFF HAND AUTO XOO OOX

CONVEYOR OFF FOR REV XOO OOX

CR17 | R | F | OL1 | CR18 — CONVEYOR MOTOR STARTER

CR28

to 56 A

to 56 B

"AS BUILT" SES 1/22/20

TYPICAL OF TWO CONTROL PANELS

1. CONTROL PANEL NEMA 4X.
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AC CONTROL EXTERNAL-YELLOW
DC POS-BLUE
DC NEG-BLUE W/WHITE
DC CONTROL-BLUE

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CAUTION!

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CONTROL WIRING
FIELD WIRING
CONTROL PANEL TERMINAL
SCREEN LCS/J-BOX TERMINAL
PRESS LCS/VALVE STAND TERMINAL

Vulcan THE PRAIRIE SCREEN CENTRE
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MISSOURI VALLEY, IA. 51555
712-642-2755
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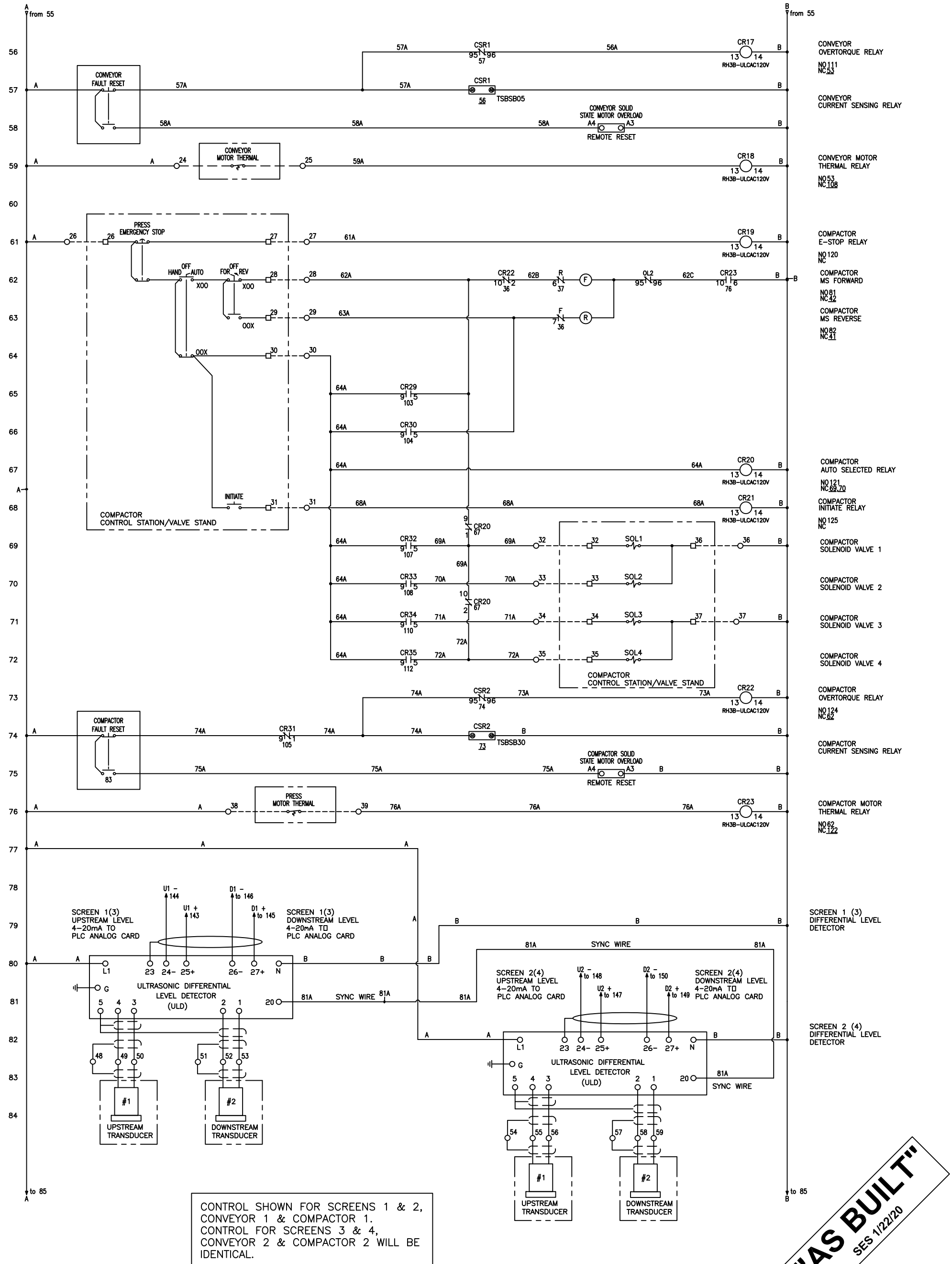
SCALE: NONE		DRAWN BY:	SES
DATE: 5/14/19	SHEET NUMBER: 2 OF 4	REVIEWED BY:	SES
TITLE: 2-VMR,1 TF CONVEYOR & 1-EWP SCHEMATIC		PROJECT NUMBER:	19177
PROJECT: WICHITA WWTP-WICHITA, KS		DRAWING NUMBER:	ED-6801-B



CONTROL SHOWN FOR SCREENS 1 & 2, CONVEYOR 1 & COMPACTOR 1. CONTROL FOR SCREENS 3 & 4, CONVEYOR 2 & COMPACTOR 2 WILL BE IDENTICAL.

"AS BUILT" SES 1/22/20

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AC NEUTRAL– WHITE
AC HOT–BLACK
GROUND–GREEN
AC CONTROL INTERNAL–RED
AC CONTROL EXTERNAL–YELLOW
DC POS–BLUE
DC NEG–BLUE W/WHITE
DC CONTROL–BLUE

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3. HEAT SHRINK WIRE MARKERS.
4. CONTROL PANEL UL LISTED 698A.
5. PVC COATED ALUMINUM CONDUIT.

——— CONTROL WIRING
– – – – – – – – – FIELD WIRING
○ CONTROL PANEL TERMINAL
◇ SCREEN LCS/J–BOX TERMINAL
□ PRESS LCS/VALVE STAND TERMINAL

TYPICAL OF TWO CONTROL PANELS

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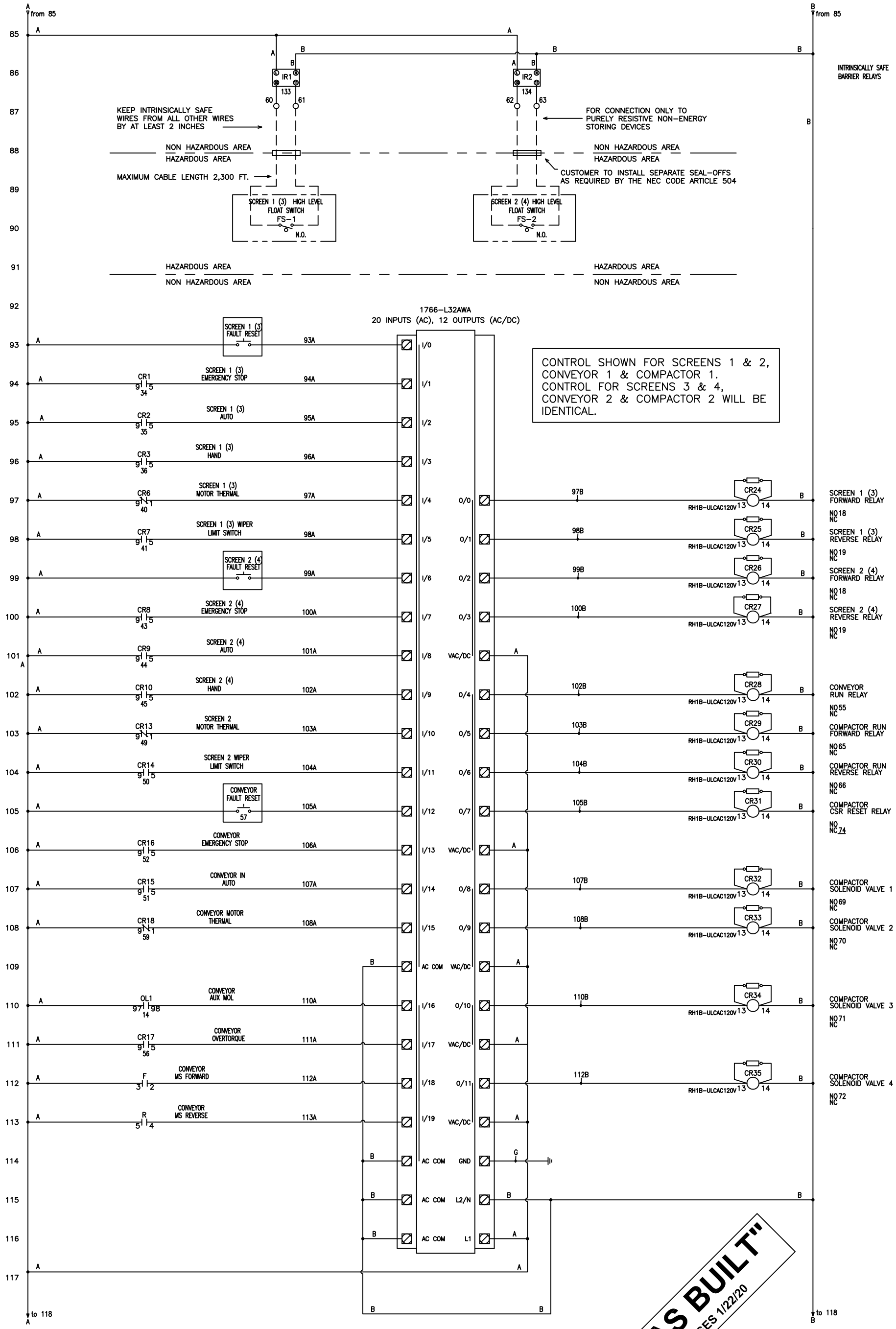
SCALE: NONE			DRAWN BY: SES
DATE: 5/14/19	SHEET NUMBER: 3 OF 4		REVIEWED BY: SES
TITLE: 2-VMR,1 TF CONVEYOR & 1-EWP SCHEMATIC			PROJECT NUMBER: 19177
PROJECT: WICHITA WWTP-WICHITA, KS			DRAWING NUMBER: ED-6801-C



"AS BUILT"
SES 1/22/20

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CONTROL PANEL TERMINAL
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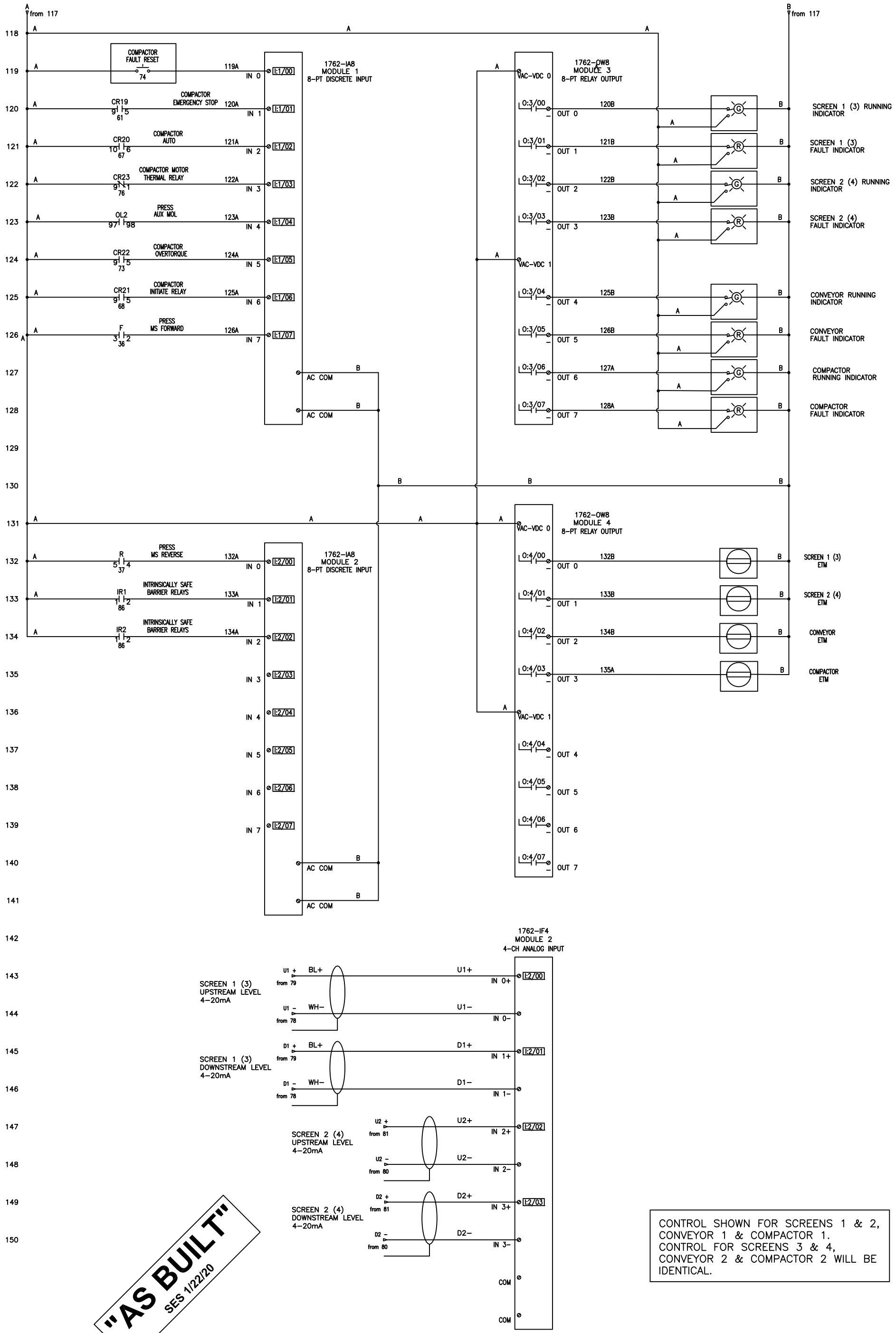
SCALE: NONE			DRAWN BY: SES
DATE: 5/14/19	SHEET NUMBER: 3 OF 4		REVIEWED BY: SES
TITLE: 2-VMR,1 TF CONVEYOR & 1-EWP SCHEMATIC			PROJECT NUMBER: 19177
PROJECT: WICHITA WWTP-WICHITA, KS			DRAWING NUMBER: ED-6801-D



"AS BUILT"
SES 1/22/20

CONTROL SHOWN FOR SCREENS 1 & 2, CONVEYOR 1 & COMPACTOR 1. CONTROL FOR SCREENS 3 & 4, CONVEYOR 2 & COMPACTOR 2 WILL BE IDENTICAL.

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DC NEG–BLUE W/WHITE
DC CONTROL–BLUE

VULCAN INDUSTRIES IS NOT RESPONSIBLE FOR CONDUIT AND WIRING BETWEEN THE CONTROL PANEL AND THE EQUIPMENT.

CAUTION!
THIS CONTROL PANEL IS DESIGNED TO BE MOUNTED IN A NON–EXPLOSIVE ENVIRONMENT. INSTALL PROPER CONDUIT RUNS AND SEALING FITTINGS BETWEEN EXPLOSIVE AND NON–EXPLOSIVE ENVIRONMENTS PER NATIONAL ELECTRIC CODES.

1. CONTROL PANEL NEMA 4X.
2. LOCAL STATION NEMA 7.
3. HEAT SHRINK WIRE MARKERS.
4. CONTROL PANEL UL LISTED 698A.
5. PVC COATED ALUMINUM CONDUIT.

——— CONTROL WIRING
– – – – – – – – – FIELD WIRING
○ CONTROL PANEL TERMINAL
◇ SCREEN LCS/J–BOX TERMINAL
□ PRESS LCS/VALVE STAND TERMINAL

Vulcan THE PROVEN SCREEN CHOICE
212 SOUTH KIRLIN STREET
MISSOURI VALLEY, IA. 51555
712-642-2755
www.vulcanindustries.com

SCALE: NONE			DRAWN BY: SES
DATE: 5/14/19	SHEET NUMBER: 3 OF 4		REVIEWED BY: SES
TITLE: 2-VMR,1 TF CONVEYOR & 1-EWP SCHEMATIC			PROJECT NUMBER: 19177
PROJECT: WICHITA WWTP-WICHITA, KS			DRAWING NUMBER: ED-6801-E

MAIN CONTROL PANEL
TERMINAL BLOCKS

1T1
1T2
1T3 — FIELD WIRING → SCREEN 1(3) LOCAL CONTROL/J–BOX TERMINAL BLOCKS 1T1, 1T2, 1T3 — SCREEN 1 DRIVE MOTOR

2T1
2T2
2T3 — FIELD WIRING → SCREEN 1(3) LOCAL CONTROL/J–BOX TERMINAL BLOCKS 1, 2 — EMERGENCY STOP PB

SCREEN 1(3) LOCAL CONTROL/J–BOX TERMINAL BLOCKS
3 — TO LCS PILOT DEVICES
4 — FROM EMERGENCY STOP PB
5 — FROM H/O/A AUTO CONTACT
6 — FROM H/O/A HAND CONTACT
7 — FROM F/O/R FORWARD CONTACT
8 — FROM F/O/R REVERSE CONTACT
9 — FROM MOTOR THERMAL
10 — FROM WIPER LIMIT SWITCH

3T1
3T2
3T3 — FIELD WIRING → CONVEYOR DRIVE MOTOR

4T1
4T2
4T3 — FIELD WIRING → COMPACTOR DRIVE MOTOR

1–10 — FIELD WIRING → SCREEN 2(4) LOCAL CONTROL/J–BOX TERMINAL BLOCKS 2T1, 2T2, 2T3 — SCREEN 2 DRIVE MOTOR

SCREEN 2(4) LOCAL CONTROL/J–BOX TERMINAL BLOCKS
11, 12 — EMERGENCY STOP PB
13 — TO LCS PILOT DEVICES
14 — FROM EMERGENCY STOP PB
15 — FROM H/O/A AUTO CONTACT
16 — FROM H/O/A HAND CONTACT
17 — FROM F/O/R FORWARD CONTACT
18 — FROM F/O/R REVERSE CONTACT
19 — FROM MOTOR THERMAL
20 — FROM WIPER LIMIT SWITCH

11–20 — FIELD WIRING → SCREEN 2(4) LOCAL CONTROL/J–BOX TERMINAL BLOCKS

21 — FIELD WIRING — TO CONVEYOR CABLE OPERATED E–STOP
22 — FROM CABLE OPERATED E–STOP N.C. CONTACT
23 — FROM CABLE OPERATED E–STOP AUX N.C. CONTACT
24, 25 — CONVEYOR N.C. MOTOR THERMAL

PRESS LOCAL CONTROL/VALVE STAND
TERMINAL BLOCKS
26, 27 — EMERGENCY STOP PB
28 — FROM F/O/R FORWARD CONTACT
29 — FROM F/O/R REVERSE CONTACT
30 — FROM H/O/A AUTO CONTACT
31 — FROM INITIATE PB
32 — TO SOLENOID VALVE 1
33 — TO SOLENOID VALVE 2
34 — TO SOLENOID VALVE 3
35 — TO SOLENOID VALVE 4
36 — NEUTRAL FOR VALVES 1 & 2
37 — NEUTRAL FOR VALVES 3 & 4

26–37 — FIELD WIRING → PRESS LOCAL CONTROL/VALVE STAND TERMINAL BLOCKS

38, 39 — FIELD WIRING — COMPACTOR N.C. MOTOR THERMAL
40, 41 — COMPACTOR DISCHARGE PIPE HEAT TRACING
42–47 — SPARE

48 — FIELD WIRING — SHEILD
49 — SCREEN 1 UPSTREAM TRANSDUCER + (BLACK)
50 — SCREEN 1 UPSTREAM TRANSDUCER – (WHITE)
51 — SHEILD
52 — SCREEN 1 DOWNSTREAM TRANSDUCER + (BLACK)
53 — SCREEN 1 DOWNSTREAM TRANSDUCER – (WHITE)

54 — SHEILD
55 — SCREEN 2 UPSTREAM TRANSDUCER + (BLACK)
56 — SCREEN 2 UPSTREAM TRANSDUCER – (WHITE)
57 — SHEILD
58 — SCREEN 2 DOWNSTREAM TRANSDUCER + (BLACK)
59 — SCREEN 2 DOWNSTREAM TRANSDUCER – (WHITE)

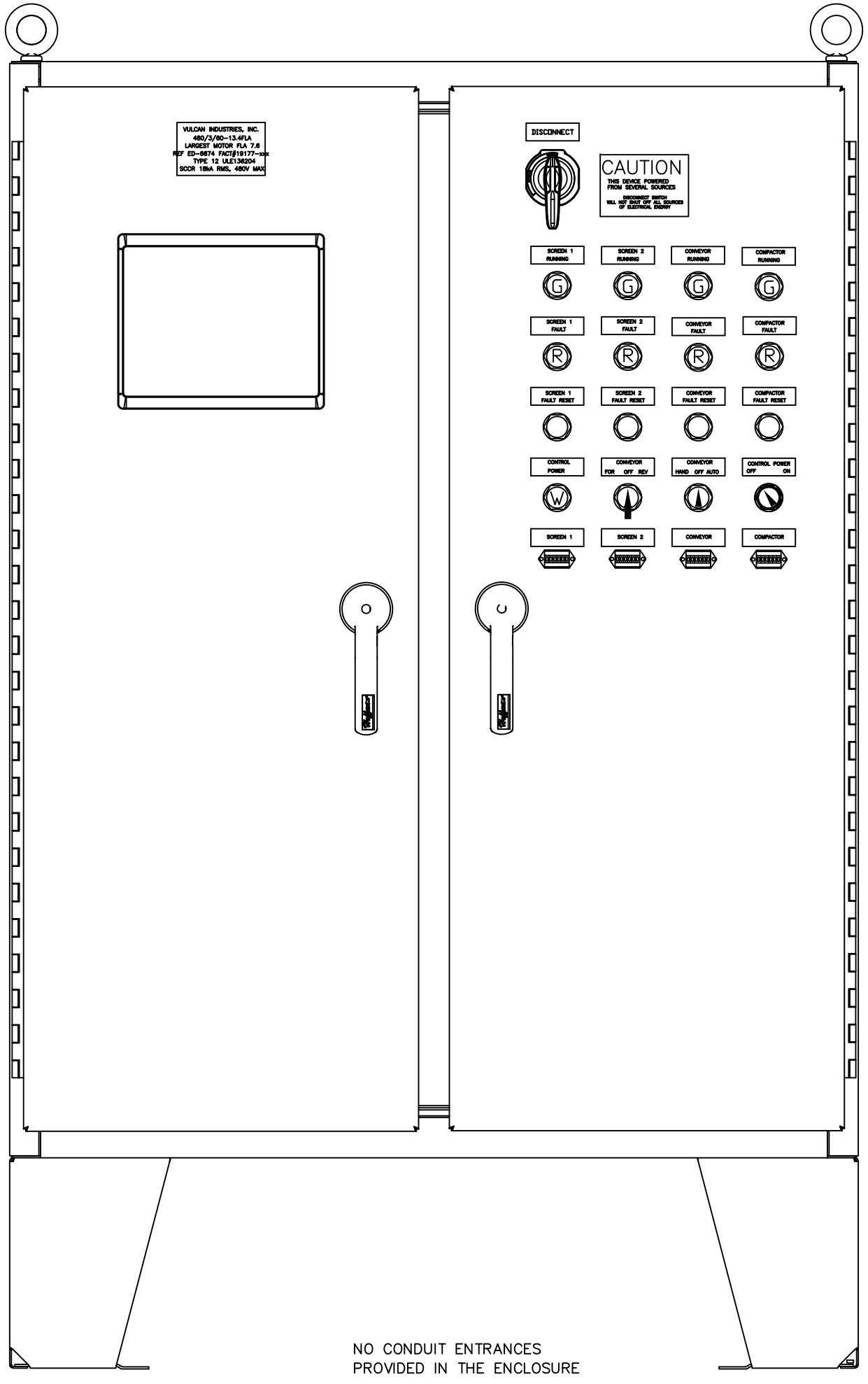
INTRINSICALLY SAFE WIRING

60, 61 — FIELD WIRING — SCREEN 1 HIGH LEVEL FLOAT SWITCH (FS–1)
62, 63 — SCREEN 2 HIGH LEVEL FLOAT SWITCH (FS–2)

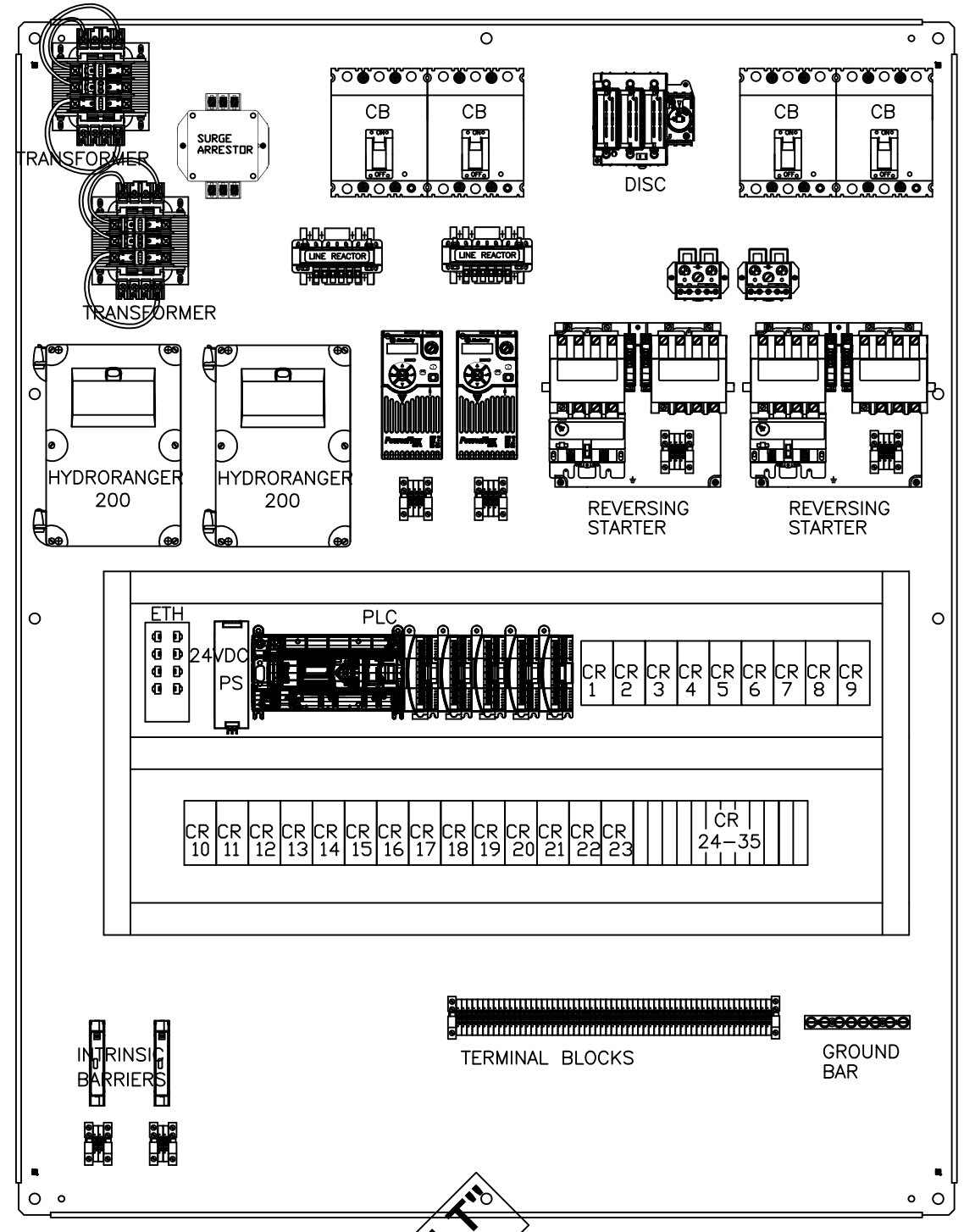
"AS BUILT"
SES 1/22/20

Vulcan
THE PROVEN SCREEN CHOICE
212 SOUTH KIRLIN STREET
MISSOURI VALLEY, IA. 51555
712-642-2755
www.vulcanindustries.com

SCALE: NONE			DRAWN BY: SES
DATE: 5/14/19	SHEET NUMBER: 1 OF 1		REVIEWED BY: SES
TITLE: TERMINAL BLOCKS			PROJECT NUMBER: 19177
PROJECT: WICHITA WWTP-WICHITA, KS			DRAWING NUMBER: ED-6802



NO CONDUIT ENTRANCES
PROVIDED IN THE ENCLOSURE



ENCLOSURE HOFFMAN A62H4812SS6LP3PT
NEMA TYPE 4X 316SS

"AS BUILT"
SES 1/22/20

TYPICAL OF TWO CONTROL PANELS

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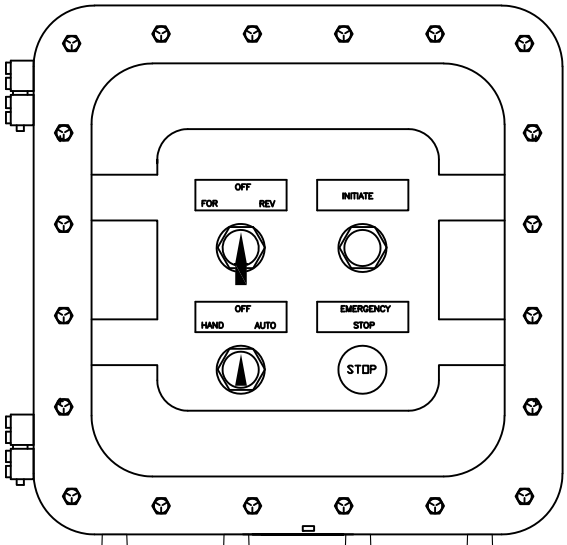
712-642-2755
www.vulcanindustries.com

SCALE: NONE		DRAWN BY: SES	
DATE: 5/14/19	SHEET NUMBER: 1 OF 1	REVIEWED BY: SES	
TITLE: PANEL LAYOUT		PROJECT NUMBER: 19177	
PROJECT: WICHITA WWTP-WICHITA, KS		DRAWING NUMBER: ED-6803	

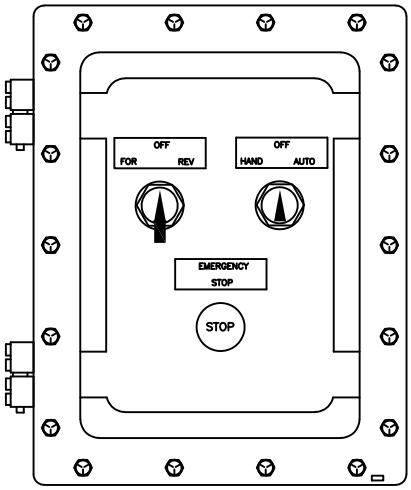
NEMA 7 ENCLOSURE
NJBEW121206HZG2
NEMA 7 SELECTOR SWITCHES
& SOLENOID VALVES
MOUNTED NEAR WASHING PRESS

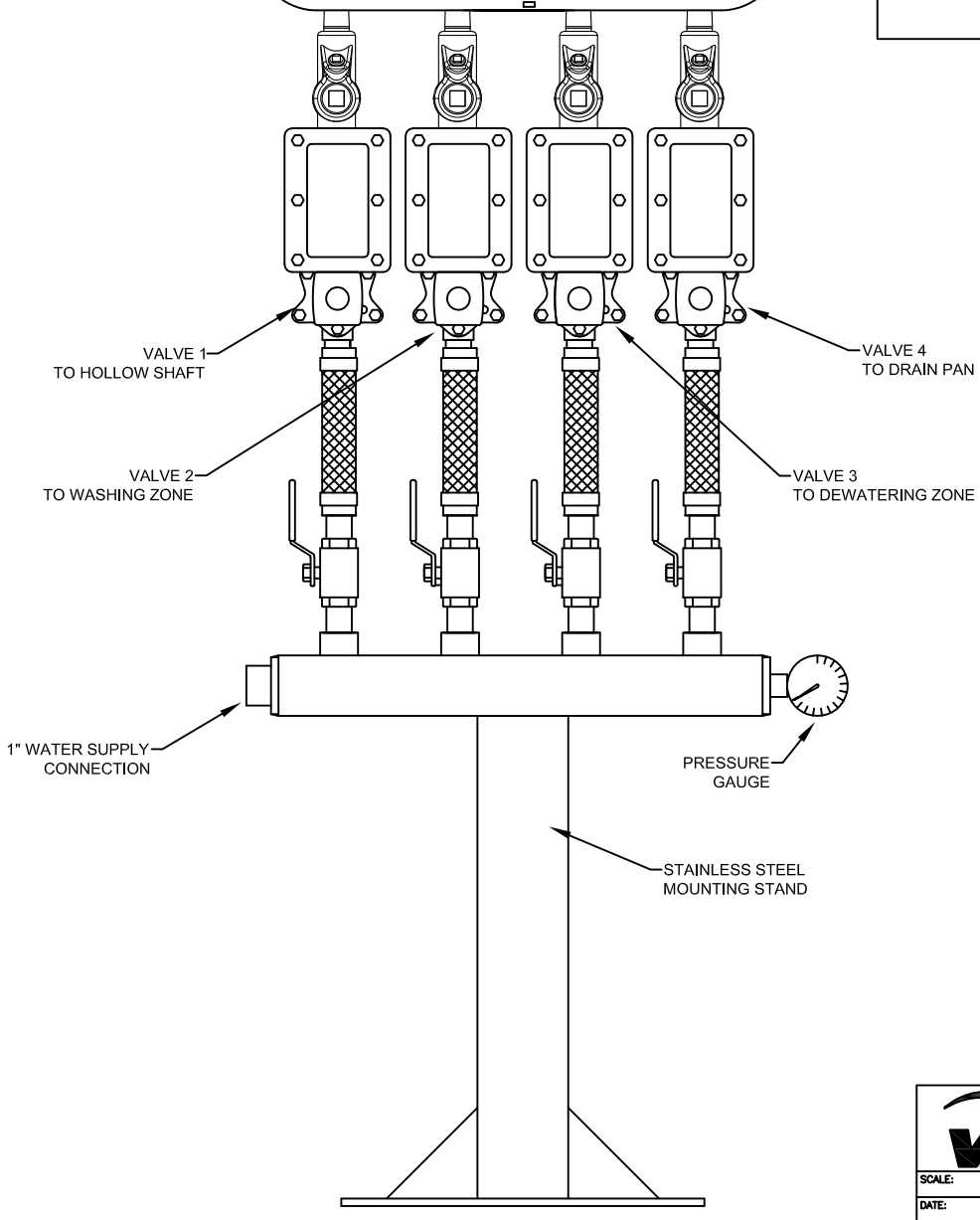
(TYPICAL OF 2)



NEMA 7 ENCLOSURE
NJBEW71106HZG2
NEMA 7 SELECTOR SWITCHES
MOUNTED TO SCREEN SIDEFRAME

(TYPICAL OF 4)





"AS BUILT"
SES 1/22/20

INTERCONNECTING CONDUIT AND WIRING TO BE PROVIDED BY OTHERS.

ALL DEVICES PREWIRED TO TERMINAL BLOCKS WITHIN ENCLOSURE

DRILLED AND TAPPED CONDUIT ENTRANCES CAN BE PROVIDED FROM THE FACTORY. PLEASE INDICATE NUMBER OF ENTRANCES AND LOCATION DESIRED IN THE RETURNED SUBMITTAL.

THE TOP OF THE SCREEN LOCAL IS RESERVED FOR FACTORY USE.

THE BOTTOM OF THE WASHING PRESS LOCAL IS RESERVED FOR FACTORY USE.

SOLENOID VALVES 3/4"

Vulcan
THE PREMIER SCREEN SOURCE
212 SOUTH KIRLIN STREET
MISSOURI VALLEY, IA. 51555
712-642-2755
www.vulcanindustries.com

SCALE: NONE		DRAWN BY: SES
DATE: 5/14/19	SHEET NUMBER: 1 OF 1	REVIEWED BY: SES
TITLE: LOCAL CONTROL STATIONS		PROJECT NUMBER: 19177
PROJECT: WICHITA WWTP-WICHITA, KS		DRAWING NUMBER: ED-6804

Electrical Components

CATALOG	DESCRIPTION	MANUFACTURER
194R-N30-1753-PYS1	DISCONNECT SWITCH	ALLEN BRADLEY
800H-AR2B	PUSH BUTTON,MOMENTARY,NEMA 4X	ALLEN BRADLEY
800H-HR2A	SWITCH,2-POS,NEMA 4X	ALLEN BRADLEY
800H-JR2A	SWITCH,3 POS,MTD,NEMA 4X	ALLEN BRADLEY
800H-JR5A	SWITCH,3 POS,SPRG RTN,NEMA 4X	ALLEN BRADLEY
800H-QRTH2G	PILOT LIGHT,PTT,GREEN,NEMA 4X	ALLEN BRADLEY
800H-QRTH2R	PILOT LIGHT,PTT,RED,NEMA 4X	ALLEN BRADLEY
800H-QRTH2W	PILOT LIGHT,PTT,WHITE,NEMA 4X	ALLEN BRADLEY
800H-AP2A	PUSH BUTTON,MOMENTARY,NEMA 7	ALLEN BRADLEY
800H-FPXJ6A1	EMERGENCY STOP PB,NEMA 7	ALLEN BRADLEY
800H-JP19KB7AXXX	SWITCH,3 POS,SPRG RTN,NEMA 7	ALLEN BRADLEY
800H-JP2KB7AXXX	SWITCH,3 POS,MTD,NEMA 7	ALLEN BRADLEY
1766-L32AWA	PLC MICROLOGIX 1400	ALLEN BRADLEY
1766-MM1	MEMORY MODULE	ALLEN BRADLEY
1762-IA8	PLC DISCRETE INPUT MODULE	ALLEN BRADLEY
1762-OW8	PLC RELAY OUTPUT MODULE	ALLEN BRADLEY
1762-IF4	PLC ANALOG INPUT MODULE	ALLEN BRADLEY
2711P-T10C21D8S	OPERATOR INTERFACE 10"	ALLEN BRADLEY
25B-D010N104	POWERFLEX 525 VARIABLE FREQUENCY DRIVE	ALLEN BRADLEY
JBEF8210G95-120	SOLENOID VALVE 3/4" EXP	ASCO
RS-1X	CABLE-OPERATED SWITCH	CCC
389589	THERMOSTAT NON EXP	CHROMALOX
388210	HEAT TRACING NON EXP	CHROMALOX
389570	END SEAL KIT NON EXP	CHROMALOX
389562	TEE BOX	CHROMALOX
2902-B2-S2-C1	FLOAT SWITCH w/20' CABLE	CONERY
NJBEW121206HZG2	ENCLOSURE	GEDNEY
NJBEW071106HZG2	ENCLOSURE	GEDNEY
1112524-B4	PROXIMITY LIMIT SWITCH	GO SWITCH
AMS4	MAGNET	GO SWITCH
20001-17	HOUR METER	HOBBS
A62H4812SS6LP3PT	ENCLOSURE NEMA 4X 2-DOOR,316SS	HOFFMAN
A60P48	BACK PANEL	HOFFMAN
RH3B-ULCAC120V	CONTROL RELAY,3 POLE	IDEC

Electrical Components

SH3B-05	RELAY BASE,3 POLE	IDEC
RH1B-ULCAC120V	CONTROL RELAY,1 POLE	IDEC
SH1B-05	RELAY BASE,1 POLE	IDEC
ITCF12010	SURGE ARRESTOR	INNOVATIVE TECHNOLOGIES
KLDR-1	FUSE	LITTLEFUSE
KLDR-3	FUSE	LITTLEFUSE
KLDR-3.5	FUSE	LITTLEFUSE
KLDR-6	FUSE	LITTLEFUSE
KLDR-7	FUSE	LITTLEFUSE
RL-00803	LINE REACTOR	MTE
UGB2/0-414-6	GROUND BAR	PANDUIT
2891002	ETEHRNET SWITCH 8 PORT	PHOENIX CONTACT
2902992	24VDC POWER SUPPLY	PHOENIX CONTACT
3044102	UNIVERSAL TERMINAL BLOCK - UT 4	PHOENIX CONTACT
800886	END CLAMP - E/UK	PHOENIX CONTACT
3047028	END COVER	PHOENIX CONTACT
RCS-1A-6V	VARISTOR	RK ELECTRONICS
7ML5034-1AA01	ULTRASONIC DIFFERENTIAL LEVEL DETECTOR	SIEMENS/MILLTRONICS
7ML1171-1DA10	TRANSDUCER W/30M CABLE	SIEMENS/MILLTRONICS
A5E36563512	HAND HELD PROGRAMMER	SIEMENS/MILLTRONICS
611-HDL36015	CIRCUIT BREAKER 15A	SQD
8736SB04V02H309S	REVERSING MOTOR STARTER	SQD
8736SB08V02H300S	REVERSING MOTOR STARTER	SQD
9999RR04	REMOTE MOL RESET MODULE	SQD
9070TF500D1	CONTROL POWER TRANSFORMER	SQD
9070TF750D1	HEAT TRACING TRANSFORMER	SQD
9170/11-13-21S	IS BARRIER RELAY 120VAC	STAHL
TSBSB05	CURRENT SENSING RELAY	TSUBAKI
TSBSB30	CURRENT SENSING RELAY	TSUBAKI

Bulletin 194R Fused And Non-Fused Disconnect Switches

Catalog Number Explanation

Cat. No. 194R-J30-1753 | Cat. No. 194R-NE160-1753

194R – J 30 – 1753 S
a b c d

a — Fuse Type

Code	Description
C	UL Class CC, CSA Type HRCI-MISC
J	UL Class J, CSA Type HRCI-J
H	CSA Type HRCII-C
B	BS88♣
D	DIN♣
F	NFC♣
L	UL Class L, CSA Type HRC-L
N	Non-fused (20...63 A)‡
NE	Non-fused, IEC (100...1250 A)‡ §
NU	Non-fused, UL (100...1200 A)‡

b — Load Size♣

Code	Description
20	20 A (BS88)
25	25 A (NFC)
30	30 A (CC, J, HRCI-J)
30	30 A (non-fused)
30	30 A (HRCII-C)
32	32 A (BS88, NFC)
32	32 A (DIN)
60	60 A (J, HRCI-J, HRCII-C)
60	60 A (non-fused)
63	63 A (BS88, DIN, NFC)
100	100 A (BS88, DIN, NFC, J, HRCI-J, HRCII-C)
125	125 A (BS88, DIN, NFC, Non-fused)
160	160 A (BS88, DIN, NFC, Non-fused)
200	200 A (BS88, DIN, NFC, J, HRCI-J, HRCII-C, non-fused)
250	250 A (BS88, DIN, NFC, J, HRCI-J, HRCII-C, non-fused)
400	400 A (BS88, DIN, NFC, J, HRCI-J, HRCII-C, non-fused)
600	600 A (BS88, DIN, NFC, J, HRCI-J, HRCII-C, non-fused)
630	630 A (BS88, DIN, NFC, non-fused)
800	800 A (BS88, DIN, NFC, L, HRCI-L, non-fused)
1200	1200 A (Non-fused)
1250	1250 A (BS88, DIN, non-fused)

⋆ See Disconnect Switch Dimension References A1, A2, B1, and B2 (30 A and 60 A) for dimensional reference data.
‡ Non-fused disconnect switches must use separately installed fuses for upstream short-circuit protection
§ Does not carry UL Certification
♣ Fuse classes BS88, DIN, and NFC are not suitable for use in North American applications

c — No. of Poles

Code	Description
1753	3-pole switch
1754	4-pole switch (non-fused:100...1250 A; fused: 20...63 A)

d — Fuse Indication

Code	Description
Blank	No fuse status indication
S	Fuse status indication (20...63 A)

Fourth pole (20...63 A), additional auxiliary contacts, and handle options available in accessory section.

UL/CSA Fused Disconnect Switches

Cat. No. 194R-J30-1753 | Cat. No. 194R-J100-1753

Non-Fused											
Fuse Description	Rated Current‡ [A]	No. of Poles	Maximum Hp Ratings				Maximum kW Ratings			Dim. Ref.	Cat. No.
			1-Phase (60 Hz)		DC		3-Phase (50 Hz)				
			120V	240V	125V	250V	220/230V	380/400/415V	660/690V		
Non-fused disconnect switches must use separately installed fuses for upstream short circuit protection.	30	3	2	3	3	5	7.5	15	20	A2	194R-N30-1753
	60	3	3	10	5	10	15	30	40	B2	194R-N60-1753
	125	3	—	—	—	—	—	63	55	F1	§ 194R-NE125-1753
		4	—	—	—	—	—	63	55	F1	§ 194R-NE125-1754
	160	3	—	—	—	—	—	80	55	F1	§ 194R-NE160-1753
		4	—	—	—	—	—	80	55	F1	§ 194R-NE160-1754
	250	3	—	—	—	—	—	132	90	F2	§ 194R-NE250-1753
		4	—	—	—	—	—	132	90	F2	§ 194R-NE250-1754
	400	3	—	—	—	—	—	220	150	F3	§ 194R-NE400-1753
		4	—	—	—	—	—	220	150	F3	§ 194R-NE400-1754
	630	3	—	—	—	—	—	280	150	F3	§ 194R-NE630-1753
		4	—	—	—	—	—	280	150	F3	§ 194R-NE630-1754
	800	3	—	—	—	—	—	450	185	F4	§ 194R-NE800-1753
		4	—	—	—	—	—	450	185	F4	§ 194R-NE800-1754
	1250	3	—	—	—	—	—	710	415	F5	§ 194R-NE1250-1753
		4	—	—	—	—	—	710	415	F5	§ 194R-NE1250-1754

‡ 30 A UL-rated device has I_{the} of 40 A per IEC. 60 A UL-rated device has I_{the} of 80 A per IEC.
§ Does not carry UL Certification.

‡ 30 A UL-rated device has I_{the} of 40 A per IEC. 60 A UL-rated device has I_{the} of 80 A per IEC.

§ Does not carry UL Certification

Note: Your order must include 1) Cat. No. of disconenct switch, 2) shaft, 3) handle, and 4) any accessories.

Complete UL/CSA Disconnect Switch Kits

Includes disconnect switch, operating handle with defeater mechanism and operating shaft, NFPA handle, auxiliary contacts, and padlock attachment.

Product Selection — Kits

Catalog Number Explanation

Switch body	Operating handle	NFPA Handle and shaft

194R – J 30 – 1753 SΔ – TY N1

a b c d e f

a

Enclosure Type

Code	Description
K	Thermoplastic, Type 4/4X
F	Painted metal, Type 3/4/12
C	Stainless steel, Type 4/4X

b

Fuse Type

Code	Description
C	UL Class CC, CSA Type HRCI-MISC (30 A)
J	UL Class J, CSA Type HRCI-J (30 A or 60 A)
H	CSA Type HRCII-C (30 A or 60 A)
B	BS88 (20 A, 32 A, or 63 A)
D	DIN (32 A or 63 A)
F	NFC (25 A, 32 A, or 63 A)
N	Non-fused (30 A or 60 A)‡

c

Load Size

Code	Description	Dimensional Ref.*
20	20 A (BS88)	A1
25	25 A (NFC)	A1
30	30 A (CC, J, HRCI-J)	A1
30	30 A (Non-Fused) ‡	A2
30	30 A (HRCII-C)	B1
32	32 A (BS88, NFC)	A1
32	32 A (DIN)	B1
60	60 A (J, HRCI-J, HRCII-C)	B1
60	60 A (Non-Fused) ‡	B2
63	63 A (BS88, DIN, NFC)	B1

* See Disconnect Switch Dimension References A1, A2, B1, and B2 (30 A and 60 A) for dimensional reference data.
‡ Non-fused disconnect switches must use separately installed fuses for upstream short-circuit protection.
♣ Fuse classes BS88, DIN, and NFC are not suitable for use in North American applications

d

No. of Poles

Code	Description
1753	3-pole switch

e

Fuse Indication

Code	Description
Blank	Fixed Thermal/Fixed Magnetic
SΔ	Fuse status indication

Δ Class C and J fuses only.

f

External Handle

Code	Description
PY	Std red/yellow handle, 4/4X, IP66 (Cat. No. 194R-HS4E)
PB	Std black handle, 4/4X, IP66 (Cat. No. 194R-HS4)
TY	Test mode red/yellow handle, 4/4X, IP66 (Cat. No. 194R-HST4E)
TB	Test mode black handle, 4/4X, IP66 (Cat. No. 194R-HST4)
LY	Extended length red/yellow handle, 4/4X, IP66 (Cat. No. 194R-HS4EL)
LB	Extended length black handle, 4/4X, IP66 (Cat. No. 194R-HS4L)

g

Other Accessories

Code	Configuration
Blank	No accessory
P	Padlock attachment

30.5 mm Push Buttons

Type 4/4X/13, Corrosion-Resistant/Watertight/Oiltight

Momentary Contact Push Button Units, Non-Illuminated

Booted Unit
Cat. No. 800H-R2A

Bootless Flush Head Unit
Cat. No. 800H-AR1A

Bootless Extended Head Unit
Cat. No. 800H-BR6A

Contact Type	Button Color	Booted	Bootless Flush Head	Bootless Extended Head
		Cat. No.	Cat. No.	Cat. No.
No Contacts	Green Black Red	800H-R1 800H-R2 800H-R6	800H-AR1 800H-AR2 800H-AR6	800H-BR1 800H-BR2 800H-BR6
1 N.O.	Green Black Red	800H-R1D1 800H-R2D1 800H-R6D1	800H-AR1D1 800H-AR2D1 800H-AR6D1	800H-BR1D1 800H-BR2D1 800H-BR6D1
1 N.C.	Green Black Red	800H-R1D2 800H-R2D2 800H-R6D2	800H-AR1D2 800H-AR2D2 800H-AR6D2	800H-BR1D2 800H-BR2D2 800H-BR6D2
1 N.O. - 1 N.C.	Green Black Red	800H-R1A 800H-R2A 800H-R6A	800H-AR1A 800H-AR2A 800H-AR6A	800H-BR1A 800H-BR2A 800H-BR6A
2 N.O. - 2 N.C.	Green Black Red	800H-R1B 800H-R2B 800H-R6B	800H-AR1B 800H-AR2B 800H-AR6B	800H-BR1B 800H-BR2B 800H-BR6B

Bootless Guarded Head
Cat. No. 800H-GR1A

Bootless Mushroom Head
Cat. No. 800H-DR6A

Jumbo Mushroom Head
Cat. No. 800H-DR6JA

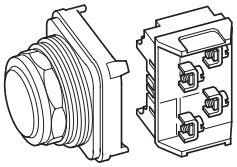
Contact Type	Button Color	Bootless Guarded Head	Bootless Mushroom Head	Jumbo Mushroom Head
		Cat. No.	Cat. No.	Cat. No.
No Contacts	Green Black Red	800H-GR1 800H-GR2 800H-GR6	800H-DR1 800H-DR2 800H-DR6	800H-DR1J 800H-DR2J 800H-DR6J
1 N.O.	Green Black Red	800H-GR1D1 800H-GR2D1 800H-GR6D1	800H-DR1D1 800H-DR2D1 800H-DR6D1	800H-DR1JD1 800H-DR2JD1 800H-DR6JD1
1 N.C.	Green Black Red	800H-GR1D2 800H-GR2D2 800H-GR6D2	800H-DR1D2 800H-DR2D2 800H-DR6D2	800H-DR1JD2 800H-DR2JD2 800H-DR6JD2
1 N.O. - 1 N.C.	Green Black Red	800H-GR1A 800H-GR2A 800H-GR6A	800H-DR1A 800H-DR2A 800H-DR6A	800H-DR1JA 800H-DR2JA 800H-DR6JA

Accessories — Page 98
Legend Plates — Page 107
Approximate Dimensions — Page 110

Momentary Contact Push Button Units, Non-Illuminated

800H ____ **– AR 1** ____ ____ **A**

a *b* *c* *d* *e*



a

Finger-Safe Guards	
Code	**Description**
Blank	No Guards
C	Guards on Terminals

b

Operator Type	
Code	**Description**
AR	Flush Head
BR	Extended Head
DR	Mushroom Head
DRX	Mushroom Head less Color Cap
R	Booted Head ❶
GR	Bootless Guarded Head

c

Color Cap	
Code	**Description**
Blank	Used only when ordering Operator Type **DRX**
1	Green
2	Black
3	Orange ❷
4	Gray ❷
5	White ❷
6	Red
7	Blue
9	Yellow

d

Special Mushroom Head	
Code	**Description**
Blank	No Special Head
J	Jumbo Mushroom Head — Plastic

Note: Special Mushroom Head options only apply to Mushroom Head operator Type Code **DR**.

e

Contact Block(s)	
Code	**Description**
Blank	No Contacts on operator
Standard	
D1	1 N.O.
D2	1 N.C.
D3	1 N.O.E.M.
D4	1 N.C.L.B.
D5	1 N.O. (Mini)
D6	1 N.C. (Mini)
A1	1 N.C.L.B. - 1 N.O.
A2 ❸	2 N.O.
A4	2 N.C.
A7	1 N.C.L.B. - 1 N.C.
A	1 N.O. - 1 N.C.
B	2 N.O. - 2 N.C.
H	3 N.O. - 3 N.C.
C	4 N.O. - 4 N.C.
Pen*TUFF* (Low Voltage)	
D1V	1 N.O.
D2V	1 N.C.
D3V	1 N.O.E.M.
D4V	1 N.C.L.B.
AV	1 N.O. - 1 N.C.
BV	2 N.O. - 2 N.C.
HV	3 N.O. - 3 N.C.
CV	4 N.O. - 4 N.C.

e (cont'd)

Contact Block(s)	
Code	**Description**
Blank	No Contacts on operator
Time Delay	
T	1 N.O. Depress to close, release to initiate delayed opening
S	1 N.C. Depress to open, release to initiate delayed closure
Class I, Div. 2/Zone 2	
Logic Reed	
D1R	1 N.O.
D2R	1 N.C.
A2R❸	2 N.O.
A4R❸	2 N.C.
AR	1 N.O. - 1 N.C.
BR	2 N.O. - 2 N.C.
HR	3 N.O. - 3 N.C.
CR	4 N.O. - 4 N.C.
Sealed Switch	
D1P	1 N.O.
D2P	1 N.C.
A2P	2 N.O.
A4P	2 N.C.
AP	1 N.O. - 1 N.C.
BP	2 N.O. - 2 N.C
Stackable Sealed Switch	
D1Y	1 N.O.
D2Y	1 N.C.
A2Y	2 N.O.
A4Y	2 N.C.
AY	1 N.O. - 1 N.C.
BY	2 N.O. - 2 N.C
HY	3 N.O. - 3 N.C.
CY	4 N.O. - 4 N.C

Time Delay Contacts
Series C field installable kits can only be used with Series T or later operators. Adjustable range of 0.5…15 sec ±25%. Maximum continuous current I_{th} 5 A.

❶ Green and black operators are flush underneath boots; red operators are extended.
❷ Not available for booted operators.
❸ **XA2** and **XA2R** contact blocks cannot be stacked upon, but they can stack on other contact blocks.

30.5 mm Push Buttons

Selector Switches

2-Position Selector Switch Devices, Non-Illuminated

Standard Knob Operator
Cat. No. 800T-H2A

Knob Lever Operator
Cat. No. 800T-H17A

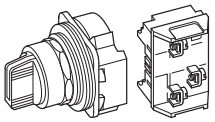
Standard Knob Operator
Cat. No. 800H-HR2A

Contact Type	Side	Contact	Operator Position		M = Maintained S = Spring Return	Type 4/13		Type 4/4X/13
						Standard Knob	Knob Lever	Standard Knob
						Cat. No.	Cat. No.	Cat. No.
No Contacts	—	—	—	—	M M	**800T-H2**	**800T-H17**	**800H-HR2**
					S→M	800T-H4	800T-H18	800H-HR4
					M←S	**800T-H5**	800T-H19	800H-HR5
1 N.O.	White	A	O	X	M M	**800T-H2D1**	**800T-H17D1**	**800H-HR2D1**
					S→M∗	**800T-H4D1**	800T-H18D1	800H-HR4D1
					M←S	**800T-H5D1**	800T-H19D1	800H-HR5D1
1 N.O. - 1 N.C.	White	A B	O X	X O	M M	**800T-H2A**	**800T-H17A**	**800H-HR2A**
					S→M∗	**800T-H4A**	**800T-H18A**	800H-HR4A
					M←S	**800T-H5A**	**800T-H19A**	**800H-HR5A**

Note: X = Closed/O = Open
∗ Target tables are reversed from those shown.

800 T ___ – HA 2 A

a b c d e



a

Protection Rating	
Code	Description
T	Metal, Type 4/13
H	Plastic, Type 4/4X/13

b

Finger-Safe Guards	
Code	Description
Blank	No guards
C	Guards on terminals

c

Knob Insert Colors		
800T Type 4/13 Code	Description	800H Type 4/4X/13 Code
H	White	HR
HX	Packet of colored inserts❄	HRX
Metal Wing Lever Colors§		
Code	Color	Code
HA	Red	—
HG	Grey	—

d

Operator Type and Function	
Standard Knob	
Code	Operator Function
2	Maintained
4	Spring return from left‡
5	Spring return from right
Knob Lever§	
Code	Operator Function
17	Maintained
18	Spring return from left‡
19	Spring return from right
Metal Wing Lever§	
Code	Operator Function
11	Maintained
15	Spring return from left‡
16	Spring return from right
Coin Slot§	
Code	Operator Function
6	Maintained
7	Spring return from left
8	Spring return from right

e

Contact Block(s)			
Code	Description		
	Contact Configuration	2-Position	
Blank	No contacts	—	—
Standard			
D1	1 N.O.	O	X
D2	1 N.C.	X	O
A	1 N.O. - 1 N.C.	O	X
		X	O
B	2 N.O. - 2 N.C.	O	X
		X	O
		O	X
		X	O
Max Duty (Horsepower Rated)♣			
D1M	1 N.O.		
D2M	1 N.C.		
Pen*TUFF* (Low Voltage)♣			
D1V	1 N.O.		
D2V	1 N.C.		
AV	1 N.O. - 1 N.C.		
BV	2 N.O. - 2 N.C.		
Class1, Div. 2/Zone 2			
Logic Reed♣			
D1R	1 N.O.		
D2R	1 N.C.		
AR	1 N.O. - 1 N.C.		
BR	2 N.O. - 2 N.C.		
Sealed Switch♣			
D1P	1 N.O.		
D2P	1 N.C.		
AP	1 N.O. - 1 N.C.		
BP	2 N.O. - 2 N.C.		
Stackable Sealed Switch♣			
D1Y	1 N.O.		
D2Y	1 N.C.		
AY	1 N.O. - 1 N.C.		
BY	2 N.O. - 2 N.C.		

❄ One insert of each color (blue, green, orange, red, and yellow).
‡ Target tables are reversed from those shown.
§ Only available on Bul. 800T, Type 4/13 operators.
♣ Contact target tables same as those listed for standard contact blocks.

30.5 mm Push Buttons

Selector Switches

3-Position Selector Switch Devices, Non-Illuminated

Standard Knob Operator
Cat. No. 800T-J2A

Knob Lever Operator
Cat. No. 800T-J17A

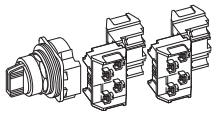
Standard Knob Operator
Cat. No. 800H-JR2A

Contact Type	Operator Position			M = Maintained S = Spring Return	Type 4/13 Standard Knob Cat. No.	Type 4/13 Knob Lever Cat. No.	Type 4/4X/13 Standard Knob Cat. No.
No Contacts	—	—	—	M M M	**800T-J2**	**800T-J17**	**800H-JR2**
				S→M M	**800T-J4**	800T-J18	**800H-JR4**
				M M←S	**800T-J5**	800T-J19	**800H-JR5**
				S→M←S	**800T-J91**	**800T-J20**	**800H-JR91**
1 N.O. - 1 N.C.	O X	O O	X O	M M M	**800T-J2A**	**800T-J17A**	**800H-JR2A**
				S→M M	**800T-J4A**	**800T-J18A**	**800H-JR4A**
				M M←S	**800T-J5A**	**800T-J19A**	**800H-JR5A**
				S→M←S	**800T-J91A**	**800T-J20A**	**800H-JR91A**

Note: X = Closed/O = Open

800 T – J 2 C

a b c d e f



a

Protection Rating	
Code	Description
T	Metal, Type 4/13
H	Plastic, Type 4/4X/13

b

Finger-Safe Guards	
Code	Description
Blank	No guards
C	Guards on terminals

c

Knob Insert Colors		
800T Type 4/13 Code	Description	800H Type 4/4X/13 Code
J	White	JR
JX	Packet of colored inserts∗	JRX
Metal Wing Lever Colors❄		
Code	Color	Code
JA	Red	—
JG	Grey	—

d

Knob/Lever Type Operators	
Standard Knob	
Code	Operator Function
2	Maintained
4	Spring return from left
5	Spring return from right
31	Spring return from both
Knob Lever❄	
Code	Operator Function
17	Maintained
18	Spring return from left
19	Spring return from right
20	Spring return from both
Metal Wing Lever❄	
Code	Operator Function
11	Maintained
15	Spring return from left
16	Spring return from right
141	Spring return from both
Coin Slot❄	
Code	Operator Function
10	Spring return from both

e

Cam Option‡♣	
Code	Description
Blank	KB7 cam (std.)
KA1	KA1 cam
KA7	KA7 cam

e (cont'd)

Cam Option‡♣	
Code	Description
KC1	KC1 cam
KC7	KC7 cam
KD7	KD7 cam
KE7§	KE7 cam
KQ1	KQ1 cam
KQ7	KQ7 cam
KR1§	KR1 cam
KR7§	KR7 cam
KT1§	KT1 cam
KT7§	KT7 cam
KU7§	KU7 cam

f

Contact Blocks	
Code	Description
Blank	No contacts on operator
Standard	
A	1 N.O. - 1 N.C. 1-**800T-XA** on white side
B	2 N.O. - 2 N.C. 2-**800T-XA**s — 1 on white side/1 on black side
PenTUFF (Low Voltage)	
AV	1 N.O. - 1 N.C. 1-**800T-XAV** on white side
BV	2 N.O. - 2 N.C. 2-**800T-XAV**s — 1 on white side/1 on black side

f (cont'd)

Contact Blocks♣	
Code	Description
Blank	No contacts
Class 1, Div. 2/Zone 2	
Logic Reed	
AR	1 N.O. - 1 N.C. 1-**800T-XAR** on white side
BR	2 N.O. - 2 N.C. 2-**800T-XAR**s — 1 on white side/1 on black side
Sealed Switch	
AP	1 N.O. - 1 N.C. 1-**800T-XAP** on white side
BP	2 N.O. - 2 N.C. 2-**800T-XAP**s — 1 on white side/1 on black side
Stackable Sealed Switch	
AY	1 N.O. - 1 N.C. 1-**800T-XAY** on white side
BY	2 N.O. - 2 N.C. 2-**800T-XAY**s — 1 on white side/1 on black side

∗ One insert of each color (blue, green, orange, red, and yellow).
❄ Only available on Bul. 800T, Type 4/13 operators.
‡ If an overlapping cam is required, consult your local distributor.
§ Not available with wing levers.
♣ See Table 1 for cam selections and associated targets.

Table 1. Cam and Contact Block Functionality Table

Contact Block Suffix Code	Contact Block Side	Circuits	Cam Codes																															
			KB7 (Std.)			KA1			KA7			KC1			KC7			KD7			KE7			KQ1			KQ7			KR1			KR7			KT1			KT7			KU7		
A_ B_ H_ C_	White	A	X	O	O	X	O	O	O	O	X	O	O	X	X	O	O	O	O	X	X	O	O	X	O	X	X	O	X	X	O	X	X	O	X	O	O	X	O	O	X	O	O
		B	O	O	X	O	X	O	O	X	O	O	X	O	O	X	O	O	X	O	O	X	X	O	X	O	O	X	O	O	X	O	O	X	O	X	O	O	O	O	X	O	X	O
	Black	A	X	O	O	X	O	O	O	O	X	O	O	X	X	O	O	X	O	O	O	O	X	O	O	X	X	O	O	O	O	X	X	O	O	O	O	X	X	O	O	O	O	X
		B	O	O	X	O	X	O	O	X	O	X	O	O	O	O	X	O	X	O	X	X	O	O	X	O	O	X	O	X	X	O	O	X	O	X	X	O	O	X	X	X	X	O
	White	A	X	O	O	X	O	O	O	O	X	O	O	X	X	O	O	O	O	X	X	O	O	X	O	X	X	O	X	X	O	X	X	O	O	X	X	O	O	X	X	O	O	O
		B	O	O	X	O	X	O	O	X	O	O	X	O	O	X	O	O	X	O	O	X	X	O	X	O	O	X	O	O	X	O	O	X	O	O	O	O	O	X	O	X	O	O
	Black	A	X	O	O	X	O	O	O	O	X	O	O	X	X	O	O	X	O	O	O	O	X	O	O	X	X	O	O	O	O	X	X	O	O	O	O	X	X	O	O	O	O	X
		B	O	O	X	O	X	O	O	X	O	X	O	O	O	O	X	O	X	O	X	X	O	O	X	O	O	X	O	X	X	O	O	X	X	X	X	O	O	X	X	X	X	O

Note: X = Closed/O = Open

30.5 mm Push Buttons

Pilot Lights

Pilot Light Devices∗

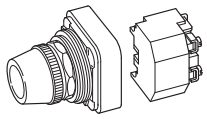
Transformer Type Pilot Light
Cat. No. 800T-P16R

Push-to-Test Pilot Light
Cat. No. 800T-PT16R

Type	Lamp Type	Volts	Color	Type 4/13		Type 4/4X/13	
				Pilot Light	Push-to-Test∗	Pilot Light	Push-to-Test∗
				Cat. No.	Cat. No.	Cat. No.	Cat. No.
Operator Only❄				800T-S00	**800T-SB00XX**	800H-SR00	800H-SRB00XX
Full Voltage‡	Incandescent	24V AC/DC	Red	**800T-Q24R**	**800T-QT24R**	**800H-QR24R**	**800H-QRT24R**
			Green	**800T-Q24G**	**800T-QT24G**	**800H-QR24G**	800H-QRT24G
			Amber	**800T-Q24A**	**800T-QT24A**	**800H-QR24A**	800H-QRT24A
	No Lamp	0…250V AC/DC	No Lens	800T-QN25	800T-QTN25	—	
Universal‡	LED	12…130 V AC/DC	Red	**800T-QH2R**	**800T-QTH2R**	**800H-QRH2R**	**800H-QRTH2R**
			Green	**800T-QH2G**	**800T-QTH2G**	**800H-QRH2G**	**800H-QRTH2G**
			Amber	**800T-QH2A**	**800T-QTH2A**	**800H-QRH2A**	**800H-QRTH2A**
Transformer‡	Incandescent	120V AC, 50/60 Hz	Red	**800T-P16R**	**800T-PT16R**	**800H-PR16R**	**800H-PRT16R**
			Green	**800T-P16G**	**800T-PT16G**	**800H-PR16G**	**800H-PRT16G**
			Amber	**800T-P16A**	**800T-PT16A**	**800H-PR16A**	**800H-PRT16A**
	LED		Red	**800T-PH16R**	**800T-PTH16R**	**800H-PRH16R**	**800H-PRTH16R**
			Green	**800T-PH16G**	**800T-PTH16G**	**800H-PRH16G**	**800H-PRTH16G**
			Amber	**800T-PH16A**	**800T-PTH16A**	**800H-PRH16A**	**800H-PRTH16A**
	No Lamp		No Lens	800T-PN16	800T-PTN16	—	—

∗ Includes one standard Cat. No. 800T-XA (1 N.O. - 1 N.C.) contact block. For typical pilot light wiring diagrams, see page 10-65.
❄ Operator only supplied without power module, lamp, lens cap, or contact blocks.
‡ All pilot lights except push-to-test without sealed contacts and dual input transformer relay, are rated for Class 1, Division 2 applications.

800	T		–	P	T		16	G	AR (Push-to-Test)
	a	*b*		*c*	*d*	*e*	*f*	*g*	*h*



a

Protection Rating	
Code	Description
T	Metal, Type 4/13
H	Plastic, Type 4/4X/13

b

Finger-Safe Guards	
Code	Description
Blank	No guards
C	Guards on terminals

c

Power Module Type		
800T Type 4/13	Description	800H Type 4/4X/13
Code		Code
P	Transformer (or dual input)	PR
Q	Full voltage/ Universal	QR

d

Lamp Test Options	
Code	Description
Blank	No test option
T	Push-to-test
D	Dual input — diode♣
DT	Dual input — transformer relay
Note: Push-to-test supplied with factory jumpered contact block.	

e

Illumination Options	
Code	Description
Blank	Incandescent
H	LED∗

f

Voltage	
Transformer	
Code	Description
16	120V AC 50/60 Hz
26	240V AC 50/60 Hz
46	480V AC 50/60 Hz
56	600V AC 50/60 Hz
Full Voltage — Incandescent	
12	12V AC/DC
24	24V AC/DC
48	48V AC/DC
10	120V AC/DC
20	240V AC/DC
Universal — LED	
2	12…130V AC/DC
Dual Input	
16	120V AC
24	24V AC/DC (Dual input diode only)

g

Lens Color		
Code	Color	Glass Code ♠
Blank	No lens	Blank
A	Amber	D
B	Blue	E
C	Clear	F
G	Green	H
R	Red	J
W	White	K

h

Contact Blocks (Push-to-test units only)	
Code	Description
Standard	
Blank	1 N.O. - 1 N.C.
Pen*TUFF* (Low Voltage)	
AV	1 N.O. - 1 N.C.
Class 1, Div. 2/Zone 2	
Logic Reed	
AR	1 N.O. - 1 N.C.
Sealed Switch	
AP	1 N.O. - 1 N.C.
Stackable Sealed Switch	
AY	1 N.O. - 1 N.C.

∗ LED illumination option is not available with diode type dual input.
♣ Diode type dual input provides circuit isolation via opposing diodes. Not recommended for use with solid-state outputs.
♠ Glass lens available on 800T pilot lights only. Not available on push-to-test units.

Momentary Contact Push Button Units, Non-Illuminated

Flush Head Unit
Cat. No. 800H-AP1A

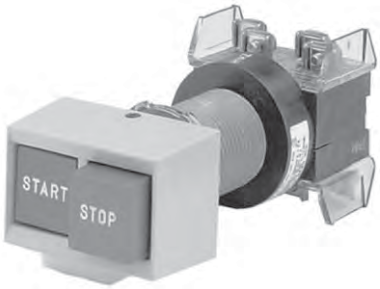
Extended Head Unit
Cat. No. 800H-BP6B

Mushroom Head Unit
Cat. No. 800H-DP6A

Contact Type	Button Color	Flush Head Cat. No.∗	Extended Head Cat. No.∗	Mushroom Head Cat. No.∗
No Contact	Green	800H-AP1	800H-BP1	800H-DP1
	Black	**800H-AP2**	800H-BP2	800H-DP2
	Red	800H-AP6	800H-BP6	800H-DP6
1 N.O.	Green	**800H-AP1D1**	800H-BP1D1	800H-DP1D1
	Black	**800H-AP2D1**	**800H-BP2D1**	800H-DP2D1
	Red	800H-AP6D1	800H-BP6D1	800H-DP6D1
1 N.C.	Green	800H-AP1D2	800H-BP1D2	800H-DP1D2
	Black	800H-AP2D2	800H-BP2D2	800H-DP2D2
	Red	800H-AP6D2	**800H-BP6D2**	800H-DP6D2
1 N.O. - 1 N.C.	Green	**800H-AP1A**	800H-BP1A	800H-DP1A
	Black	**800H-AP2A**	800H-BP2A	800H-DP2A
	Red	**800H-AP6A**	**800H-BP6A**	**800H-DP6A**
2 N.O. - 2 N.C.	Green	800H-AP1B	800H-BP1B	800H-DP1B
	Black	800H-AP2B	800H-BP2B	800H-DP2B
	Red	800H-AP6B	800H-BP6B	800H-DP6B

∗ For long barrel versions, add an **L** to the cat. no. **Example:** Cat. No. 800H**L**-AP1.

Dual Momentary Contact Push Button Units



Dual Push Button Unit
Cat. No. 800H-DPH16AXX64

Contact Arrangement		Legend Marking		
Type	Contacts	Left	Right	Cat. No.❄
2 N.O. - 2 N.C.		START (Flush/Green)	STOP (Extended/Red)	**800H-DPH16AAXX64**
		ON (Flush/Black)	OFF (Flush/Black)	800H-DPH22AAXX50
		OPEN (Flush/Black)	CLOSE (Flush/Black)	800H-DPH22AAXX57
		UP (Flush/Black)	DOWN (Flush/Black)	800H-DPH22AAXX66
		Blank (Flush/Black)	Blank (Flush/Black)	800H-DPH22AAXX

❄ For long barrel versions, add an **L** to the cat. no. **Example:** Cat. No. 800H**L**-DPH16AAXX64.

10

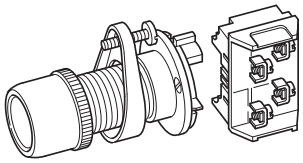
Hazardous Location Push Buttons

Product Selection

Momentary Contact Push Button Units, Non-Illuminated

800 H – AP 1 ____ A

a b c d e



a

Barrel Type	
Code	Description
H	Standard barrel length
HL	Long barrel

b

Operator Type	
Code	Description
AP	Flush head
BP	Extended head
DP	Mushroom head
DPX	Mushroom head less color cap

c

Color Cap	
Code	Description
Blank	Used only when ordering operator type DPX (Table b)
1	Green
2	Black
3	Orange
4	Grey
6	Red
7	Blue
9	Yellow

d

Special Mushroom Head	
Code	Description
Blank	No special head
J	Jumbo mushroom head — plastic
L	Jumbo mushroom head — metal

Note: Special mushroom head options only apply to mushroom head operator type DP (Table b).

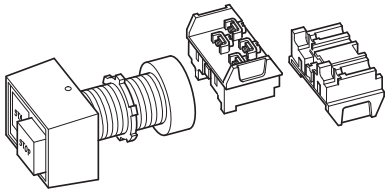
e

Contact Block(s)∗	
Standard	
Code	Description
Blank	No contacts
D1	1 N.O.
D2	1 N.C.
D5	1 N.O. (Mini)
D6	1 N.C. (Mini)
A2	2 N.O.
A4	2 N.C.
A	1 N.O. - 1 N.C.
B	2 N.O. - 2 N.C.
H	3 N.O. - 3 N.C.
C	4 N.O. - 4 N.C.
Pen*TUFF* (Low Voltage)	
Code	Description
D1V	1 N.O.
D2V	1 N.C.
AV	1 N.O. - 1 N.C.
BV	2 N.O. - 2 N.C.
HV	3 N.O. - 3 N.C.
CV	4 N.O. - 4 N.C.

Dual Push Button Units

800 H – DP H 16 AAXX 64

a b c d e f



a

Barrel Type	
Code	Description
H	Standard barrel
HL	Long barrel

b

Operator Type	
Code	Description
DP	Dual push button

c

Mounting	
Code	Description
H	Horizontal
B	Vertical

d

Color of Button	
Code	Description
16	Left green flush/right red extended
22	Left black flush/right black flush

e

Contact Block(s)∗		
Code	Contact Arrangement	
	Left button for horizontal Top button for vertical	Right button for horizontal Bottom button for vertical
AAXX	1 N.O. - 1 N.C.	1 N.O. - 1 N.C.
AAAA	2 N.O. - 2 N.C.	2 N.O. - 2 N.C.

f

Marking		
Code	Description	
	Left button for horizontal Top button for vertical	Right button for horizontal Bottom button for vertical
Blank	No mark specified	No mark specified
64	START	STOP
50	ON	OFF
51	FORWARD	REVERSE
57	OPEN	CLOSE
66	UP	DOWN
99❄	Marking specified	Marking specified

∗ For sealed switch and Logic Reed contact blocks, see page 10-175.
❄ To order with special marking, specify marking; seven characters maximum per button, single line only.

10

2-Position Push-Pull Units, Non-Illuminated

2-Position Push-Pull
Cat. No. 800H-FPX6A5

Contact Type	Operator Position: Maintained Out	Operator Position: Maintained In	Button Color	Push-Pull Cat. No.∗
N.C.L.B.	X	O	Red	**800H-FPX6D4**
N.O. - N.C.L.B.	O X	X O	Red	**800H-FPX6A1**
N.C.L.B. - N.C.L.B.	X X	O O	Red	**800H-FPX6A5**

Note: X = Closed/O = Open
∗ For long barrel versions, add an **L** to the cat. no. **Example:** Cat. No. 800H**L**-FPX6D4.

3-Position Push-Pull Units, Non-Illuminated

3-Position Push-Pull
Cat. No. 800H-FPXM6A7

Contact Type	Operator Position: Momentary Out	Operator Position: Maintained Center	Operator Position: Maintained In	Button Color	Push-Pull Cat. No.❄
N.C. - N.C.L.B.	X X	O X	O O	Red	800H-FPXM6A7

Contact Type	Operator Position: Momentary Out	Operator Position: Maintained Center	Operator Position: Momentary In	Button Color	Push-Pull Cat. No.❄
N.C. - N.C.L.B.	X X	O X	O O	Red	800H-FPXN6A7

Note: X = Closed/O = Open
❄ For long barrel versions, add an **L** to the cat. no. **Example:** Cat. No. 800H**L**-FPXM6A7.

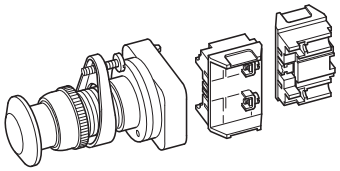
10

Hazardous Location Push Buttons

Product Selection

2-Position Push-Pull Units, Non-Illuminated

800	H	– FPX		1	A1
	a	*b*	*c*	*d*	*e*



a

Barrel Type	
Code	Description
H	Standard barrel length
HL	Long barrel

b

Operator Type	
Code	Description
FPX	Push-pull unit

c

Head Type	
Code	Description
Blank	Mushroom head
J	Jumbo mushroom head∗

d

Color Cap	
Code	Color
Blank	No cap
1	Green
2	Black
4	Grey (silver)
6	Red
7	Blue
9	Yellow (gold)

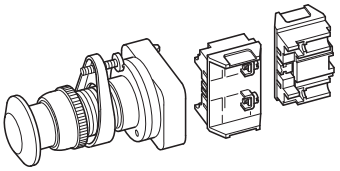
e

Contact Block(s)			
Standard			
Code	Operator Position		Description
	Out	In	
Blank	—	—	No contacts
A1	O X	X O	1 N.O. - 1 N.C.L.B.∗
A5	X X	O O	2 N.C.L.B.∗
D1	O	X	1 N.O.
D4	X	O	1 N.C.L.B.∗
Pen*TUFF* (Low Voltage)			
D1V	O	X	1 N.O.
AV	O X	X O	1 N.O. - 1 N.C.
Note: X = Closed/O = Open.			

∗ Normally closed late break contact. When button is pushed from the OUT to the IN position, the mechanical detent action of the operator occurs before electrical contacts change state. When the button is pulled from the IN to the OUT position, the electrical contacts change state before the mechanical detent occurs.

3-Position Push-Pull Units, Non-Illuminated

800	H	– FPX		M	1	A7
	a	*b*	*c*	*d*	*e*	*f*



a

Barrel Type	
Code	Description
H	Standard barrel length
HL	Long barrel

b

Operator Type	
Code	Description
FPX	Push-pull unit

c

Head Type	
Code	Description
Blank	Mushroom head
J	Jumbo mushroom head❄

❄ Not valid with color cap option **Blank** (no cap).

d

Operator Function			
Code	Operator Position		
	Out	Center	In
M	Momentary	Maintained	Maintained
N	Momentary	Maintained	Momentary

e

Color Cap	
Code	Color
Blank	No cap
1	Green
2	Black
4	Grey (silver)
6	Red
7	Blue
9	Yellow (gold)

f

Contact Block(s)				
Standard				
Code	Operator Position			Description
	Out	Ctr.	In	
Blank	—	—	—	No contacts
A	O X	O O	X O	1 N.O. - 1 N.C.
A1	O X	O X	X O	1 N.O. - 1 N.C.L.B.
A7	X X	O X	O O	1 N.C. - 1 N.C.L.B.
B6	X X	O X	O O	2 N.C. - 2 N.C.L.B.
Pen*TUFF* (Low Voltage)				
AV	O X	O O	X O	1 N.O. - 1 N.C.
Note: X = Closed/O = Open.				

3-Position Selector Switch Units, Non-Illuminated

Standard Knob Operator
Cat. No. 800H-JP2KB7AXXX

Knob Lever Operator
Cat. No. 800H-JP17KB7AXXX

Metal Wing Lever Operator
Cat. No. 800H-JP11KB7AXXX

Contact Type	Operator Position			M = Maintained S = Spring Return	Standard Knob Cat. No.‡	Knob Lever Cat. No.‡	Metal Wing Lever Cat. No.‡
No Contacts	—	—	—	M M M	**800H-JP2KB7**	800H-JP17KB7	800H-JP11KB7
				S→M M	800H-JP4KB7	800H-JP18KB7	800H-JP15KB7
				M M←S	800H-JP5KB7	800H-JP19KB7	800H-JP16KB7
				S→M←S	800H-JP91KB7	800H-JP20KB7	800H-JP141KB7
1 N.O. - 1 N.C.	O X	O O	X O	M M M	**800H-JP2KB7AXXX**	800H-JP17KB7AXXX	800H-JP11KB7AXXX
				S→M M	800H-JP4KB7AXXX	800H-JP18KB7AXXX	800H-JP15KB7AXXX
				M M←S	800H-JP5KB7AXXX	800H-JP19KB7AXXX	800H-JP16KB7AXXX
				S→M←S	**800H-JP91KB7AXXX**	800H-JP20KB7AXXX	800H-JP141KB7AXXX
2 N.O. - 2 N.C.	O X O X	O O O O	X O X O	M M M	**800H-JP2KB7AAXX**	800H-JP17KB7AAXX	800H-JP11KB7AAXX
				S→M M	800H-JP4KB7AAXX	800H-JP18KB7AAXX	800H-JP15KB7AAXX
				M M←S	800H-JP5KB7AAXX	800H-JP19KB7AAXX	800H-JP16KB7AAXX
				S→M←S	800H-JP91KB7AAXX	800H-JP20KB7AAXX	800H-JP141KB7AAXX

Note: X = Closed/O = Open

3-Position Cylinder Lock Operator
Cat. No. 800H-JP42KB7AXXX

Contact Type	Operator Position			M = Maintained S = Spring Return	Cylinder Lock Key Removal Left Cat. No.‡	Key Removal Center Cat. No.‡	Key Removal All∗ Cat. No.‡
No Contacts	O	X	X	M M M	800H-JP41KB7	800H-JP42KB7	800H-JP44KB7
				S→M∗	—	800H-JP50KB7	800H-JP51KB7
				M←S	800H-HP5KL8DXXX	800H-JP38KB7	800H-JP73KB7
				M M	—	800H-JP631KB7	—
1 N.O. - 1 N.C.	O X	O O	X O	M M M∗	800H-JP41KB7AXXX	800H-JP42KB7AXXX	800H-JP44KB7AXXX
				M←S	—	800H-JP50KB7AXXX	800H-JP51KB7AXXX
				M M←S	800H-JP69KB7AXXX	800H-JP38KB7AXXX	800H-JP73KB7AXXX
				S→M←S	—	800H-JP631KB7AXXX	—

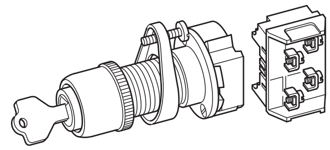
Note: X = Closed/O = Open
∗ Key removable in maintained positions only.
‡ For long barrel versions, add an **L** to the cat. no. **Example:** Cat. No. 800H**L**-JP41KB7.

10

3-Position Selector Switch Units, Non-Illuminated

800	H	–	JP		2	KB7	AAXX	(Knob/Wing Lever)
	a		*b*	*c*	*d*	*e*	*f*	

800	H	–	JP	41		KB7	AAXX	(Cylinder Lock)
	a		*b*	c_1	d_1	*e*	*f*	



a

Barrel Type	
Code	Description
H	Standard barrel length
HL	Long barrel

b

Number of Positions	
Code	Description
JP	3-position

c

Knob Insert Colors∗	
Code	Color
Blank	White knob insert or cylinder lock operator
X	Packet of colored inserts❄
Metal Wing Lever Colors	
Code	Color
A	Red
Blank	Grey

c_1

Cylinder Lock Operators	
Maintained Position	
Code	Locking Position
41	Left
42	Center
43	Right
44	All
45	Left and center
46	Right and left
47	Right and center
Spring Return from Left	
Code	Locking Position
50	Center
52	Right
51	Right and center
Spring Return from Right	
Code	Locking Position
69	Left
38	Center
73	Left and center
Spring Return from Both	
Code	Locking Position
631	Center

d

Knob/Lever Type Operators	
Standard Knob	
Code	Operator Function
2	Maintained
4	Spring return from left
5	Spring return from right
91	Spring return from both
Knob Lever	
Code	Operator Function
17	Maintained
18	Spring return from left
19	Spring return from right
20	Spring return from both
Metal Wing Lever§	
Code	Operator Function
11	Maintained
15	Spring return from left
16	Spring return from right
141	Spring return from both

d_1

Operator Type/Function‡	
Standard Knob	
Code	Key No.
Blank	D018 (standard key)
Note: Refer to page 10-164 for additional key option codes.	

e

Cam Option	
Code	Description
KB7	Standard cam KB7
KA1	Cam KA1
KA7	Cam KA7
Note: For additional Cam descriptions, see Table 5.	

f

Contact Block Option	
Code	Description
Blank	No contacts
AXXX	Two contact targets for a given cam as shown in the W (white side) column of Table 5.
AAXX	Two contact targets for a given cam as shown in the W (white side) column of Table 1 **and** 2 contact targets for the same cam as shown in the B (black side) column of Table 5. (One **Cat. No. 800T-XA** contact block per side. Two contact blocks total.)
AAAA	Four contact targets for a given cam as shown in the W (white side) column of Table 5 **and** 4 contact targets for the same cam as shown in the B (black side) column of Table 5. (Two **Cat. No. 800T-XA** contact blocks per side. Four contact blocks total.)

Table 5. Cam and Contact Block Functionality Table

Contact Block Suffix Code	Contact Block Side	Circuits	Cam Codes: KB7 (Std.)			KA1			KA7			KC1			KC7			KD7			KE7			KQ1			KQ7			KR1			KR7			KT1			KT7			KU7		
A_	White	A	X	O	O	X	O	O	O	O	X	O	O	X	X	O	O	O	O	X	X	O	O	X	O	X	X	O	X	X	O	X	X	O	X	O	O	X	X	O	O	X	O	O
B_		B	O	O	X	O	X	O	O	X	O	O	X	O	O	X	O	O	X	O	O	X	X	O	X	O	O	X	O	O	X	O	O	X	O	X	O	O	O	O	X	O	X	O
H_	Black	A	X	O	O	X	O	O	O	O	X	O	O	X	X	O	O	X	O	O	O	O	X	O	O	X	X	O	O	O	O	X	X	O	O	O	O	X	X	O	O	O	O	X
C_		B	O	O	X	O	X	O	O	X	O	X	O	O	O	O	X	O	X	O	X	X	O	O	X	O	O	X	O	X	X	O	O	X	X	X	X	O	O	X	X	X	X	O
	White	A	X	O	O	X	O	O	O	O	X	O	O	X	X	O	O	O	O	X	X	O	O	X	O	X	X	O	X	X	O	X	X	O	X	O	O	X	X	O	O	X	O	O
		B	O	O	X	O	X	O	O	X	O	O	X	O	O	X	O	O	X	O	O	X	X	O	X	O	O	X	O	O	X	O	O	X	O	X	O	O	O	O	X	O	X	O
	Black	A	X	O	O	X	O	O	O	O	X	O	O	X	X	O	O	X	O	O	O	O	X	O	O	X	X	O	O	O	O	X	X	O	O	O	O	X	X	O	O	O	O	X
		B	O	O	X	O	X	O	O	X	O	X	O	O	O	O	X	O	X	O	X	X	O	O	X	O	O	X	O	X	X	O	O	X	X	X	X	O	O	X	X	X	X	O

Note: X = Closed/O = Open

∗ Each standard and knob lever operator is factory assembled with a white insert. Other colors available, factory assembled, if ordered in quantities of 10 or more.
❄ One insert of each color (blue, green, orange, red, and yellow).
‡ For additional keys, see page 10-164.
§ Wing levers are not suitable with KE7 cam code.

LISTEN. THINK. SOLVE.℠

MICROLOGIX PROGRAMMABLE CONTROLLERS

SELECTION GUIDE

~~**BULLETIN 1761 - MicroLogix 1000**~~

~~**BULLETIN 1763 - MicroLogix 1100**~~

~~**BULLETIN 1762 - MicroLogix 1200**~~

BULLETIN 1766 - MicroLogix 1400

~~**BULLETIN 1764 - MicroLogix 1500**~~

ALLEN-BRADLEY • ROCKWELL SOFTWARE

Rockwell Automation

MicroLogix 1400 Controller

The MicroLogix 1400 controller is our newest family of controllers to join the popular MicroLogix 1000, MicroLogix 1100, MicroLogix 1200, and MicroLogix 1500 controllers, and is designed to broaden application coverage through available embedded analog inputs, Ethernet communication, faster high-speed counter (HSC), and pulse train output (PTO) capabilities. MicroLogix 1400 controllers maintain the same critical features you have come to expect from the MicroLogix 1100 controller, and expands that capability with more I/O, faster HSC/PTO, and an additional serial port. MicroLogix 1400 controllers complement our low-end controllers for applications that require up to 144 digital I/O.

Each MicroLogix 1400 controller includes 20 digital inputs and 12 digital outputs. In addition, several models include 4 embedded analog inputs and 2 embedded analog outputs. The controller can also expand its I/O capabilities by using the same modules as the MicroLogix 1200 controller. Up to seven of the 1762 I/O modules can be used with a single MicroLogix 1400 controller.

Using the latest version of our world-class RSLogix 500 programming software, the MicroLogix 1400 controller can be programmed with an instruction set that is common with the MicroLogix 1000, MicroLogix 1100, MicroLogix 1200, MicroLogix 1500, and SLC 500 families of controllers. RSLogix 500 Starter, Standard, and Professional applications, as well as RSLogix Micro software, all support the MicroLogix 1400 controller, including its online editing capabilities.

Each controller has 2 serial ports with DF1/DH485/Modbus RTU/DNP3/ASCII protocol support and a built-in Ethernet port, which supports EtherNet/IP peer-to-peer messaging.

An embedded LCD screen lets you monitor controller and I/O status, as well as make changes to bit and integer data.

Advantages for the MicroLogix 1400 Controller

- Large memory (10 KB user program with 10 KB user data) to solve a variety of applications.
- True online editing allows tuning of program, including PID, without going offline.
- Support for MicroLogix 1400 controller online editing in RSLogix 500 Professional, Standard, and Starter software version 8.1 and later, as well as RSLogix Micro.
- Mode switch for Run/Remote/Program through LCD keypad operation.
- Time-based or event-triggered data logging capability stores controller data records with optional time stamp in a separate 128 Kbyte memory area for later analysis (for example, trending and I/O status during alarm condition data).
- Recipe storage (up to 64 KB that is deducted from Data Logging memory) that is accessible by your ladder program, enabling quick and easy batch changes of program data for timers, counters, and other data types.
- High performance expansion I/O options (up to seven 1762 I/O modules, in any combination).
- Twelve high-speed inputs (except 1766-L32AWA and 1766-L32AWAA controllers) that can be used individually as latching (pulse-catch) inputs, event interrupts, or alternately combined as three 100 kHz high-speed counters featuring 10 modes of operation.
- Two available built-in 0...10V DC analog outputs (for controllers with analog I/O options) with 12-bit resolution (not isolated).
- Three high-speed outputs that can be configured as 100 kHz pulse train output (PTO) or 40 kHz as pulse width modulated (PWM) outputs (only on 1766-L32BXB and 1766-L32BXBA controllers).
- Multiple input commons let you use the controller for either sinking or sourcing input devices, and multiple output commons provide individual isolation in multi-voltage output applications.
- One, 1 ms, selectable timed interrupt (STI).
- High-resolution, 1 ms timers.
- Communication Channel 0 provides isolated RS-232 or RS-485 electrical compatibility (selectable through the choice of communication cables).
- Through RS-232, we support all serial protocols.
- Through RS-485, we support direct interface to DH-485, DF1 half-duplex master/slave, ASCII, and Modbus RTU master/slave networks, DNP 3 slave using the 1763-NC interface (1761-NET-AIC interface is not required).
- Communication Channel 1 consists of an embedded RJ45 port that supports EtherNet/IP network for peer-to-peer messaging. This 10/100 Mbps port supports BOOTP and DHCP.
- Communication channel 2 provides a 9-pin, non-isolated RS-232 port supporting all serial protocols.
- Communication toggle selection that allows the controller's Channel 0 port to toggle between user-configured communication parameters and factory default settings for an easy way to switch from Modbus RTU or ASCII protocols (which do not support programming) to DF1 full-duplex (to upload/download, monitor, or edit your program). So a programming computer is able to connect to a controller with an unknown or incorrect communication-parameter settings for troubleshooting.
- Embedded real-time clock.
- Embedded web server with email functionality.

- Optional memory module for external program backup, for program transport, and transfer to another controller. Program and data in the controller is also battery backed for secure storage.
- Data file download protection prevents critical user data from being altered via program downloads from programming computers or memory modules.
- Built-in LCD provides access to binary and integer files that can be changed, or optionally protected, for monitor only access by an operator.
- LCD instruction allows the controller to output messages to the LCD, and optionally receive user input.
- IP address can be monitored and configured directly through the built-in LCD.
- Two built-in digital trim potentiometers.
- 32-bit signed integer math.
- Floating-point and double-integer data file support.
- Built-in PID capabilities.
- Finger-safe removable terminal blocks meet global safety standards.
- Customizable OEM logos on the LCD display.
- Regulatory agency certifications for world-wide market (CE, C-Tick, and UL including Class 1 Division 2 Hazardous Location).

Select MicroLogix 1400 Controllers

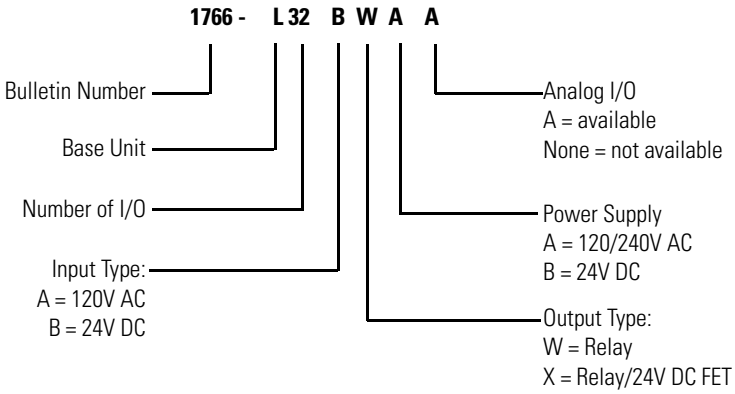
Step 10 - Select:

- controller - review power and I/O configurations to select a controller catalog number; see power supply and I/O specification for more detailed information
- accessories - memory modules
- record your selection in the Selection Record (starts on page 85)

MicroLogix 1400 Base Units

The base unit houses embedded inputs, outputs, power supply, and communication ports. The base unit also provides the interface to expansion I/O when required by an application.

MicroLogix 1400 Controller Catalog Number Detail



MicroLogix 1400 Controller Power and I/O Configuration

Cat. No.	Line Voltage	Number of Inputs	Number of Outputs	Embedded Analog I/O
1766-L32BWA	120/240V AC	(12) Fast 24V DC (8) Normal 24V DC	(12) Relay	---
1766-L32AWA	120/240V AC	(20) 120V AC	(12) Relay	---
1766-L32BXB	24V DC	(12) Fast 24V DC (8) Normal 24V DC	(6) Relay (3) Fast 24V DC (3) Normal 24V DC	---
1766-L32BWAA	120/240V AC	(12) Fast 24V DC (8) Normal 24V DC	(12) Relay	(4) Voltage Inputs (2) Voltage Outputs
1766-L32AWAA	120/240V AC	(20) 120V AC	(12) Relay	(4) Voltage Inputs (2) Voltage Outputs
1766-L32BXBA	24V DC	(12) Fast 24V DC (8) Normal 24V DC	(6) Relay (3) Fast 24V DC (3) Normal 24V DC	(4) Voltage Inputs (2) Voltage Outputs

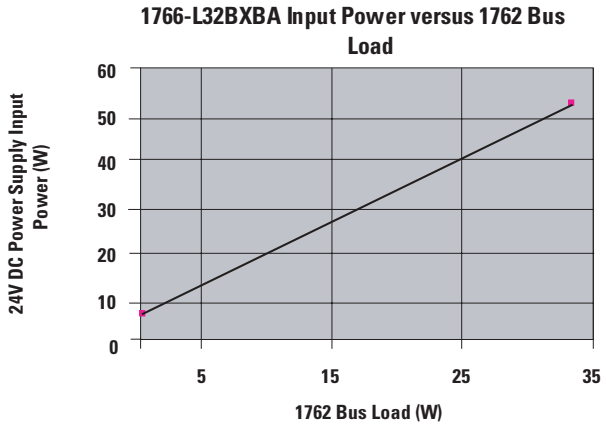
MicroLogix 1400 Controller Power Supply Specifications

Attribute	1766-L32AWA, 1766-L32AWAA	1766-L32BWA, 1766-L32BWAA	1766-L32BXB, 1766-L32BXBA
Power Supply Voltage	100.240V AC ((-15%, 10%) at 47...63 Hz		12…24V DC (-15%, 10%) Class 2 SELV

MicroLogix 1400 Controller Power Supply Specifications

Attribute	1766-L32AWA, 1766-L32AWAA	1766-L32BWA, 1766-L32BWAA	1766-L32BXB, 1766-L32BXBA
Power Consumption	100 VA	120 VA	7.5...53 W
Power Supply Inrush Current, max	120V AC: 25 A for 8 ms 240V AC: 40 A for 4 ms		24V DC: 15 A for 20 ms
24V DC Sensor Power	---	24V DC at 250 mA, 400µF capacitance, max	---

MicroLogix 1400 Controller DC Input Power Requirements for 1766-L32BXB and 1766-L32BXBA Units



1762 Digital I/O

1762 Digital Expansion Input Modules Specifications

Attribute	1762-IA8	1762-IQ8	1762-IQ8OW6 (inputs)	1762-IQ16
Voltage Category	100/120V AC	24V DC (sink/source)(1)	24V DC (sink/source)(1)	24V DC (sink/source)(1)
Operating Voltage Range	79…132V AC @ 47…63 Hz	10…26.4V DC @ 55 °C (131 °F) 10…30V DC @ 30 °C (86 °F)	10…26.4V DC @ 65 °C (149 °F) 10…30V DC @ 30 °C (86 °F)	10…26.4V DC @ 55 °C (131 °F) 10…30V DC @ 30 °C (86 °F)
Number of Inputs	8	8	8	16
Number of Commons	1	1	inputs: 2 outputs: 1	2
Bus Current Draw, max	50 mA @ 5V DC (0.25 W)	50 mA @ 5V DC (0.25 W)	110 mA @ 5V DC (0.55 W) 80 mA @ 24V DC (1.92 W)	60 mA @ 5V DC (0.25 W)
Heat Dissipation, max	2.0 Total Watts	3.7 Total Watts	5.0 Total Watts @ 30V 4.4 Total Watts @ 26.4V	5.3 Total Watts @ 30V 4.2 Total Watts @ 26.4V
Signal Delay, max	On Delay: 20.0 ms Off Delay: 20.0 ms	On Delay: 8.0 ms Off Delay: 8.0 ms	On Delay: 8.0 ms Off Delay: 8.0 ms	On Delay: 8.0 ms Off Delay: 8.0 ms
Off-State Voltage, max	20V AC	5V DC	5V DC	5V DC
Off-State Leakage Current, max	2.5 mA	1.5 mA	1.5 mA	1.5 mA
On-State Voltage, min	79V AC, min, 132V AC, max	10V DC	10V DC	10V DC
On-State Current min nom max	 5.0 mA @ 79V AC 47 Hz 12.0 mA @ 120V AC 60 Hz 16.0 mA @ 132V AC 63 Hz	 2.0 mA @ 10V DC 8.0 mA @ 24V DC 12.0 mA @ 30V DC	 2.0 mA @ 10V DC 8.0 mA @ 24V DC 12.0 mA @ 30V DC	 2.0 mA @ 10V DC 8.0 mA @ 24V DC 12.0 mA @ 30V DC
Inrush Current, max	250 mA	---	250 mA	---
Impedance, nom	12 kΩ @ 50 Hz 10 kΩ @ 60 Hz	3 kΩ	3 kΩ	3 kΩ
Isolated Groups	Group 1: inputs 0…7 (internally connected commons)	Group 1: inputs 0…7 (internally connected commons)	Group 1: inputs 0…3 Group 2: inputs 4…7 Group 3: outputs 0…5	Group 1: inputs 0…7 Group 2: inputs 8…15
Input Group to Backplane Isolation	Verified by one of the following dielectric tests: 1517V AC for 1 s or 2145V DC for 1 s 132V AC working voltage (IEC Class 2 reinforced insulation)	Verified by one of the following dielectric tests: 1200V AC for 1 s or 1697V DC for 1 s 75V DC working voltage (IEC Class 2 reinforced insulation)	Verified by one of the following dielectric tests: Input Group to Backplane isolation - 1200V AC for 1 s or 1697V DC for 1 s 75V DC working voltage (IEC Class 2 reinforced insulation) Output Group to Backplane isolation - 1836V AC for 1 s or 2596V DC for 1 s 265V AC working voltage (IEC Class 2 reinforced insulation) Input Group to Output Group isolation - 1836V AC for 1 s or 2596V DC for 1 s 265V AC working voltage (basic insulation) 150V AC working voltage (IEC Class 2 reinforced insulation)	Verified by one of the following dielectric tests: 1200V AC for 1 s or 1697V DC for 1 s 75V DC working voltage (IEC Class 2 reinforced insulation)

(1) Sinking/Sourcing Inputs - Sourcing/sinking describes the current flow between the I/O module and the field device. Sourcing I/O circuits supply (source) current to sinking field devices. Sinking I/O circuits are driven by a current sourcing field device. Field devices connected to the negative side (DC Common) of the field power supply are sinking field devices. Field devices connected to the positive side (+V) of the field supply are sourcing field devices.

1762 Digital Expansion DC Output Modules Specifications

Attribute	1762-OA8	1762-OB8	1762-OB16
Voltage Category	100…240V AC	24V DC	24V DC
Operating Voltage Range	85…265V AC @ 47…63 Hz	20.4…26.4V DC	20.4…26.4V DC
Number of Outputs	8	8	16
Number of Commons	2	1	1
Bus Current Draw, max	115 mA @ 5V DC (0.575 W)	115 mA @ 5V DC (0.575 W)	175 mA @ 5V DC (0.88 W)
Heat Dissipation, max	2.9 Total Watts	1.61 Total Watts	2.9 Total watts @ 30 °C (86 °F) 2.1 Total watts at 55 °C (131 °F)
Signal Delay, max - resistive load	On Delay: 1/2 cycle Off Delay: 1/2 cycle	On Delay: 0.1 ms Off Delay: 1.0 ms	On Delay: 0.1 ms Off Delay: 1.0 ms
Off-State Leakage, max	2 mA @ 132V 2.5 mA @ 265V	1.0 mA	1.0 mA
On-State Current, min	10 mA	1.0 mA	1.0 mA
On-State Voltage Drop, max	1.5V @ 0.5 A	1.0V DC	1.0Vdc
Continuous Current per Point, max	0.25 A @ 55 °C (131 °F) 0.5 A @ 30 °C (86 °F)	0.5 A @ 55 °C (131 °F) 1.0 A @ 30 °C (86 °F)	0.5 A @ 55 °C (131 °F) 1.0 A @ 30 °C (86 °F)
Continuous Current per Common, max	1.0 A @ 55° (131 °F) 2.0 A @ 30 °C (86 °F)	4.0 A @ 55 °C (131 °F) 8.0 A @ 30 °C (86 °F)	4.0 A @ 55 °C (131 °F) 8.0 A @ 30 °C (86 °F)
Continuous Current per Module, max	2.0 A @ 55 °C (131 °F) 4.0 A @ 30 °C (86 °F)	4.0 A @ 55 °C (131 °F) 8.0 A @ 30 °C (86 °F)	4.0 A @ 55 °C (131 °F) 8.0 A @ 30 °C (86 °F)
Surge Current, max	5.0 A(1)	2.0 A(2)	2.0(2)

(1) Repeatability is once every 2 seconds for a durations of 25 ms.

(2) Repeatability is once every 2 seconds @ 55 °C (131 °F), once every second @ 30 °C (86 °F) for a duration of 10 ms.

1762 Digital Expansion Relay Output Modules Specifications

Attribute	1762-IQ8OW6 (outputs)	1762-OW8	1762-OW16	1762-OX6I
Voltage Category	AC/DC normally open relay	AC/DC normally open relay	AC/DC normally open relay	AC/DC Type C Relay
Operating Voltage Range	5…265V AC 5…125V DC	5…265V AC 5…125V DC	5…265V AC 5…125V DC	5…265V AC 5…125V DC
Number of Outputs	6	8	16	6 (N.C., N.O.)
Number of Commons	inputs: 2 outputs: 1	2	2	6
Bus Current Draw, max	110 mA @ 5V DC (0.55 W) 80 mA @ 24V DC (1.92 W)	80 mA @ 5V DC (0.40 W) 90 mA @ 24V DC (2.16 W)	120 mA @ 5V DC (0.60 W) 140 mA @ 24V DC (3.36 W)	110 mA @ 5V DC (0.55 W) 110 mA @ 24V DC (2.64 W)
Heat Dissipation, max	5.0 Total Watts @ 30V 4.4 Total Watts @ 26.4V	2.9 Total Watts	5.6 Watts	2.8 Watts
Signal Delay, max - resistive load	On Delay: 10 ms Off Delay: 10 ms	On Delay: 10 ms Off Delay: 10 ms	On Delay: 10 ms Off Delay: 10 ms	On Delay: 10 ms Off Delay: 20 ms
Off-State Leakage, max	0 mA	0 mA	0 mA	0 mA
On-State Current, min	10 mA @ 5V DC	10 mA @ 5V DC	10 mA	100 mA
On-State Voltage Drop, max	N/A	N/A	N/A	N/A
Continuous Current per Point, max	2.5 A (Also see MicroLogix 1500 Controller Relay Contact Rating on page 71.)			7 A (Also see MicroLogix 1500 Controller Relay Contact Rating on page 71.)
Continuous Current per Common, max	8 A	8 A	8 A	7 A (Also see MicroLogix 1500 Controller Relay Contact Rating on page 71.)
Continuous Current per Module, max	8 A	16 A	16 A	30 A
Surge Current, max	See MicroLogix 1500 Controller Relay Contact Rating on page 71.			

1762 Analog Modules

1762 Analog Expansion Modules Common Specifications

Attribute	1762-IF4	1762-IF2OF2	1762-OF4
Bus Current Draw, max	40 mA @ 5V DC 50 mA @ 24V DC	40 mA @ 5V DC 105 mA @ 24V DC	40 mA @ 5V DC 165 mA @ 24V DC
Analog Normal Operating Range	Voltage: -10…10V DC Current: 4…20 mA	Voltage: 0…10V DC Current: 4…20 mA	Voltage: 0…0V DC Current: 4…20 mA
Full Scale(1) Analog Ranges	Voltage: -10.5…10.5V DC Current: -21…21 mA	Voltage: 0…0.5V DC Current: 0…21 mA	Voltage: 0…0.5V DC Current: 0…21 mA
Resolution	15 bits	12 bits (unipolar)	12 bits (unipolar)
Repeatability(2)	±0.1%	±0.1%	±0.1%
Input and Output Group to System Isolation	30V AC/30V DC rated working voltage(3) (N.E.C. Class 2 required) (IEC Class 2 reinforced insulation) type test: 500V AC or 707V DC for 1 minute		30V AC/30V DC rated working voltage (IEC Class 2 reinforced insulation) type test: 500V AC or 707V DC for 1 minute

(1) The over- or under-range flag is set when the normal operating range is exceeded. The module continues to convert the analog input up to the maximum full scale range.

(2) Repeatability is the ability of the input module to register the same reading in successive measurements for the same input signal.

(3) Rated working voltage is the maximum continuous voltage that can be applied at the terminals with respect to Earth ground.

1762 Analog Expansion Input Modules Specifications

Attribute	1762-IF4	1762-IF2OF2
Number of Inputs	4 differential (bipolar)	2 differential (unipolar)
Update Time (typical)	130, 250, 290, 450, 530 ms (selectable)	2.5 ms
A/D Converter Type	Successive approximation	Successive approximation
Common Mode Voltage Range(1)	±27V	±27V
Common Mode Rejection(2)	> 55 dB @ 50 and 60 Hz	> 55 dB @ 50 and 60 Hz
Non-linearity (in percent full scale)	±0.1%	±0.1%
Typical Overall Accuracy(3)	±0.3% full scale @ 0…55 °C (32…131 °F) ±0.24% full scale @ 25 °C (77 °F)	±0.5% full scale @ 0…55 °C (32…131 °F) ±0.3% full scale @ 25 °C (77 °F)
Input Impedance	Voltage Terminal: 200 kΩ, Current Terminal: 275 Ω	Voltage Terminal: 200 kΩ, Current Terminal: 250 Ω
Current Input Protection	±32 mA	±32 mA
Voltage Input Protection	±30V	±30V
Channel Diagnostics	Over or under range or open circuit condition by bit reporting for analog inputs.	

(1) For proper operation, both the plus and minus input terminals must be within ±27V of analog common.

(2) V_{cm} = 1 V_{pk-pk} AC.

(3) V_{cm} = 0 (includes offset, gain, non-linearity and repeatability error terms).

1762 Analog Expansion Output Modules Specifications

Attribute	1762-IF2OF2	1762-OF4
Number of Outputs	2 single-ended (unipolar)	4 single-ended (bipolar)
Update Time (typical)	4.5 ms	2.5 ms
D/A Converter Type	Resistor string	R-2R Ladder Voltage Switching
Resistive Load on Current Output	0…500 Ω (includes wire resistance)	0…500 Ω (includes wire resistance)
Load Range on Voltage Output	> 1 kΩ	> 1 kΩ
Reactive Load, Current Output	< 0.1 mH	< 0.1 mH
Reactive Load, Voltage Output	< 1 µF	< 1 µF
Typical Overall Accuracy(1)	±1% full scale @ 0…55 °C (32…131 °F), ±0.5% full scale @ 25 °C (77 °F)	±1% full scale @ 0…55°C ±0.5% full scale @ 25°C
Output Ripple, range 0…500 Hz (referred to output range)	< ±0.1%	< ±0.1%
Non-linearity (in percent full scale)	< ±0.5%	< ±0.5%
Open and Short-Circuit Protection	Continuous	Continuous
Output Protection	±32 mA	±32 mA

(1) Includes offset, gain, non-linearity and repeatability error terms.

Allen-Bradley

PanelView Plus 7 Standard Terminals

Catalog Numbers 2711P-T4W21D8S, 2711P-T4W22D8S, 2711P-T4W21D8S-B, 2711P-T4W22D8S-B, 2711P-T6C21D8S, 2711P-T6C22D8S, 2711P-T6C21D8S-B, 2711P-T6C22D8S-B, 2711P-T7C21D8S, 2711P-T7C22D8S, 2711P-T7C21D8S-B, 2711P-T7C22D8S-B, 2711P-T9W21D8S, 2711P-T9W22D8S, 2711P-T9W21D8S-B, 2711P-T9W22D8S-B, 2711P-T10C21D8S, 2711P-T10C22D8S, 2711P-T10C21D8S-B, 2711P-T10C22D8S-B, 2711P-T12W21D8S, 2711P-T12W22D8S, 2711P-T12W21D8S-B, 2711P-T12W22D8S-B, 2711P-T15C21D8S, 2711P-T15C22D8S, 2711P-T15C21D8S-B, 2711P-T15C22D8S-B

Summary of Changes

Topic	Page
In the Technical Specifications table, corrected the measurements (in inches) in the Cutout dimensions line for the 9 in. terminals.	5

The PanelView™ Plus 7 Standard terminals are operator interface devices. They monitor and control devices that are attached to ControlLogix® 5570 and CompactLogix™ 5370 controllers on an EtherNet/IP network. Animated graphic and text displays provide operators a view into the operating state of a machine or process. Operators interact with the control system by using touch screen input.

The PanelView Plus 7 Standard terminals include these features:

- Terminal functionality permits connection to 1 controller, up to 25 screens, and up to 200 alarms.
- FactoryTalk® View Machine Edition software provides a familiar environment for creating HMI applications.
- Windows CE operating system with desktop access for configuration and third-party applications.
- Ethernet communication that supports linear and star network topology.
- PDF viewer to access PDF files that are stored on the terminal.

- More screen options including 4-in., 6-in., 7-in., 9-in., 10-in., 12-in., and 15-in. terminals.
- Widescreen on three sizes, 4-in., 9-in., and 12-in. terminals.
- Greater screen resolution.
- Terminals are available with an Allen-Bradley brand marking, or with no marking for customers who want to put their own brand label on the terminal.
- Certifications including Class I, Div. 2; Class II, Div. 2; Class III; and ATEX and INMETRO Zones 2 and 22.

Environmental Specifications

Table 1 - Environmental Specifications - 2711P-T4W21D8S, 2711P-T4W22D8S, 2711P-T4W21D8S-B, 2711P-T4W22D8S-B, 2711P-T6C21D8S, 2711P-T6C22D8S, 2711P-T6C21D8S-B, 2711P-T6C22D8S-B, 2711P-T7C21D8S, 2711P-T7C22D8S, 2711P-T7C21D8S-B, 2711P-T7C22D8S-B, 2711P-T9W21D8S, 2711P-T9W22D8S, 2711P-T9W21D8S-B, 2711P-T9W22D8S-B, 2711P-T10C21D8S, 2711P-T10C22D8S, 2711P-T10C21D8S-B, 2711P-T10C22D8S-B, 2711P-T12W21D8S, 2711P-T12W22D8S, 2711P-T12W21D8S-B, 2711P-T12W22D8S-B, 2711P-T15C21D8S, 2711P-T15C22D8S, 2711P-T15C21D8S-B, 2711P-T15C22D8S-B(1)

Attribute	Value
Temperature, operating	0…55 °C (32…131 °F)
Temperature, nonoperating	-25…+70 °C (-13…+158 °F)
Relative humidity	5…95% without condensation
Heat dissipation	4 in., 15 W = 51 BTU 6 in., 15 W = 51 BTU 7 in., 15 W = 51 BTU 9 in., 20 W = 68 BTU 10 in., 20 W= 68 BTU 12 in., 30 W= 102 BTU 15 in., 30 W= 102 BTU
Altitude, operating	2000 M
Vibration 4.3-in., 5.7-in., 6.5-in., 9.0-in., 10.4-in., 12.1-in., and 15-in.	 0.012 pk-pk, 10…57 Hz 2g peak at 57…500 Hz
Shock, operating	15 g at 11 ms
Shock, nonoperating	30 g at 11 ms
Enclosure ratings	NEMA and UL Type 12, 13, 4X (indoor use only), also rated IP54 or IP66 as Classified by UL

(1) Catalog numbers with a -B extension denote terminals that do not include the Allen-Bradley brand marking. Customers can put their own brand labels on these terminals.

Certifications

Table 2 Certifications - 2711P-T4W21D8S, 2711P-T4W22D8S, 2711P-T4W21D8S-B, 2711P-T4W22D8S-B, 2711P-T6C21D8S, 2711P-T6C22D8S, 2711P-T6C21D8S-B, 2711P-T6C22D8S-B, 2711P-T7C21D8S, 2711P-T7C22D8S, 2711P-T7C21D8S-B, 2711P-T7C22D8S-B, 2711P-T9W21D8S, 2711P-T9W22D8S, 2711P-T9W21D8S-B, 2711P-T9W22D8S-B, 2711P-T10C21D8S, 2711P-T10C22D8S, 2711P-T10C21D8S-B, 2711P-T10C22D8S-B, 2711P-T12W21D8S, 2711P-T12W22D8S, 2711P-T12W21D8S-B, 2711P-T12W22D8S-B, 2711P-T15C21D8S, 2711P-T15C22D8S, 2711P-T15C21D8S-B, 2711P-T15C22D8S-B(1)

Certification(2)	Value
cULus	cULus Listed Industrial Control Equipment for use in Hazardous Locations (E10314) per standards ANSI / ISA 12.12.01 and CSA C22.2 No. 213. rated: • Class I, Division 2, Groups A, B, C and D • Class II, Division 2, Groups F and G • Class III Enclosure type ratings per UL50 and CSA C22.2 No. 94.2-07. Enclosure ingress protection classified by UL per IEC 60529
ATEX	European Union 94/9/EC ATEX Directive, compliant with: • EN 60079-0:2009; EN 60079-11:2012; EN 60079-15:2010; and EN 60079-31:2009 • II 3 GD • Ex ic nA IIC T4 Gc • Ex tc IIIC T135 °C (275 °F) Dc IP66 • Tamb = 0 °C to +55 °C (32 °F to +131 °F) • DEMKO 14 ATEX 1302X
INMETRO	ABNT NBR IEC 60079-0:2008+Errata 1:2011; ABNT NBR IEC 60079-11:2009; ABNT NBR IEC 60079-15:2012; ABNT NBR IEC 60079-31:2011 Ex ic nA IIC T4 Gc Ex tc IIIC T135 °C (275 °F) Dc IP66 Tamb = 0 °C to +55 °C (32 °F to +131 °F) UL-BR 14.0716X
CE (EMC)	European Union 2004/108/EC EMC Directive, compliant with: • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers
CE (LVD)	European Union 2006/95/EC Low Voltage Directive, compliant with: • EN 61131-2; Programmable Controllers
RCM	Australian Radio Communications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions
EAC	Certificate of compliance
RoHS	China RoHS, Turkey RoHS, European RoHS
KCC	Certificate of compliance

(1) Catalog numbers with a -B extension denote terminals that do not include the Allen-Bradley brand marking. Customers can put their own brand labels on these terminals.

(2) When marked. See the Product Certification link on http://www.ab.com for declarations of conformity, certificates, and other certification details.

Technical Specifications

Table 3 - PanelView Plus 7 Standard 4-in and 6-in Terminals

Attribute	4-in. Touch 2711P-T4W21D8S, 2711P-T4W21D8S-B, 2711P-T4W22D8S, 2711P-T4W22D8S-B	6-in. Touch 2711P-T6C21D8S, 2711P-T6C21D8S-B, 2711P-T6C22D8S, 2711P-T6C22D8S-B
Operator input	Touch	Touch
Display type	Color TFT LCD	Color TFT LCD
Display size, diagonal	4.3 in. widescreen	5.7 in.
Viewing area	95 x 54 mm	115 x 86 mm
Display resolution	480 x 272 WQVGA, 18-bit color graphics	640 x 480 VGA, 18-bit color graphics
Aspect ratio	16:9	4:3
Brightness, typical	300 nits	
Backlight life	50,000 h life, min. at 40° C to half-brightness. Backlight is not replaceable	
Touch screen	Analog resistive Actuation rating: 1 million presses Operating force: 100 grams	
Battery (real-time clock backup)	Accuracy: +/-2 minutes per month. Battery life: 4 years min at 25 °C (77 °F) Replacement: CR2032 lithium coin cell (Allen-Bradley part number 2711P-RY2032)	
Memory		
System	512 MB RAM and 512 MB storage	
User	80 MB nonvolatile storage for applications	
Secure Digital (SD) card slot	One SD card slot for storing application files Replacement: Allen-Bradley part number 1784-SD1 (1 GB) and 1784-SD2 (2 GB)	
USB ports		
Host	One USB 2.0 high-speed host port (type A) support removal flash drives for storage	
Device	One high-speed 1.0 device port (type B) supports connection to host computer	
Ethernet port		
Cat. Nos. with 21	One 10/100Base-T, Auto MDI/MDI-X Ethernet port with IEEE1588 support	
Cat. Nos. with 22	Two 10/100Base-T, Auto MDI/MDI-X Ethernet ports supporting star, linear, or DLR network topology	
Operating system	Windows CE includes FTP, VNC client server, ActiveX controls, PDF reader, third-party device support	
Software	FactoryTalk View Studio for Machine Edition, version 8.0 or later, FactoryTalk ViewPoint, version 2.6 or later	
Electrical		
Input voltage, DC	24V DC nom (18…30V DC), nonisolated DC power supply	
Power consumption, DC	35 W max (1.46A at 24V DC)	
Power supply	DIN-rail power supply, AC-to-DC, 85…265V AC, 47…63 Hz Replacement: Allen-Bradley part number 2711P-RSACDIN	
Mechanical		
Weight, approx	0.44 kg (0.97 lb)	0.70 kg (1.53 lb)
Dimensions, HxWxD, approx.	110 x 135 x 56.5 mm (4.33 x 5.31 x 2.22 in.)	152 x 176 x 56.5 mm (5.98 x 6.93 x 2.22 in.)
Cutout dimensions, HxW, approx.	92 x 117 mm (3.62 in. x 4.61 in.)	123 x 156 mm (4.84 x 6.14 in.)

Table 4 - PanelView Plus 7 Standard 7-in., 9-in., and 10-in. Terminals

Attribute	7-in. Touch 2711P-T7C21D8S, 2711P-T7C21D8S-B, 2711P-T7C22D8S, 2711P-T7C22D8S-B	9-in. Touch 2711P-T9W21D8S, 2711P-T9W21D8S-B, 2711P-T9W22D8S, 2711P-T9W22D8S-B	10-in. Touch 2711P-T10C21D8S, 2711P-T10C21D8S-B, 2711P-T10C22D8S, 2711P-T10C22D8S-B
Operator input	Touch	Touch	Touch
Display type	Color TFT LCD	Color TFT LCD	Color TFT LCD
Display size, diagonal	6.5 in.	9 in. widescreen	10.4 in.
Viewing area	132 x 99 mm	196 x 118 mm	211 x 158 mm
Display resolution	640 x 480 VGA, 18-bit color graphics	800 x 480 WVGA, 18-bit color graphics	800 x 600 SVGA, 18-bit color graphics
Aspect ratio	4:3	5:3	4:3
Brightness, typical	300 nits		
Backlight life	50,000 hr life, min at 40° C (104 °F) to half-brightness. Backlight is not replaceable.		
Touch screen	Analog resistive Actuation rating: 1 million presses Operating force: 100 grams		
Battery (real-time clock backup)	Accuracy: ±2 minutes per month. Battery life: 4 years min at 25 °C (77 °F) Replacement: CR2032 lithium coin cell (Allen-Bradley part number 2711P-RY2032)		
Memory System User	 512 MB RAM and 512 MB storage 80 MB nonvolatile storage for applications		
Secure Digital (SD) card slot	One SD card slot for storing application files Replacement: Allen-Bradley part number 1784-SD1 (1 GB) and 1784-SD2 (2 GB)		
USB ports Host Device	 One USB 2.0 high-speed host port (type A) support removal flash drives for storage One high-speed 1.0 device port (type B) supports connection to host computer		
Ethernet port Cat. Nos. with 21 Cat. Nos. with 22	 One 10/100Base-T, Auto MDI/MDI-X Ethernet port with IEEE1588 support Two 10/100Base-T, Auto MDI/MDI-X Ethernet ports supporting star, linear, or DLR network topology		
Operating system	Windows CE includes FTP, VNC client server, ActiveX controls, PDF reader, third-party device support		
Software	FactoryTalk View Studio for Machine Edition, version 8.0 or later, FactoryTalk ViewPoint, version 2.6 or later		
Electrical			
Input voltage, DC	24V DC nom (18…30V DC), nonisolated DC power supply		
Power consumption, DC	50 W max (2.1A at 24V DC)		
Power supply	DIN-rail power supply, AC-to-DC, 85…265V AC, 47…63 Hz Replacement: Allen-Bradley part number 2711P-RSACDIN		
Mechanical			
Weight, approx	0.85 kg (1.86 lb)	1.29 kg (2.84 lb)	1.82 kg (4.0 lb)
Dimensions, HxWxD, approx	170 x 212 x 56.5 mm (6.69 x 8.35 x 2.22 in.)	190 x 280 x 56.5 mm (7.48 x 11.02 x 2.22 in.)	252 x 297 x 56.5 mm (9.92 x 11.69 x 2.22 in.)
Cutout dimensions, HxW, approx.	142 x 184 mm (5.59 x 7.24 in.)	162 x 252 mm (6.38 x 9.92 in.)	224 x 269 mm (8.82 x 10.59 in.)

Table 5 - PanelView Plus 7 Standard 12-in. and 15-in. Terminals

Attribute	12-in. Touch 2711P-T12W21D8S, 2711P-T12W21D8S-B, 2711P-T12W22D8S, 2711P-T12W22D8S-B	15-in. Touch 2711P-T15C21D8S, 2711P-T15C21D8S-B, 2711P-T15C22D8S, 2711P-T15C22D8S-B
Operator Input	Touch	Touch
Display type	Color TFT LCD	Color TFT LCD
Display size, diagonal	12.1 in. widescreen	15-in.
Viewing area	261 x 163 mm	304 x 228 mm
Display resolution	1280 x 800 WXGA, 18-bit color graphics	1024 x 768 XGA, 18-bit color graphics
Aspect ratio	5:3	4:3
Brightness, typical	300 nits	
Backlight life	50,000 h life, min. at 40° C to half-brightness. Backlight is not replaceable	
Touch screen	Analog resistive Actuation rating: 1 million presses Operating force: 100 grams	
Battery (real-time clock backup)	Accuracy: +/-2 minutes per month Battery life: 4 years min at 25 °C (77 °F) Replacement: CR2032 lithium coin cell	
Memory		
System	512 MB RAM and 512 MB storage	
User	80 MB nonvolatile storage for applications	
Secure Digital (SD) card slot	One SD card slot for storing application files Replacement: Allen-Bradley part number 1784-SD1 (1 GB) and 1784-SD2 (2 GB)	
USB ports		
Host	One USB 2.0 high-speed host port (type A) support removal flash drives for storage	
Device	One high-speed 1.0 device port (type B) supports connection to host computer	
Ethernet port		
Cat. Nos. with 21	One 10/100Base-T, Auto MDI/MDI-X Ethernet port with IEEE1588 support	
Cat. Nos. with 22	Two 10/100Base-T, Auto MDI/MDI-X Ethernet ports supporting star, linear, or DLR network topology	
Operating system	Windows CE includes FTP, VNC client server, ActiveX controls, PDF reader, third-party device support	
Software	FactoryTalk View Studio for Machine Edition, version 8.0 or later, FactoryTalk ViewPoint, version 2.6 or later	
Electrical		
Input voltage, DC	24V DC nom (18…30V DC), nonisolated DC power supply	
Power consumption, DC	50 W max (2.1A at 24V DC)	
Power supply	DIN-rail power supply, AC-to-DC, 85…265V AC, 47…63 Hz Replacement: Allen-Bradley part number 2711P-RSACDIN	
Mechanical		
Weight, approx.	1.95 kg (4.29 lb)	3.07 kg (6.75 lb)
Dimensions, HxWxD, approx.	240 x 340 x 56.5 mm (9.65 x 13.39 x 2.22 in.)	318 x 381 x 56.5mm (12.52 x 15.00 x 2.22 in.)
Cutout dimensions, HxW, approx.	218 x 312 mm (8.58 x 12.28 in.)	290 x 353 mm (11.42 x 13.90 in.)

Product Dimensions

The table provides product dimensions. The 5.7-in. and 10.4-in. touch-screen terminals are shown for illustrative purposes. All other terminal sizes look similar. For information on proper mounting clamp installation, refer to the PanelView Plus 7 Standard Terminals User Manual, publication 2711P-UM007.

Figure 1 - Series A and Series B Terminals, Front View

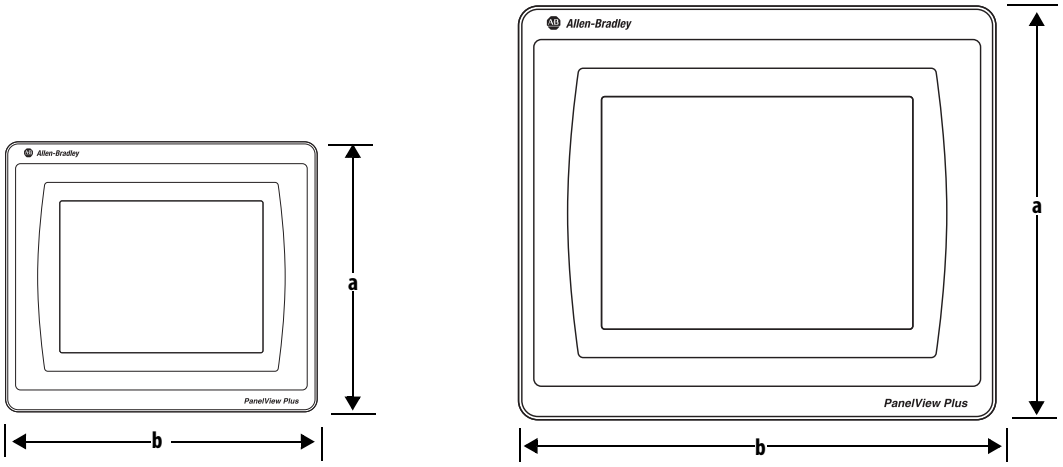


Figure 2 - Series A and Series B Terminals with Single Ethernet Port, Bottom View

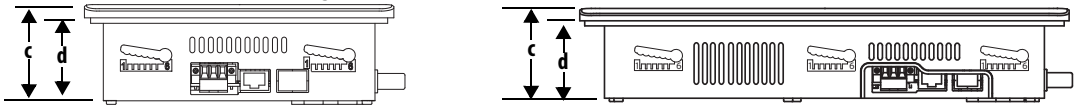


Figure 3 - Series B Terminals with Dual Ethernet Ports, Bottom View

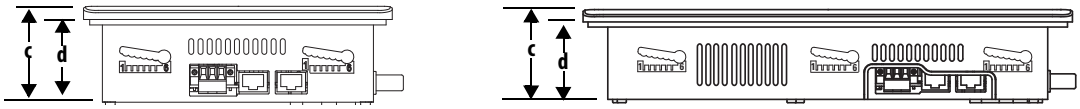


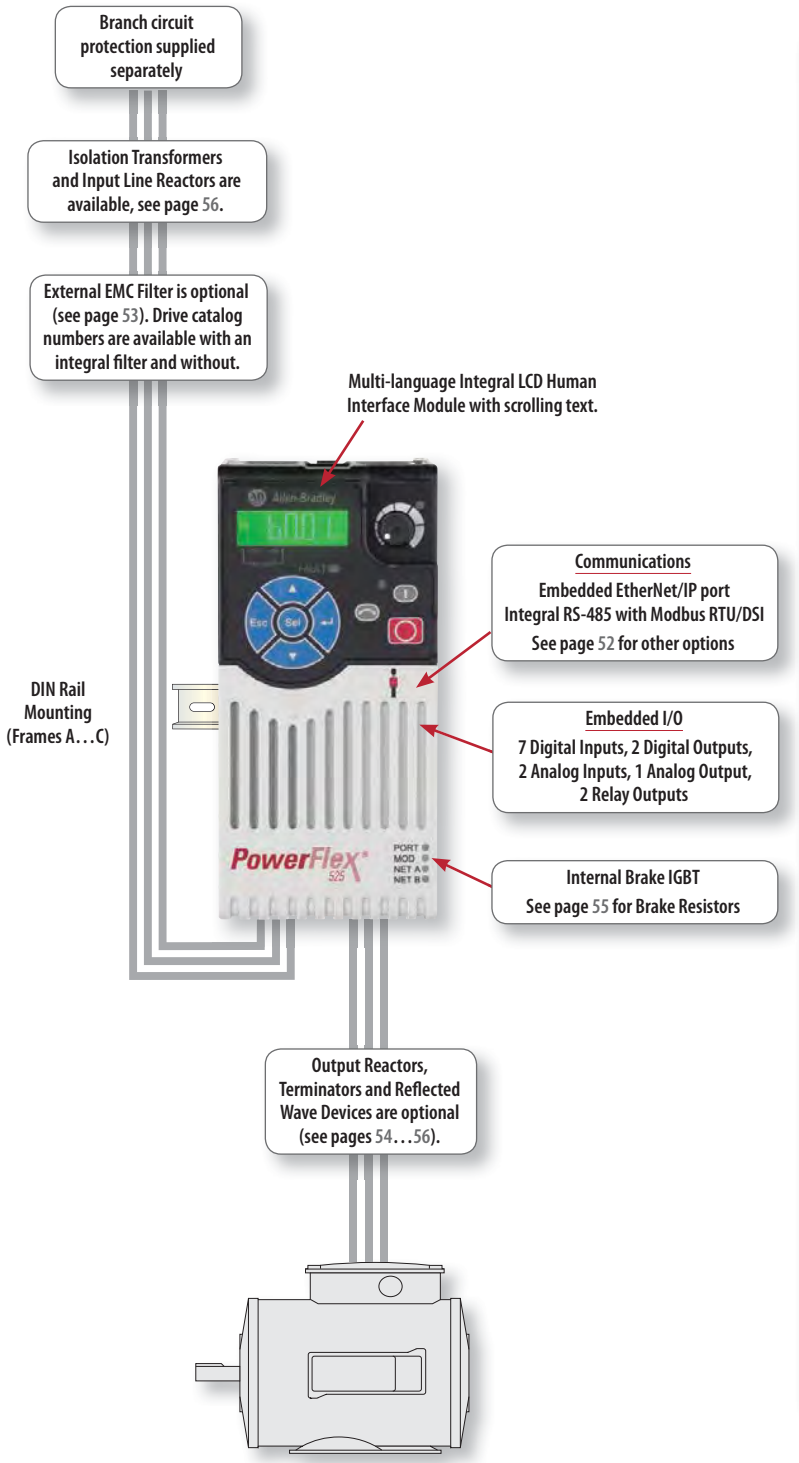
Table 6 - PanelView Plus 7 Standard Dimensions

Terminal Size	Input Type	Height (a) mm (in.)	Width (b) mm (in.)	Overall Depth (c) mm (in.)	Mounted Depth (d) mm (in.)
4.3 in.	Touch	110 (4.33)	135 (5.31)	56.5 (2.22)	50.14 (1.97)
5.7 in.	Touch	152 (5.98)	176 (6.93)	56.5 (2.22)	50.14 (1.97)
6.5 in.	Touch	170 (6.69)	212 (8.35)	56.5 (2.22)	50.14 (1.97)
9 in.	Touch	190 (7.48)	280 (11.02)	56.5 (2.22)	50.14 (1.97)
10.4 in.	Touch	252 (9.92)	297 (11.69)	56.5 (2.22)	50.14 (1.97)
12.1 in.	Touch	240 (9.65)	340 (13.39)	56.5 (2.22)	50.14 (1.97)
15 in.	Touch	318 (12.52)	381 (15.00)	56.5 (2.22)	50.14 (1.97)

TIP When mounted in a panel, the front of the bezel extends less than 6.36 mm (0.25 in.) from the front of the panel.

PowerFlex 525 AC Drive

PowerFlex 525 AC drives feature an innovative, modular design offering fast and easy installation and configuration. These cost-effective compact drives come with embedded EtherNet/IP™ communications, safety, USB configuration and a high ambient operating temperature capability. PowerFlex 525 AC drives also provide a variety of motor control algorithms including volts per hertz, sensorless vector control and closed loop velocity vector control, making these drives ideal for a vast array of applications.



PowerFlex 525 AC Drive at a glance

Ratings	
100…120V:	0.4…1.1 kW / 0.5…1.5 Hp / 2.5…6 A
200…240V:	0.4…15 kW / 0.5…20 Hp / 2.5…62.1 A
380…480V:	0.4…22 kW / 0.5…30 Hp / 2.5…62.1 A
525…600V::	0.4…22 kW / 0.5…30 Hp / 0.9…32 A
Motor Control	• V/Hz Control • Sensorless Vector Control • Closed Loop Velocity Vector Control • Permanent Magnet Motor Control ♣
Enclosures	• IP20, NEMA/UL Type Open • IP30, NEMA/UL Type 1 (with optional kit)
Safety	Safe Torque-Off PLd/SIL2 Cat 3 (meets ISO 13849-1)
Additional Features	• Modular design eases installation • Operating temperatures from -20 °C (-4 °F) up to 50 °C (122 °F). Up to 70 °C (158 °F) with current derating and optional control module fan kit. • Embedded EtherNet/IP port • Option for dual port EtherNet/IP adapter which supports DLR functionality. DeviceNet and PROFIBUS DP adapters also available. • Embedded Safe Torque-Off PLd/SIL2 Cat 3 • LCD HIM with multi-language support • MainsFree™ Programming via USB • Configure using Connected Components Workbench Software • Add-on Profiles for Studio 5000™ Logix Designer Software • Automatic Device Configuration • Economizer motor control for energy savings • Application specific parameter groups • Simple positioning control with optional encoder card • Conformal coating to IEC 60721 3C2 standards
Certifications	• ACS 156 • ATEX • C-Tick • c-UL, UL • CE • EPRI/SEMI F47 • GOST-R • KCC • Lloyd's Register • RoHS • TÜV FS ISO/EN13849-1 (EN954-1)
Options	See pages 52… 56

♣ Permanent magnet motor control is scheduled for a future firmware release.

Additional Information

PowerFlex 520-Series Technical Data, publication 520-TD001
PowerFlex 520-Series User Manual, publication 520-UM001

Catalog Number Explanation

25B –	D	6P0	N	1	1	4
	Voltage Rating	Rating	Enclosure		Internal EMC Filter 0 = No 1 = Yes	

Product Selection

100…120V AC, Single-Phase, 50/60 Hz

Drive Ratings						No Filter	with Integral EMC Filter
Normal Duty		Heavy Duty		Output Current			
kW	Hp	kW	Hp	A	Frame Size	Cat. No.	Cat. No.
0.4	0.5	0.4	0.5	2.5	A	25B-V2P5N104	–
0.75	1	0.75	1	4.8	B	25B-V4P8N104	–
1.1	1.5	1.1	1.5	6	B	25B-V6P0N104	–

200…240V AC, Single-Phase, 50/60 Hz

Drive Ratings						No Filter	with Integral EMC Filter ‡
Normal Duty		Heavy Duty		Output Current			
kW	Hp	kW	Hp	A	Frame Size	Cat. No.	Cat. No.
0.4	0.5	0.4	0.5	2.5	A	25B-A2P5N104	25B-A2P5N114
0.75	1	0.75	1	4.8	A	25B-A4P8N104	25B-A4P8N114
1.5	2	1.5	2	8	B	25B-A8P0N104	25B-A8P0N114
2.2	3	2.2	3	11	B	25B-A011N104	25B-A011N114

‡ This filter is suitable for use with cable lengths up to 10 meters (32.8 feet) for C2 spec and 20 meters (65.6 feet) for C3 spec.

200…240V AC, Three-Phase, 50/60 Hz

Drive Ratings						No Filter	with Integral EMC Filter
Normal Duty		Heavy Duty		Output Current			
kW	Hp	kW	Hp	A	Frame Size	Cat. No.	Cat. No.
0.4	0.5	0.4	0.5	2.5	A	25B-B2P5N104	—
0.75	1	0.75	1	5	A	25B-B5P0N104	—
1.5	2	1.5	2	8	A	25B-B8P0N104	—
2.2	3	2.2	3	11	A	25B-B011N104	—
4	5	4	5	17.5	B	25B-B017N104	—
5.5	7.5	5.5	7.5	24	C	25B-B024N104	—
7.5	10	7.5	10	32.2	D	25B-B032N104	—
11	15	11	15	48.3	E	25B-B048N104	—
15	20	11	15	62.1	E	25B-B062N104	—

380…480V AC, Three-Phase, 50/60 Hz

Drive Ratings						No Filter	with Integral EMC Filter ‡
Normal Duty		Heavy Duty		Output Current			
kW	Hp	kW	Hp	A	Frame Size	Cat. No.	Cat. No.
0.4	0.5	0.4	0.5	1.4	A	25B-D1P4N104	25B-D1P4N114
0.75	1	0.75	1	2.3	A	25B-D2P3N104	25B-D2P3N114
1.5	2	1.5	2	4	A	25B-D4P0N104	25B-D4P0N114
2.2	3	2.2	3	6	A	25B-D6P0N104	25B-D6P0N114
4	5	4	5	10.5	B	25B-D010N104	25B-D010N114
5.5	7.5	5.5	7.5	13	C	25B-D013N104	25B-D013N114
7.5	10	7.5	10	17	C	25B-D017N104	25B-D017N114
11	15	11	15	24	D	25B-D024N104	25B-D024N114
15	20	11	15	30	D	25B-D030N104	25B-D030N114
18.5	25	15	20	37	E	25B-D037N114 §	25B-D037N114
22	30	18.5	25	43	E	25B-D043N114 §	25B-D043N114

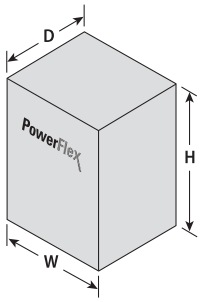
‡ This filter is suitable for use with cable lengths up to 10 meters (32.8 feet) for C2 spec and 20 meters (65.6 feet) for C3 spec.
§ With EMC filter.

525…600V AC, Three-Phase, 50/60 Hz

Drive Ratings						No Filter	with Integral EMC Filter
Normal Duty		Heavy Duty		Output Current			
kW	Hp	kW	Hp	A	Frame Size	Cat. No.	Cat. No.
0.4	0.5	0.4	0.5	0.9	A	25B-E0P9N104	—
0.75	1	0.75	1	1.7	A	25B-E1P7N104	—
1.5	2	1.5	2	3	A	25B-E3P0N104	—
2.2	3	2.2	3	4.2	A	25B-E4P2N104	—
4	5	4	5	6.6	B	25B-E6P6N104	—
5.5	7.5	5.5	7.5	9.9	C	25B-E9P9N104	—
7.5	10	7.5	10	12	C	25B-E012N104	—
11	15	11	15	19	D	25B-E019N104	—
15	20	11	15	22	D	25B-E022N104	—
18.5	25	15	20	27	E	25B-E027N104	—
22	30	18.5	25	32	E	25B-E032N104	—

Approximate Dimensions and Weights

Dimensions are in mm (in.) - weights are in kg (lb)



IP20, NEMA/UL Type Open

Frame	H	W	D	Weight
A	152.0 (5.98)	72.0 (2.83)	172.0 (6.77)	1.10 (2.4)
B	180.0 (7.08)	87.0 (3.42)	172.0 (6.77)	1.60 (3.5)
C	220.0 (8.66)	109.0 (4.29)	184.0 (7.24)	2.30 (5.1)
D	260.0 (10.23)	130.0 (5.11)	212.0 (8.34)	3.20 (7.1)
E	300.0 (11.81)	185.0 (7.28)	279.0 (10.98)	12.90 (28.4)

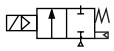
ASCO® Red-Hat®

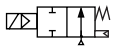
Pilot Operated

General Service Solenoid Valves

Brass or Stainless Steel Bodies

3/8" to 2 1/2" NPT

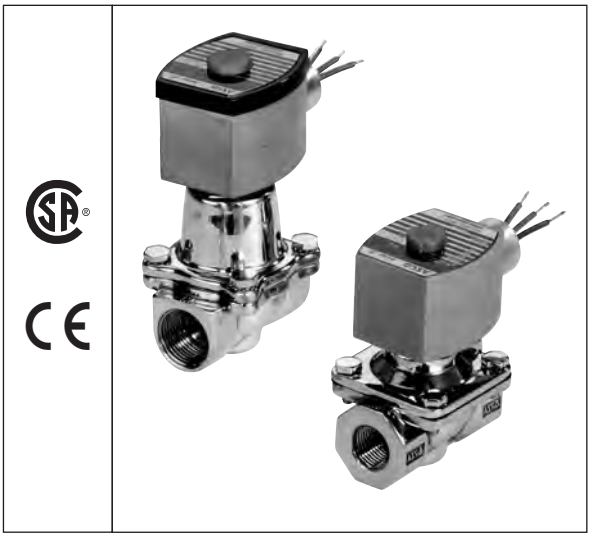
NC 

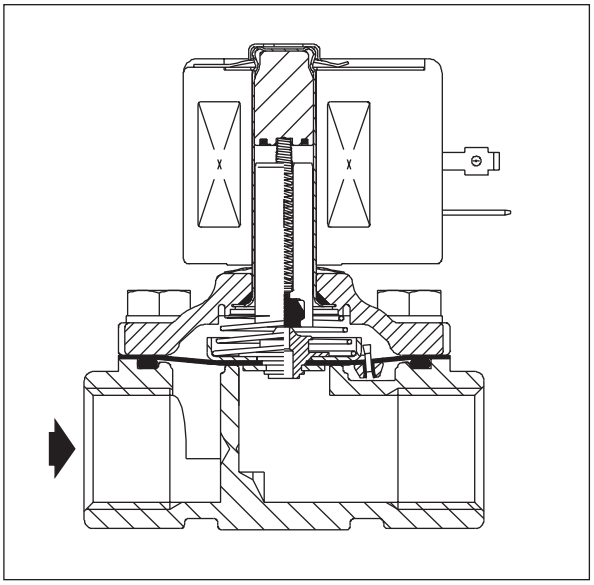
NO 

2/2
SERIES
8210

Features

- Wide range of pressure ratings, sizes, and resilient materials provide long service life and low internal leakage.
- High Flow Valves for liquid, corrosive, and air/inert gas service.
- Industrial applications include:
  - Car wash
  - Laundry equipment
  - Air compressors
  - Industrial water control
  - Pumps





Construction

Valve Parts in Contact with Fluids		
Body	Brass	304 Stainless Steel
Seals and Discs	NBR or PTFE	
Disc-Holder	PA	
Core Tube	305 Stainless Steel	
Core and Plugnut	430F Stainless Steel	
Springs	302 Stainless Steel	
Shading Coil	Copper	Silver

Electrical

Standard Coil and Class of Insulation	Watt Rating and Power Consumption				Spare Coil Part Number			
		AC			General Purpose		Explosionproof	
	DC Watts	Watts	VA Holding	VA Inrush	AC	DC	AC	DC
F	-	6.1	16	40	238210	-	238214	-
F	11.6	10.1	25	70	238610	238710	238614	238714
F	16.8	16.1	35	180	272610	97617	272614	97617
F	-	17.1	40	93	238610	-	238614	-
F	-	20	43	240	99257	-	99257	-
F	-	20.1	48	240	272610	-	272614	-
H	30.6	-	-	-	-	74073	-	74073
H	40.6	-	-	-	-	238910		238914

Standard Voltages: 24, 120, 240, 480 volts AC, 60 Hz (or 110, 220 volts AC, 50 Hz). 6, 12, 24, 120, 240 volts DC. Must be specified when ordering. Other voltages available when required.

Solenoid Enclosures

Standard: Red-Hat II - Watertight, Types 1, 2, 3, 3S, 4, and 4X; Red-Hat - Type I.

Optional: Red-Hat II - Explosionproof and Watertight, Types 3, 3S, 4, 4X, 6, 6P, 7, and 9; Red-Hat - Explosionproof and Watertight, Types 3, 4, 4X, 7, and 9.
(To order, add prefix "EF" to catalog number, except Catalog Numbers 8210B57, 8210B58, and 8210B59. Valves not available with Explosionproof enclosures.)

See Optional Features Section for other available options.

Nominal Ambient Temperature Ranges:

Red-Hat II/
Red-Hat AC: 32˚F to 125˚F (0˚C to 52˚C)
Red-Hat II DC: 32˚F to 104˚F (0˚C to 40˚C)
Red-Hat DC: 32˚F to 77˚F (0˚C to 25˚C)
(104˚F/40˚C occasionally)

Refer to Engineering Section for details.

Approvals:

CSA certified. Red-Hat II meets applicable CE directives.

Refer to Engineering Section for details.

Specifications (English units)

Pipe Size (ins.)	Orifice Size (ins.)	Cv Flow Factor	Operating Pressure Differential (psi)							Max. Fluid Temp. °F		Brass Body			Stainless Steel Body			Watt Rating/ Class of Coil Insulation ⑦	
				Max. AC			Max. DC												
			Min.	Air-Inert Gas	Water	Light Oil @ 300 SSU	Air-Inert Gas	Water	Light Oil @ 300 SSU	AC	DC	Catalog Number	Constr. Ref. No. ④	UL ⑤ Listing	Catalog Number	Constr. Ref. No. ④	UL ⑤ Listing	AC	DC
NORMALLY CLOSED (Closed when de-energized), NBR or PTFE ② Seating																			
3/8	3/8	1.5	①	150	125	-	40	40	-	180	150	8210G73 ③	1P	●	8210G36 ③	1P	●	6.1/F	11.6/F
3/8	5/8	3	0	150	150	-	40	40	-	180	150	8210G93	5D	❍	-	-	-	10.1/F	11.6/F
3/8	5/8	3	5	200	150	135	125	100	100	180	150	8210G1	6D	❍	-	-	-	6.1/F	11.6/F
3/8	5/8	3	5	300	300	300	-	-	-	175	-	8210G6	5D	❍	-	-	-	17.1/F	-
1/2	7/16	2.2	①	150	125	-	40	40	-	180	150	8210G15 ③	2P	●	8210G37 ③	2P	●	6.1/F	11.6/F
1/2	5/8	4	0	150	150	-	40	40	-	180	150	8210G94	5D	❍	-	-	-	10.1/F	11.6/F
1/2	5/8	4	0	150	150	125	40	40	-	175	150	-	-	-	8210G87	7D	●	17.1/F	11.6/F
1/2	5/8	4	5	200	150	135	125	100	100	180	150	8210G2	6D	❍	-	-	-	6.1/F	11.6/F
1/2	5/8	4	5	300	300	300	-	-	-	175	-	8210G7	5D	❍	-	-	-	17.1/F	-
1/2	3/4	4	5	-	300	-	-	300	-	180	125	8210G227	5D	❍	-	-	-	17.1/F	40.6/H
3/4	5/8	4.5	0	150	150	125	40	40	-	175	150	-	-	-	8210G88	7D	●	17.1/F	11.6/F
3/4	3/4	5	5	125	125	125	100	90	75	180	150	8210G9	9D	❍	-	-	-	6.1/F	11.6/F
3/4	3/4	5	0	150	150	-	40	40	-	180	150	8210G95	8D	❍	-	-	-	10.1/F	11.6/F
3/4	3/4	6.5	5	250	150	100	125	125	125	180	150	8210G3	11D	❍	-	-	-	6.1/F	11.6/F
3/4	3/4	6	0	-	-	-	200	180	180	-	77	8210B26 ② ‡	10P	-	-	-	-	-	30.6/H
3/4	3/4	6	0	350	300	200	-	-	-	200	-	8210G26 ② ‡	40P	●	-	-	-	16.1F	-
1	1	13	0	-	-	-	100	100	80	-	77	8210B54 ‡	31D	-	8210D89	15D	-	-	30.6/H
1	1	13	0	150	125	125	-	-	-	180	-	8210G54	41D	●	8210G89	45D	●	16.1/F	-
1	1	13	5	150	150	100	125	125	125	180	150	8210G4	12D	❍	-	-	-	6.1/F	11.6/F
1	1	13.5	0	300	225	115	-	-	-	200	-	8210G27 ‡	42P	●	-	-	-	20.1/F	-
1	1	13.5	10	300	300	300	-	-	-	175	-	8210G78 ②	13P	-	-	-	-	17.1/F	-
1 1/4	1 1/8	15	0	-	-	-	100	100	80	-	77	8210B55 ‡	32D	-	-	-	-	-	30.6/H
1 1/4	1 1/8	15	0	150	125	125	-	-	-	180	-	8210G55	43D	●	-	-	-	16.1/F	-
1 1/4	1 1/8	15	5	150	150	100	125	125	125	180	150	8210G8	16D	❍	-	-	-	6.1/F	11.6/F
1 1/2	1 1/4	22.5	0	-	-	-	100	100	80	-	77	8210B56 ‡	33D	-	-	-	-	-	30.6/H
1 1/2	1 1/4	22.5	0	150	125	125	-	-	-	180	-	8210G56 ‡	44D	●	-	-	-	16.1/F	-
1 1/2	1 1/4	22.5	5	150	150	100	125	125	125	180	150	8210G22	18D	●	-	-	-	6.1/F	11.6/F
2	1 3/4	43	5	150	125	90	50	50	50	180	150	8210G100	20P	●	-	-	-	6.1/F	11.6/F
2 1/2	1 3/4	45	5	150	125	90	50	50	50	180	150	8210G101	21P	●	-	-	-	6.1/F	11.6/F
NORMALLY OPEN (Open when de-energized), NBR Seating (PA Disc-Holder, except as noted)																			
3/8	5/8	3	0	150	150	125	125	125	80	180	150	8210G33	23D	●	-	-	-	10.1/F	11.6/F
3/8	5/8	3	5	250	200	200	250	200	200	180	180	8210G11 ⑧ ⑨	39D	●	-	-	-	10.1/F	11.6/F
1/2	5/8	4	0	150	150	125	125	125	80	180	150	8210G34	23D	●	-	-	-	10.1/F	11.6/F
1/2	5/8	3	0	150	150	100	125	125	80	180	150	-	-	-	8210G30	37D	●	10.1/F	11.6/F
1/2	5/8	4	5	250	200	200	250	200	200	180	180	8210G12 ⑧ ⑨	39D	●	-	-	-	10.1/F	11.6/F
3/4	3/4	5.5	0	150	150	125	125	125	80	180	150	8210G35	25D	●	-	-	-	10.1/F	11.6/F
3/4	5/8	3	0	150	150	100	125	125	80	180	150	-	-	-	8210G38	38D	●	10.1/F	11.6/F
3/4	3/4	6.5	5	-	-	-	250	200	200	-	180	8210C13	24D	●	-	-	-	-	16.8/F
3/4	3/4	6.5	5	250	200	200	-	-	-	180	-	8210G13	46D	●	-	-	-	16.1/F	-
1	1	13	0	125	125	125	-	-	-	180	-	8210B57 ⑥ ⑩	34D	●	-	-	-	20/F	-
1	1	13	5	-	-	-	125	125	125	-	180	8210D14	26D	●	-	-	-	-	16.8/F
1	1	13	5	150	150	125	-	-	-	180	-	8210G14	47D	●	-	-	-	16.1/F	-
1 1/4	1 1/8	15	0	125	125	125	-	-	-	180	-	8210B58 ⑥ ⑩	35D	●	-	-	-	20/F	-
1 1/4	1 1/8	15	5	-	-	-	125	125	125	-	180	8210D18	28D	●	-	-	-	-	16.8/F
1 1/4	1 1/8	15	5	150	150	125	-	-	-	180	-	8210G18	48D	●	-	-	-	16.1/F	-
1 1/2	1 1/4	22.5	0	125	125	125	-	-	-	180	-	8210B59 ⑥ ⑩	36D	●	-	-	-	20/F	-
1 1/2	1 1/4	22.5	5	-	-	-	125	125	125	-	180	8210D32	29D	●	-	-	-	-	16.8/F
1 1/2	1 1/4	22.5	5	150	150	125	-	-	-	180	-	8210G32	49D	●	-	-	-	16.1/F	-
2	1 3/4	43	5	-	-	-	125	125	125	-	150	8210103	30P	●	-	-	-	-	16.8/F
2	1 3/4	43	5	125	125	125	-	-	-	180	-	8210G103	50P	●	-	-	-	16.1/F	-
2 1/2	1 3/4	45	5	-	-	-	125	125	125	-	150	8210104	27P	●	-	-	-	-	16.8/F
~~2 1/2~~	~~1 3/4~~	~~45~~	~~5~~	~~125~~	~~125~~	~~125~~	-	-	-	~~180~~	-	~~8210G104~~	~~51P~~	●	-			~~16.1/F~~	-

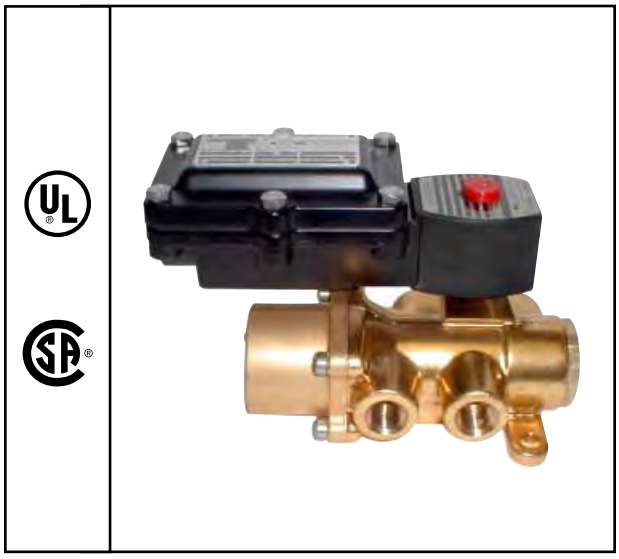
Notes: ① 5 psi on Air; 1 psi on Water.
② Valve provided with PTFE main disc.
③ Valve includes Ultem (G.E. trademark) piston.
④ Letter "D" denotes diaphragm construction; "P" denotes piston construction.
⑤ ❍ Safety Shutoff Valve; ● General Purpose Valve. Refer to Engineering Section (Approvals) for details.
⑥ Valves not available with Explosionproof enclosures.
⑦ On 50 hertz service, the watt rating for the 6.1/F solenoid is 8.1 watts.
⑧ AC construction also has PA seating.
⑨ No disc-holder.
⑩ Stainless Steel disc-holder.
‡ Must have solenoid mounted vertical and upright.

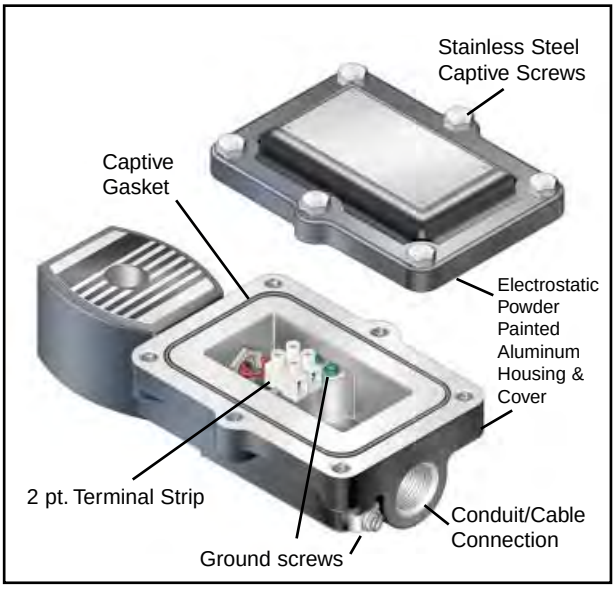
ASCO®

Explosion Proof Junction Box for Hazardous Locations

Features

- Junction Box Enclosure for the wiring of ASCO solenoids are Rain-tight Type 3 and 3S, Water-tight Type 4 and 4X, Submersible Type 6 and 6P, Explosion proof Class 7, Class I,Groups B, C, and D Dust-Ignition proof Type 9, Class II, Div. I, Groups E, F and G, Nonincendive Class I, Div. II (1.4 watts only).
- Worldwide agency approvals: UL, CSA. Cenelec pending.
- Electrostatic powder paint, stainless steel screws, and molded epoxy coils provide excellent protection in corrosion environments.
- Factory pre-wired and assembled to any explosion proof ASCO Red-Hat II solenoid valve.
- Reduces installation costs by eliminating the need to use a separate explosion proof splice box to terminate the solenoid valve's wiring.





Materials of Construction

Housing & Cover	Epoxy painted die cast aluminum
Gasket	Buna-N
Cover Screws	Stainless Steel
Coil	Epoxy Molded
Ground Screws	Steel
Terminal Block	Plastic
Lock Nut	Zinc

Electrical

Standard Voltages

AC: ~~24~~ 120, 240, 480 volts, 60 Hz
or (110, 220 volts, 50 Hz)

DC: 6, 12, 24, 120, 240

(Valves with JBEF housing maintain wattage and current ratings as shown on individual catalog sheets.)

Conduit Sizes

1/2" NPT	JBEF Prefix	(Standard)
3/4" NPT	JCEF Prefix	(Optional)
M20	JDEF Prefix	(Optional)

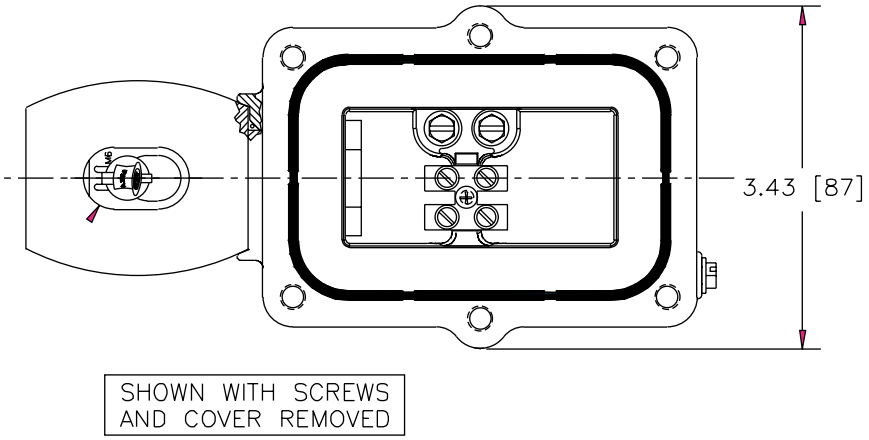
Ordering Information

Add prefix corresponding to specific conduit size required to any Red-Hat II valve catalog numbers & specify the voltage. Example JBEF8210G095, 120/60.

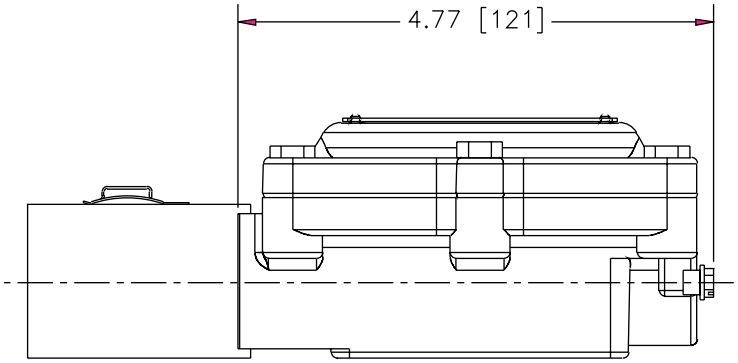
Approvals

UL & CSA (CSA to -25˚F), (Cenelec Pending)

Dimensions: inches (mm)

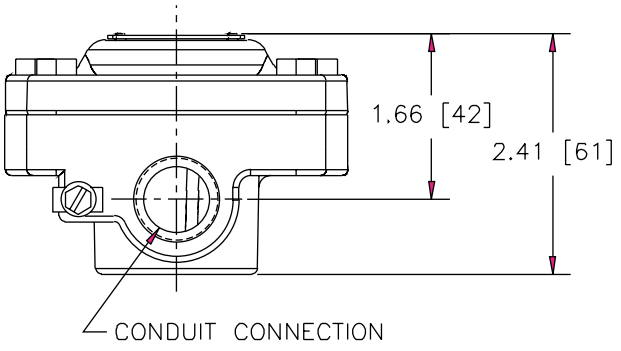


SHOWN WITH SCREWS AND COVER REMOVED



Replacement Coil Kits

Kit Number	Size (watts)	Voltage
278000-032	6.1	120/60
278000-132	9.1	120/60
278001-006	10.6	24DC
278012-032	10.1	120/60
278012-132	17.1	120/60
278013-006	11.6	24DC
278024-032	20.1	120/60



Installation & Maintenance Instructions

2–WAY INTERNAL PILOTED–OPERATED SOLENOID VALVES
NORMALLY CLOSED OPERATION — GENERAL SERVICE
3/8″, 1/2″ OR 3/4″ NPT

SERIES
8210
8211

Form No.V5848R2

NOTICE: See separate solenoid installation and maintenance instructions for information on: Wiring, Solenoid Temperature, Cause of Improper Operation, Coil or Solenoid Replacement.

DESCRIPTION

Series 8210 valves are 2–way normally closed internal pilot–operated solenoid valves designed for general service. Valves are made of rugged forged brass. Series 8210 valves are provided with a general purpose solenoid enclosure.
Series EF8210 and 8211 are the same as Series 8210 except they are provided with an explosionproof or explosionproof/watertight solenoid enclosure.

OPERATION

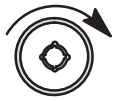
Normally Closed: Valve is closed when solenoid is de–energized; open when energized.

IMPORTANT: Minimum operating pressure differential required is 5 psi.

Manual Operator (optional feature)

Manual operator allows manual operation when desired or during an electrical power outage. To engage manual operator (open the valve), push in knurled cap and rotate stem clockwise 180°. Valve will now be in the same position as when the solenoid is energized. To disengage manual operator (close the valve), turn stem counterclockwise 180°.

Push in and rotate
180˚clockwise to operate



⚠ CAUTION: For valve to operate electrically, manual operator stem must be fully rotated counterclockwise.

Relocation of Manual Operator

Manual operator may be relocated at 90° increments by rotating the valve bonnet as follows:

⚠ WARNING: To prevent the possibility of death, serious injury or property damage, turn off electrical power, depressurize valve, and vent fluid to a safe area before relocating manual operator.

1. See separate solenoid installation and maintenance instruction's and follow instructions to loosen solenoid to allow rotation of enclosure.
2. Be sure manual operator stem is fully rotated counterclockwise.
3. Remove bonnet screws from valve body.
4. Lift valve bonnet slightly and rotate to desired position. Do not rotate the diaphragm assembly with the valve bonnet.
5. Replace bonnet screws and torque in a crisscross manner to 95 ± 10 in–lbs [10,7 ± 1,1 Nm].
6. Position and tighten solenoid in place, see separate instructions.

⚠ WARNING: To prevent the possibility of death, serious injury or property damage, check valve for proper operation before returning to service.

7. Test operate valve electrically and manually. Be sure valve can be test operated without effecting other equipment.
8. Restore line pressure and electrical power supply to valve.

INSTALLATION

Check nameplate for correct catalog number, pressure, voltage, frequency, and service. Never apply incompatible fluids or exceed pressure rating of the valve. Installation and valve maintenance to be performed by qualified personnel.

Future Service Considerations

Provision should be made for performing seat leakage, external leakage, and operational tests on the valve with a nonhazardous, noncombustible fluid after disassembly and reassembly.

Temperature Limitations

For maximum valve ambient and fluid temperatures, refer to chart below. Check catalog number and watt rating on nameplate.

Watt Rating AC or DC	Catalog Number Prefix	Solenoid Class	Max. Amb. Temp. °F	Max. Fluid Temp. °F
6 AC	None or DF	F	122	180
	HT	H	140	180
6.1 AC	None, KF, SF, or SC	F	125	180
	HT, KH, ST or SU	H	140	180
11.2 DC	None or HT	F or H	77	150
11.6 DC	None, HT, KF, KH, SC, SF or ST	F or H	104	150

Positioning

This valve is designed to perform properly when mounted in any position. However, for optimum life and performance, the solenoid should be mounted vertically and upright to reduce the possibility of foreign matter accumulating in the solenoid base sub–assembly area.

Mounting

For mounting bracket (optional feature) dimensions, refer to Figure 1.

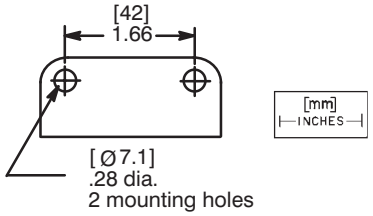


Figure 1. Mounting bracket dimensions

Piping

Connect piping to valve according to markings on valve body. Apply pipe compound sparingly to male pipe threads only. If applied to valve threads, the compound may enter the valve and cause operational difficulty. Avoid pipe strain by properly supporting and aligning piping. When tightening the pipe, do not use valve or solenoid as a lever. Locate wrenches applied to valve body or piping as close as possible to connection point.

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⚠ CAUTION: To protect the solenoid valve, install a strainer or filter suitable for the service involved in the inlet side as close to the valve as possible. Clean periodically depending on service conditions. See ASCO Series 8600, 8601 and 8602 for strainers.

MAINTENANCE

⚠ WARNING: To prevent the possibility of death, serious injury or property damage, turn off electrical power, depressurize valve, and vent fluid to a safe area before servicing the valve.

NOTE: It is not necessary to remove the valve from the pipeline for repairs.

Cleaning

All solenoid valves should be cleaned periodically. The time between cleanings will vary depending on the medium and service conditions. In general, if the voltage to the coil is correct, sluggish valve operation, excessive noise or leakage will indicate that cleaning is required. In the extreme case, faulty valve operation will occur and the valve may fail to open or close. Clean strainer or filter when cleaning the valve.

Preventive Maintenance

- Keep the medium flowing through the valve as free from dirt and foreign material as possible.
- While in service, the valve should be operated at least once a month to insure proper opening and closing.
- Depending on the medium and service conditions, periodic inspection of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

Causes of Improper Operation

- **Incorrect Pressure:** Check valve pressure. Pressure to valve must be within range specified on nameplate.
- **Excessive Leakage:** Disassemble valve and clean all parts. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

Valve Disassembly

1. Disassemble valve in an orderly fashion using exploded views for identification and placement of parts. Refer to Figure 2 for AC construction; Figure 3 for DC construction.
2. Remove solenoid enclosure. See separate instructions.

- ***For AC construction (standard or with manual operator), proceed as follows:***

3. For standard construction, remove bonnet screws, solenoid base sub−assembly, core spring, core assembly, diaphragm spring, diaphragm assembly and body gasket from valve body.
4. For manual operator constructions, unscrew solenoid base sub−assembly first then follow step 3 for removal of parts.
5. For normal maintenance (cleaning) it is not necessary to disassemble the manual operator unless an ASCO Rebuild Kit is being installed. To disassemble, remove stem pin, manual operator stem, stem spring and stem gaskets (2).

- ***For DC construction (standard or with manual operator), proceed as follows:***

6. Unscrew solenoid base sub−assembly first then follow step 3 and 5 for removal of parts.

Note: Diaphragm spring is omitted for DC construction.

7. All Parts are now accessible for cleaning or replacement. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

Valve Reassembly

1. Lubricate body gasket and solenoid base gasket with DOW CORNING® 200 Fluid lubricant or an equivalent high−grade silicone fluid.
2. Lubricate manual operator stem gaskets (2) with DOW CORNING® 111 Compound lubricant or an equivalent high−grade silicone grease.
3. Replace body gasket and diaphragm assembly. Locate bleed hole in diaphragm assembly approximately 45° from valve outlet.

- ***For AC construction (standard or with manual operator), proceed as follows:***

4. Position diaphragm spring on diaphragm assembly. Be sure ***large end*** of diaphragm spring seats in cup of diaphragm assembly. For manual operator constructions, ***small end*** of diaphragm spring seats in cup of diaphragm assembly.
5. Install wide end of core spring in core assembly first, closed end protrudes from top of core assembly.
6. For standard construction, position core assembly with core spring and solenoid base sub−assembly (integral with bonnet) over diaphragm spring and diaphragm assembly.
7. Install bonnet screws and hand thread screws as far as possible, then torque bonnet screws in a crisscross manner to 95 ± 10 in−lbs [10,7 ± 1,1 Nm].
8. For valve constructions with a manual operator, first install valve bonnet and bonnet screws as described in step 7.
9. Install solenoid base gasket, core assembly with core spring and solenoid base sub−assembly.
10. Torque solenoid base sub−assembly to 175 ± 25 in−lbs [19,8 ± 2,8 Nm].
11. For valves with a manual operator proceed as follows:
    A. Install two manual operator stem gaskets on stem. Refer to Step 2 for lubrication instructions.
    B. Install stem spring and stem assembly with gaskets into valve bonnet.
    C. Push stem assembly into valve bonnet; align stem pin hole and install stem pin.
    D. Operate manual operator to be sure there is no misalignment or binding. Then rotate manual operator stem counterclockwise as far as possible.

- ***For DC construction (standard or with manual operator), proceed as follows:***

12. For standard or manual operator constructions, replace valve bonnet and follow steps 7, 9 and 10. For manual operator constructions, install core spring in core assembly following step 5.
13. Install solenoid. See separate instructions.

⚠ WARNING: To prevent the possibility of death, serious injury or property damage, check valve for proper operation before returning to service. Also perform internal seat and external leakage tests with a nonhazardous, noncombustible fluid.

14. Restore line pressure and electrical power supply to valve.
15. After maintenance is completed, operate the valve a few times to be sure of proper operation. A metallic *click* signifies the solenoid is operating.

ORDERING INFORMATION FOR ASCO REBUILD KITS

Parts marked with an asterisk (*) in the exploded view are supplied in Rebuild Kits. When Ordering Rebuild Kits for ASCO valves, order the Rebuild Kit number stamped on the valve nameplate. If the number of the kit is not visible, order by indicating the number of kits required, and the Catalog Number and Serial Number of the valve(s) for which they are intended.

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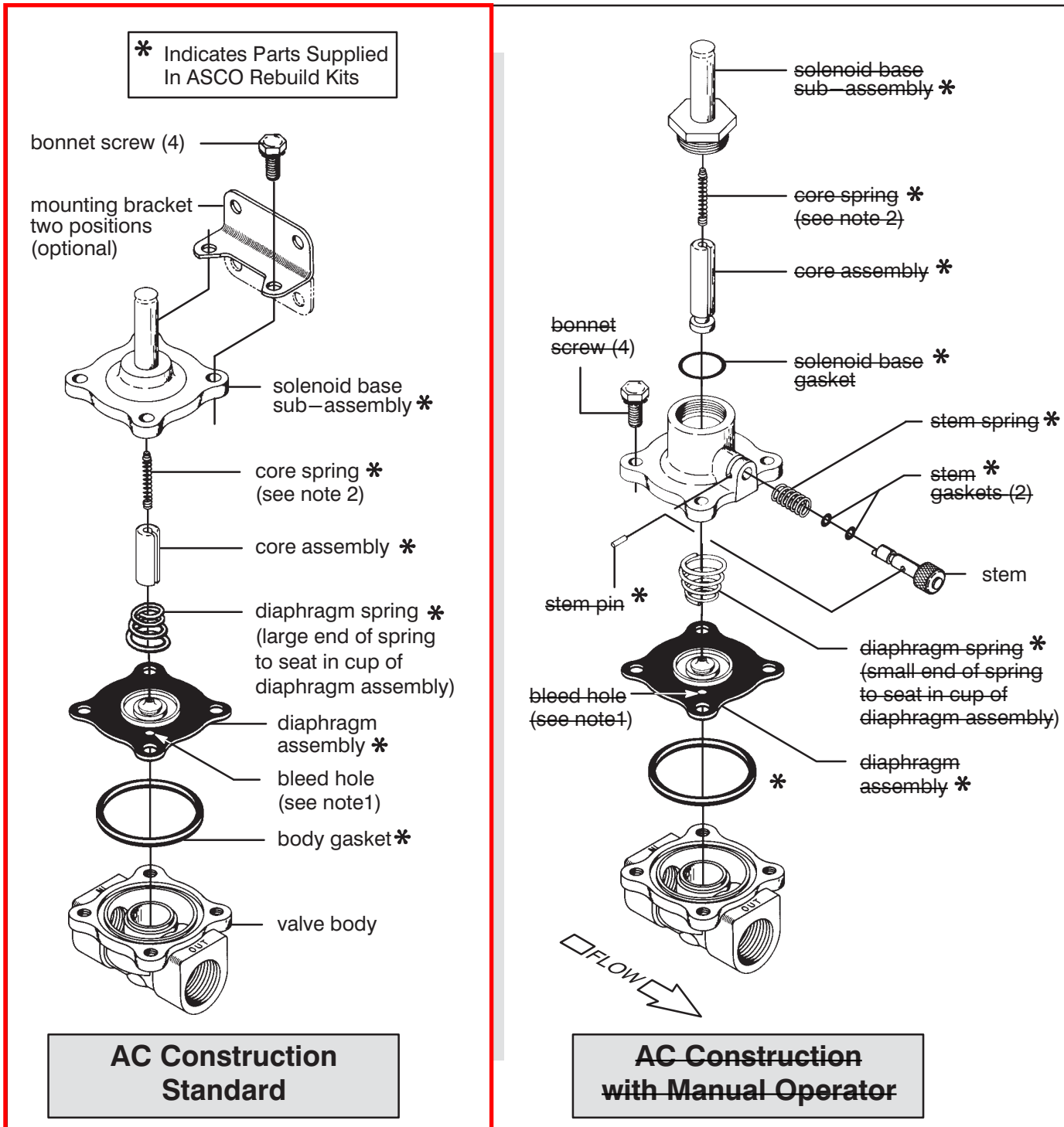
Torque Chart

Part Name	Torque Value Inch—Pounds	Torque Value Newton—Meters
Solenoid base sub—assembly	175 ± 25	19,8 ± 2,8
Bonnet screws	95 ± 10	10,7 ± 1,1



Note:

1. Locate bleed hole in diaphragm assembly approximately 45° from valve outlet.
2. Wide end of core spring in core first, closed end protrudes from top of core.

Figure 2. Series 8210 — AC construction without solenoid.

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Installation & Maintenance Instructions

ASCO Red-Hat II® SOLENOID WITH

EXPLOSIONPROOF JUNCTION BOX ENCLOSURE

SERIES
8016G
with prefix JBEF, JCEF or JDEF

Form No.V7458

NOTICE: See separate valve installation and maintenance instructions for information on: Operation, Positioning, Mounting, Cleaning, Preventive Maintenance, Causes of Improper Operation, Disassembly and Reassembly of basic valve.

DESCRIPTION

Series JBEF8016G, JCEF8016G and JDEF8016G are epoxy encapsulated solenoids with explosionproof junction boxes. These solenoids are designed to meet Enclosure Types 3 and 3S−Raintight, Types 4 and 4X−Watertight, Types 6 and 6P−Submersible, Type 7 (B, C, & D) Explosionproof Class I, Division 1, Groups B, C, & D and Type 9 (E, F, & G)−Dust−Ignitionproof Class II, Division 1, Groups E, F, & G. The Class II, Groups F & G Dust Locations designation is not applicable for solenoids or solenoid valves used for steam service or when a class "H" solenoid is used. See *Temperature Limitations* section for solenoid identification and nameplate/retainer for service. When installed just as a solenoid and not attached to an ASCO valve, the core has a 0.250−28 UNF−2B tapped hole, 0.38 minimum full thread.

OPERATION

When the solenoid is energized, the core is drawn into the solenoid base sub−assembly. **IMPORTANT: When the solenoid is de−energized, the initial return force for the core, whether developed by spring, pressure, or weight, must exert a minimum force to overcome residual magnetism created by the solenoid. Minimum return force for AC construction is 11 ounces, and 4 ounces for DC construction.**

INSTALLATION

Check nameplate for correct catalog number, service, and wattage. Check front of solenoid for voltage and frequency. Installation and maintenance to be performed by qualified personnel.

⚠ CAUTION: To prevent fire or explosion, do not install solenoid and/or valve where ignition temperature of hazardous atmosphere is less than 165°C. On valves used for steam service or when a class "H" solenoid is used, do not install in hazardous atmosphere where ignition temperature is less than 180°C. See nameplate/retainer for service.

NOTE: These solenoids have an internal non−resetable thermal fuse to limit solenoid temperature in the event that extraordinary conditions occur which could cause excessive temperatures. These conditions include high input voltage, a jammed core, excessive ambient temperature or a shorted solenoid, etc. This unique feature is standard on solenoids with explosionproof junction box enclosures.

⚠ CAUTION: To protect the solenoid valve or operator, install a strainer or filter, suitable for the service involved in the inlet side as close to the valve or operator as possible. Clean periodically depending on service conditions. See ASCO Series 8600, 8601, and 8602 for strainers.

Temperature Limitations

For maximum valve ambient temperatures, refer to chart. The temperature limitations listed, only indicate maximum application temperatures for field wiring rated at 90°C. Check catalog number prefix and watt rating on nameplate to determine maximum ambient temperature. See valve installation and maintenance instructions for maximum fluid temperature.

Temperature Limitations For Solenoids Used on Valves Rated at 6.1, 8.1, 9.1, 10.6, or 11.1 Watts

Watt Rating	Catalog Number Coil Prefix	Class of Insulation	Maximum † Ambient Temperature
6,1 8.1, 9.1, & 11.1	None	F	125°F (51.7°C)
6.1, 8.1, 9.1, & 11.1	HB & HT	H	140°F (60°C)
10.6 &18.6	None	F	104°F (40°C)
10.6 & 18.6	HB & HT	H	104°F (40°C)

†Minimum ambient temperature −13°F (−25° C).

Positioning

This solenoid is designed to perform properly when mounted in any position. However, for optimum life and performance, the solenoid should be mounted vertically and upright to reduce the possibility of foreign matter accumulating in the solenoid base sub−assembly area.

Wiring

Wiring must comply with local codes and National Electric Code. The junction box enclosure is provided with 1/2 NPT, 3/4 NPT or a 20 mm conduit connection depending upon requirements. For the explosionproof enclosure, electrical fitting must be approved for use in the approved hazardous locations. To make electrical connections to terminal block, loosen cover screws and remove cover. The junction box enclosure is provided with an internal and external grounding screw (green). For electrical connections use solid or stranded copper wire from # 18AWG to # 12AWG. Strip wire 1/4″ and torque terminal screws 5 − 7 in − lbs [0,6−0,8 Nm]. Within the junction box use field wire that is rated 90°C or greater for connections. For steam service use 105° C rated wire up to 50 psi or use 125°C rated wire above 50 psi. Before operating, torque cover screws in a crisscross manner to 100 ± 10 in − lbs [11,3 ± 1,1 Nm] to ensure proper gasket compression.

⚠ CAUTION: Excessive conduit strain on junction box enclosure may damage solenoid or cause valve malfunction. Be sure the conduit run to the junction box is properly aligned and supported.

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NOTE: Alternating current (AC) and direct current (DC) solenoids are built differently. To convert from one to the other, it may be necessary to change the complete solenoid including the core and solenoid base sub−assembly, not just the solenoid. Consult ASCO.

Installation of Solenoid

Solenoids may be assembled as a complete unit. Tightening is accomplished by means of a hex flange at the base of the solenoid. The 3/4″ bonnet construction (Figure 1) must be disassembled for installation and installed with a special wrench adapter.

Installation of Panel Mounted Solenoid

Disassemble solenoid following instruction under ***Solenoid Replacement*** then proceed.

3/4″ Valve Bonnet Construction (See Figure 1)

1. Install retainer (convex side to solenoid) in 1.312 diameter mounting hole in customer panel.
2. Then position spring washer over plugnut/core tube sub−assembly.
3. Install plugnut/core tube sub−assembly through retainer in customer panel. Then replace solenoid, nameplate/retainer and red cap.

15/16″ Valve Bonnet Construction (See Figure 2)

1. Install solenoid base sub−assembly through 0.69 diameter mounting hole in customer panel.
2. Position spring washer on opposite side of panel over solenoid base sub−assembly then replace.

Solenoid Temperature

Standard solenoids are designed for continuous duty service. When the solenoid is energized for a long period, the solenoid becomes hot and can be touched by hand only for an instant. This is a safe operating temperature.

MAINTENANCE

⚠ WARNING: To prevent the possibility of death, serious injury or property damage, turn off electrical power, depressurize solenoid operator and/or valve, and vent fluid to a safe area before servicing.

Cleaning

All solenoid operators and valves should be cleaned periodically. The time between cleaning will vary depending on medium and service conditions. In general, if the voltage to the solenoid is correct, sluggish valve operation, excessive noise or leakage will indicate that cleaning is required. In the extreme case, faulty valve or solenoid operation will occur and the valve or operator may fail to shift. Clean strainer or filter when cleaning the valve.

Preventive Maintenance

- Keep the medium flowing through the solenoid operator or valve as free from dirt and foreign material as possible.
- While in service, the solenoid operator or valve should be operated at least once a month to insure proper opening and closing.
- Depending on the medium and service conditions, periodic inspection of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. Replace any worn or damaged parts.

Causes of Improper Operation

- **Faulty Control Circuit:** Check the electrical system by energizing the solenoid. A metallic *click* signifies that the solenoid is operating. Absence of the *click* indicates loss of power supply. Check for loose or blown fuses, open−circuited or grounded solenoid, broken lead wires or splice connections.
- **Burned−Out Solenoid:** Check for open−circuited solenoid. Replace if necessary. Check supply voltage; it must be the same as specified on nameplate/retainer and marked on the solenoid. Check ambient temperature and check that the core is not jammed.
- **Low Voltage:** Check voltage across the terminals. Voltage must be at least 85% of rated voltage.

Solenoid Replacement

1. Loosen cover screws and remove cover assembly then, disconnect lead wires, grounding wire and conduit from housing.
2. Snap off red cap from top of solenoid base sub−assembly.
3. Push down on solenoid. Then using a suitable screwdriver, insert blade in slot provided between solenoid and nameplate/retainer. Pry up slightly and push to remove. Then remove solenoid from solenoid base sub−assembly.
4. Reassemble using exploded views for parts identification and placement.

Disassembly and Reassembly of Solenoid

1. Remove solenoid , see ***Solenoid Replacement.***
2. Remove finger washer or spring washer from solenoid base sub−assembly.
3. Unscrew solenoid base sub−assembly.

NOTE: Some solenoid constructions have a plugnut/core tube sub−assembly, bonnet gasket and bonnet in place of the solenoid base sub−assembly. To remove bonnet use special wrench adapter supplied in ASCO Rebuild Kit. For wrench adapter only, order ASCO Wrench Kit No.K218948.

4. The core is now accessible for clean or replacement.
5. If the solenoid is part of a valve, refer to basic valve installation and maintenance instructions for further disassembly.
6. Reassemble using exploded views for identification and placement of parts.
7. Torque for bonnet, solenoid base sub−assembly, bonnet screw see chart.

ORDERING INFORMATION

FOR REPLACEMENT SOLENOID

KIT ASSEMBLIES

When ordering, specify catalog number, serial number, voltage, frequency and service. Specify number printed on solenoid, if possible.

Torque Chart

Part Name	Torque Value Inch − Pounds	Torque Value Newton− Meters
solenoid base sub−assembly	175 ± 25	19,8± 2,8
bonnet screw (3/4″ bonnet construction)	90 ± 10	10,2 ± 1,1
cover screw	100 ± 10	11, 3 ±1,1
terminal screw	5 − 7	0,6 − 0,8

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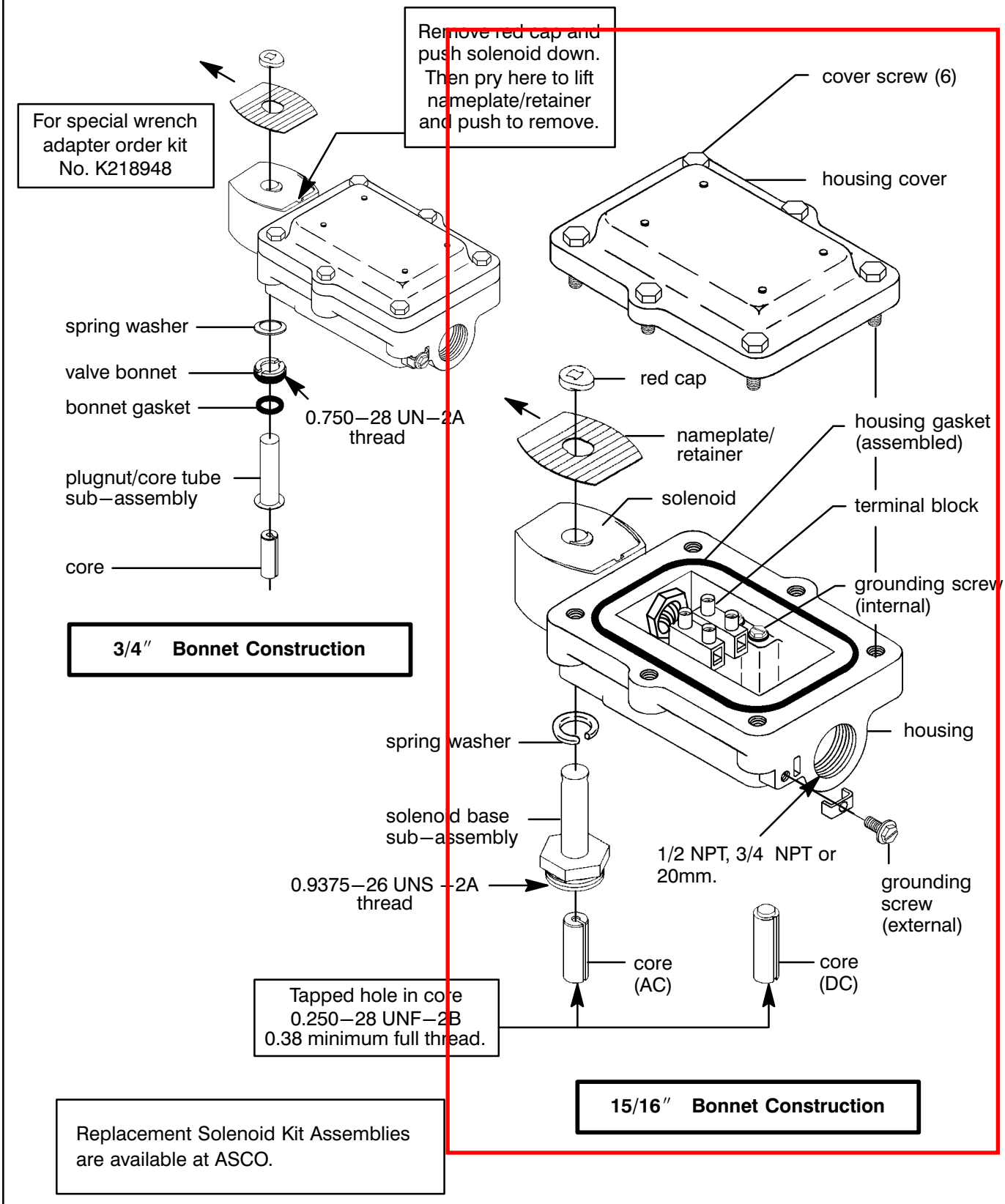

Figure 1. Series 8016G solenoid with explosionproof junction box enclosure.

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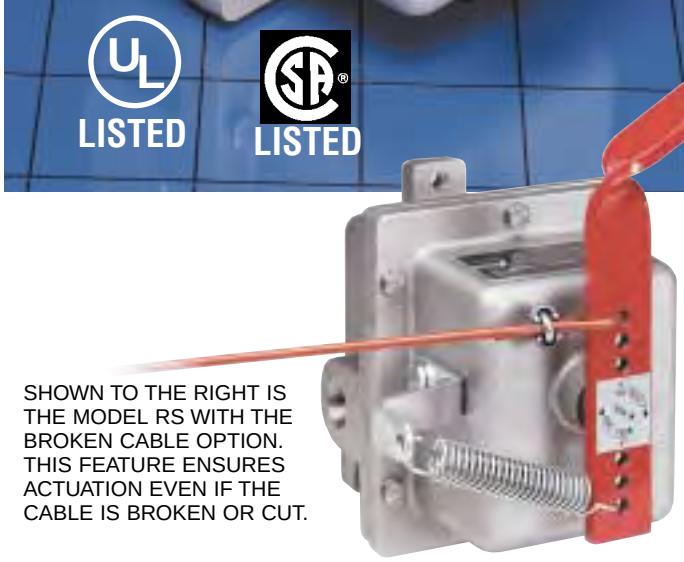
MODEL RS

CABLE OPERATED SAFETY STOP SWITCH FOR CONVEYORS

The model RS Safety Stop Switch in operation for immediate shutdown of conveyor system at a sand and gravel company.



SHOWN TO THE RIGHT IS THE MODEL RS WITH THE BROKEN CABLE OPTION. THIS FEATURE ENSURES ACTUATION EVEN IF THE CABLE IS BROKEN OR CUT.

WHAT IT IS AND DOES:

The Model RS is a rugged safety switch that provides a quick positive shut off of dangerous equipment in emergencies or normal operation. It is actuated by a cable pulled by endangered personnel. The output contacts of the Model RS can control up to two separate circuits, one for machinery shutdown and one for alarm.

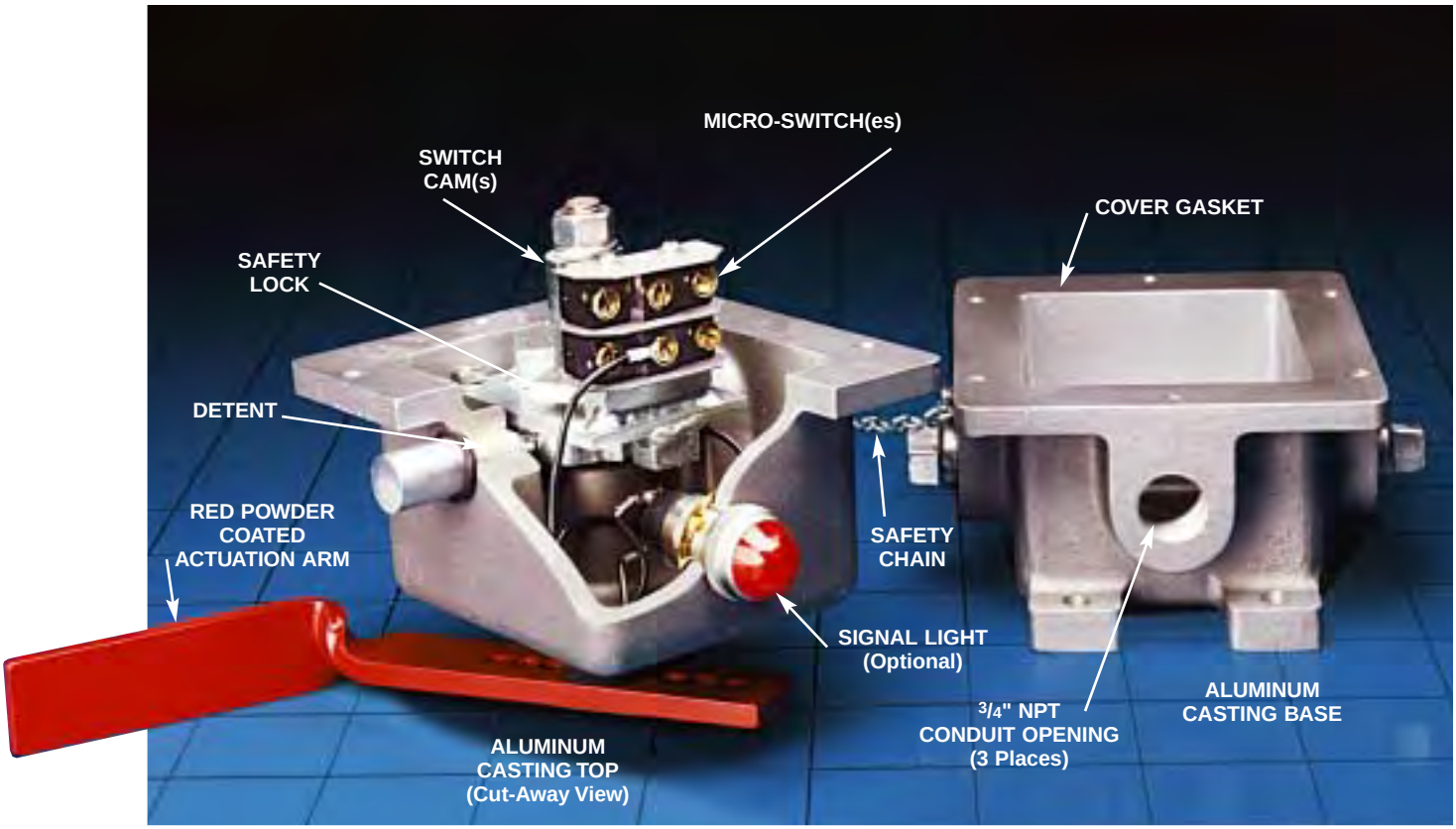
WHY IS IT NECESSARY?

Safety minded operators of conveyors, production lines, elevator equipment, assembly lines, material handling systems, cranes, etc. consider it a must for employee protection. Most states have safety statutes that require these switches on conveyor and related equipment. American National Standard Institute recommends their use in ANSI standard No. ASME B20.1 - 1993-5.11. This ANSI standard will probably soon become part of the Williams-Steiger Act of 1970-the OSHA Act.

EXCLUSIVE FEATURES

1. The Model RS is equipped with a positive safety lock. Having once been actuated, it cannot be accidentally reset causing dangerous equipment to restart. In order to reset the switch, the actuation arm must be pushed in and turned. It takes no longer and it makes this a true “safety” switch.
2. The Model RS is installed with cable extending in both directions from the actuating handle. There is one electrical connection inside. This simple arrangement eliminates the double electrical connections required in two ended units employing a separate micro switch for cable in each direction.
3. The actuation force required is simply adjusted in the field by a change in the position of the cable in holes provided in the actuation arm. One of our units will handle as much cable length as a double ended competitive unit and there is no longer a need to specify actuating force or right or left handed units.
4. The standard construction of the unit is a corrosion resistant aluminum housing complete with stainless steel hardware and red powder coated actuation handle. The actuation shaft is of stainless steel. Powder coated cast iron construction is available if necessary. Epoxy coating of either casting is also available if required.
5. The Model RS controls are listed by Underwriters Laboratories, Inc. and Canadian Standards Association. The general purpose models are listed for non hazardous atmospheres. Explosion proof models are listed for use in hazardous atmospheres as defined by the National Electric Code handbook and the National Electrical Manufacturers Association Standards for NEMA 7 and 9 hazardous locations. Specifically, they are listed for Class I, Groups C and D; and Class II, Groups E,F, and G.
6. Model RS offers the lowest cost per foot of protection because it incorporates fewer switches and less wiring is required. Cable may be extended in either or both directions with no changes required in the internal mechanism of the unit and the wiring is still of a simple uncomplicated nature.
7. The switch is available with a warning light that may be wired to indicate actuation. This permits easy identification of actuated switches in areas where visual identification is difficult.

UL Listed for General Purpose and EXPLOSION PROOF Environments . . . the only switch of its kind to meet these requirements



OPERATION OF THE UNIT:

The unit is usually installed with cable running in both directions from the crank type actuating arm. Each of the two sections of cable runs to a fixed point through eve-bolts spaced at regular intervals.

A pull on the cable at any point along its run will rotate the red actuation arm 60°. The actuation arm will end in a position that is easily seen from a distance, thus identifying the actuated unit. Two spring loaded detents riding on a hardened steel cam provide resistance to arm rotation. When the actuation force overcomes this resistance the assembly rotated the 60° and is locked in place by the detents. Affixed to the rotating shaft is a cam mechanism which actuates up to two micro switches during rotation. The micro switches are held in the actuated position by the detents.

To reset the unit and deactuate the micro switches, the actuation arm is pushed in a rotated backwards.

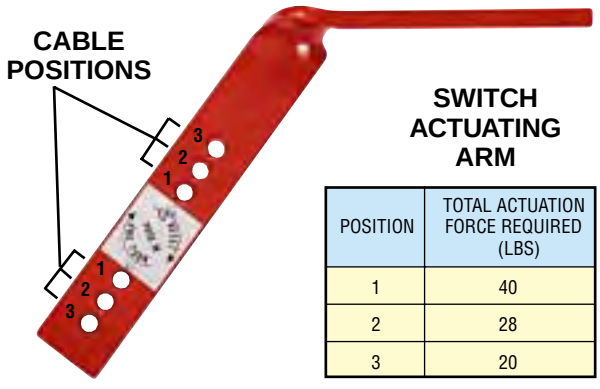
DETERMINATION OF NUMBER OF UNITS REQUIRED:

The Model RS control is designed so that a maximum of 100' of cable can be used on each side of the unit. S single switch can therefore cover a maximum of 200' of conveyor belt or other machinery. Of course, if necessary, cable can be extended in only one direction from either side of the unit. The electrical characteristics of the application will determine the numbers of micro switches to be specified in the unit: either one, or two. The environmental considerations will determine whether or not the unit is to be explosion proof or to have special paint or coatings. The possibility of a light to aid in identification of actuated units should be considered.

We recommend that high quality cable be used with the switch to assure proper actuation with no stretching. We recommend our own galvanized aircraft cable which is available with either vinyl or nylon coating. It is orange in color and weighs .0273 lbs. per foot and has an outside diameter of 3/16".

As shown in the chart and picture of the actuating arm, the actuation force can be varied by attaching the cable at any one of the three positions.

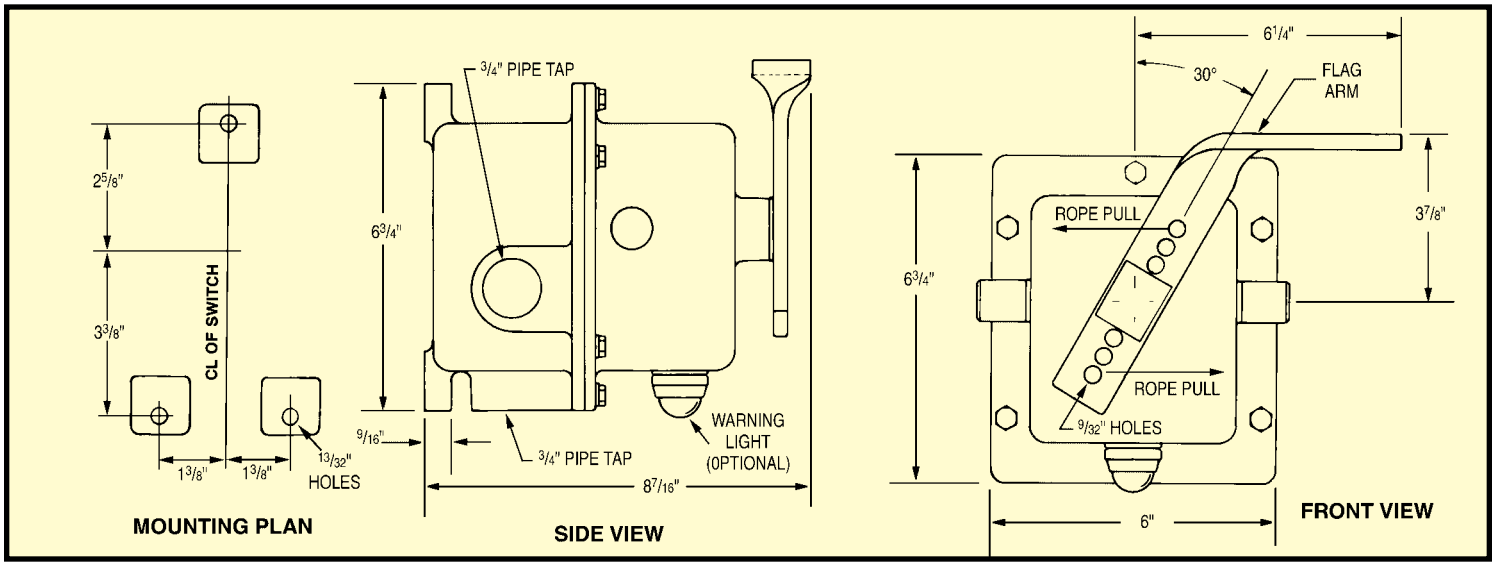
The cable should be supported by eyebolts every 8-10'. These supports ensure that the weight of the cable alone will not actuate the switch.



SWITCH ACTUATING ARM

POSITION	TOTAL ACTUATION FORCE REQUIRED (LBS)
1	40
2	28
3	20

MODEL RS DIMENSIONAL INFORMATION



TECHNICAL INFORMATION

MODEL	DESCRIPTION
RS-1	One sp/dt micro switch
RS-2	Two sp/dt micro switches
RS-2L	Two sp/dt micro switches with external signal light includes 110V lamp
RS-1X	Explosion proof with one sp/dt micro switch for NEMA 7 and 9
RS-2X	Explosion proof with two sp/dt micro switches for NEMA 7 and 9
RSB-1	One sp/dt switch w/cable break detection
RSB-1X	Explosion proof version
RSB-2	Two sp/dt switches w/cable break detection
RSB-2X	Explosion proof version

Standard Construction – rubber gaskets seal unit for outside applications listed by Underwriter Laboratories for for NEMA 4 dust-tight and raintight construction. Applies to units RS-1, RS-2, and RS-2L.
Housing – aluminum or cast iron. Epoxy coating available.
Conduit Opening – 3/4" NPT standard. 1" NPT optional. Standard units have three conduit openings., explosion proof have one at the bottom.
Actuating Arm – Red epoxy coated steel handle with stainless steel shaft.
Internal Cam and Wear Plate – hardened steel.
External Hardware – stainless steel
Switches – sp/dt micro switch. Rated 20 amp at 125, 250 or 480V AC. Switches may be wired for single throw operation, either normally open or normally closed as required.

INSTALLATION INSTRUCTIONS

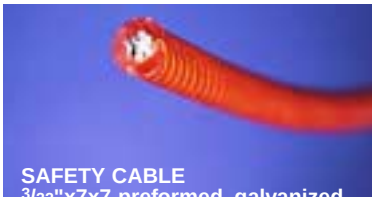
1. The controls should be mounted on a flat surface using the three mounting holes on the bottom half of the housing. The holes are designed for 3/8" bolts.
2. Each switch can cover a maximum of 200' of conveyor — 100' in each direction. Safety considerations dictate that not more than 100' of cable be attached on each side. More cable might result in too much slack, delaying actuation.
3. The eyebolts supporting the cable should be placed at intervals from 8-10'. Care must be taken that the cable does not become too slack. However, if the cable is too tight, false actuation of the switch might occur.
4. The Model RS control is designed for pilot duty. The control circuit should be wired through the motor starter circuit of the conveyor or other equipment to be controlled. Do not wire the unit directly into a heavy duty motor circuit.
5. The unit should be tested after installation by actuation of the cable. The protected equipment should stop and alarms should sound as required with a minimum of effort on the cable. Cable tension can be adjusted if necessary by changing the location of the cable on the handle.

RS-30 BRACKET for mounting the Model RS stop switch to the conveyor stringer at an idler

OPTIONAL CABLE AND FITTINGS

CABLE SUPPOET EYE BOLT
1/2"x6" plated, 2 1/2" long N.C. thread. 1" eye, two nuts and one lockwasher.

CABLE END FITTING
Secures protective cable to switch handle and supports.



SAFETY CABLE
3/32"x7x7 preformed, galvanized aircraft cable. Protective coating in either orange coated vinyl or nylon. 3/16" O.D.

CONDUIT PLUG
3/4" metal, socket head conduit plug.

CONVEYOR COMPONENTS COMPANY

130 Seltzer Road, PO Box 167 · Croswell, MI 48422 USA
PHONE: (810) 679-4211 · TOLL FREE (800) 233-3233 · FAX: (810) 679-4510
Email: info@conveyorcomponents.com · http://www.conveyorcomponents.com

MODEL RS: ROPE SAFETY CONTROL INSTALLATION INSTRUCTIONS

TECHNICAL INFORMATION

Raintight units (standard):

Enclosure type 1, 3, 3R, 4 and 4X dust-tight and raintight construction with corrosion resistance.
Gasket sealed for indoor/outdoor applications.
Aluminum or optional cast iron housing with 3 conduit openings in base casting.

Dual Rated Units:

Enclosure type 1, 3, 3R, 4 and 4X dust-tight and raintight construction, also for use in Class II, Groups E, F & G and Class III Hazardous Locations.
Aluminum or optional cast iron housing with 1 conduit opening in base casting.

Explosion Proof units:

Enclosure for use in Class I, Groups C & D; and Class II, Groups E, F & G, and Class III Hazardous Locations.
Aluminum or optional cast iron housing with 1 conduit opening in base casting.

Electrical Ratings:

SPDT switches:	DPDT switches:
20 Amps, 125/250/480 VAC	15 Amps, 125/250 VAC
10 Amps, 125 VAC Inductive	N/A
1 hp, 125 VAC	3/4 hp, 125 VAC
2 hp, 250 VAC	1 1/2 hp, 250 VAC
½ Amp, 24 VDC	N/A
½ Amp, 125 VDC	N/A
¼ Amp, 250 VDC	N/A

Micro-switch(es) may be wired for single throw operation, either normally open or normally closed as required. See figure 1.

Figure 1: Contacts

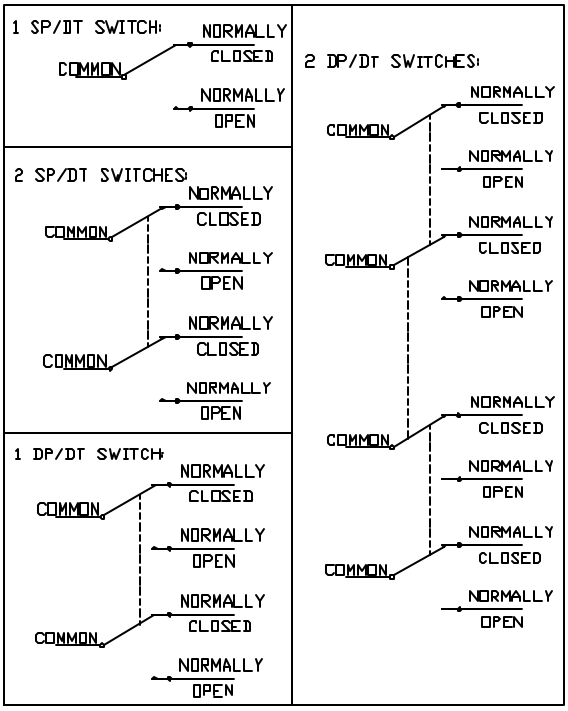
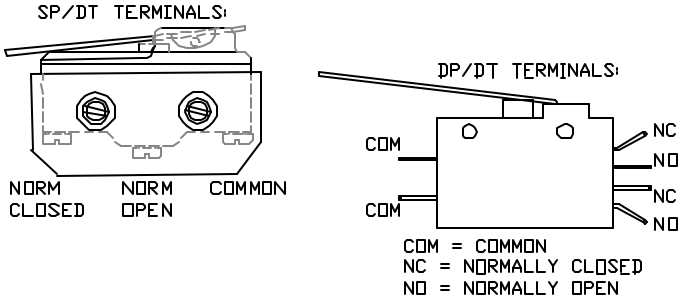


Figure 2: Electrical Terminals



INSTALLATION INSTRUCTIONS

1. The base should be mounted on a flat surface using the three (3) mounting holes in the base casting (see figure 3). The holes in the base are manufactured for 3/8" bolts.

2. Each unit can cover a maximum of 200 feet of conveyor – 100 feet in each direction. Safety considerations dictate that not more than 100 feet of cable should be attached to each side.

3. The eyebolts supporting the cable should be placed at intervals from 8' – 10'. Care must be taken that the cable does not become too slack. However, if the cable is too tight, false actuation of the unit may occur.

4. This unit is designed for pilot duty. The control circuit should be wired through the motor starter circuit of the conveyor or other equipment to be controlled. Do not wire the unit directly into a heavy duty motor circuit. See "Switch" information on front page.

5. The control should be tested after installation by actuation of the cable. The protected equipment should stop and alarms should sound as required with a minimum effort on the cable. Cable tension can be adjusted as necessary by changing the location of the cable on the handle (see figure 4).

Figure 4: Cable Positions

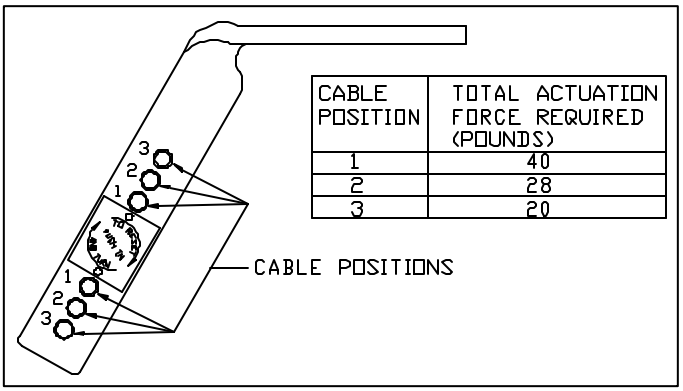
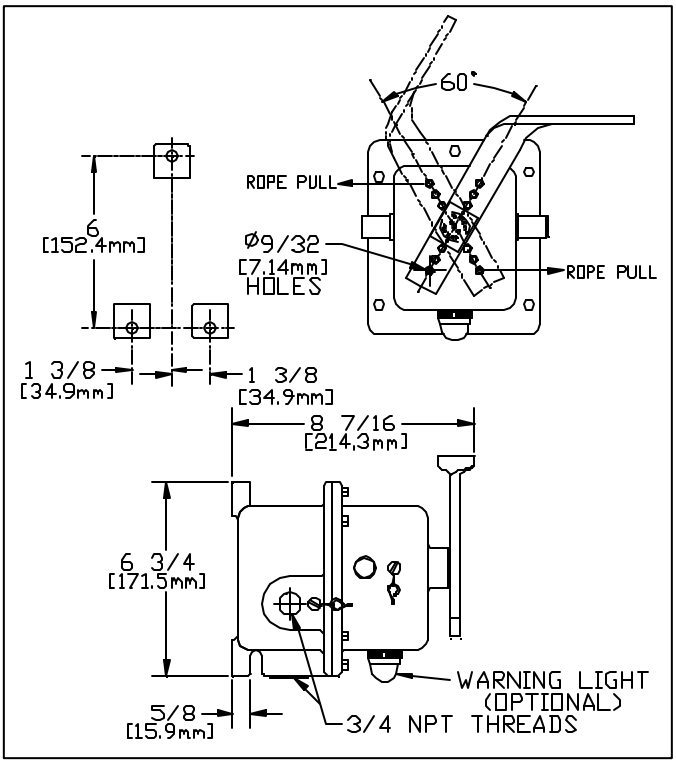


Figure 3: Control Dimensions



DL
Integrated Temperature Controls

- **Line or Ambient Sensing Thermostats**
- **ElectroMechanical Control**
- **Rugged, Corrosion Resistant Construction**
- **NEMA 4X Design with Corrosion and Weather Resistant Ryton® Construction**
- **Ambient Sensing**
  - **120 - 480 Vac**
  - **0 - 225°F Temp. Rating**
  - **9/16" OD x 4" SS Probe**
  - **Ordinary & Hazardous Area (Div. 2) Approvals**
- **Bulb & Capillary**
  - **120 - 480 Vac**
  - **0 - 400°F Setpoint Range**
  - **1/4" OD x 7-1/4" SS Bulb and 3 Ft. Capillary**
  - **Ordinary & Hazardous Area (Div. 2) Approvals**

Description

The DL Series Single Point On/Off Temperature Controls from Chromalox represent the state of the art in heat tracing and are available in five models to handle a broad range of applications. Models include two ambient sensing thermostats, two line sensing thermostats and a line sensing solid state controller. These high-quality models combine temperature control and power connection in a convenient, easy to use and economical package.

Applications

- Hydrocarbon and Chemical Product Piping
- Process Temperature Maintenance
- Fluid Flow and Viscosity Maintenance
- Freeze Protection

Features

- Integrated Controls and Power Connections reduce installation hardware
- Molded of Durable Plastic Material (Ryton® PPS)[1]
- High Service Temperature
- Corrosion Resistant
- Thermal Stability
- Non-Flammability
- High Strength and Rigidity
- Stainless Steel Sensor Sheath
- Hermetically Sealed Switches on EP models permit control in Div. 2 hazardous areas
- Stainless Steel Hardware to ensure the integrity of the system
- Cable Terminations inside enclosure reduce installation time and cost
- Liquid Tight Design prevents moisture from reaching the electrical connections. All models are rated NEMA 4X.

Approvals[2]

UL, CSA, FM is carried by most models, consult specific product information.

UL Listed for ordinary areas

CSA Certified for ordinary and:

- Class I, Div. 2, Groups A, B, C, D
- Class II, Div. 2, Groups E, F, G

FM Approved for ordinary and:

- Class I, Div. 2, Groups B, C, D
- Class II, Div. 2, Groups E, F
- Class III, Div. 2 Areas.

Notes —
1. Ryton®, is a registered trade name of Phillips Chemical Company.
2. Depends on specific model and cable applied.

DL
Integrated Temperature Controls *(cont'd.)*

RTAS & RTAS-EP Ambient Sensing

RTAS is an ambient-sensing thermostat which is generally used for freeze protection in ordinary (non-hazardous) areas. The thermostat is mounted through the end of the oblique sided enclosure lid. In fact, because there is so much room in this model, multiple heating cables can be terminated. The stainless steel sheathed, inverted bellows probe provides good sensitivity, resulting in more accurate control.

RTAS-EP is a modified version of the RTAS which utilizes a hermetically sealed switch. Since this switch has no arcing contacts, it can be used in Division 2 Hazardous Areas.

Specifications

Temp. Setpoint Range — 0 to 225°F (-18 to 107°C) for RTAS/RTAS-EP

Microswitch® Rating — 22 Amps SPDT for RTAS; 11 Amps, RTAS-EP

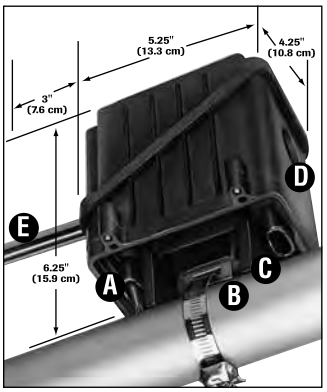
Scale Division — 10°F (5.6°C)

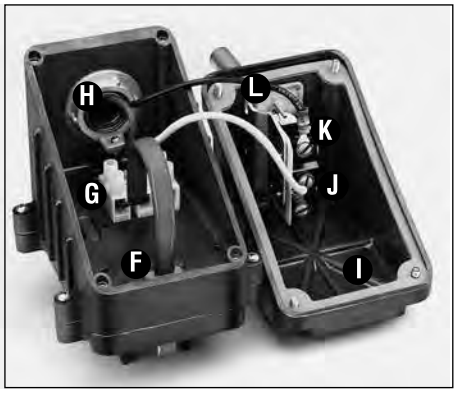
Max. Sensor Exposure Temp. — 250°F (121°C)

Sensor Dimensions — 9/16" Dia. x 3" Long

Operating Ambient Temp. Range — -40°F to 160°F (-40 to 71°C)

Factory Preset and Calibrated — 40°F





Construction

- **A** Strategically placed cable entries allow maximum flexibility for insulation (Heating cable cut away for clarity).
- **B** Stainless steel tiedown support provides positive attachment to pipes.[1]
- **C** Heavy duty support legs give stable pipe mounting and provide conduit clearance for applications with up to three inches of insulation.
- **D** Opening for 3/4" (20 mm) conduit hub.[1]
- **E** Stainless steel sheath temperature sensor.
- **F** Cable grommets provide water-tight seal between base, box and cable. Use GRSR with all self-regulating cables. Use GRCW with constant wattage cables. One of each grommet included in kit. See table below for spare grommets.
- **G** Three position terminal block for easy wiring.
- **H** Power wiring entry. Conduit hub not included.
- **I** Gasket provides water-tight seal between box and lid. It is affixed to the lid and holds the mounting hardware during assembly.
- **J** Thermostat switch.
- **K** Setpoint adjustment knob.
- **L** Setpoint indicator.

Note 1 —Refer to DL & EL General Application Accessories at the end of this section.

Spare Grommets		*PCN*
GRS	RTD/Capillary type	**385000**
GR0	Blank	**385019**
GRSR	Self-regulating cable type	**389714**
GRCW	Constant wattage cable type	**389722**

Ordering Information

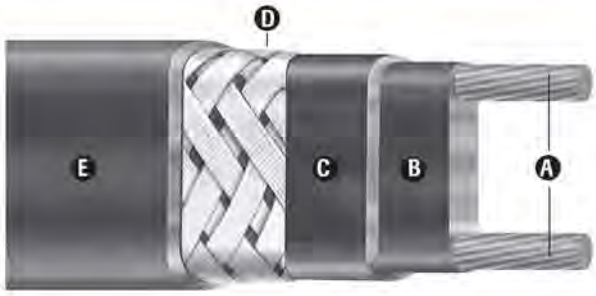
Model	PCN	Switch Rating (Amps/Volts)	Max. Continuous Exposure Temp.		Max. Intermittent Exposure Temp.		Wt. (Lbs.)
			°F	°C	°F	°C	
RTAS	389589	22A @ 120 - 480	400	200	500	260	2
RTAS-EP	389597	11A @ 120 - 250	400	200	500	260	2

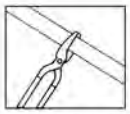
Stock Status: **S** = stock NS = non-stock
To Order—Specify model, PCN and quantity.

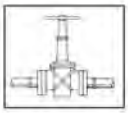
SRM/E

Self-Regulating Medium Temperature

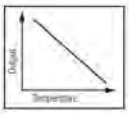
- **Self-Regulating, Energy Efficient**
- **16 AWG Buss Wire**
- **Circuit Lengths to 750 Feet**
- **Process Temperature Maintenance to 302°F (150°C)**
- **Maximum Continuous Exposure Temperature, Power Off, 420°F (215°C)**
- **Industrial Process Maintenance Applications**
- **Industrial Freeze Protection Applications**
- **Single or Dual Monitor Wires Available**
- **Steam Cleanable on Process Equipment Up to 300 PSIG**
- **5, 8, 10, 15 and 20 W/Ft.**
- **120 and 208 - 277 Volt From Stock**
- **Approximate Size 3/8"W x 1/8"H**
- **Minimum Bend Radius 1-1/8"**
- **For Use on Metallic Pipes Only**




Cut to Length in Field


Can be Overlapped

Medium Temperature


Self Regulating Output

Description

Chromalox SRM/E self-regulating heating cable provides safe, reliable heat tracing for process temperature maintenance and freeze protection of pipes, valves, tanks and similar applications. Constructed of industrial grade 16 AWG buss wire with metal braid and optional overjacketing, SRM/E ensures operating integrity in most hostile industrial environments. The 420°F (215°C) maximum exposure temperature rating allows steam cleaning of process equipment with up to 300 psig steam.

WARNING — A ground fault protection device is required by NEC to minimize the danger of fire if the heating cable is damaged or improperly installed. A minimum trip level of 30mA is recommended to minimize nuisance tripping.

Features

- Energy efficient, self-regulating SRM/E uses less energy when less heat is required.
- Easy to install, SRM/E can be cut to any length (up to max. circuit length) in the field.
- Field splices can be performed easily in minutes with no scrap or wasted cold sections.
- With lower installed cost than steam tracing, SRM/E features less maintenance expense and downtime.
- SRM/E can be overlapped without burnout, which simplifies heat tracing of in-line process equipment such as valves, elbows and pumps.
- Because SRM/E is self-regulating, overtemperature conditions are minimized.
- Chromalox termination, splice, tee and end seal kits reduce installation time.

Construction

A **Twin 16 AWG Copper Buss Wires** — Provide reliable electrical current capability.

B **Semiconductive Polymer Core Matrix** — "Self-Regulating" component of the cable, its electrical resistance varies with temperature. As process temperature drops, the core's heat output increases; as process temperature rises, the heat output decreases.

C **High Temperature Fluoropolymer Jacket** — Flame retardant, electrically insulates the matrix and provides corrosion resistance.

D **Metallic Braid** — Provides additional mechanical protection in any environment and a positive ground path.

E **High Temperature Fluoropolymer Overjacket (optional)** — Corrosion resistant, flame retardant overjacket is highly effective in hostile, aqueous and chemically active environments. It also protects against abrasion and impact damage.

Approvals

Factory Mutual (FM) Approved, UL Listed, and CSA certified for ordinary areas. UL Listed for freeze protection of fire protection system piping. ATEX, IECEx, FM, and CSA Approved for hazardous (classified) areas when used with U Series, HL, DL, and EL accessories.

CSA and FM Approved:

- Class I, Div. 1* & 2 Groups A*, B, C, D (gases, vapors)
- Class II, Div. 1*& 2 Groups E*, F, G (combustible dust)
- Class III, Div. 2 (easily ignitable fibers and fillings)
- 5 and 8 Watt Rated T3 Temperature Class
- 10, 15, and 20 Watt Rated T2D Temperature Class

*CSA Only
*-CT overjacket only

ATEX Approved:

- Ⓔx CE 0359 IIG Ex e IIC T* Gb Ta -60°C to 195°C

IECEx Approved:

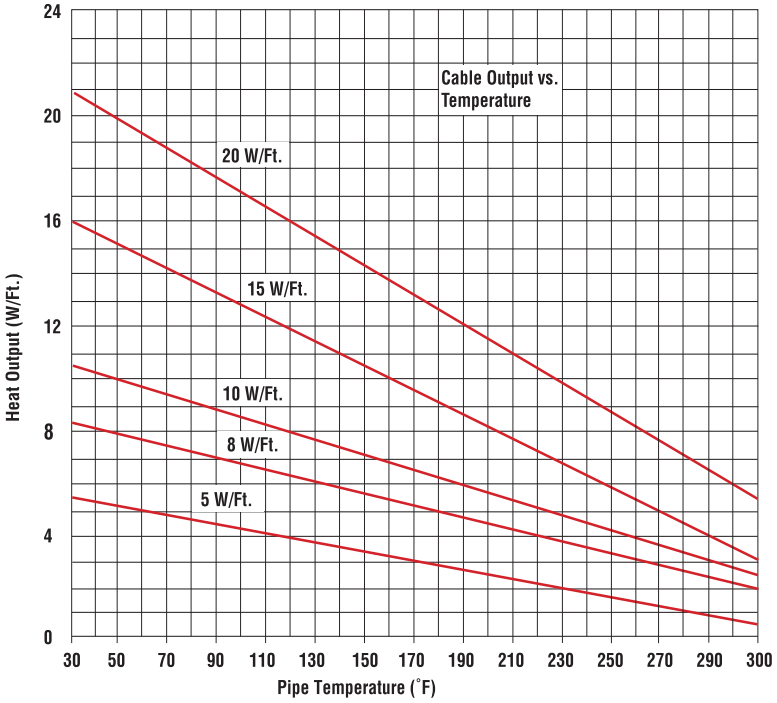
- ITS 07.0018X Ex e IIC T3 Gb Ta -60°C to 195°C

Note 1 Exception — Cable Surface Temperature shall not exceed 190°C in Class II, Div. 2, Group F; 165°C in Class II, Div. 2 Group G.

SRM/E

Self-Regulating Medium Temperature *(cont'd.)*

Thermal Output Ratings on Insulated Metal Pipe[1]



Note 1 — Thermal output is determined per IEEE 515-2011 Standard for testing, design installation, and maintenance of electrical resistance heat tracing section 4.1.11 Method C.

Output Wattage at Alternate Voltages (W/Ft.)

Model	208V	% Change In Output	220V	% Change In Output	277V	% Change In Output
SRM/E 5	3.85	-23	4.25	-15	6.45	+23
SRM/E 8	6.4	-20	6.88	-14	10.24	+22
SRM/E 10	8.3	-17	8.80	-12	12.50	+20
SRM/E 15	12.75	-15	13.50	-10	18.45	+19
SRM/E 20	17.6	-12	18.40	-8	24.40	+19

Circuit Breaker Selection (Max. Circuit Lengths in Ft.)

Cable Rating	50°F Start-Up (Ft.)					0°F Start-Up (Ft.)					-20°F Start-Up (Ft.)				
	15A	20A	30A	40A	50A	15A	20A	30A	40A	50A	15A	20A	30A	40A	50A
SRM/E 5-1	180	240	360	375	NR	165	220	330	375	NR	155	210	310	375	NR
SRM/E 5-2	360	480	720	750	NR	325	430	645	750	NR	310	415	620	750	NR
SRM/E 8-1	145	190	285	325	NR	135	175	265	325	NR	130	165	250	325	NR
SRM/E 8-2	285	380	575	650	NR	255	345	520	650	NR	245	335	490	650	NR
SRM/E 10-1	95	125	190	250	NR	90	110	175	250	NR	85	100	170	245	250
SRM/E 10-2	190	255	385	490	NR	165	225	345	490	NR	155	215	330	470	490
SRM/E 15-1	70	95	145	190	210	65	85	125	165	210	60	80	120	150	210
SRM/E 15-2	145	190	290	385	420	120	175	270	360	420	115	165	260	340	420
SRM/E 20-1	60	75	115	155	160	50	65	105	140	160	45	65	100	135	160
SRM/E 20-2	115	155	230	305	350	100	135	200	270	350	90	130	195	255	335

NR = Not Required. Maximum circuit length has been reached in a smaller breaker size.
Note — Thermal magnetic circuit breakers are recommended since magnetic circuit breakers could "nuisance trip" at low temperature.

SRM/E
Self-Regulating Medium Temperature *(cont'd.)*

Ordering Information

Output (W/Ft.)	Volts	Model	Stock	PCN	Wt./1000' (Lbs.)
5 @ 50°F	120	SRM/E 5-1C SRM/E 5-1CT	S S	388084 388092	80 100
	208 - 277	SRM/E 5-2C SRM/E 5-2CT	S S	388113 388121	80 100
8 @ 50°F	120	SRM/E 8-1C SRM/E 8-1CT	S S	388148 388156	80 100
	208 - 277	SRM/E 8-2C SRM/E 8-2CT	S S	388172 388180	80 100
10 @ 50°F	120	SRM/E 10-1C SRM/E 10-1CT	S S	388201 388210	80 100
	208 - 277	SRM/E 10-2C SRM/E 10-2CT	S S	388236 388244	80 100
15 @ 50°F	120	SRM/E 15-1C SRM/E 15-1CT	S S	388260 388279	80 100
	208 - 277	SRM/E 15-2C SRM/E 15-2CT	S S	388308 388316	80 100
20 @ 50°F	120	SRM/E 20-1C SRM/E 20-1CT	S S	388332 388340	80 100
	208 - 277	SRM/E 20-2C SRM/E 20-2CT	S S	388367 388375	80 100

To Order — Specify length, model, PCN and installation accessories.

Accessories

Accessories		U Series	DL	EL
Power Connection	Heat trace to electrical service connection	UPC	RTPC	SSK
Splice & Tee		UMC	RTST	RT-TST
End Seal	For terminating cable	UES	RTES	N/A
Lighted End Seal		UESL	RTST-SL	N/A
Thermostat	Ambient air sensing thermostat	UAS	RTAS	THL/TXL
	Line sensing mechanical thermostat	UBC	RTBC	THR/TXR

To Order — General Application & Installation Accessories such as tape, pipe straps, warning labels, etc., refer to the U Series, DL & EL General Application Accessories page at the end of this section.

Ordering Information

To Order — *Complete the Model Number using the Matrix provided.*

Model	Self-Regulating Medium Temperature		
SRM/E	Self-Regulating, Medium Temperatue Enhanced Heating Cable		
	Code	**Output (W/Ft.)**	
	5	Five	
	8	Eight	
	10	Ten	
	15	Fifteen	
	20	Twenty	
	Code	**Voltage**	
	1	120	
	2	208 - 277	
	Code	**Braid and Overcoat Options**	
	C	Tin-Plated copper metallic braid for additional protection and ground path	
	CT	Fluoropolymer corrosion resistant overjacket over braid for hostile/ corrosive environments	
SRM/E	**8**	**1**	**CT** **Typical Model Number**

More Information is Available Online on Heat Trace.

Bookmark Your Browser to ***www.chromalox.com*** *and Select* ***Manuals****.*

DL
Integrated Connection Accessories

- **Power Connection Box**
  - **NEMA 4X Enclosure**
  - **Cable Entry Up to 3 Cables**
  - **3/4" Conduit Hub Opening**
- **Splice & Tee Box**
  - **NEMA 4X Enclosure**
  - **Cable Entry Up to 3 Cables**
  - **Straight or Tee Connections**
- **End Seal Fitting**
  - **NEMA 4X Enclosure**
  - **Fits All Pipe Sizes**
  - **Mounting Feet for Installing on Flat Surfaces**
- **Stainless Steel Hardware**
- **Corrosion & Weather Resistant Ryton® Construction**

RTPC

RTST

RTES

Description

The DL Series Installation Accessories for Chromalox heat tracing products represents the state of the art in heat tracing. Each model in the series is designed to satisfy the demands of a particular operation. These high-quality models combine a variety of functions in a convenient, easy to use and economical package.

Applications

Connection of all Rapid Trace Heating Cables to Customer Supplied Power Wiring in any of the following applications:

- Hydrocarbon and Chemical Product Piping
- Process Temperature Maintenance
- Fluid Flow and Viscosity Maintenance
- Freeze Protection.

Features

- Molded of Durable Plastic Material (Ryton®, PPS)[1]
- High Service Temperature
- Corrosion Resistant
- Integrated Connection Accessories and Controls
- Thermal Stability
- Non-Flammable
- High Strength and Rigidity
- Stainless Steel Hardware to Ensure the Integrity of the System
- Liquid Tight Design prevents moisture from reaching the electrical connections. All models are rated NEMA 4X.

Approvals[2]

UL, CSA, FM Approved for most models, consult specific product information.

UL Listed for ordinary areas

CSA Certified for ordinary and:
- Class I, Div. 2, Groups A, B, C, D
- Class II, Div. 2, Groups E, F, G

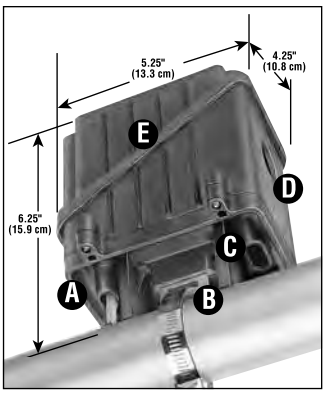
FM Approved for ordinary and:
- Class I, Div. 2, Groups B, C, D
- Class II, Div. 2, Groups E, F
- Class III, Div. 2 Areas.

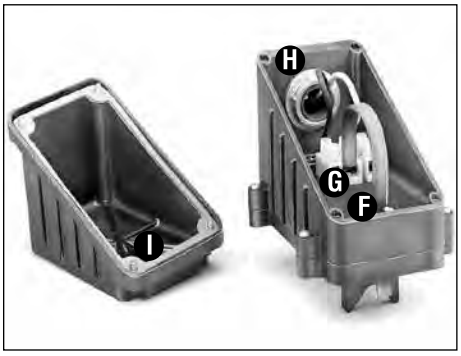
Notes —
1. Ryton®, is a registered trade name of Phillips Chemical Company.
2. Depends on specific model and cable applied.

DL
Integrated Connection Accessories *(cont'd.)*

RTPC — Power Connection Kit

RTPC Power Connection Box is a NEMA 4X rated junction box designed to connect all Chromalox Rapid Trace Heating Cables to customer supplied power wiring. This kit provides waterproof cable entry for up to three cables, enclosure support, terminal block and a waterproof, corrosion resistant wiring enclosure with an opening to accept a 3/4" conduit hub (Chromalox CCH-2 or equal). A pipe strap (Chromalox PS or equal) is required to attach this model to a pipe.





RTPC — Power Connection Kit

1 molded junction box consisting of:
- 1 base
- 1 box w/conduit opening
- 1 lid

1 three position terminal block
1 mounting screw for terminal block
1 GRSR self-regulating cable sealing grommet
1 GRCW constant wattage sealing grommet

Ordering Information — RTPC

Model	PCN	Stock	Wt. (Lbs.)
RTPC	389554	S	1
RTPC-SL1	389626	S	2
RTPC-SL2	389634	S	2
RTPC-SL3	389642	S	2

Construction

- **A** Three strategically placed cable entries allow maximum flexibility for insulation (Heating cable cut away for clarity).
- **B** Stainless steel tiedown support provides positive attachment to pipes.[1]
- **C** Heavy duty support legs give stable pipe mounting and provide conduit clearance for applications with up to three inches of insulation.
- **D** Opening for 3/4" (20 mm) conduit hub.[1]
- **E** Oblique sided box and cover allow easy access for wiring.
- **F** Cable grommets provide water-tight seal between base, box and cable. Use GRSR with all self-regulating cable. Use GRCW for constant wattage cables. One of each grommet included in kit. See table below for spare grommets.
- **G** Three position terminal block for easy wiring.
- **H** Power wiring entry. Conduit hub not included.[1]
- **I** Gasket provides water-tight seal between box and lid. It is affixed to the lid and holds the mounting hardware during assembly.

Note 1 — Refer to DL & EL General Application Accessories at the end of this section.

RTPC-SL — Power Connection Kit w/Signal Light (Ordinary Area Only)

1 molded junction box consisting of:
- 1 base
- 1 box w/conduit opening
- 1 lid *w/signal light installed (LED style)*
  Specify: SL1(120V), SL2(208-240V), SL3(277V) operation

1 three position terminal block
1 mounting screw for terminal block
1 GRSR self-regulating cable sealing grommet
1 GRCW constant wattage sealing grommet

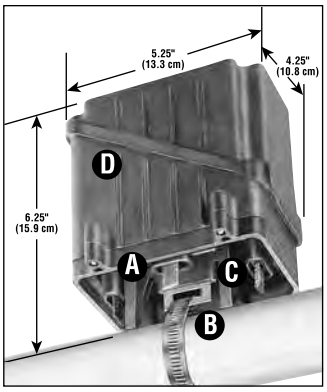
Spare Grommets

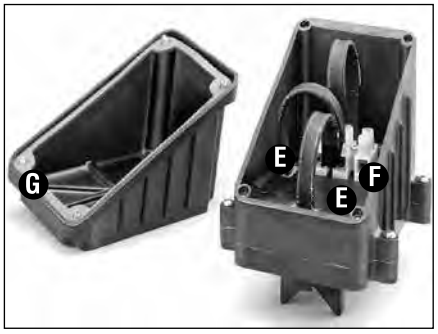
		PCN
GRS	RTD/Capillary type	**385000**
GR0	Blank	**385019**
GRSR	Self Regulating type	**389714**
GRCW	Constant Wattage type	**389722**

DL
Integrated Connection Accessories *(cont'd.)*

RTST — Splice & Tee Kit

RTST Splice & Tee Box is a NEMA 4X rated junction box designed to make straight or tee splices for all Chromalox Rapid Trace Heating Cables. This model provides waterproof cable entry (for two cables for a splice or three cables for a tee), enclosure support, terminal block and a waterproof, corrosion resistant wiring enclosure. A pipe strap (Chromalox PS or equal) is required to attach this model to a pipe.





RTST — Splice & Tee Kit

1 molded junction box consisting of:
- 1 base
- 1 box
- 1 lid

1 three position terminal block
1 mounting screw for terminal block
3 GRSR Self-regulating cable sealing grommet
3 GRCW Constant wattage sealing grommets

Ordering Information — RTPC

Model	PCN	Stock	Wt. (Lbs.)
RTST	389562	S	1
RTST-SL1	389650	S	2
RTST-SL2	389669	S	2
RTST-SL3	389677	S	2

Construction

- **A** Three strategically placed cable entries allow maximum flexibility for insulation (heating cable cut away for clarity).
- **B** Stainless steel tiedown support provides positive attachment to pipes.[1]
- **C** Heavy duty support legs give stable pipe mounting and provide conduit clearance for applications with up to three inches of insulation.
- **D** Oblique sided box and cover allow easy access for wiring.
- **E** Cable grommets provide water-tight seal between base, box and cable. Use GRSR with all self-regulating cable. Use GRCW for constant wattage cables. Three of each grommet included in kit. See table below for spare grommets.
- **F** Three position terminal block for easy wiring.
- **G** Gasket provides water-tight seal between box and lid. It is affixed to the lid and holds the mounting hardware during assembly.

Note 1 — Refer to DL & EL General Application Accessories at the end of this section.

RTST-SL — Splice & Tee Kit w/Signal Light (Ordinary Area Only)

1 molded junction box consisting of:
- 1 base
- 1 box
- 1 lid *w/signal light installed (LED style)*
  Specify: SL1 for 120 Volt, SL2 for 208-240 Volt, SL3 for 277 Volt operation

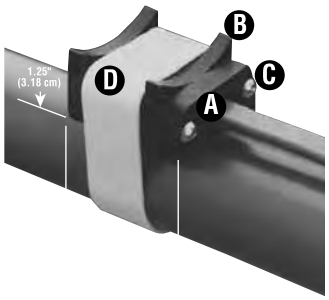
1 three position terminal block
1 mounting screw for terminal block
1 GRSR Self-regulating cable sealing grommet
1 GRCW Constant wattage sealing grommet

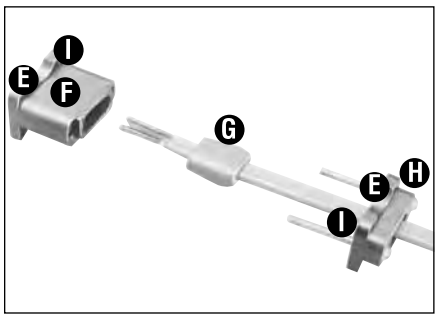
Spare	*Grommets*	*PCN*
GRS	RTD/Capillary type	**385000**
GR0	Blank	**385019**
GRSR	Self Regulating type	**389714**
GRCW	Constant Wattage type	**389722**

DL
Integrated Connection Accessories *(cont'd.)*

RTES — End Seal Kit

RTES End Seal Fitting is a NEMA 4X rated enclosure designed to terminate all Chromalox Rapid Trace Heating Cables. This model provides waterproof cable entry for one cable, enclosure support and a waterproof corrosion resistant enclosure. The fitting has two different curved mounting surfaces. One side has a 1-1/2" radius curved surface that provides stable support on pipes with a diameter of 3" or more. The other side has a 1/2" radius curved surface which permits a better fit on smaller pipes. In addition, this side also has four "feet" for installation on flat surfaces.





RTES — End Seal Kit

1 end cap
1 pressure plate
1 GRSR Self-regulating cable sealing grommet
1 GRCW Constant wattage cable sealing grommet

Construction

- **A** Cable entry.
- **B** Three inch diameter curved mounting surface.
- **C** Captured stainless steel hardware.
- **D** One inch wide strapping channel for secure mounting.
- **E** One-half inch radius curved mounting surface.
- **F** End cap.
- **G** Cable grommet provides water-tight seal between end cap and pressure plate. Use GRSR with all self-regulating cables. Use GRCW with constant wattage cables. One of each grommet included in kit. See table below for spare grommets.
- **H** Pressure plate.
- **I** Mounting feet for installation on flat surfaces.

Ordering Information — RTES

Model	PCN	Stock	Wt. (Lbs.)
RTES	389570	S	1

Spare Grommets — *PCN*

GRS	RTD/Capillary type	**385000**
GR0	Blank	**385019**
GRSR	Self-Regulating type	**389714**
GRCW	Constant wattage type	**389722**

DL Accessory Components

MP-1 (385780)

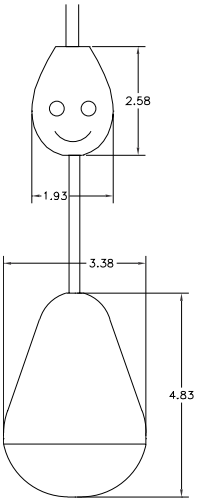
Mounting Plate Kit Attachments

For installing RTPC and RTST kits on flat surfaces. Kit includes:
1 mounting plate
1 lock washer
1 bolt
1 washer
1 nut

Note — The complete line of DL & EL Mounting Accessories is located at the end of this section.

Control Duty Mercury Narrow Angle Switch

c UL us LISTED

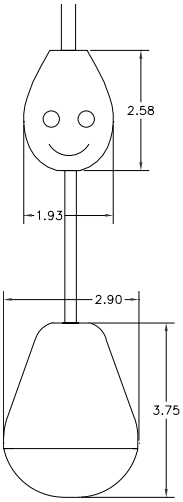


Designed for accurate liquid level control in many applications including sewage and wastewater environments. The float switch can be utilized to signify specific water levels or for direct alarm actuation.

NORMALLY OPEN (N/O)
As the float rises 1" (5°) above horizontal, the contacts become closed and actuate (turn on) the switch. This float is generally used in pump down applications.

NORMALLY CLOSED (N/C)
As the float rises 1" (5°) above horizontal, the contacts become open and actuate (turn off) the switch. This float is generally used in pump up applications.

SINGLE POLE, DOUBLE THROW (SPDT)
A variation of the N/O & N/C, this float switch can be wired to operate as either (but not both) a normally open or normally closed switch based on the user's need.



The float uses a steel tube mercury switch designed to operate under min/max temperatures of 32 -170˚ F, and has an electrical rating of 10 Amps @ 120 Vac, 3 Amps at 240 Vac.

The power cord is a chlorinated polyethylene type SJOW-300Volt and 18/2 for N/O or N/C switch, or 18/3 for SPDT switch.

The float is constructed of a durable polypropylene outer shell and a solid polyurethane foam interior. It is tested and proven to be leak proof, shock proof, and impact resistant. For use with intrinsically safe circuits.

The cord weight is made of zinc plated cast iron @ 1.22 lbs. , the split weight design allows for easy adjustment, and a secure and permanent attachment to the cord.

Control Duty Mercury Narrow Angle Switch

Normally open control duty float switch

Single pole - single throw

10 amp @ 120 Vac or 3 amp @ 240 Vac

		10'	15'	20'	25'	30'	40'	50'
2900 - B1-S1	Std bulb	$27.00	$29.00	$32.00	$35.00	$38.00	$44.00	$50.00
2900 - B2-S1	Mini bulb	27.00	29.00	32.00	35.00	38.00	44.00	50.00
2900 - B1-S1-C1	Std bulb w/cord weight	30.50	32.50	35.50	38.50	41.50	47.50	53.50
2900 - B2-S1-C1	Mini bulb w/cord weight	30.50	32.50	35.50	38.50	41.50	47.50	53.50
2900 - B1-S1-C3	Std bulb w/clamp - stainless band	30.50	32.50	35.50	38.50	41.50	47.50	53.50
2900 - B2-S1-C3	Mini bulb w/clamp - stainless band	30.50	32.50	35.50	38.50	41.50	47.50	53.50
2900 - B1-S1-C4	Std bulb w/releasable tie strap	29.00	31.00	34.00	37.00	40.00	46.00	52.00
2900 - B2-S1-C4	Mini bulb w/releasable tie strap	29.00	31.00	34.00	37.00	40.00	46.00	52.00

Normally closed control duty float switch

Single pole - single throw

10 amp @ 120 Vac or 3 amp @ 240 Vac

2901 - B1-S1	Std bulb	28.00	30.00	33.00	36.00	39.00	45.00	51.00
2901 - B2-S1	Mini bulb	28.00	30.00	33.00	36.00	39.00	45.00	51.00
2901 - B1-S1-C1	Std bulb w/cord weight	31.50	33.50	36.50	39.50	42.50	48.50	54.50
2901 - B2-S1-C1	Mini bulb w/cord weight	31.50	33.50	36.50	39.50	42.50	48.50	54.50
2901 - B1-S1-C3	Std bulb w/clamp - stainless band	31.50	33.50	36.50	39.50	42.50	48.50	54.50
2901 - B2-S1-C3	Mini bulb w/clamp - stainless band	31.50	33.50	36.50	39.50	42.50	48.50	54.50
2901 - B1-S1-C4	Std bulb w/releasable tie strap	30.00	32.00	35.00	38.00	41.00	47.00	53.00
2901 - B2-S1-C4	Mini bulb w/releasable tie strap	30.00	32.00	35.00	38.00	41.00	47.00	53.00

Normally open/closed control duty float switch

Single pole - double throw (SPDT)

10 amp @ 120 Vac or 3 amp @ 240 Vac

2902 - B1-S2	Std bulb	40.00	42.00	46.50	51.00	55.50	64.50	73.50
2902 - B2-S2	Mini bulb	40.00	42.00	46.50	51.00	55.50	64.50	73.50
2902 - B1-S2-C1	Std bulb w/cord weight	43.50	45.50	50.00	54.50	59.00	68.00	77.00
2902 - B2-S2-C1	Mini bulb w/cord weight	43.50	45.50	50.00	54.50	59.00	68.00	77.00
2902 - B1-S2-C3	Std bulb w/clamp - stainless band	43.50	45.50	50.00	54.50	59.00	68.00	77.00
2902 - B2-S2-C3	Mini bulb w/clamp - stainless band	43.50	45.50	50.00	54.50	59.00	68.00	77.00
2902 - B1-S2-C4	Std bulb w/releasable tie strap	42.00	44.00	48.50	53.00	57.50	66.50	75.50
2902 - B2-S2-C4	Mini bulb w/releasable tie strap	42.00	44.00	48.50	53.00	57.50	66.50	75.50

Additional float switch options

Packaging options

Bulk boxed - standard

K1	Individually boxed	ADD $1.10 to list price per float switch
K2	Individually bagged	ADD $0.70 to list price float switch

Cable length options

S1	Additional cable lengths	ADD $3.00 to list price per float switch per 5'
S2/S3	Additional cable lengths	ADD $4.50 to list price per float switch per 5'

NJBEW Cast Junction Boxes

Explosionproof, Dust-Ignitionproof

NEC/CEC:
Class I, Division 1 and 2, Groups B◊, C◊, D
Class I, Zone 1 and 2, Groups IIA, IIB◊+H_2◊, IP66
Class II, Division 1 and 2, Groups E, F, G
Class III

NEC/CEC:
NEMA 4, 7B◊C◊D, 9EFG

Application

- Explosionproof junction boxes are used where hazardous materials are handled or stored. These enclosures may be used for:
  — Terminals
  — Splicing wires
  — Pull boxes
  — Bus boxes

Features

- Precision machined flame path between box and cover.
- Bolt on stainless steel slotted mounting feet for horizontal or vertical mounting.
- Flexible hinge mounting either left or right side is standard on all boxes 12 x 12 x 06 and larger.
- External flange maximizes internal space.
- Wall thickness suitable for minimum of five full threads.
- Provision for mounting pan.
- Wide range of drilled and tapped outlets.
- Ground lug package and installation instructions for termination of ground wires enclosed.
- O-ring gasket insures watertight integrity.

Standard Materials

- Bodies and covers: sand cast copperfree (4/10 of 1% max.) aluminum
- Cover bolts: stainless steel
- O-ring: neoprene
- Hinges: stainless steel
- Mounting pan: galvanized steel

Standard Finishes

- Bodies and covers: shot blast finish standard

Options

- Custom drilling and tapping.
- Set of 4 standoffs 12.7 mm (0.50") high. For factory-installed option add suffix -**AB**.
- Breather, NEMA 4X (includes outlets and installation). For factory-installed option add suffix -**BR**, for field-installed option order catalog number **BRTB4X**.
- Drain, NEMA 4X (includes outlets and installation). For factory-installed option add suffix -**DN** for field-installed option order catalog number **ECD50B4X**.
- Desiccate package. For factory-installed option add suffix -**DP1**, for field-installed option order catalog number **AWG13/1CT**.
- External grounding stud 3/8"-16. For factory-installed option add suffix -**EGS**.
- Gray epoxy powder coat (outside). For factory-installed option add suffix -**G1**.
- Gray epoxy powder coat available to provide NEMA 4X rating (inside and outside). For factory-installed option add suffix -**G2**.
- Internal Ground Stud, #14 - #2. For factory-installed option add suffix -**GNDKIT**.
- Hinges: stainless steel hinge available for boxes up to 11 x 30 x 03. For factory-installed option add suffix -**H**.
- Hinge Kit, 2 light duty SS hinges. For field-installed option order catalog number **AHOF12SS**.

- Hinge Kit, 2 heavy duty SS hinges. For field-installed option order catalog number **AHOF22SS**.
- Hinge Kit, 3 heavy duty SS hinges. For field-installed option order catalog number **AHOF23SS**.
- Terminal blocks 600 Volt, 30 Amp Indicate number of points: example: 5 points = 5K. For factory-installed option add suffix -**K**.
- Plastic nameplate, 50.8 x 101.6 mm (2.00 x 4.00"), 3.3 mm (13") black letters on white surface, 3 lines max, specify legend. For factory-installed option add suffix -**NP**.
- SS captive Quad-Lead bolts. For factory-installed option add suffix -**Q**.
- ATEX complete product certification add suffix -**X**.
- ATEX U component certification add suffix -**XU**.
- Mounting pan. For factory-installed option add suffix -**Z**.

NEC/CEC Certifications and Compliances

- UL Standard: UL 886 (UL 1203)
- UL Listed: E85310
- CSA Standard: C22.2 No. 25, C22.2 No.30
- CSA Certified: 042129

◊ For Groups B and C, all conduits must be sealed within 50.8 mm (2") of the enclosure.

EMERSON

NJBEW Cast Junction Boxes

Explosionproof, Dust-Ignitionproof

NEC/CEC:
Class I, Division 1 and 2, Groups B◊, C◊, D
Class I, Zone 1 and 2, Groups IIA, IIB◊+H_2◊, IP66
Class II, Division 1 and 2, Groups E, F, G
Class III

NEC/CEC:
NEMA 4, 7B◊C◊D, 9EFG

Dimensions in Millimeters (Inches)												Max. Conduit Size	Ship Weight kg	Mounting Hardware Catalog	Catalog
Overall Dimensions			Mounting Dimensions					Inside Dimensions							
F	E	G	A	AA	B	BB	W	H	Db	Dc	K	Inches	(lb)	Number	Number
181.1 (7.13)	231.9 (9.13)	155.7 (6.13)	N/A	171.5 (6.75)	N/A	54.1 (2.13)	101.6 (4.00)	152.4 (6.00)	95.3 (3.75)	19.1 (0.75)	63.5 (2.50)	1-1/2	9.1 (20)	**NMH2**	**NJBEW040604**
227.1 (8.94)	342.9 (13.50)	155.7 (6.13)	101.6 (4.00)	N/A	279.4 (11.00)	N/A	128.5 (5.06)	241.3 (9.50)	88.9 (3.50)	28.7 (1.13)	50.8 (2.00)	1-1/2	9.1 (20)	**NMH2**	**NJBEW050903**
244.6 (9.63)	237.0 (9.33)	158.8 (6.25)	N/A	222.3 (8.75)	N/A	308.1 (12.13)	152.4 (6.00)	152.4 (6.00)	101.6 (4.00)	19.1 (0.75)	60.5 (2.38)	2	9.1 (20)	**NMH2**	**NJBEW060604**
264.2 (10.40)	315.0 (12.40)	165.1 (6.50)	114.3 (4.50)	231.9 (9.13)	268.2 (10.56)	114.3 (4.50)	152.4 (6.00)	203.2 (8.00)	95.3 (3.75)	19.1 (0.75)	63.5 (2.50)	2	9.1 (20)	**NMH2**	**NJBEW060804**
264.2 (10.40)	317.5 (12.50)	206.5 (8.13)	N/A	238.3 (9.38)	N/A	114.3 (4.50)	152.4 (6.00)	203.2 (8.00)	146.1 (5.75)	19.1 (0.75)	60.5 (2.38)	2	9.1 (20)	**NMH2**	**NJBEW060806**
270.0 (10.63)	387.4 (15.25)	171.5 (6.75)	139.7 (5.50)	N/A	333.5 (13.13)	N/A	155.7 (6.13)	273.1 (10.75)	96.8 (3.81)	36.6 (1.44)	50.8 (2.00)	2	12.2 (27)	**NMH2**	**NJBEW061004**
270.0 (10.63)	421.6 (16.60)	162.1 (6.38)	N/A	231.9 (9.13)	N/A	215.9 (8.50)	155.7 (6.13)	308.1 (12.13)	103.1 (4.06)	25.4 (1.00)	57.2 (2.25)	2	11.3 (25)	**NMH2**	**NJBEW061204**
279.4 (11.00)	520.7 (20.50)	174.8 (6.88)	152.4 (6.00)	N/A	457.2 (18.00)	N/A	165.1 (6.50)	406.4 (16.00)	104.9 (4.13)	35.1 (1.38)	58.7 (2.31)	2	14.5 (32)	**NMH2**	**NJBEW061604**
311.2 (12.25)	403.4 (15.88)	254.0 (10.00)	162.1 (6.38)	N/A	342.9 (13.50)	N/A	187.5 (7.38)	289.1 (11.38)	149.4 (5.88)	63.5 (2.50)	85.9 (3.38)	2	15.9 (35)	**NMH2**	**NJBEW071106**
311.2 (12.25)	311.2 (12.25)	209.6 (8.25)	114.3 (4.50)	273.1 (10.75)	273.1 (10.75)	114.3 (4.50)	203.2 (8.00)	203.2 (8.00)	146.1 (5.75)	19.1 (0.75)	82.6 (3.25)	2	13.6 (30)	**NMH2**	**NJBEW080806**
317.5 (12.50)	368.3 (14.50)	215.9 (8.50)	177.8 (7.00)	273.1 (10.75)	317.5 (12.50)	165.1 (6.50)	203.2 (8.00)	254.0 (10.00)	146.1 (5.75)	19.1 (0.75)	88.9 (3.50)	2	16.3 (36)	**NMH2**	**NJBEW081006**
317.5 (12.50)	443.0 (17.44)	263.7 (10.38)	N/A	254 (10.00)	N/A	215.9 (8.50)	203.2 (8.00)	331.7 (13.06)	88.9 (3.50)	88.9 (3.50)	69.9 (2.75)	2	13.6 (30)	**NMH2**	**NJBEW081307**
352.6 (13.88)	393.7 (15.50)	220.7 (8.69)	184.2 (7.25)	300.2 (11.82)	333.5 (13.13)	217.4 (8.56)	238.3 (9.00)	282.7 (11.13)	122.2 (4.81)	47.8 (1.88)	82.6 (3.25)	2	10.0 (22)	**NMH2**	**NJBEW091105**
362.0 (14.25)	519.2 (20.44)	215.9 (8.50)	184.2 (7.25)	300.0 (11.81)	454.2 (17.88)	338.1 (13.31)	241.3 (9.50)	395.2 (15.56)	120.7 (4.75)	44.5 (1.75)	76.2 (3.00)	2	15.0 (33)	**NMH2**	**NJBEW091504**
376.2 (14.81)	376.2 (14.81)	231.9 (9.13)	165.1 (6.50)	273.8 (10.78)	330.2 (13.00)	114.3 (4.50)	260.4 (10.25)	260.4 (10.25)	146.1 (5.75)	38.1 (1.50)	85.9 (3.38)	2	20.00 (44)	**NMH2**	**NJBEW101006**
368.3 (14.50)	469.9 (18.50)	214.4 (8.44)	177.8 (7.00)	330.2 (13.00)	422.4 (16.63)	270 (10.63)	254.0 (10.00)	355.6 (14.00)	149.4 (5.88)	19.1 (0.75)	79.5 (3.13)	2	24.9 (55)	**NMH4**	**NJBEW101406**
368.3 (14.50)	469.9 (18.50)	244.6 (9.63)	N/A	330.2 (13.00)	N/A	270 (10.63)	254.0 (10.00)	355.6 (14.00)	196.9 (7.75)	19.1 (0.75)	112.8 (4.44)	4	27.2 (60)	**NMH2**	**NJBEW101408**
416.1 (16.38)	638.3 (25.13)	190.5 (7.50)	260.4 (10.25)	368.3 (14.50)	574.8 (22.63)	428.8 (16.88)	289.1 (11.38)	508.0 (20.00)	124.0 (4.88)	38.1 (1.50)	88.9 (3.50)	3	38.6 (85)	**NMH2**	**NJBEW112005**
400.1 (15.75)	746.3 (29.38)	258.8 (10.19)	215.9 (8.50)	358.9 (14.13)	689.1 (27.13)	508 (20.00)	273.1 (10.75)	619.3 (24.38)	152.4 (6.00)	41.4 (1.63)	101.6 (4.00)	3	32.7 (72)	**NMH8**	**NJBEW112406**

◊ For Groups B and C, all conduits must be sealed within 50.8 mm (2") of the enclosure.

EMERSON

NJBEW Cast Junction Boxes

Explosionproof, Dust-Ignitionproof

NEC/CEC:
Class I, Division 1 and 2, Groups B◊, C◊, D
Class I, Zone 1 and 2, Groups IIA, IIB◊+H_2◊, IP66
Class II, Division 1 and 2, Groups E, F, G
Class III

NEC/CEC:
NEMA 4, 7B◊C◊D, 9EFG

Dimensions in Millimeters (Inches)												Max. Conduit Size Inches	Ship Weight kg (lb)	Mounting Hardware Catalog Number	Catalog Number
Overall Dimensions			Mounting Dimensions					Inside Dimensions							
F	E	G	A	AA	B	BB	W	H	Db	Dc	K				
416.1 (16.38)	889.0 (35.00)	260.4 (10.25)	241.3 (9.50)	384.3 (15.13)	835.2 (32.88)	692.2 (27.25)	285.8 (11.25)	759.0 (29.88)	157.2 (6.19)	47.8 (1.88)	106.4 (4.19)	3	51.3 (113)	**NMH8**	**NJBEW113006**
441.5 (17.38)	441.5 (17.38)	235 (9.25)	219.2 (8.63)	397.0 (15.63)	397.0 (15.63)	219.2 (8.63)	311.2 (12.25)	311.2 (12.25)	146.1 (5.75)	38.1 (1.50)	95.3 (3.75)	3	29.5 (65)	**NMH8**	**NJBEW121206**
441.5 (17.38)	441.5 (17.38)	292.1 (11.50)	219.2 (8.63)	397.0 (15.63)	397.0 (15.63)	219.2 (8.63)	311.2 (12.25)	311.2 (12.25)	196.9 (7.75)	38.1 (1.50)	120.7 (4.75)	3	31.8 (70)	**NMH8**	**NJBEW121208**
431.8 (17.00)	584.2 (23.00)	231.9 (9.13)	177.8 (7.00)	400.1 (15.75)	533.4 (21.00)	358.9 (14.13)	311.2 (12.25)	463.6 (18.25)	146.1 (5.75)	38.1 (1.50)	88.9 (3.50)	4	40.8 (90)	**NMH5**	**NJBEW121806**
431.8 (17.00)	584.2 (23.00)	282.7 (11.13)	177.8 (7.00)	400.1 (15.75)	533.4 (21.00)	358.9 (14.13)	311.2 (12.25)	463.6 (18.25)	222.3 (8.75)	38.1 (1.50)	108.0 (4.25)	4	45.8 (101)	**NMH5**	**NJBEW121808**
425.5 (16.75)	730.3 (28.75)	282.7 (11.13)	N/A	400.1 (15.75)	N/A	466.9 (18.38)	304.8 (12.00)	609.6 (24.00)	196.9 (7.75)	25.4 (1.00)	108.0 (4.25)	4	62.6 (138)	**NMH4**	**NJBEW122408**
425.5 (16.75)	1035.1 (40.75)	301.8 (11.88)	N/A	400.1 (15.75)	N/A	736.6 (29.00)	304.8 (12.00)	914.4 (36.00)	196.9 (7.75)	38.1 (1.50)	115.8 (4.56)	4	98.9 (218)	**NMH5**	**NJBEW123608**
457.2 (18.00)	1079.5 (42.50)	265.2 (10.44)	409.7 (16.13)	301.8 (11.88)	1035.1 (40.75)	857.3 (33.75)	346.2 (13.63)	962.2 (37.88)	155.7 (6.13)	38.1 (1.50)	109.5 (4.31)	3-1/2	86.2 (190)	**NMH8**	**NJBEW133806**
492.3 (19.38)	492.3 (19.38)	242.8 (9.56)	247.7 (9.75)	450.9 (17.75)	450.9 (17.75)	247.7 (9.75)	374.7 (14.75)	374.7 (14.75)	146.1 (5.75)	35.1 (1.38)	98.6 (3.88)	3-1/2	44.5 (98)	**NMH8**	**NJBEW141406**
492.3 (19.38)	492.3 (19.38)	293.6 (11.56)	247.7 (9.75)	450.9 (17.75)	450.9 (17.75)	247.7 (9.75)	374.7 (14.75)	374.7 (14.75)	196.9 (7.75)	35.1 (1.38)	101.6 (4.00)	3	47.6 (105)	**NMH8**	**NJBEW141408**
498.6 (19.63)	736.6 (29.00)	304.8 (12.00)	333.5 (13.13)	N/A	698.5 (27.50)	N/A	378 (14.88)	616.0 (24.25)	203.2 (8.00)	38.1 (1.50)	101.6 (4.00)	4	59.4 (131)	**NMH6**	**NJBEW142408**
539.8 (21.25)	1092.2 (43.00)	306.3 (12.06)	349.3 (13.75)	508.0 (20.00)	1057.4 (41.63)	812.8 (32.00)	397 (15.63)	946.2 (37.25)	189.0 (7.44)	38.1 (1.50)	133.4 (5.25)	4	113.4 (250)	**NMH8**	**NJBEW153707**
533.4 (21.00)	533.4 (21.00)	249.2 (9.81)	279.4 (11.00)	501.7 (19.75)	501.7 (19.75)	279.4 (11.00)	419.1 (16.50)	419.1 (16.50)	146.1 (5.75)	38.1 (1.50)	98.6 (3.88)	3-1/2	59.9 (132)	**NMH8**	**NJBEW161606**
533.4 (21.00)	533.4 (21.00)	314.7 (12.39)	279.4 (11.00)	501.7 (19.75)	501.7 (19.75)	279.4 (11.00)	419.1 (16.50)	419.1 (16.50)	212.9 (8.38)	38.1 (1.50)	124.0 (4.88)	4	63.5 (140)	**NMH8**	**NJBEW161608**
543.1 (21.38)	593.9 (23.38)	382.5 (15.06)	304.8 (12.00)	482.6 (19.00)	533.4 (21.00)	355.6 (14.00)	412.8 (16.25)	463.6 (18.25)	301.8 (11.88)	9.7 (0.38)	177.8 (7.00)	4	68.0 (150)	**NMH8**	**NJBEW161812**
546.1 (21.50)	693.7 (27.31)	230.1 (9.06)	330.2 (13.00)	505.0 (19.88)	641.4 (25.25)	393.7 (15.50)	417.6 (16.44)	571.5 (22.50)	146.1 (5.75)	31.8 (1.25)	84.1 (3.31)	3	59.0 (130)	**NMH8**	**NJBEW162206**
533.4 (21.00)	711.2 (28.00)	308.1 (12.13)	N/A	501.7 (19.75)	N/A	466.9 (18.38)	412.8 (16.25)	616.0 (24.25)	209.6 (8.25)	38.1 (1.50)	134.9 (5.31)	4	81.6 (180)	**NMH6**	**NJBEW162408**
527.1 (20.75)	831.9 (32.75)	219.2 (8.63)	330.2 (13.00)	N/A	781.1 (30.75)	N/A	412.8 (16.25)	717.6 (28.25)	146.1 (5.75)	38.1 (1.50)	79.5 (3.13)	3	68.0 (150)	**NMH5**	**NJBEW162806**
593.9 (23.38)	593.9 (23.38)	252.5 (9.94)	330.2 (13.00)	552.5 (21.75)	552.5 (21.75)	330.2 (13.00)	463.6 (18.25)	463.6 (18.25)	146.1 (5.75)	38.1 (1.50)	104.9 (4.13)	3-1/2	85.3 (188)	**NMH8**	**NJBEW181806**

◊ For Groups B and C, all conduits must be sealed within 50.8 mm (2") of the enclosure.

EMERSON

NJBEW Cast Junction Boxes

Explosionproof, Dust-Ignitionproof

NEC/CEC:
Class I, Division 1 and 2, Groups B◊, C◊, D
Class I, Zone 1 and 2, Groups IIA, IIB◊+H_2◊, IP66
Class II, Division 1 and 2, Groups E, F, G
Class III

NEC/CEC:
NEMA 4, 7B◊C◊D, 9EFG

Dimensions in Millimeters (Inches)												Max. Conduit Size	Ship Weight	Mounting Hardware	Catalog
Overall Dimensions			Mounting Dimensions					Inside Dimensions						Catalog	Number
F	E	G	A	AA	B	BB	W	H	Db	Dc	K	Inches	kg (lb)	Number	
593.9 (23.38)	593.9 (23.38)	303.3 (11.94)	330.2 (13.00)	552.5 (21.75)	552.5 (21.75)	330.2 (13.00)	463.6 (18.25)	463.6 (18.25)	196.9 (7.75)	38.1 (1.50)	114.3 (4.50)	4	89.8 (198)	**NMH8**	**NJBEW181808**
608.1 (23.94)	762.0 (30.00)	309.4 (12.18)	409.7 (16.13)	552.5 (21.75)	704.9 (27.75)	466.9 (18.38)	463.6 (18.25)	614.4 (24.19)	196.9 (7.75)	38.1 (1.50)	128.5 (5.06)	4	101.6 (224)	**NMH8**	**NJBEW182408**
608.1 (23.94)	762.0 (30.00)	360.2 (14.18)	409.7 (16.13)	552.5 (21.75)	704.9 (27.75)	466.9 (18.38)	463.6 (18.25)	614.4 (24.19)	247.7 (9.75)	38.1 (1.50)	146.1 (5.75)	4	106.6 (235)	**NMH8**	**NJBEW182410**
574.8 (22.63)	879.6 (34.63)	308.1 (12.13)	N/A	552.5 (21.75)	N/A	584.2 (23.00)	463.6 (18.25)	768.4 (30.25)	196.9 (7.75)	38.1 (1.50)	120.7 (4.75)	4	120.2 (265)	**NMH5**	**NJBEW183008**
596.9 (23.50)	1060.5 (41.75)	312.7 (12.31)	279.4 (11.00)	552.5 (21.75)	1003.3 (39.50)	736.6 (29.00)	463.6 (18.25)	927.1 (36.50)	196.9 (7.75)	38.1 (1.50)	120.7 (4.75)	4	113.4 (250)	**NMH8**	**NJBEW183608**
596.9 (23.50)	1060.5 (41.75)	363.5 (14.31)	279.4 (11.00)	552.5 (21.75)	1003.3 (39.50)	736.6 (29.00)	463.6 (18.25)	927.1 (36.50)	247.7 (9.75)	38.1 (1.50)	139.7 (5.50)	4	122.5 (270)	**NMH8**	**NJBEW183610**
606.6 (23.88)	1216.2 (47.88)	301.8 (11.88)	406.4 (16.00)	584.2 (23.00)	1152.7 (45.38)	974.9 (38.38)	473.2 (18.63)	1073.2 (42.25)	177.8 (7.00)	38.1 (1.50)	127.0 (5.00)	4	140.6 (310)	**NMH8**	**NJBEW184207**
635.0 (25.00)	1651.0 (65.00)	323.9 (12.75)	N/A	596.9 (23.50)	N/A	1270.0 (50.00)	508.0 (20.00)	1524.0 (60.00)	174.8 (6.88)	38.1 (1.50)	120.7 (4.75)	4	236.3 (521)	**NMH5**	**NJBEW206008**
746.3 (29.38)	746.3 (29.38)	312.7 (12.31)	466.9 (18.38)	711.2 (28.00)	711.2 (28.00)	466.9 (18.38)	622.3 (24.50)	622.3 (24.50)	196.9 (7.75)	38.1 (1.50)	127.0 (5.00)	4	102.1 (225)	**NMH8**	**NJBEW242408**
746.3 (29.38)	746.3 (29.38)	363.5 (14.31)	466.9 (18.38)	711.2 (28.00)	711.2 (28.00)	466.9 (18.38)	622.3 (24.50)	622.3 (24.50)	247.7 (9.75)	38.1 (1.50)	155.7 (6.13)	4	108.9 (240)	**NMH8**	**NJBEW242410**
736.6 (29.00)	889.0 (35.00)	330.2 (13.00)	457.2 (18.00)	711.2 (28.00)	863.6 (34.00)	584.2 (23.00)	609.6 (24.00)	762.0 (30.00)	203.2 (8.00)	49.3 (1.94)	133.4 (5.25)	4	190.5 (420)	**NMH8**	**NJBEW243008**
781.1 (30.75)	1092.2 (43.00)	331.7 (13.06)	463.6 (18.25)	711.2 (28.00)	1016.0 (40.00)	736.6 (29.00)	616.0 (24.25)	920.8 (36.25)	196.9 (7.75)	41.4 (1.63)	130.3 (5.13)	4	190.5 (420)	**NMH5**	**NJBEW243608**
781.1 (30.75)	1092.2 (43.00)	382.5 (15.06)	463.6 (18.25)	711.2 (28.00)	1016.0 (40.00)	736.6 (29.00)	616.0 (24.25)	920.8 (36.25)	247.7 (9.75)	41.4 (1.63)	152.4 (6.00)	4	204.1 (450)	**NMH5**	**NJBEW243610**
914.4 (36.00)	1117.6 (44.00)	349.3 (13.75)	N/A	889.0 (35.00)	N/A	736.6 (29.00)	762.0 (30.00)	965.2 (38.00)	196.9 (7.75)	50.8 (2.00)	155.7 (6.13)	4	272.2 (600)	**NMH6**	**NJBEW303808**
914.4 (36.00)	1117.6 (44.00)	509.5 (20.06)	N/A	889.0 (35.00)	N/A	736.6 (29.00)	762.0 (30.00)	965.2 (38.00)	196.9 (7.75)	196.9 (7.75)	155.7 (6.13)	4	362.9 (800)	**NMH6**	**NJBEW303816** ①

① Cast Junction Box does not have ATEX/IECEx certification.
◊ For Groups B and C, all conduits must be sealed within 50.8 mm (2") of the enclosure.

NJBEW Cast Junction Box Options and Accessories

Explosionproof, Dust-Ignitionproof

NEC/CEC:
Class I, Division 1 and 2, Groups B◊, C◊, D
Class I, Zone 1 and 2, Groups IIA, IIB◊+H_2◊,
IP66
Class II, Division 1 and 2, Groups E, F, G
Class III

NEC/CEC:
NEMA 4, 7B◊C◊D, 9EFG

Options

Factory–Installed Suffix	Field–Installed Catalog Number	Description
AB	Not Available	Set of 4 standoffs 12.7 mm (0.50") high
BR	**BRTB4X**	Breather, NEMA 4X (includes outlets and installation)
DN	**ECD50B4X**	Drain, NEMA 4X (includes outlets and installation)
DP1	**AWG13/1CT**	Desiccate package
EGS	**EGSKIT**	External grounding stud 3/8"-16
G1	Not Available	Gray powder coat epoxy (outside)
G2	Not Available	Gray powder coat epoxy (inside and outside)
GNDKIT		Internal Ground Stud, #14 - #2
H		Hinges stainless steel
	AHOF12SS	Hinge Kit, 2 light duty SS hinges
	AHOF22SS	Hinge Kit, 2 heavy duty SS hinges
	AHOF23SS	Hinge Kit, 3 heavy duty SS hinges
K	Not Available	Terminal blocks 600 Volt, 30 Amp *Indicate number of points: example: 5 points = 5K*
NP	Not Available	Plastic nameplate, 50.8 x 101.6 mm (2.00 x 4.00"), 3.3 mm (13") black letters on white surface, 3 lines max, specify legend.
Q	Not Available	SS captive Quad-Lead bolts
X	Not Available	ATEX Certification
XU	Not Available	ATEX Component Certification
Z	See table on following page	Mounting pan

Drill and Tap Options

(For drill and tap schedule, Drilling and Tapping Guidelines)

Symbol	Conduit Size (NPT) Inches	Symbol	Conduit Size (NPT) Inches
A	1/2	**F**	2
B	3/4	**G**	2-1/2
C	1	**H**	3
D	1-1/4	**J**	3-1/2
E	1-1/2	**K**	4

Blind Tapped Holes	
Suffix	Screw Size
BT1	#6 - 1/4"
BT2	5/16" - 1/2"

Mounting Hardware

Refer to ordering information for Enclosure-Mounting Hardware Correlation.

Factory–Installed Suffix	Field–Installed Catalog Number	Description
MH1	**NMH1**	1/4" - 20 x 1-1/4" Bolt, 1/4" - 20 Hex Nut, 1/4" Washers
MH2	**NMH2**	3/8" -16 x 1-1/4" Bolt, 3/8" -16 Hex Nut, 3/8" Washers
MH3	**NMH3**	7/16" - 14 x 1-3/4" Bolt, 7/16" - 14 Hex Nut, 7/16" Washers
MH4	**NMH4**	1/2" - 13 x 1-3/4" Bolt, 1/2" - 13 Hex Nut, 1/2" Washers
MH5	**NMH5**	1/2" - 13 x 2" Bolt, 1/2" - 13 Hex Nut, 1/2" Washers
MH6	**NMH6**	5/8" - 11 x 2" Bolt, 5/8" - 11 Hex Nut, 5/8" Washers
MH7	**NMH7**	1/2" - 13 x 1-1/4" Bolt, 1/2" - 13 Hex Nut, 1/2" Washers
MH8	**NMH8**	5/8" - 11 x 1-1/4" Bolt, 5/8" - 11 Hex Nut, 5/8" Washers

◊ For Groups B and C, all conduits must be sealed within 50.8 mm (2") of the enclosure.

EMERSON

NJBEW Cast Junction Box Drilling and Tapping Guidelines

Explosionproof, Dust-Ignitionproof

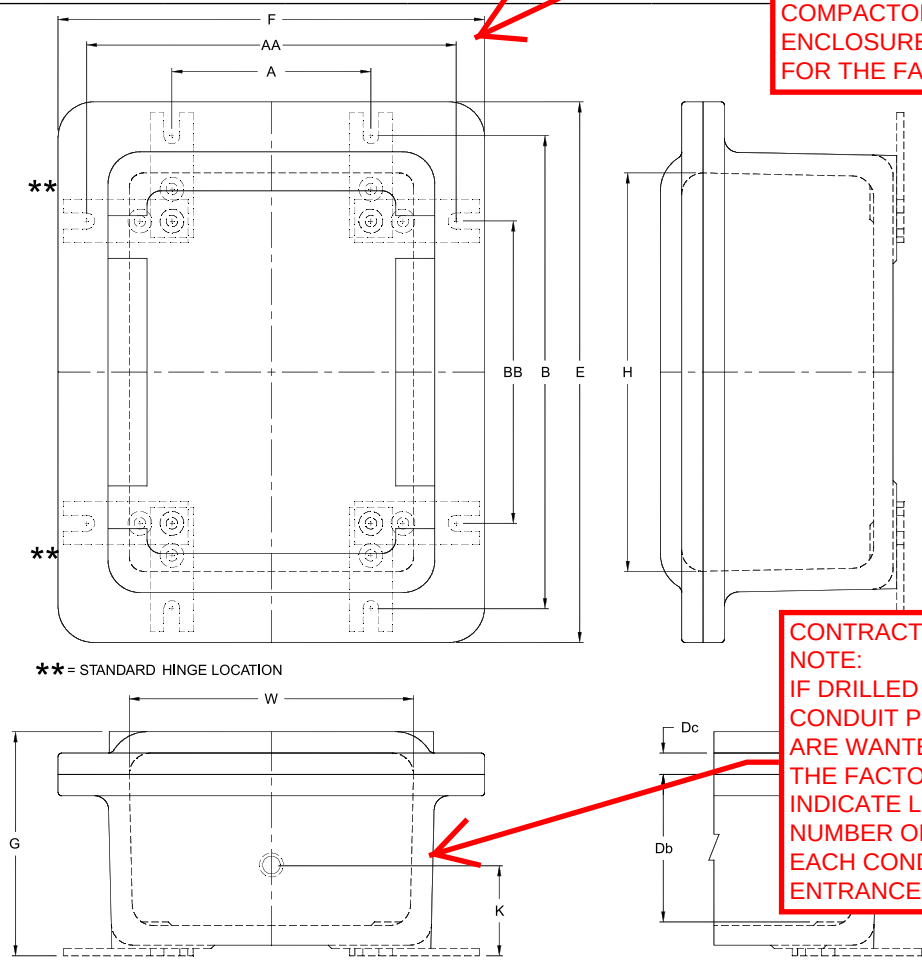
NEC/CEC:
Class I, Division 1 and 2, Groups B◊, C◊, D
Class I, Zone 1 and 2, Groups IIA, IIB◊+H_2◊, IP66
Class II, Division 1 and 2, Groups E, F, G
Class III

NEC/CEC:
NEMA 4, 7B◊C◊D, 9EFG

PLEASE NOTE: THE TOP OF THE SCREEN LOCAL ENCLOSURE IS RESERVED FOR THE FACTORY'S USE.

THE BOTTOM OF THE COMPACTOR LOCAL ENCLOSURE IS RESERVED FOR THE FACTORY'S USE.

Dimensions in Millimeters (Inches)



CONTRACTOR TAKE NOTE:
IF DRILLED AND TAPPED CONDUIT PROVISIONS ARE WANTED DONE AT THE FACTORY, PLEASE INDICATE LOCATION, NUMBER OF AND SIZE OF EACH CONDUIT ENTRANCE.

Drilling and Tapping Guidelines

Conduit Size (NPT)	Minimum Spacing For Conduit Centers in Millimeters (Inches)									
	1/2	3/4	1	1–1/4	1–1/2	2	2–1/2	3	3–1/2	4
1/2	54.1 (2.13)	54.1 (2.13)	57.2 (2.25)	66.8 (2.63)	71.4 (2.81)	79.5 (3.13)	92.2 (3.63)	101.6 (4.00)	114.3 (4.50)	114.3 (4.50)
3/4	54.1 (2.13)	54.1 (2.13)	57.2 (2.25)	66.8 (2.63)	71.4 (2.81)	79.5 (3.13)	92.2 (3.63)	101.6 (4.00)	114.3 (4.50)	114.3 (4.50)
1	57.2 (2.25)	57.2 (2.25)	60.5 (2.38)	71.4 (2.81)	76.2 (3.00)	82.6 (3.25)	95.3 (3.75)	104.9 (4.13)	114.3 (4.50)	117.6 (4.63)
1-1/4	66.8 (2.63)	66.8 (2.63)	71.4 (2.81)	79.5 (3.13)	84.1 (3.31)	92.2 (3.63)	104.9 (4.13)	114.3 (4.50)	120.7 (4.75)	127.0 (5.00)
1-1/2	71.4 (2.81)	71.4 (2.81)	76.2 (3.00)	84.1 (3.31)	88.9 (3.50)	96.8 (3.81)	109.5 (4.31)	117.6 (4.63)	125.5 (4.94)	133.4 (5.25)
2	79.5 (3.13)	79.5 (3.13)	82.6 (3.25)	92.2 (3.63)	96.8 (3.81)	104.9 (4.13)	117.6 (4.63)	127.0 (5.00)	148.1 (5.83)	146.1 (5.75)
2-1/2	92.2 (3.63)	92.2 (3.63)	95.3 (3.75)	104.9 (4.13)	109.5 (4.31)	117.6 (4.63)	130.3 (5.13)	84.1 (3.31)	146.1 (5.75)	155.7 (6.13)
3	101.6 (4.00)	101.6 (4.00)	104.9 (4.13)	114.3 (4.50)	117.6 (4.63)	127.0 (5.00)	84.1 (3.31)	146.1 (5.75)	152.4 (6.00)	158.8 (6.25)
3-1/2	114.3 (4.50)	114.3 (4.50)	114.3 (4.50)	120.7 (4.75)	125.5 (4.94)	136.7 (5.38)	146.1 (5.75)	152.4 (6.00)	158.8 (6.25)	165.1 (6.50)
4	114.3 (4.50)	114.3 (4.50)	117.6 (4.63)	127.0 (5.00)	133.4 (5.25)	146.1 (5.75)	155.7 (6.13)	158.8 (6.25)	165.1 (6.50)	171.5 (6.75)

◊ For Groups B and C, all conduits must be sealed within 50.8 mm (2") of the enclosure.

EMERSON

Models 11 and 21

GO Switch Models 11 and 21 are the world's original leverless limit switches.

Their simple design, rugged enclosures, long sensing ranges, and global approvals make these switches the ideal choice wherever reliable position sensing is needed.

Features:
- SPDT 10A contacts
- Side Sensing
- -40⁰ to 221⁰F operating temperature

Options:
- Suitable for Zone 0, 1, or 2 explosion proof
- -40⁰ to 350⁰F high temperature
- Quick disconnect connector
- Underwater capabilities

FAST TRACK DELIVERY

11-11110-00 **21-11110-00**
CSA Class I Div 2
Side Terminal Block

11-12110-00
CSA Class I Div 2
Extended Sensing

11-12510-00 **21-11510-00**
CSA Class I Div 2
Bottom Terminal Block

11-12518-A2 **21-11516-A2**
UL/CSA General Purpose
3 ft. leads

21-11524-A2
CSA Class I Div 1; 3 ft. leads

Model

Repeatability: .002" (.05 mm)

Response Time: 8 milliseconds

Differential: Approx. 5/16" (8 mm)

Operating Temperature: -40⁰ to 221⁰F (-40⁰ to 105⁰C). HiTemp™ option to 350⁰F) (176⁰C)

- ☑ **11** Size: 1 1/2" (38 mm) square x 4 9/16" (116 mm) overall. Add 1/2" (13 mm) for bottom conduit outlet
- ☑ **21** Size: 1 1/2" (38 mm) square x 3 13/16" (97 mm) overall. Add 1/2" (13 mm) for bottom conduit outlet

Need Accessories?

See pp. 92-103 for:

Range Extending
Target Magnets
Mounting Brackets
Connectors and more!

Contact Form

Contact Material: Silver cadmium oxide, gold flashed

Forms: SPDT, DMDB

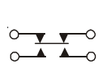
Ratings: Resistive

AC		DC	
Volts	Amps	Volts	Amps
120	10	24	3
240	5	48	1
480	2.5	125	0.5
		250	0.5

- ☑ **1** Single Pole Double Throw (Form C)
- **3** Single Pole Double Throw (Form C) Latching (maintained contact) (Outlet position must be 2, 4 or 5)
- **5** Double Make Double Break, two-circuit, Form Z*
- **6** Double Make Double Break, two circuit, Form Z Latching* (maintained contact) (Outlet position must be 2, 4 or 5)

*CSA and SAA certification for Double Make Double Break require potted-in leads or cable.

Form C - SPDT



Form Z - SPDT-DB

Sensing Range

Target Material: Ferrous steel

Sensing Range: Approx. 3/8" (10mm) standard; 9/16" (14mm) extended sensing (Model 11)

Sensing Range with Target Magnet: up to 3 3/4" (95 mm) (max)

- ☑ **1** Standard sensing - approx. 3/8" (10 mm) side sensing
- ☑ **2** Extended sensing - approx. 9/16" (14 mm) side sensing (Contact Form must be 1 or 3) (Model 11)
- **7** Precision sensing - approx. 1/4" (6 mm) side sensing (minimal differential)

Outlet Position

Conduit Outlet: 1/2" NPT

- ☑ **1** Behind sensing area
- **2** Left of sensing area
- **3** Right of sensing area
- **4** Same side as sensing area
- ☑ **5** Bottom of enclosure

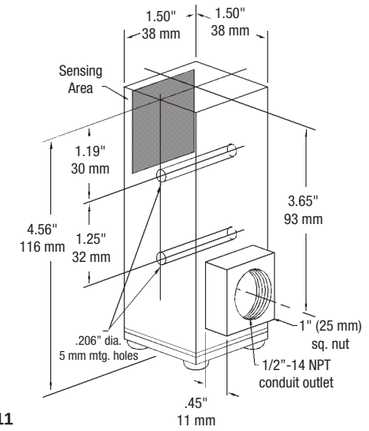
Ordering Guide

Fill in the boxes to create your 'ordering number.'

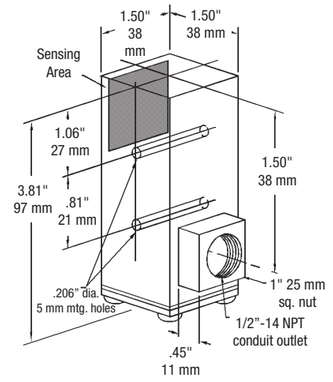
Model - Contact Form - Sensing Range - Outlet Position

Square Switches

Dimensions



Model 11



Model 21

Enclosure Material

Material: Brass or Stainless Steel

- ☑ **1** Brass - coated with flat black lacquer
- **2** Stainless steel**
- **3** Brass - corrosion resistant coating (polyurethane)
- **4** Stainless steel - corrosion resistant coating (polyurethane)**

**All-welded stainless steel switches are recommended for wet or harsh environments.

Approvals

- **2** High temperature to 350⁰F (176⁰C) with Teflon™ insulated leads (Model 11) (Contact form must be 1 or 3) (Sensing must be 1) (Enclosure must be 2) (Wiring must be F)
- **3** UL listed explosion proof for Cl I, Div 1 & 2; Grps A,B,C,D; Cl II, Div 1 & 2, Grps E-G; Cl III (Enclosure must be 2 or 4) (Lead seal req'd within 18")
- ☑ **4** CSA / FM certified explosion proof for Cl I, Div 1 & 2; Grps A,B,C,D; Cl II, Div 1 & 2, Grps E-G; Cl III. (Enclosure must be 2 or 4)
- **5** Mine Safety Health Administration (MSHA) approved "Explosion Proof", File #X / P-1504-1, X / P-1504-2; 6 ft. (1.829m) potted-in SO cable only (Enclosure must be 2) (Wiring must be B3)
- ☑ **6** CSA / FM certified explosion proof for Cl I, Div 2; Grps A,B,C,D; Cl II, Div 2, Grps E-G; Cl III
- **7** CSA certified General Purpose
- ☑ **8** UL listed General Purpose
- ☑ **0** CSA / FM certified Cl I, Div 2, Grps A,B,C,D; Cl II, Div 2, Grps F & G; Cl III Terminal block. (Contact form must be 1 or 3) (Wiring must be 00)
- **A** SAA: Ex s IIC T6 IP65; Cl I Zone 1 & 2; EX S IIC T6 IP65; Cl I Zone 0; DIP Cl II (Intrinsically safe with entity approved barrier. Install per NEC Article 501.) (Wiring must be A or 00) (Metric hub available)
- **B** SAA: High Temp 350⁰F (176⁰C): EX S IIC T6 IP65; Cl I Zone 1 & 2; EX S IIC T6 IP65; Cl I Zone 0; DIP Cl II (Intrinsically safe with entity approved barrier. Install per NEC Article 501.) (Wiring must be F) (Metric hub available)
- **C** SAA: Ex e IIC T6 IP65; Cl I Zone 1 (Rated to 275 VAC) (Wiring must be 00) (Metric hub available)

Wiring Options

Terminal Block
- ☑ **00** Terminal block only (not recommended for underwater use) (Approval must be 0, 7 or 8)

Lead Wires 18 Gauge (.110" dia.) potted-in PVC insulated AWM / TEW stranded lead wires rated at 221⁰F (105⁰C) 600V UL / CSA listed
- ☑ **A2** 36" (914 mm)
- **A3** 72" (1829 mm)
- **A4** 144" (3658 mm)
- **A_ _ _** Lengths greater than 144" (Specify length in feet (e.g. A150 = 150 ft. of leads))

Cable 18 Gauge (.450" dia.) potted-in SO rubber covered cable rated at 194⁰F (90⁰C) 600V UL / CSA listed
- **B2** 36" (914 mm)
- **B3** 72" (1829 mm)
- **B4** 144" (3658 mm)
- **B_ _ _** Lengths greater than 144" (Specify length in feet (e.g. B150 = 150 ft. of cable))

Quick Disconnect Male Quick Disconnect only, potted-in connector. (CSA requires a case ground) (Approval must be 7 or 8) Refer to pp. 92-103 for mating cable assemblies and Aura Light Adapters.

Mini-change®		Micro-change®	
DCA	3 - pin Mini-change® type	**DBA**	3 - pin Micro-change® type
DCD	4 - pin Mini-change® type	**DBD**	4 - pin Micro-change® type
DCG	5 - pin Mini-change® type	**DBG**	5 - pin Micro-change® type

SubSea™ Underwater Connector (Enclosure must be 2 or 4) (Approval 7 or 8)
- **3DD** 3 pin, certified not to leak underwater (includes male/female Delrin™ lock sleeves)
- **4DD** 4 pin, certified not to leak underwater (includes male/female Delrin™ lock sleeves)
- **3DE** 3 pin right-angle, certified not to leak underwater
- **4DE** 4 pin right-angle, certified not to leak underwater

HiTemp Wire 18 gauge (.070") dia. potted-in Teflon™ insulated leads rated at 482⁰F (250⁰C) 600V UL / CSA listed
- **F2** 36" (914 mm)
- **F3** 72" (1829 mm)
- **F4** 144" (3658 mm)
- **F_ _ _** Lengths greater than 144" (Specify length in feet (e.g. F150 = 150 ft. of leads))

Enclosure Material - Approvals - Wiring Options

Extended Sensing with External Target Magnets

AMP3 Target Magnet

Contact Form		10 Series 1 Standard	10 Series 2 Extended	10 Series 7 Precision	20 Series 1 Standard	20 Series 7 Precision
SPDT	**Sensing Differential**	**1" (25mm) 1/2" (13mm)**	**1-1/4" (32mm) 5/8" (16mm)**	11/16" (17mm) 7/16" (11 mm)	1" (25 mm) 3/4" (19 mm)	3/4" (19 mm) 7/16" (11 mm)
SPDT Latching	Sensing Differential	15/16" (24mm) N/A	1-1/4" (32mm) N/A	3/4" (19mm) N/A	1" (25 mm) N/A	13/16" (21 mm) N/A
DMDB	Sensing Differential	1" (25mm) 11/16" (17mm)	N/A	9/16" (14mm) 7/16" (11mm)	1" (25 mm) 1" (25 mm)	3/4" (19 mm) 11/16" (17 mm)
DMDB Latching	Sensing Differential	1" (25mm) N/A	N/A	N/A	1-1/4" (32 mm) N/A	N/A

AMS4 Target Magnet

Contact Form		10 Series 1 Standard	10 Series 2 Extended	10 Series 7 Precision	20 Series 1 Standard	20 Series 7 Precision
SPDT	**Sensing Differential**	**1-1/4" (32mm) 11-16" (17mm)**	**1-9/16" (40mm) 11/16" (17mm)**	7/8" (22mm) 1/2" (13 mm)	1-3/8" (35 mm) 7/8" (22 mm)	1" (25 mm) 7/16" (11 mm)
SPDT Latching	Sensing Differential	1-3/16" (30mm) N/A	1-5/8" (40mm) N/A	1" (25 mm) N/A	1-7/16" (37mm) N/A	1" (25 mm) N/A
DMDB	Sensing Differential	1-1/4" (32 mm) 7/8" (22 mm)	N/A	13/16" (21mm) 1/2" (13mm)	1-15/16" (37mm) 9/16" (14 mm)	1" (25 mm) 3/4" (19 mm)
DMDB Latching	Sensing Differential	1-11-32" (34 mm) N/A	N/A	N/A	1-9/16" (40mm) N/A	N/A

AMC5 Target Magnet

Contact Form		10 Series 1 Standard	10 Series 2 Extended	10 Series 7 Precision	20 Series 1 Standard	20 Series 7 Precision
SPDT	**Sensing Differential**	**3-3/8" (86mm) 1-1/2" (38mm)**	**3-3/4" (95mm) 1-1/2" (38mm)**	2-3/8" (60mm) 1" (25mm)	3-3/8" (86mm) 1-3/4" (44mm)	2-5/8" (86mm) 1" (25mm)
SPDT Latching	Sensing Differential	3-3/32" (79mm) N/A	3-7/8" (98mm) N/A	2-11/16" (68mm) N/A	3-7/16" (87mm) N/A	2-13/16" (71mm) N/A
DMDB	Sensing Differential	3-7/16" (87mm) 1-13/16"(46mm)	N/A	2-7/32" (56mm) 1" (25mm)	3-3/8" (86mm) 2" (51mm)	2-5/8" (67mm) 1-3/8" (35mm)
DMDB Latching	Sensing Differential	3-3/8" (86mm) N/A	N/A	N/A	3-7/8" (98mm) N/A	N/A

AMF6 Target Magnet

Contact Form		10 Series 1 Standard	10 Series 2 Extended	10 Series 7 Precision	20 Series 1 Standard	20 Series 7 Precision
SPDT	**Sensing Differential**	**2-7/16" (62mm) 1-1/2" (38mm)**	**3" (76mm) 1-11/16"(38mm)**	1-15/16" (33mm) 1-3-32" (28mm)	**2-7/16"(62mm) 1-15/16"(49mm)**	1-9/16" (40mm) 7/8" (22mm)
SPDT Latching	Sensing Differential	2-5/32" (55mm) N/A	3-3/16"(81 mm) N/A	1-9/16" (40mm) N/A	2-1/2" (64mm) N/A	1-13/16"(46mm) N/A
DMDB	Sensing Differential	2-1/4" (57mm) 1-13/16" (46mm)	N/A	1-1/8" (29mm) 1-3/32" (28mm)	2-3/8" (60mm) 2-13/16"(71mm)	1-1/2" (38mm) 1-1/2" (38mm)
DMDB Latching	Sensing Differential	2-7/16" (62mm) N/A	N/A	N/A	3" (76mm) N/A	N/A

Agency Approvals

Approvals	(3) UL Class 1 Div 1	(4) CSA/FM Class 1 Div 1	(5) MSHA	(6) CSA/FM Class 1 Div 2	(7) CSA General Purpose	(8) UL General Purpose	(0) CSA/FM Class 1 Div 2	(A) SAA Exs IIc T6 IP65	(C) SAA Exe IIc IP65
Termination Options									
00 - Terminal Block					X	X	X	X	X
A - Potted PVC Leads	X	X		X	X	X		X	
B - Potted SO Cable	X	X	X	X	X	X			
D - Quick Disconnect					X	X			
D - SubSea™ Connector					X	X			
F - Potted HiTemp™ Leads	X	X		X	X	X			

X = Approvals Available

NEMA Ratings

	Non-Hazardous				Hazardous	
NEMA CLASSES	**4**	**4X**	**6**	**6P**	**7**	**9**
00 - Terminal Block	X					
A - Potted PVC Leads	X	SS	X	SS	SS	SS
B - Potted SO Cable	X	SS	X	SS	SS	SS
D - Quick Disconnect	X	SS	X	SS		
D - SubSea™ Connector	X	SS	X	SS		
F - Potted HiTemp™ Leads	X	SS	X	SS	SS	SS

SS = Stainless steel
X = Designed to meet respective NEMA specifications

Wiring Diagrams (male view)

4 Wire PVC & HiTemp Leads	
N/C	Red
N/O	Blue
COM	Black
GND	Green

Terminations A & F

SO Cable	
N/C	Red
N/O	White
COM	Black
GND	Green

Termination B

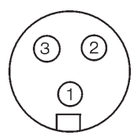
DMDB Form Z	PVC Leads
N/C 1 & 2	Red & Red/White Stripe
N/O 1 & 2	Blue & Blue/White Stripe

Termination A

DMDB Form Z Mini-Change QDC - 4 Pin	
Pin 1	N/O 2
Pin 2	N/C 2
Pin 3	N/C 1
Pin 4	N/O 1

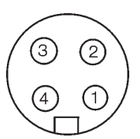
Termination DCD

Mini-Change QDC - 3 Pin	
Pin 1	COM
Pin 2	N/C
Pin 3	N/O



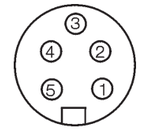
Termination DCA

Mini-Change QDC - 4 Pin	
Pin 1	COM
Pin 2	N/O
Pin 3	N/C
Pin 4	GND



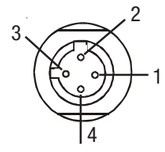
Termination DCD

Mini-Change QDC - 5 Pin	
Pin 1	N/O
Pin 2	N/C
Pin 3	GND
Pin 4	Inactive
Pin 5	COM



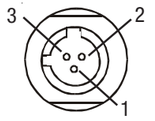
Termination DCG

Micro-Change QDC - 4 Pin	
Pin 1	COM
Pin 2	N/O
Pin 3	N/C
Pin 4	GND



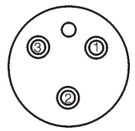
Termination DBD

Micro-Change QDC - 3 Pin	
Pin 1	COM
Pin 2	N/C
Pin 3	N/O



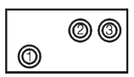
Termination DBA

SubSea - 3 Pin - Lock Sleeve	
Pin 1	N/C
Pin 2	COM
Pin 3	N/O



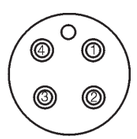
Termination 3DD

SubSea - 3 Pin - Right Angle	
Pin 1	COM
Pin 2	N/O
Pin 3	N/C



Termination 3DE

SubSea - 4 Pin - Lock Sleeve	
Pin 1	COM
Pin 2	N/O
Pin 3	N/C
Pin 4	GND



Termination 4DD

Hobbs AC Hour Meters

Back Next

20000 Series

When there's a need to keep track of run time, quality-minded companies choose Hobbs! Whether it's for testing purposes, leasing applications, maintenance reasons, and/or warranty programs, you want an accurate and reliable hour meter. The **Hobbs 20000 Series** hour meter delivers!

To ensure our high standards of quality, all parts are in-process inspected. Every meter must pass 100% function and timing accu-racy tests before shipping. These "Deluxe" AC meters are also totally sealed and benefit from an uncommon design which integrates the motor and frame into one substructure.

Specifications

- Records up to 99,999 hours Automatic recycle to zero
- 24,120 and 240 VAC models available (Range ±10%)
- 50 and 60 Hertz versions
- 3.0 watts power rating
- Operating temperature: - 65° F to +154°F (-54° C to +68°C)
- Accuracy: ±.02%.
- Weight: 3 oz
- Screw termination or 7" lead wires

Rectangular 2 Screw

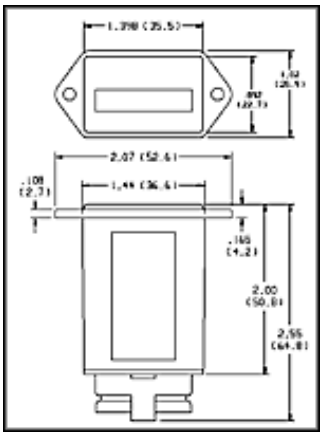
Operating Voltage	Hertz	Termination	Part #
108 to 132 VAC	50	Screw *	20028
108 to 132 VAC	50	7" Leads **	20034
108 to 132 VAC	60	Screw *	20001
108 to 132 VAC	60	7" Leads **	20035
216 to 264 VAC	50	Screw *	20029
216 to 264 VAC	50	7" Leads **	20036
216 to 264 VAC	60	Screw *	20007
216 to 264 VAC	60	7" Leads **	20037

Round 3 Screw

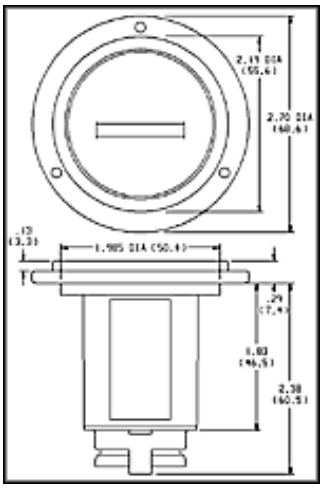
Operating Voltage	Hertz	Termination	Part #
108 to 132 VAC	50	Screw *	20016
108 to 132 VAC	50	7" Leads **	20042
108 to 132 VAC	60	Screw *	20017
108 to 132 VAC	60	7" Leads **	20043
216 to 264 VAC	50	Screw *	20018
216 to 264 VAC	50	7" Leads **	20044
216 to 264 VAC	60	Screw *	20019
216 to 264 VAC	60	7" Leads **	20045

* UL Listed, CSA Certified and CE Mark
** UL Recognized, CSA Certified and CE Mark

Deluxe AC Hour Meters



Two-Screw Mount: Panel cut out 1.45 x .95 rectangular opening. Two .150 holes spaced 1.750.*



Three-Screw Mount Panel cut out 2.00 diameter opening. Three .125 holes equally spaced on 2.42 bolt circle diameter. *

TWO-DOOR WITH 3-POINT LATCHES, TYPE 4X

INDUSTRY STANDARDS

UL 508A Listed; Type 3R, 4, 4X, 12; File No. E61997
cUL Listed per CSA C22.2 No 94; Type 3R, 4, 4X, 12; File No. E61997

NEMA Type 3, 3R, 4, 4X, 12, 13
IEC 60529, IP66
Meets NEMA Type 3RX requirements

APPLICATION

These two-door enclosures provide industry-leading protection for large components or complex mounting configurations in highly-corrosive environments. Three-point latching with the Hoffman POWERGLIDE™ padlocking handles and a foam-in-place gasket combine convenience with security. They are well-suited for use in petrochemical plants; pulp and paper processing; water treatment facilities; and food, pharmaceutical and packaging applications.

SPECIFICATIONS

- Manufactured from 12 gauge Type 304 or 316L stainless steel
- Backs are 10 or 12 gauge stainless steel with x-form stiffeners
- Seams continuously welded and ground smooth; no holes or knockouts
- Removable centerpost for easy panel installation
- Collar studs provided for mounting optional panels
- Panel supports included
- Heavy-duty lifting eyes are Type 316L stainless steel
- Heavy-duty 3-point latching mechanism operated by Type 316L stainless steel POWERGLIDE padlocking handles
- Body flange trough collar excludes liquids and contaminants
- Heavy-duty stainless steel continuous hinges support each door
- Bonding provision on doors; grounding studs on body
- Accessory mounting channel provided in enclosure top
- Data pocket is high-impact thermoplastic
- 12-in. (305-mm) removable floor stands are bolted to enclosure
- Seamless foam-in-place one-piece gasket provides oil-tight and dust-tight seal against contaminants
- External hardware manufactured of Type 316 stainless steel

FINISH

Enclosures are unpainted. Front, sides, top and back have smooth #4 brushed finish. Optional mild steel panels are painted white. Optional conductive panels are available.

ACCESSORIES

See also Accessosries.
Industrial Corrosion Inhibitors
Electric Heater
Electrical Interlocks
PANELITE™ Enclosure Lights Overview
Panel Support Kit

MODIFICATION AND CUSTOMIZATION

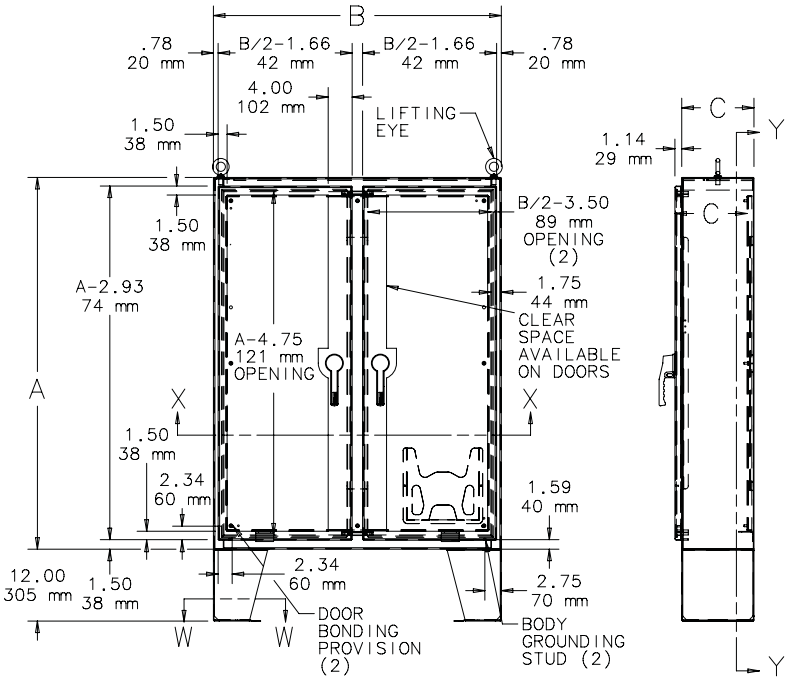
Hoffman excels at modifying and customizing products to your specifications. Contact your local Hoffman sales office or distributor for complete information.

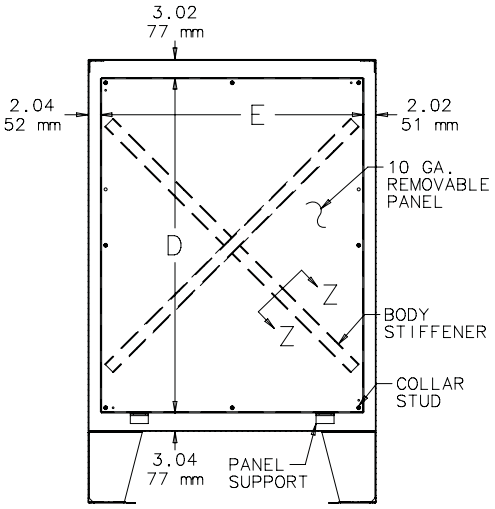
BULLETIN: A4S3

Standard Product

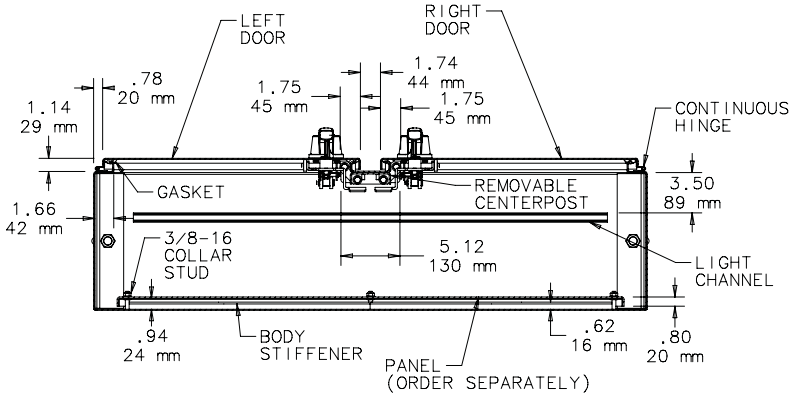
Catalog Number	AxBxC in.	AxBxC mm	Stainless Steel Type	Panel	Conductive Panel	Panel Size D x E (in.)	Panel Size D x E (mm)
A62H4812SSLP3PT	62.06 x 48.06 x 12.06	1576 x 1221 x 306	304	A60P48	A60P48G	56.00 x 44.00	1422 x 1118
A62H4812SS6LP3PT	62.06 x 48.06 x 12.06	1576 x 1221 x 306	316L	A60P48	A60P48G	56.00 x 44.00	1422 x 1118
A62H6012SSLP3PT	62.06 x 60.06 x 12.06	1576 x 1526 x 306	304	A60P60	A60P60G	56.00 x 56.00	1422 x 1422
A62H6012SS6LP3PT	62.06 x 60.06 x 12.06	1576 x 1526 x 306	316L	A60P60	A60P60G	56.00 x 56.00	1422 x 1422
A74H6012SSLP3PT	74.06 x 60.06 x 12.06	1881 x 1526 x 306	304	A72P60	A72P60G	68.00 x 56.00	1727 x 1422
A74H6012SS6LP3PT	74.06 x 60.06 x 12.06	1881 x 1526 x 306	316L	A72P60	A72P60G	68.00 x 56.00	1727 x 1422
A74H7212SSLP3PT	74.06 x 72.06 x 12.06	1881 x 1830 x 306	304	A72P72	A72P72G	68.00 x 68.00	1727 x 1727
A74H7212SS6LP3PT	74.06 x 72.06 x 12.06	1881 x 1830 x 306	316L	A72P72	A72P72G	68.00 x 68.00	1727 x 1727
A62H4818SSLP3PT	62.06 x 48.06 x 18.06	1576 x 1221 x 459	304	A60P48	A60P48G	56.00 x 44.00	1422 x 1118
A62H4818SS6LP3PT	62.06 x 48.06 x 18.06	1576 x 1221 x 459	316L	A60P48	A60P48G	56.00 x 44.00	1422 x 1118
A62H6018SSLP3PT	62.06 x 60.06 x 18.06	1576 x 1526 x 459	304	A60P60	A60P60G	56.00 x 44.00	1422 x 1118
A62H6018SS6LP3PT	62.06 x 60.06 x 18.06	1576 x 1526 x 459	316L	A60P60	A60P60G	56.00 x 44.00	1422 x 1118
A74H6018SSLP3PT	74.06 x 60.06 x 18.06	1881 x 1526 x 459	304	A72P60	A72P60G	68.00 x 56.00	1727 x 1422
A74H6018SS6LP3PT	74.06 x 60.06 x 18.06	1881 x 1526 x 459	316L	A72P60	A72P60G	68.00 x 56.00	1727 x 1422
A74H7218SSLP3PT	74.06 x 72.06 x 18.06	1881 x 1830 x 459	304	A72P72	A72P72G	68.00 x 68.00	1727 x 1727
A74H7218SS6LP3PT	74.06 x 72.06 x 18.06	1881 x 1830 x 459	316L	A72P72	A72P72G	68.00 x 68.00	1727 x 1727
A74H7224SSLP3PT	74.06 x 72.06 x 24.06	1881 x 1830 x 611	304	A72P72	A72P72G	68.00 x 68.00	1727 x 1727
A74H7224SS6LP3PT	74.06 x 72.06 x 24.06	1881 x 1830 x 611	316L	A72P72	A72P72G	68.00 x 68.00	1727 x 1727

Purchase panels separately.

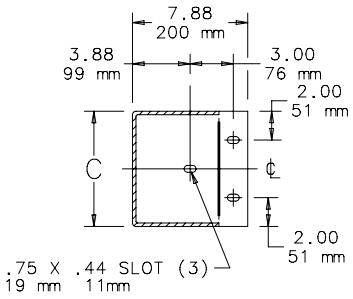




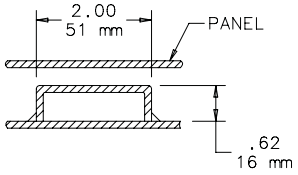
SECTION Y-Y



SECTION X-X



SECTION W-W



SECTION Z-Z

87784698

RH Series Compact Power Relays

Key features

- SPDT through 4PDT, 10A contacts
- Compact power type relays
- Miniature power relays with a large capacity
- 10A contact capacity
- Compact size saves space

Part Number Selection

Contact	Model	Part Number: Blade Terminal	Part Number: PCB Terminal	Coil Voltage Code (Standard Stock in bold)
SPDT 	Standard	RH1B-U ☐	RH1V2-U ☐	AC6V, AC12V, **AC24V**, AC110V, **AC120V**, AC220V, **AC240V** DC6V, **DC12V**, **DC24V**, DC48V, DC110V
	With Indicator	RH1B-UL ☐	—	
	With Check Button	RH1B-UC ☐	—	
	With Indicator and Check Button	RH1B-ULC ☐	—	
	Top Bracket Mounting	RH1B-UT ☐	—	
	With Diode (DC coil only)	RH1B-UD ☐	RH1V2-UD ☐	DC6V, **DC12V**, **DC24V**, DC48V, DC110V
	With Indicator and Diode (DC coil only)	RH1B-ULD ☐	—	**DC12V**, **DC24V**, DC48V, DC110V
DPDT 	Standard	RH2B-U ☐	RH2V2-U ☐	AC6V, AC12V, **AC24V**, **AC110-120V**, **AC220-240V** DC6V, **DC12V**, **DC24V**, DC48V, DC100-110V
	With Indicator	RH2B-UL ☐	RH2V2-UL ☐	
	With Check Button	RH2B-UC ☐	—	
	With Indicator and Check Button	RH2B-ULC ☐	—	
	Top Bracket Mounting	RH2B-UT ☐	—	
	With Diode (DC coil only)	RH2B-UD ☐	RH2V2-UD ☐	DC6V, **DC12V**, **DC24V**, DC48V, DC100-110V
	With Indicator and Diode (DC coil only)	RH2B-ULD ☐	RH2V2-ULD ☐	
3PDT 	Standard	RH3B-U ☐	RH3V2-U ☐	AC6V, AC12V, **AC24V**, AC110V, **AC120V**, AC220V, **AC240V** DC6V, **DC12V**, **DC24V**, DC48V, DC110V
	With Indicator	RH3B-UL ☐	RH3V2-UL ☐	
	With Check Button	RH3B-UC ☐	—	
	With Indicator and Check Button	RH3B-ULC ☐	—	
	Top Bracket Mounting	RH3B-UT ☐	—	
	With Diode (DC coil only)	RH3B-UD ☐	—	DC6V, DC12V, DC24V, DC48V, DC110V
	With Indicator and Diode (DC coil only)	RH3B-ULD ☐	—	
4PDT 	Standard	RH4B-U ☐	RH4V2-U ☐	AC6V, AC12V, **AC24V**, AC110V, **AC120V**, AC220V, **AC240V** DC6V, **DC12V**, **DC24V**, DC48V, DC110V
	With Indicator	RH4B-UL ☐	RH4V2-UL ☐	
	With Check Button	RH4B-UC ☐	—	
	With Indicator and Check Button	RH4B-ULC ☐	—	
	Top Bracket Mounting	RH4B-UT ☐	—	
	With Diode (DC coil only)	RH4B-UD ☐	RH4V2-UD ☐	DC6V, DC12V, DC24V, DC48V, DC110V
	With Indicator and Diode (DC coil only)	RH4B-ULD ☐	—	

PCB terminal relays are designed to mount directly to a circuit board without any socket.

Ordering Information
When ordering, specify the Part No. and coil voltage code:
(example) **RH3B-U** (Part No.) **AC120V** (Coil Voltage Code)

Sockets (for Blade Terminal Models)

Relays	Standard DIN Rail Mount [1]	Finger-safe DIN Rail Mount [1]	Through Panel Mount	PCB Mount
RH1B	SH1B-05	SH1B-05C	SH1B-51	SH1B-62
RH2B	SH2B-05	SH2B-05C	SH2B-51	SH2B-62
RH3B	SH3B-05	SH3B-05C	SH3B-51	SH3B-62
RH4B	SH4B-05	SH4B-05C	SH4B-51	SH4B-62




1. DIN Rail mount socket comes with two horseshoe clips. Do not use unless you plan to insert pullover wire spring. Replacement horseshoe clip part number is Y778-011.

Hold Down Springs & Clips

Appearance	Item	Relay	For DIN Mount Socket	For Through Panel & PCB Mount Socket
	Pullover Wire Spring	RH1B	SY2S-02F1 [2]	SY4S-51F1
		RH2B	SY4S-02F1 [2]	
		RH3B	SH3B-05F1 [2]	
		RH4B	SH4B-02F1 [2]	
	Leaf Spring (side latch)	RH1B, RH2B, RH3B, RH4B	SFA-202 [3]	SFA-302 [3]
	Leaf Spring (top latch)	RH1B, RH2B, RH3B, RH4B	SFA-101 [3]	SFA-301 [3]

2. Must use horseshoe clip when mounting in DIN mount socket. Replacement horseshoe clip part number is Y778-011.
3. Two required per relay.

AC Coil Ratings

Voltage (V)	Rated Current (mA) ±15% at 20°C								Coil Resistance (Ω) ±10% at 20°C				Operation Characteristics (against rated values at 20°C)		
	AC 50Hz				AC 60Hz										
	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	Max. Continuous Applied Voltage	Pickup Voltage	Dropout Voltage
6	170	240	330	387	150	200	280	330	330	9.4	6.4	5.4	110%	80% maximum	30% minimum
12	86	121	165	196	75	100	140	165	165	39.3	25.3	21.2			
24	42	60.5	81	98	37	50	70	83	83	153	103	84.5			
110	9.6	—	18.1	21.6	8.4	—	15.5	18.2	18.2	—	2,200	1,800			
110-120	—	9.4-10.8	—	—	—	8.0-9.2	—	—	—	—	—	—			
120	8.6	—	16.4	19.5	7.5	—	14.2	16.5	16.5	—	10,800	7,360			
220	4.7	—	8.8	10.7	4.1	—	7.7	9.1	9.1	—	10,800	7,360			
220-240	—	4.7-5.4	—	—	—	4.0-4.6	—		—	18,820	—	—			
240	4.9	—	8.2	9.8	4.3	—	7.1	8.3	8.3	—	12,100	9,120			

DC Coil Ratings

Voltage (V)	Rated Current (mA) ±15% at 20°C				Coil Resistance (Ω) ±10% at 20°C				Operation Characteristics (against rated values at 20°C)		
	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	Max. Continuous Applied Voltage	Pickup Voltage	Dropout Voltage
6	128	150	240	250	47	40	25	24	110%	80% maximum	10% minimum
12	64	75	120	125	188	160	100	96			
24	32	36.9	60	62	750	650	400	388			
48	18	18.5	30	31	2,660	2,600	1,600	1,550			
100-110	—	8.2-9.0	—	—	—	12,250	—	—			
110	8	—	12.8	15	13,800	—	8,600	7,340			

Standard coil voltages are in **BOLD**.

Submittal Spec Sheet
PS158004EN

Effective October 2013
Supersedes May 2007

Critical filter and surge protective device—ITCFxxx10xxx models

ITCFxxx10

Introduction

Since 1980, Eaton's Innovative Technology® has provided surge protective devices (SPDs) to power quality equipment users around the world. Whatever your electrical surge protection need may be, Eaton's Innovative Technology has a surge protective device to fill it.

Product description

Series or parallel wired, terminal strip connected, multi-stage hybrid Active Tracking Network (ATN®) sine wave tracking surge protective device.

Application description

Dedicated AC and DC power circuits operating at 5–275 Vac / 5–300 Vdc, ≤10A, feeding variable speed drives, variable frequency drives, process controllers, PLCs, power supplies, microprocessor-based loads, CNCs, and a wide variety of other mission-critical and general-purpose loads.

Features

- Peak surge current: 40 kA per phase; 20 kA per mode
- Warranty: 10-year free replacement ①
- Enclosure: ABS plastic UL® 94-5VA
- Connection: wire clamping box terminals
  - Minimum 22 AWG (0.34 mm²) wire size
  - Maximum 12 AWG (4.0 mm²) wire size
- Weight: ≈ 1 lb (0.45 kg)
- Operating temperature: –40°F (–40°C) to +140°F (+60°C)
- Provides three modes of protection: L–G, L–N, and N–G
- Input power frequency: 0–64 Hz (AC)
- Response time: active <1 nanosecond
- Maximum continuous operating current: 10A rms up to 250V
- Circuit interrupt: reference installation instructions for details
- UL nominal discharge current rating: 5 kA ②
- UL SCCR: 10 kA ②
- UL voltage protection rating: 500 L–G, 500 L–N, 500 N–G ②

① With product registration.

② 120 Vac model only.

Table 1. Maximum EMI/RFI Attenuation—MIL-STD-220

10 kHz	100 kHz	1 MHz	10 MHz	100 MHz	Maximum Attenuation Frequency
Model xxCF12010					
17 dB	35 dB	64 dB	33 dB	51 dB	64 dB at 1.0 MHz
Model xxCF12010-CP					
16 dB	35 dB	62 dB	40 dB	50 dB	68 dB at 1.25 MHz

Standards and certifications

- Unit listings: recognized components under UL 1449 Third Edition (certain models, see performance data table on page 2), UL 1283 Fifth Edition filter, CSA®
- Manufacturer qualifications: ISO® 9001:1994 Quality System Certification BSI FM 30833
- RoHS compliant

Powering Business Worldwide

RoHS COMPLIANT

ISO 9001

EXCLUSIVE *I.T.* 10 YEAR WARRANTY FREE REPLACEMENT

Performance data

Table 2. Technical Specifications

Catalog Number	Voltage Range	Protection Modes	VPR	MCOV	I_n	SCCR	Peak Surge Current Per Mode
ITCF02410 ①	5–38 Vdc ①	L–N, L–G, N–G	—	—	—	—	4, 2, 2 kA
ITCF04810 ①	24–65 Vdc ①	L–N, L–G, N–G	—	—	—	—	13, 6.5, 6.5 kA
ITCF12010 ②	48–149 Vdc ① 100–127 Vac	L–N	500	150	5 kA	10 kA	40 kA
		L–G	500	150	5 kA	10 kA	20 kA
		N–G	500	150	5 kA	10 kA	20 kA
ITCF24010 ③	150–300 Vdc ① 200–240 Vac	L–N, L–G, N–G	—	—	—	—	16, 8, 8 kA

① UL 1449 Third Edition does not list SPD products rated less than 100 Vac or DC voltages.

② UL 1449 Third Edition, UL 1283 Fifth Edition.

③ UL 1283 Fourth Edition, EMI filter.

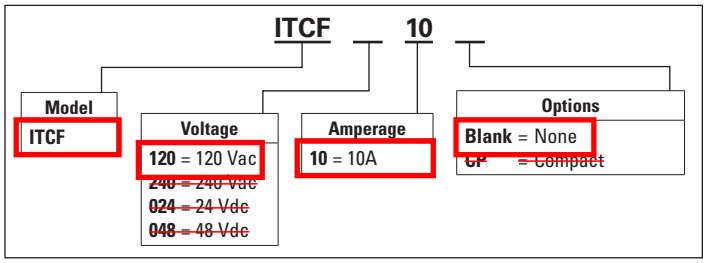
Table 3. Let-Through Voltages Based Upon IEEE Std C62.62-2010 Testing Waveforms ①

Test Impulse	xxCF12010	xxCF12010-CP
IEEE Category A 100 kHz ring wave—6000V, 200A	150V	300V
IEEE Category B 100 kHz ring wave—6000V, 500A	330V	400V
IEEE Category B combination wave—6000V, 3000A (UL 1449-3 VPR)	470V	460V

① All tests conducted on 120 Vac units.

Product selection

Table 4. Catalog Numbering Selection



Dimensions

Approximate dimensions in inches (mm).

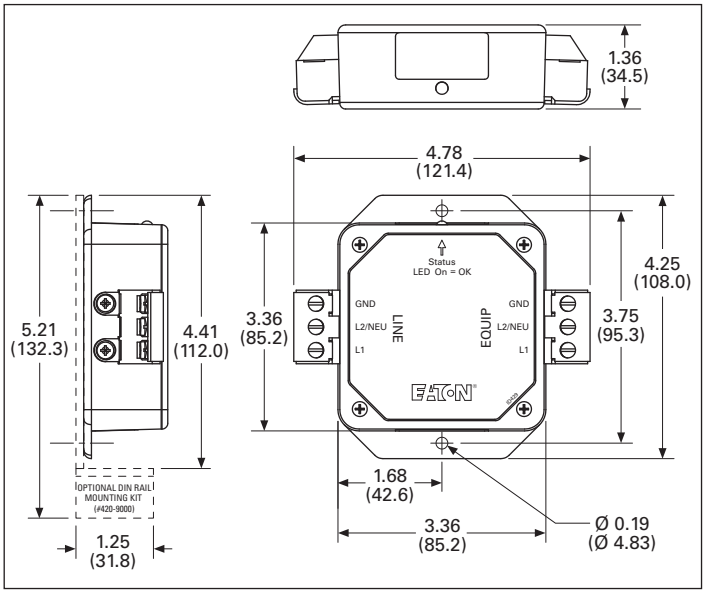


Figure 1. ITCFxxx10 Model Dimensions

For additional information, go to www.itvss.com or call 1-800-809-2772 option 4, option 2.

Eaton
1000 Eaton Boulevard
Cleveland, OH 44122
United States
Eaton.com

Printed in USA
Publication No. PS158004EN / Z14346
October 2013

Powering Business Worldwide

Class CC and Class CD Fuses

600 VAC • 1/10 – 60 Amperes

CCMR Series

For space saving protection of motor circuits up to 40 HP**, we recommend Littelfuse POWR-PRO® CCMR series fuses. These fuses are the only true dual-element time-delay CC fuses specifically engineered for motor-branch circuit protection. They provide Type 2 "No Damage" protection to both NEMA-rated and the more sensitive IEC (International Electrotechnical Commission) type motor circuit components.

CCMR series fuses are now available in larger sizes — from 35 to 60 amperes! **No other 600V fuse is available with this current carrying capacity in a package this small.**

***Consult the Motor Protection Tables in the Fuse-ology section for specific motor sizing information*

For more information on CCMR series Class CC fuses, see the CCMR series pages in the POWR-PRO section of this catalog.
1/10 – 30A: UL Listed Class CC
35 – 60A: UL Listed Class CD

Ampere Ratings

2/10	1¼	2½	5	9	30
¼	1 4/10	2 8/10	5 6/10	10	35
3/10	1½	3	6	12	40
½	1 6/10	3 2/10	6¼	15	45
6/10	1 8/10	3½	7	17½	50
8/10	2	4	7½	20	60
1	2¼	4½	8	25	

Example part number (series & amperage): CCMR 30

KLDR Series

KLDR fuses are time-delay fuses specifically designed for the protection of control transformers, solenoids and similar inductive components with high magnetizing currents during the first half-cycle. They closely match most control power transformer characteristics, which permits the fuses to be sized in accordance with the latest revisions of UL 508 (Industrial Control) and UL 845 (Motor Control Centers). When the time delay of KLDR fuses is adequate to carry motor starting current, they provide excellent protection of motor branch circuits containing IEC or NEMA rated motor controllers or contactors.

Ampere Ratings

1/10	6/10	1 8/10	4½	10
1/8	¾	2	5	12
15/100	8/10	2¼	5 6/10	15
1/16	1	2½	6	17½
2/10	1⅛	2 8/10	6¼	20
¼	1¼	3	7	25
3/10	1 4/10	3 2/10	7½	30
4/10	1½	3½	8	
½	1 6/10	4	9	

Example part number (series & amperage): KLDR 5 6/10

KLKR Series

KLKR series Class CC fuses are fast acting fuses intended for general purpose branch circuit protection. Their compact size, fast acting overload response, and highly current-limiting design make them ideal for use in OEM equipment and control panels. Solid state devices such as SCRs and other electronic equipment generally require fast acting protection.

Ampere Ratings

1/10	½	2½	6	12
1/8	¾	3	7	15
2/10	1	3½	8	20
¼	1½	4	9	25
3/10	2	5	10	30

Example part number (series & amperage): KLKR 25

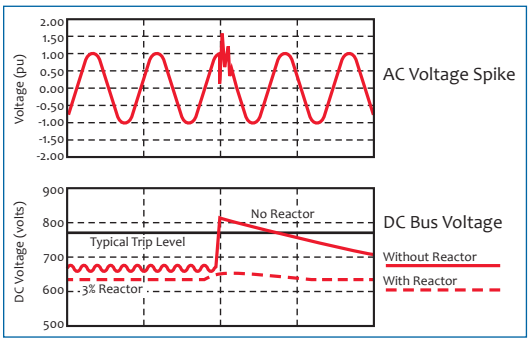
AN SL POWER ELECTRONICS COMPANY

RL Line / Load Reactors

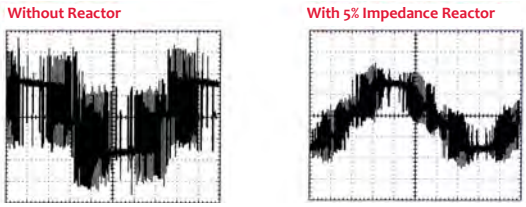
Selection Table, Technical Details & Product Application Guide

MTE HARMONIC COMPENSATED LINE/LOAD REACTORS help keep your equipment running longer by absorbing many of the power line disturbances which otherwise damage or shut down your inverters, variable frequency drives (VFDs), variable speed controllers, or other sensitive equipment. They are a robust filtering solution for virtually any 6 pulse rectifier or power conversion unit. There is no need to de-rate MTE Reactors as they are harmonic compensated and IGBT protected to assure optimum performance in the presence of harmonics, and are very effective at reducing harmonics produced by inverters and drives. Standard MTE Reactors may be applied up to 690 VAC with compatible impedance ratings. MTE RL Reactors have higher continuous and overload ratings.

VOLTAGE SPIKE PROTECTION - Voltage spikes on the AC power lines cause rapid elevation of the DC Bus voltage which may cause the inverter to "trip-off" and indicate an over-voltage protection condition. RL Reactors absorb these line spikes and offer protection to the rectifiers and DC Bus capacitors while minimizing nuisance tripping of the inverter. A 3% impedance RL Reactor is 90% effective at protecting against transients or nuisance tripping of AC voltage source inverters due to voltage spikes. The 5% RL Reactor extends spike protection to 99%.



MOTOR PROTECTION - MTE RL Reactors help to protect motors and cables from the high peak voltages and fast rise times (dV/dt) which can be experienced in IGBT inverter applications when the distance between the inverter and motor is up to 300 feet. For guaranteed long lead protection up to 1000 feet use the MTE **dV/dt Filter** or the MTE **Sine Wave Filter** as the ultimate in motor and wire protection.



HARMONICS:

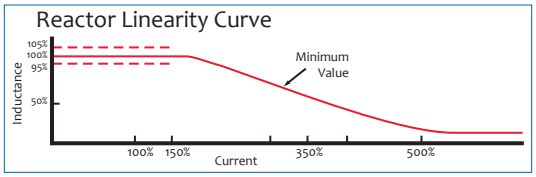
Drive Harmonic currents will be reduced by adding an input line reactor.

3% impedance reactor yields 35-55% THID

5% impedance reactor yields 25-45% THID

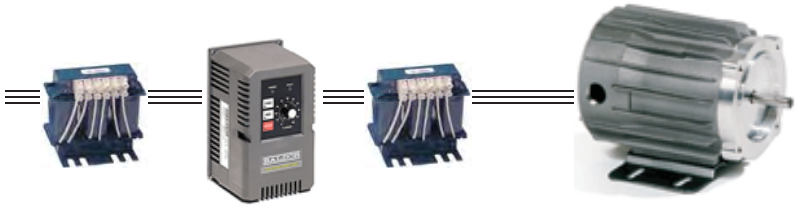
Note: for guaranteed compliance to IEEE519 (5% THID) use a MTE Matrix Series D Filter

REACTOR LOADED PERFORMANCE: The curve to the right illustrates the linearity of MTE RL Reactors. Even at 150% of their rated current, these reactors still have 100% of their nominal inductance. This assures maximum filtering of distortion even in the presence of severe harmonics and the best absorption of surges. The typical tolerance on rated inductance is plus-or-minus 10%.



Typical uses include:

- Protect Motors from Long Lead Effects
- Reduce Output Voltage dV/dt
- Virtually Eliminate Nuisance Tripping
- Extend Semiconductor Life
- Reduce Harmonic Distortion
- Reduce Motor Temperature
- Reduce Motor Audible Noise



For three phase applications you can use the same MTE catalog part number to protect both line and load side of a VFD.

MTE RL Reactor Selection Tables

Selection Table 208-690 VAC Three-Phase and Single-Phase Applications

Input Voltage		% Impedance	0.25hp 0.18kw	0.33hp 0.25kw	0.5hp 0.37kw	0.75hp 0.55kw	1hp 0.75kw	1.5hp 1.1kw	2hp 1.5kw	3hp 2.2kw	5hp 3.7kw	7.5hp 5.5kw	10hp 7.5kw	15hp 11kw	20hp 15kw	25hp 18.5kw
Three Phase input or output applications selected by Motor	208 vac 60Hz	3%	RL-00204	RL-00204	RL-00401	RL-00401	RL-00802	RL-00801	RL-01201	RL-01801	RL-02501	RL-03501	RL-04501	RL-05501	RL-08001	RL-10001
		5%	RL-00201	RL-00201	RL-00402	RL-00803	RL-00802	RL-00802	RL-01202	RL-01802	RL-02502	RL-03502	RL-05502	RL-08002	RL-10002	RL-08001
	240 vac 60Hz	3%	RL-00201	RL-00204	RL-00204	RL-00401	RL-00401	RL-00801	RL-00801	RL-01201	RL-01801	RL-02501	RL-03501	RL-04501	RL-08001	RL-10001
		5%	RL-00202	RL-00201	RL-00403	RL-00402	RL-00803	RL-00802	RL-00802	RL-01202	RL-01802	RL-03502	RL-03502	RL-05502	RL-08002	RL-10002
	400 vac 50Hz	3%	RL-00103	RL-00103	RL-00202	RL-00202	RL-00201	RL-00403	RL-00402	RL-00803	RL-01202	RL-01202	RL-01802	RL-02502	RL-03502	RL-04502
		5%	RL-00102	RL-00102	RL-00203	RL-00203	RL-00202	RL-00404	RL-00404	RL-00804	RL-01203	RL-01203	RL-01803	RL-02503	RL-03503	RL-04503
	480 vac 60Hz	3%	RL-00103	RL-00103	RL-00104	RL-00201	RL-00201	RL-00402	RL-00402	RL-00803	RL-00802	RL-01202	RL-01802	RL-02502	RL-03502	RL-03502
		5%	RL-00102	RL-00102	RL-00103	RL-00202	RL-00202	RL-00404	RL-00404	RL-00804	RL-00803	RL-01203	RL-01803	RL-02503	RL-03503	RL-03503
	600 vac 60Hz	3%	RL-00102	RL-00102	RL-00103	RL-00202	RL-00202	RL-00201	RL-00403	RL-00402	RL-00803	RL-01202	RL-01202	RL-01802	RL-02502	RL-02502
		4%	RL-00101	RL-00101	RL-00102	RL-00203	RL-00203	RL-00202	RL-00404	RL-00404	RL-00804	RL-01203	RL-01203	RL-01803	RL-02503	RL-02503
	690 vac 50Hz	2%								RL-00403	RL-00402	RL-00801	RL-01202	RL-01202	RL-01802	RL-02502
		3%								RL-00402	RL-00404	RL-00804	RL-01203	RL-01203	RL-01803	RL-02503
Single Phase input Applications	Use outer two windings															
	120 vac 60Hz	5%	RL-00801	RL-001201	RL-01801	RL-02501	RL-02501	RL-03503	RL-03501	RL-05501	RL-10001	RL-13001	RL-13001			
	208 vac 60Hz	5%	RL-00401	RL-00401	RL-00401	RL-01202	RL-00801	RL-01201	RL-02502	RL-03502	RL-03501	RL-04501	RL-05501	RL-08001	RL-13001	RL-13001
	240 vac 60Hz	5%	RL-00402	RL-00401	RL-00803	RL-00802	RL-01202	RL-01201	RL-01201	RL-01801	RL-04502	RL-08002	RL-08002	RL-08001	RL-10001	RL-16002
	240 vac 50Hz	5%	RL-hp	RL-00402	RL-00402	RL-00802	RL-00802	RL-01802	RL-01802	RL-02502	RL-03502	RL-05502	RL-08002	RL-10002	RL-13002	RL-16002
	400 vac 50Hz	5%	RL-00103	RL-00202	RL-00201	RL-00201	RL-00403	RL-00402	RL-00803	RL-01203	RL-01803	RL-02503	RL-03503	RL-04502	RL-05502	RL-08002
	480 vac 60Hz	5%	RL-00202	RL-00202	RL-00202	RL-00404	RL-00403	RL-00402	RL-00803	RL-01203	RL-01803	RL-02503	RL-02502	RL-05503	RL-08003	RL-08003
	600 vac 60 Hz	5%			RL-00202	RL-00202	RL-00404	RL-00403	RL-00403	RL-00803	RL-01203	RL-01803	RL-02503	RL-03503	RL-04503	RL-05503

For detailed product specifications refer to the RL User Manual or RL Reference Sheet.

This table is suitable for selection of both input & output 3-phase reactors because their harmonic compensation & conservative design allow them to be used in either application. Specific current & inductance ratings are indicated on Pages 4 & 5. Consult factory for any special applications (higher current, motor rating different than controller rating, etc).

Select RL line/load reactors based upon motor horsepower (or kilowatts) and voltage. Verify that the motor full load ampere name plate rating is within the RMS current rating of the reactor, & the drive/inverter rating is within the maximum continuous current rating of the reactor

Agency Approvals:

MTE RL Reactors are manufactured to the exacting standards of MIL-I-45208, VDE-0550, & are UL Listed and CSA certified. All UL approvals are for USA & Canada.

- **CSA File #LR29753-13, open units up to 2400A**
- **UL-508 File #E180243, open and enclosed up to 2400A**

NEMA Cabinets:

RL reactors are available as either open type or in a NEMA Type 1 general purpose enclosure or NEMA type 3R weather. To order a reactor mounted in a cabinet simply change the second last digit of the part number from "0" to "1" (NEMA1) or "3" for (NEMA 3R) Cabinets.
Example: RL-00802 enclosed becomes RL-00812.

Impedance Rating:

3% impedance reactors are typically sufficient to absorb power line spikes and motor current surges. They will prevent nuisance tripping of drives or circuit breakers in most applications.

5% impedance reactors are best for reducing harmonic currents and frequencies. Use them when you must reduce VFD drive generated harmonics, and to reduce motor operating temperature, or to reduce motor noise.

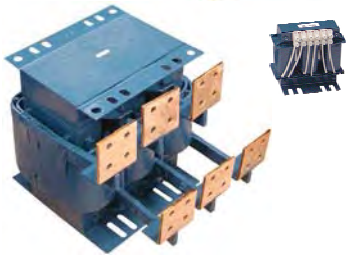
$$\%_{impedance} = \frac{I_{RMS} \times 2\pi F_{50/60Hz} \times L_{RLinductance} \times \sqrt{3}}{V_{L\text{-}L}} \times 100$$

Note: The effective impedance of the reactor changes with actual RMS current through the reactor as seen in the above equation.

A 5% impedance reactor becomes 3% if its current is reduced to 60%.

Product Specifications - RL Three Phase Reactors

Refer to the RL Line /Load Reactor User Manual for Detailed Specifications



Standard impedance values by calculation:	1.5%, 2, 3%, 4%, 5% available
Impedance basis	Reactor rated current, line voltage, frequency and inductance
Service Factor *(continuous)*	***Note: Select reactor based on rated current only***
Reactors rated 1 to 750 Amps	150% of rating
Reactors rated above 750 Amps	125% of rated minimum
Overload rating	200% of rated for 30 minutes
	300% of rated for 1 minute
Maximum system voltage	600 Volts (units with terminal blocks)
	690 Volts (units with box lugs or tab terminals)
Maximum switching frequency	20 KHz
Insulation system	Class N (**200°C** 392°F)
Temperature rise (*open or enclosed reactors*)	**135°C** 275°F (maximum)
Ambient temperature (*open or enclosed reactors*)	**45°C** 113°F (Full rated)
Altitude (*maximum*)	1000 meters
Fundamental frequency (*Line or Load*)	50/60 Hz
Approvals:	CE, UL-508, CSA C22.2
Inductance curve (*typical*)	100% at 100% current
	100% at 150% current
	50% at 350% current (minimum)
Inductance tolerance	+/- 10%
Impregnation:	High Bond Strength "Solvent-Less" Epoxy, 200° C
	UL94HB recognized
Dielectric Strength	3000 volts rms (4243 volts peak)
dV/dT Protection	Meets NEMA MG-1, part 31 (same as inverter duty motors)
AGENCY APPROVALS:	
UL-508	File E180243 Component Listed (1 amp – 2400 amps)
UL-508	File E180243 **UL Listed** NEMA 1 units (1 amp – 2400 amps)
Note: Short Circuit rating not required under Exception No.1 of UL508A SB4.2.1 effective 4/25/06	
CSA C22.2	File LR29753-13 CSA Certified (1 amp – 2400 amps)
Class N, 200° C	File E66214, Type 200-18, UL Recognized Insulation System
CE	Marked
MATERIAL:	
Core Steel:	Electrical grade high frequency silicon steel
Windings:	High dielectric withstand solid copper conductor (220° C)
Enclosures:	Sheet steel per UL and CSA requirements. Painted ANSI-61 Grey
Brackets:	ASTM structural steel or structural aluminum
Sheet Insulation:	DuPont Nomex 410 (220° C)
Epoxy:	Ripley Resin Type 468-2 (220° C)
CONSTRUCTION:	
CORE:	Electrical grade silicon steel magnetic laminations.
WINDINGS:	3000 volts rms dielectric strength (coil-to-coil & coil-to-core).
ASSEMBLY:	Windings are assembled onto EI laminations, secured in place & epoxy impregnated for minimum noise & maximum structural rigidity.
COLOR:	Royal Blue
TESTING:	Inductance, Hi-Pot 3000 Volts rms (5656 volts peak)

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The Global Power Quality Resource

StructuredGround™ Universal Ground Bar System

PANDUIT®

SPECIFICATION SHEET

specifications

Provide a field wiring terminal for the connection of an equipment grounding conductor in each control panel and enclosure. The terminal shall be UL 467 Listed or CSA 22.2 certified. The equipment grounding conductor shall have electrical continuity with the enclosure or sub-panel. The field wiring terminal may also provide multiple locations or ports for terminating equipment ground conductors from devices inside the panel or enclosure, functioning as the ground bar within the panel or enclosure. The ground bar shall provide a means to attach and to identify the main equipment grounding conductor.

PATENT PENDING

technical information

Performance level:	UL 467 Listed and CSA 22.2 Certified for grounding and bonding an equipment grounding conductor up to 2/0 AWG; meets UL 508A requirements
Main:	Provides a location for the main equipment grounding conductor using a compression or mechanical connector
Wire ports:	Accept bare stripped copper wire from #14 to #4 AWG Accept wire ferrules from #14 AWG to #6 AWG Top of ground bar accepts ring terminals, compression connectors or mechanical connectors with a ¼" stud hole size and maximum width of 0.55"
Materials:	Ground bars and bonding stand-offs precision machined from 110 electrolytic copper with a 99.9% copper content and then tin-plated for additional corrosion resistance
Packaging:	Each part is provided with all fasteners required for terminating wires and for each mounting option

key features and benefits

Flexible design	Works with all types of wire termination methods including stripped wire, ferrules, terminals, and compression or mechanical connectors; compatible with over 140 Panduit connectors
Multiple mounting options	In addition to surface mounting, two mounting stand-off options are available, one that bonds to the mounting surface and one that isolates from the mounting surface; both options provide additional finger wiring space in tight places
Unique geometry	The unique shape of the universal ground bar allows more surface contact between the wire connectors and the ground bar

applications

The StructuredGround™ Universal Ground Bar System (UGB) offers multiple termination methods and mounting options making it ideal for any control panel or enclosure application. The UGB enables the end user to choose the method in which to terminate conductors with connectors of their choice or simply cut and strip the wires. The UGB system will help reduce the types of ground bars that a panel shop or distributor needs to keep in stock to meet the various applications and customer requirements.

Universal Ground Bar System

6-port ground bar:	UGB2/0-414-6
12-port ground bar:	UGB2/0-414-12
18-port ground bar:	UGB2/0-414-18
Isolation standoffs:	UGB-IN-SO
Bonding standoffs:	UGB-B-SO

Recommended Connectors for Main Equipment Ground Conductor, Maximum 2/0 AWG

Copper Mechanical with Anti-Rotation

#14 – 2/0 AWG:	CLMAR2/0-14-Q

Two-Hole Copper Compression, 1/4" Stud Hole with 5/8" Spacing; #14 to 2/0 AWG

#14 – 10 AWG:	LCA10-14A-L
#8 AWG:	LCD8-14A-L
#6 AWG:	LCD6-14A-L
#4 AWG:	LCD4-14A-L
#2 AWG:	LCD2-14A-Q
#1 AWG:	LCD1-14A-E
1/0 AWG:	LCD1/0-14A-X
2/0 AWG:	LCD2/0-14A-X

One-Hole Copper Compression, 1/4" Stud Hole; #14 to 2/0 AWG

#14 – 10 AWG:	LCA10-14-L
#8 AWG:	LCAS8-14-L
#6 AWG:	LCAS6-14-L
#4 AWG:	LCAS4-14-L
#2 AWG:	LCAS2-14-Q
#1 AWG:	LCAS1-14-E
1/0 AWG:	LCAS1/0-14-X
2/0 AWG:	LCAS2/0-14-X

One and two-hole copper compression connectors available for both code and flex conductors, with narrow tongue and bent tongue configurations.

Recommended Connectors for Port Connections

Ring Terminals, ¼" Stud Hole, Maximum Width of 0.55"; #22 to #4 AWG

Ring terminals available with vinyl, nylon, KYNAR*, high-temp, or heavy duty insulation or non-insulated.

Compression Connectors, Maximum Width of 0.55"; up to #4 AWG Typical

Ferrules, Minimum Pin Depth of 12mm; #14 to #6 AWG

*KYNAR is a registered trademark of Atofina Chemicals, Inc.

Industrial Ethernet Switch - FL SWITCH SFNB 8TX - 2891002

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Ethernet switch, 8 TP RJ45 ports, automatic detection of data transmission speed of 10/100 Mbps (RJ45), autocrossing function

Your advantages

- Auto negotiation and autocrossing detection simplifies installation and setup
- Local diagnostic indicators with LEDs
- RJ45 ports support a transmission speed of 10/100 Mbps

RoHS

Key Commercial Data

Packing unit	1 pc
GTIN	4 046356 457170
GTIN	4046356457170
Weight per Piece (excluding packing)	400.000 g
Custom tariff number	85176200
Country of origin	Taiwan

Technical data

Note

Utilization restriction	EMC: class A product, see manufacturer's declaration in the download area

Dimensions

Width	50 mm
Height	110 mm
Depth	70 mm

Industrial Ethernet Switch - FL SWITCH SFNB 8TX - 2891002

Technical data

Ambient conditions

Degree of protection	IP20
Ambient temperature (operation)	-10 °C ... 60 °C
Ambient temperature (storage/transport)	-20 °C ... 85 °C
Permissible humidity (operation)	5 % ... 95 % (non-condensing)
Permissible humidity (storage/transport)	5 % ... 95 % (non-condensing)
Air pressure (operation)	86 kPa ... 108 kPa (up to 1500 m above sea level)

Interfaces

Interface	Ethernet (RJ45)
No. of ports	8 (RJ45 ports)
Note on the connection method	Auto negotiation and autocrossing
Transmission physics	Ethernet in RJ45 twisted pair
Transmission speed	10/100 Mbps

Function

Basic functions	Unmanaged switch / auto negotiation, complies with IEEE 802.3, store and forward switching mode
Additional functions	Autonegotiation
Status and diagnostic indicators	LEDs: U_S, link and activity per port

Network expansion parameters

Cascading depth	Network, linear, and star structure: any
Maximum conductor length (twisted pair)	100 m

Supply voltage

Supply voltage	24 V DC
Residual ripple	3.6 V_{PP} (within the permitted voltage range)
Supply voltage range	9 V DC ... 32 V DC
Typical current consumption	140 mA (at U_S = 24 V DC)
Max. current consumption	380 mA (@9 V DC)

General

Mounting type	DIN rail
Type AX	Block design
Net weight	385 g
Housing material	Aluminum

Standards and Regulations

Electromagnetic compatibility	Conformance with EMC Directive 2004/108/EC
Noise emission	EN 61000-6-4
Noise immunity	EN 61000-6-2:2005

Industrial Ethernet Switch - FL SWITCH SFNB 8TX - 2891002

Technical data

Standards and Regulations

UL, USA/Canada	Class I, Div. 2, Groups A, B, C, D

Environmental Product Compliance

	Lead 7439-92-1
China RoHS	Environmentally Friendly Use Period = 10;
	For details about hazardous substances go to tab “Downloads”, Category “Manufacturer's declaration”

Power supply unit - UNO-PS/1AC/24DC/ 60W - 2902992

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Primary-switched UNO POWER power supply for DIN rail mounting, input: 1-phase, output: 24 V DC/60 W

Product Description

UNO POWER power supplies with basic functionality
Thanks to their high power density, compact UNO POWER power supplies are the ideal solution for loads up to 240 W, particularly in compact control boxes. The power supply units are available in various performance classes and overall widths. Their high degree of efficiency and low idling losses ensure a high level of energy efficiency.

Why buy this product

- Flexible mounting by simply snapping onto the DIN rail
- More space in the control cabinet with up to 20 % higher power density
- Maximum energy efficiency, thanks to over 90 % efficiency and extremely low idling losses under 0.3 W
- Outdoor installation, thanks to the wide temperature range from -25°C to +70°C

RoHS

Key Commercial Data

Packing unit	1 STK
GTIN	4 046356 729208
GTIN	4046356729208
Weight per Piece (excluding packing)	240.000 g
Custom tariff number	85044030
Country of origin	Poland

Technical data

Dimensions

Width	35 mm
Height	90 mm

Power supply unit - UNO-PS/1AC/24DC/ 60W - 2902992

Technical data

Dimensions

Depth	84 mm

Ambient conditions

Degree of protection	IP20
Ambient temperature (operation)	-25 °C ... 70 °C (> 55 °C Derating: 2.5 %/K)
Ambient temperature (start-up type tested)	-40 °C
Ambient temperature (storage/transport)	-40 °C ... 85 °C
Max. permissible relative humidity (operation)	≤ 95 % (at 25 °C, non-condensing)
Climatic class	3K3 (in acc. with EN 60721)
Degree of pollution	2

Input data

Nominal input voltage range	100 V AC ... 240 V AC
Input voltage range	85 V AC ... 264 V AC
Current consumption	1.3 A (100 V AC)
	0.6 A (240 V AC)
Nominal power consumption	135.5 VA
Inrush surge current	< 30 A (typical)
Mains buffering	> 20 ms (120 V AC)
	> 85 ms (230 V AC)
Input fuse	2.5 A (slow-blow, internal)
Choice of suitable circuit breakers	6 A ... 16 A (Characteristics B, C, D, K)
Power factor (cos phi)	0.49
Type of protection	Transient surge protection
Protective circuit/component	Varistor

Output data

Nominal output voltage	24 V DC ±1 %
Nominal output current (I_N)	2.5 A (-25 °C ... 55 °C)
Derating	55 °C ... 70 °C (2.5%/K)
Connection in parallel	Yes, for redundancy and increased capacity
Connection in series	yes
Feedback resistance	< 35 V DC
Protection against surge voltage on the output	≤ 35 V DC
Control deviation	< 1 % (change in load, static 10 % ... 90 %)
	< 2 % (Dynamic load change 10 % ... 90 %, 10 Hz)
	< 0.1 % (change in input voltage ±10 %)
Residual ripple	< 30 mV_{PP} (with nominal values)
Output power	60 W

Power supply unit - UNO-PS/1AC/24DC/ 60W - 2902992

Technical data

Output data

Typical response time	< 1 s
Maximum power dissipation in no-load condition	< 0.3 W
Power loss nominal load max.	< 7 W

General

Net weight	0.2 kg
Efficiency	typ. 88 % (120 V AC)
	typ. 90 % (230 V AC)
Insulation voltage input/output	4 kV AC (type test)
	3 kV AC (routine test)
Protection class	II (in closed control cabinet)
Degree of protection	IP20
MTBF (IEC 61709, SN 29500)	> 785000 h (40 °C)
Mounting position	horizontal DIN rail NS 35, EN 60715
Assembly instructions	alignable: 0 mm horizontally, 30 mm vertically

Connection data, input

Connection method	Screw connection
Conductor cross section solid min.	0.2 mm²
Conductor cross section solid max.	2.5 mm²
Conductor cross section flexible min.	0.2 mm²
Conductor cross section flexible max.	2.5 mm²
Conductor cross section AWG min.	24
Conductor cross section AWG max.	14
Stripping length	8 mm
Screw thread	M3

Connection data, output

Connection method	Screw connection
Conductor cross section solid min.	0.2 mm²
Conductor cross section solid max.	2.5 mm²
Conductor cross section flexible min.	0.2 mm²
Conductor cross section flexible max.	2.5 mm²
Conductor cross section AWG min.	24
Conductor cross section AWG max.	14
Stripping length	8 mm
Screw thread	M3

Standards and Regulations

Power supply unit - UNO-PS/1AC/24DC/ 60W - 2902992

Technical data

Standards and Regulations

Electromagnetic compatibility	Conformance with EMC Directive 2014/30/EU
Noise immunity	EN 61000-6-2:2005
Connection in acc. with standard	CUL
Standards/regulations	EN 61000-4-2
Contact discharge	4 kV (Test Level 2)
Standards/regulations	EN 61000-4-3
Frequency range	80 MHz ... 1 GHz
Test field strength	10 V/m
Frequency range	1.4 GHz ... 2 GHz
Test field strength	3 V/m
Standards/regulations	EN 61000-4-4
Comments	Criterion B
Standards/regulations	EN 61000-4-5
	EN 61000-6-3
	EN 61000-4-6
Frequency range	10 kHz ... 80 MHz
Voltage	10 V (Test Level 3)
Standards/regulations	EN 61000-4-11
Low Voltage Directive	Conformance with LV directive 2006/95/EC
Standard - Safety of transformers	EN 61558-2-16
Standard - Electrical safety	IEC 60950-1/VDE 0805 (SELV)
Standard – Electronic equipment for use in electrical power installations and their assembly into electrical power installations	EN 50178/VDE 0160 (PELV)
Standard – Safety extra-low voltage	IEC 60950-1 (SELV) and EN 60204-1 (PELV)
Standard - Safe isolation	DIN VDE 0100-410
Standard – Limitation of mains harmonic currents	EN 61000-3-2
UL approvals	UL/C-UL listed UL 508
	UL/C-UL Recognized UL 60950-1
	NEC Class 2 as per UL 1310
	UL/C-UL Listed ANSI/ISA-12.12.01 Class I, Division 2, Groups A, B, C, D T4A (Hazardous Location)
Shock	18 ms, 30g, in each space direction (according to IEC 60068-2-27)
Vibration (operation)	< 15 Hz, amplitude ±2.5 mm (according to IEC 60068-2-6)
	15 Hz ... 150 Hz, 2.3g, 90 min.
Approval - requirement of the semiconductor industry with regard to mains voltage dips	EN 61000-4-11
Information technology equipment - safety (CB scheme)	CB Scheme

Environmental Product Compliance

Feed-through terminal block - UT 4 - 3044102

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Feed-through terminal block, Connection method: Screw connection, Cross section: 0.14 mm² - 6 mm², AWG: 26 - 10, Width: 6.2 mm, Color: gray, Mounting type: NS 35/7,5, NS 35/15

Product Features

- The large wiring space enables the connection of solid and stranded conductors without ferrules, even above the nominal cross section
- Tested for railway applications
- As well as saving space, the compact design enables user-friendly wiring in a small amount of space
- The multi-conductor connection offers maximum flexibility and wiring density
- Optimum screwdriver guidance through closed screw shafts
- The cable entry funnel enables the use of conductors with ferrules and plastic collars within the nominal cross section

Key commercial data

Packing unit	1 pc
Weight per Piece (excluding packing)	9.46 GRM
Custom tariff number	85369010
Country of origin	Germany

Classifications

eCl@ss

eCl@ss 4.0	27141120
eCl@ss 4.1	27141120
eCl@ss 5.0	27141120
eCl@ss 5.1	27141120
eCl@ss 6.0	27141120
eCl@ss 7.0	27141120
eCl@ss 8.0	27141120

End cover - D-UT 2,5/10 - 3047028

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End cover, Length: 47.7 mm, Width: 2.2 mm, Height: 48.4 mm, Color: gray

Key commercial data

Packing unit	1 pc
Minimum order quantity	50 pc
Weight per Piece (excluding packing)	2.4 GRM
Custom tariff number	85389099
Country of origin	Germany

Classifications

eCl@ss

eCl@ss 4.0	27141111
eCl@ss 4.1	27141111
eCl@ss 5.0	27141133
eCl@ss 5.1	27141133
eCl@ss 6.0	27141133
eCl@ss 7.0	27141133
eCl@ss 8.0	27141133

ETIM

ETIM 2.0	EC000886
ETIM 3.0	EC000886
ETIM 4.0	EC000886
ETIM 5.0	EC000886

UNSPSC

UNSPSC 6.01	30211827
UNSPSC 7.0901	39121424
UNSPSC 11	39121424

End clamp - E/NS 35 N - 0800886

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End clamp, width: 9.5 mm, color: gray

Product Features

- Large-surface labeling

Key commercial data

Packing unit	1 pc
GTIN	4 017918 129309
Weight per Piece (excluding packing)	14.8 GRM
Custom tariff number	39269097
Country of origin	Germany

Classifications

eCl@ss

eCl@ss 4.0	27141199
eCl@ss 4.1	27141199
eCl@ss 5.0	27141135
eCl@ss 5.1	27141145
eCl@ss 6.0	27141135
eCl@ss 7.0	27141135
eCl@ss 8.0	27141135

ETIM

ETIM 2.0	EC000761
ETIM 3.0	EC001041
ETIM 4.0	EC001041
ETIM 5.0	EC001041

Single Phase 120VAC & 240VAC Transient Voltage Filters

RCS

Specifications

Electrical

Input Voltage: Up to 240VAC, 1Ø, 50/60Hz.
Capacitance: 0.47 microfarads, ±10%
Resistance: 22 to 680 ohms, ±10%, 0.5 watt
Varistors:

Voltage Code	Max. Allowable AC Voltage	Max. Clamping Voltage	Energy (Joules)
1	130VAC	340V @ 10A	10
2	130VAC	340V @ 10A	10
3	250VAC	650V @ 10A	17
7	150VAC	395V @ 25A	25

Power Consumption: 10VA @ 240VAC

Physical

Termination: #18 Stranded Wire Leads or #20 Solid Wire Leads
Packaging: Epoxy Filled
Weight: 1 Oz.

Ambient Temperatures

Operating: -40°C to 85°C
Storage: -40°C to 85°C

Ordering Information

RC S 1 A - 6

R-K Model

Arrangement
S - Single Phase

Voltage Series
1 - 120VAC Nom.
130VAC Max. with Varistor
2 - 240VAC Nom.
130VAC Max. with Varistor
3 - 240VAC Nom.
250VAC Max. with Varistor
7 - 150VAC Nom.
150VAC Max. with Varistor

Resistors
A - 220 Ohms
B - 22 Ohms
C - 33 Ohms
D - 47 Ohms
E - 68 Ohms
F - 82 Ohms
G - 100 Ohms
H - 150 Ohms
J - 180 Ohms
K - 330 Ohms
L - 470 Ohms
M - 680 Ohms
18 - 18 Ohms
Z - No Resistor

Varistor Option
V - Varistor (May change AC voltage)

Lead Length
6 - 6 Inches
__ - Specify Lead Length
SW - Solid Wire

DIN Rail Bracket #DRB-1

- **120 & 240 Volt Ratings**
- **Single Phase (1Ø) Applications**
- **Varistor Options**
- **Stranded Wire or Solid Wire Leads**

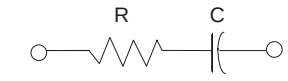
E71902
STANDARD 508

LR43414

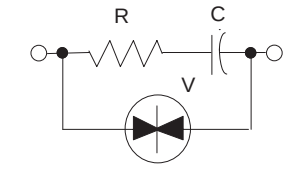
Operation

Transient Voltage Filters
R-C networks (Resistance-Capacitance) are applied to circuits where transient electrical voltages can cause a malfunction or damage in solid state controls or control systems (PLCs, CNCs, NCs, Solid State Counters, etc.) The RCSs are typically applied in parallel with single phase inductive loads (motor starter coils, contactor coils, solenoid valves, etc.) to absorb the transients generated when the load is de-energized.

Connections

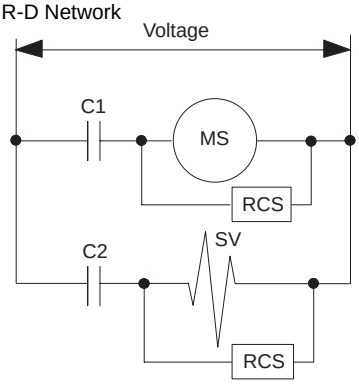


Without Varistor

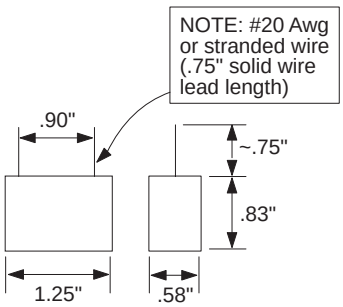


With Varistor

Hook-Up Example
MS = Motor Starter
C1 = Contact
RCS = R-D Network
SV = Solenoid Valve
C2 = Contact



Dimensions



HydroRanger 200

Overview

HydroRanger 200 is an ultrasonic level controller for up to six pumps and provides control, differential control and open channel flow monitoring.

Benefits

- Monitors wet wells, weirs and flumes
- Digital communications with built-in Modbus RTU via RS-485
- Compatible with SmartLinx system and SIMATIC PDM configuration software
- Single or dual point level monitoring
- 6 relay (standard), 1 or 3 relay (optional)
- Auto False-Echo Suppression for fixed obstruction avoidance
- Anti-grease ring/tide mark buildup
- Differential amplifier transceiver for common mode noise rejection and improved signal-to-noise ratio
- Wall and panel mounting options

Application

For water authorities, municipal water, and wastewater plants, HydroRanger 200 is an economical, low-maintenance solution delivering control efficiency and productivity needed to meet today's exacting standards. It offers single point monitoring with all models, and optional dual-point monitoring with 6 relay model. As well, it has digital communications with built-in Modbus RTU via RS-485.

The standard 6 relay HydroRanger 200 will monitor open channel flow and features more advanced relay alarming and pump control functions as well as volume conversion. It is compatible with SIMATIC PDM, allowing for PC configuration and setup. Sonic Intelligence® advanced echo-processing software provides increased reading reliability. The optional 1 or 3 relay models provide accurate level measurement functions only; these two models do not provide open channel flow, differential level measurement or volume conversion functions.

HydroRanger 200 uses proven continuous ultrasonic echo ranging technology to monitor water and wastewater of any consistency up to 15 m (50 ft) in depth. Achievable resolution is 0.1 % with accuracy to 0.25 % of range. Unlike contacting devices, HydroRanger 200 is immune to problems caused by suspended solids, harsh corrosives, grease or silt in the effluent, reducing downtime.

- Key Applications: wet wells, flumes/weirs, bar screen control

Technical specifications

Mode of Operation	
Measuring principle	Ultrasonic level measurement
Measuring range	0.3 ... 15 m (1 ... 50 ft), transducer dependent
Measuring points	1 or 2
Input	
Analog	0 ... 20 mA or 4 ... 20 mA, from alternate device, scaleable (6 relay model)
Discrete	10 ... 50 V DC switching level Logical 0 = < 0.5 V DC Logical 1 = 10 ... 50 V DC Max. 3 mA
Output	
Echomax® Transducer	44 kHz
Ultrasonic transducer	Compatible transducers: ST-H and Echomax series XPS-10/10F, XPS 15/15F, XCT-8, XCT-12 and XRS-5
Relays[1)]	Rating 5 A at 250 V AC, non-inductive
• Model with 1 relay[2)]	1 SPST Form A
• Model with 3 relays[2)]	2 SPST Form A/1 SPDT Form C
• Model with 6 relays	4 SPST Form A/2 SPDT Form C
mA output	0 ... 20 mA or 4 ... 20 mA
• Max. load	750 Ω, isolated
• Resolution	0.1 % of range
Accuracy	
Error in measurement	0.25 % of range or 6 mm (0.24"), whichever is greater
Resolution	0.1 % of measuring range or 2 mm (0.08"), whichever is greater[3)]
Temperature compensation	• -50 ... +150 °C (-58 ... +302 °F) • Integral temperature sensor in transducer • External TS-3 temperature sensor (optional) • Programmable fixed temperature values
Rated operating conditions	
Installation conditions	
• Location	Indoor / outdoor
• Installation category	II
• Pollution degree	4
Ambient conditions	
• Ambient temperature (enclosure)	-20 ... +50 °C (-4 ... +122 °F)
Design	
Weight	
• Wall mount	1.37 kg (3.02 lbs)
• Panel mount	1.50 kg (3.31 lbs)
Material (enclosure)	Polycarbonate
Degree of protection (enclosure)	
• Wall mount	IP65/Type 4X/NEMA 4X
• Panel mount	IP54/Type 3/NEMA 3

Cable	
• Transducer and mA output signal	2-core copper conductor, twisted, shielded, 300 Vrms, 0.82 mm² (18 AWG), Belden® 8760 or equivalent is acceptable
• Max. separation between transducer and transceiver	365 m (1200 ft)
Displays and controls	100 x 40 mm (4 x 1.5") multi-block LCD with backlighting
Programming	Programming using handheld programmer or via PC with SIMATIC PDM software
Power supply[4]	
AC version	100 ... 230 V AC ±15 %, 50/60 Hz, 36 VA (17 W)
DC version	12 ... 30 V DC (20 W)
Certificates and approvals	• CE, C-TICK[5] • Lloyd's Register of Shipping • ABS Type Approval • FM, $CSA_{US/C}$, UL listed • $CSA_{US/C}$ Class I, Div. 2, Groups A, B, C and D, Class II, Div. 2, Groups F and G, Class III (wall mount only) • MCERTS Class 1 approved for Open Channel Flow
Communication	• RS-232 with Modbus RTU or ASCII via RJ-11 connector • RS-485 with Modbus RTU or ASCII via terminal blocks • Optional: SmartLinx® cards for - PROFIBUS DP - DeviceNet™ - Allen-Bradley® Remote I/O

1) All relays certified for use with equipment that fails in a state at or under the rated maximums of the relays
2) This model is level control only; no open channel flow, differential level or volume conversion functions
3) Program range is defined as the empty distance to the face of the transducer plus any range extension
4) Maximum power consumption is listed
5) EMC performance available upon request

HydroRanger 200

Selection and Ordering data		Order No.
Siemens HydroRanger 200 Ultrasonic level controller for up to six pumps that provides control, differential control and open channel flow monitoring. The HydroRanger 200 is also available as a level measurement controller only. Select option from model code below.	L	7ML5034-
Mounting		
Wall mount, standard enclosure		1
Wall mount, 4 entries, 4 M20 cable glands included		2
Panel mount[1]		3
Power supply		
100 ... 230 V AC		A
12 ... 30 V DC		B
Number of measurement points		
Single point model, 6 relays		A
Dual point model, 6 relays		B
Single point model, level only, 1 relay[2]		C
Single point model, level only, 3 relays[2]		D
Communication (SmartLinx)		
Without module		0
SmartLinx® Allen-Bradley® Remote I/O module		1
SmartLinx PROFIBUS DP module		2
SmartLinx DeviceNet™ module See SmartLinx product page 5/310 for more information.		3
Approvals		
General Purpose CE, FM, CSA$_{US/C}$, UL listed, C-TICK		1
CSA Class I, Div. 2, Groups A, B, C and D; Class II, Div 2, Groups F and G; Class III (for wall mount applications only)		2

1) Available with approval option 1 only
2) This model is level control only; no open channel flow, differential level, or volume conversion functions

L) Subject to export regulations AL: N, ECCN: 3A991X

®Modbus is a registered trademark of Schneider Electric.

®Belden is a registered trademark of Belden Wire and Cable Company.

®Allen-Bradley is a registered trademark of Rockwell Automation.

™DeviceNet is a trademark of Open DeviceNet Vendor Association (ODVA)

Selection and Ordering data		Order code
Further designs		
Please add "**-Z**" to Order No. and specify Order code(s).		
Stainless steel tag [69 x 50 mm (2.71 x 1.97")]: Measuring-point number/identification (max. 16 characters) specify in plain text		**Y15**
Operating Instructions		Order No.
English	C)	**7ML1998-5FC03**
French	C)	**7ML1998-5FC11**
German	C)	**7ML1998-5FC32**
Note: The Operating Instructions should be ordered as a separate item on the order. This device is shipped with the Siemens Milltronics manual CD containing the complete ATEX Quick Start and Operating Instructions library.		
Other Operating Instructions		
SmartLinx Allen-Bradley Remote I/O, English	C)	**7ML1998-1AP03**
SmartLinx PROFIBUS DP, English	C)	**7ML1998-1AQ03**
SmartLinx PROFIBUS DP, German	C)	**7ML1998-1AQ33**
SmartLinx PROFIBUS DP, French	C)	**7ML1998-1AQ12**
SmartLinx DeviceNet, English Note: The appropriate SmartLinx Operating Instructions should be ordered as a separate line on the order.	C)	**7ML1998-1BH02**
Accessories		
Handheld programmer		**A5E36563512**
Tag, stainless steel, 12 x 45 mm (0.47 x 1.77"), one text line, suitable for enclosure		**7ML1930-1AC**
SITRANS RD100 Remote display - see Chapter 8		
SITRANS RD200 Remote display - see Chapter 8		
SITRANS RD500 Remote display - see Chapter 8		
Spare parts		
Power Supply Board (100 ... 230 V AC)	C)	**7ML1830-1MD**
Power Supply Board (12 ... 30 V DC)	C)	**7ML1830-1ME**
Display Board	C)	**7ML1830-1MF**

C) Subject to export regulations AL: N, ECCN: EAR99

Selection and Ordering data		Order No.
Milltronics HydroRanger 200 Ultrasonic level controller for up to six pumps that provides control, differential control and open channel flow monitoring. The HydroRanger 200 is also available as a level measurement controller only. Select option from model code below.	L)	**7ML1034-**
Mounting		
Wall mount, standard enclosure		**1**
Wall mount, 4 entries, 4 M20 cable glands included		**2**
Panel mount[1]		**3**
Power supply		
100 ... 230 V AC		**A**
12 ... 30 V DC		**B**
Communication (SmartLinx)		
Without module		**A**
SmartLinx® Allen-Bradley® Remote I/O module		**B**
SmartLinx PROFIBUS DP module		**C**
SmartLinx DeviceNet™ module See SmartLinx product page 5/310 for more information.		**D**
Approvals		
General Purpose CE, FM, CSA$_{US/C}$, UL listed, C-TICK		**1**
CSA Class I, Div. 2, Groups A, B, C and D; Class II, Div 2, Groups F and G; Class III (for wall mount applications only)		**2**
Number of measurement points		
Single point model, 6 relays		**1**
Dual point model, 6 relays		**2**
Single point model, level only, 1 relay[2]		**3**
Single point model, level only, 3 relays[2]		**4**

[1] Available with approval option 1 only
[2] This model is level control only; no open channel flow, differential level, or volume conversion functions

L) Subject to export regulations AL: N, ECCN: 3A991X

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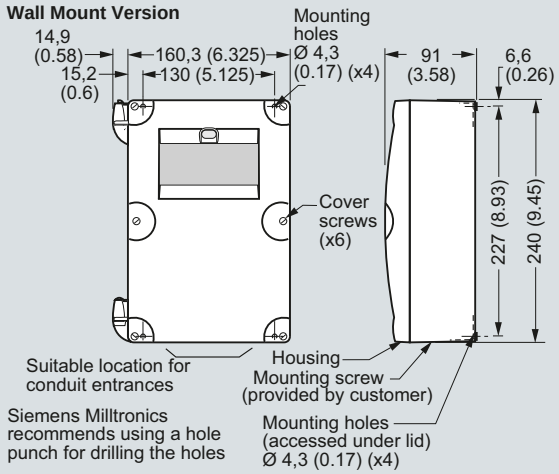
™DeviceNet is a trademark of Open DeviceNet Vendor Association (ODVA)

Selection and Ordering data		Order code
Further designs		
Please add "**-Z**" to Order No. and specify Order code(s).		
Stainless steel tag [69 x 50 mm (2.71 x 1.97")]: Measuring-point number/identification (max. 16 characters) specify in plain text		**Y15**
Operating Instructions		Order No.
English	C)	**7ML1998-1FC05**
French	C)	**7ML1998-1FC14**
German Note: The Operating Instructions should be ordered as a separate item on the order. This device is shipped with the Siemens Milltronics manual CD containing the complete ATEX Quick Start and Operating Instructions library.	C)	**7ML1998-1FC34**
Other Operating Instructions		
SmartLinx Allen-Bradley Remote I/O, English	C)	**7ML1998-1AP03**
SmartLinx PROFIBUS DP, English	C)	**7ML1998-1AQ03**
SmartLinx PROFIBUS DP, German	C)	**7ML1998-1AQ33**
SmartLinx PROFIBUS DP, French	C)	**7ML1998-1AQ12**
SmartLinx DeviceNet, English Note: The appropriate SmartLinx Operating Instructions should be ordered as a separate line on the order.	C)	**7ML1998-1BH02**
Accessories		
Handheld programmer		**7ML1830-2AM**
Tag, stainless steel, 12 x 45 mm (0.47 x 1.77"), one text line, suitable for enclosure		**7ML1930-1AC**
SITRANS RD100 Remote display - see Chapter 8		
SITRANS RD200 Remote display - see Chapter 8		
SITRANS RD500 Remote display - see Chapter 8		
Spare parts		
Power Supply Board (100 ... 230 V AC)	C)	**7ML1830-1MD**
Power Supply Board (12 ... 30 V DC)	C)	**7ML1830-1ME**
Display Board	C)	**7ML1830-1MF**

C) Subject to export regulations AL: N, ECCN: EAR99

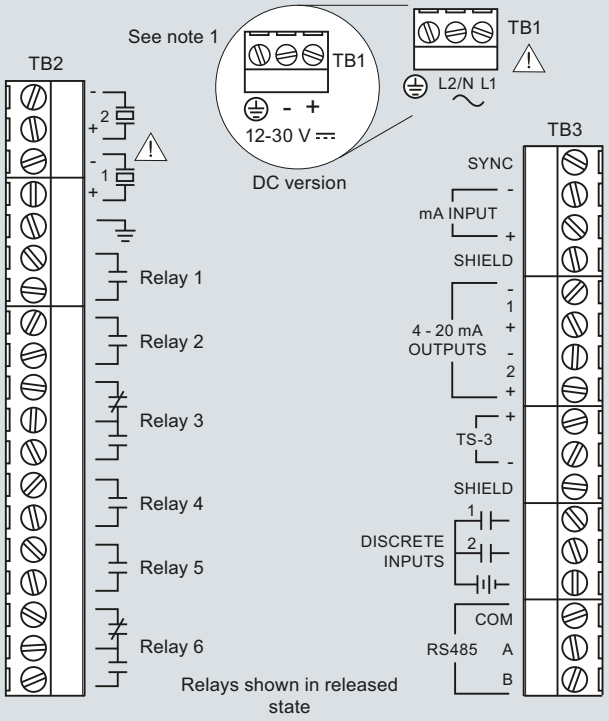
HydroRanger 200

Dimensional drawings



HydroRanger 200, dimensions in mm (inch)

Schematics



Note:

1. Use 2-core copper wire, twisted, with shield, for expansion up to 365 m (1200 ft). Route cable in grounded metal conduit, separate from other cables.
2. Verify that all system components are installed in accordance with instructions.
3. Connect all cable shields to the HydroRanger 200 Shield Connections. Avoid differential ground potentials by not connecting cable shields to ground (earth) anywhere else.
4. Keep exposed conductors on shielded cables as short as possible to reduce noise on the line caused by stray transmissions and noise pickup.

HydroRanger 200 connections

Echomax XPS and XCT

Overview

Echomax XPS/XCT transducers use ultrasonic technology to measure level in a wide range of liquids and solids.

Benefits

- Integral temperature compensation
- Low ringing effect reduces blanking distance
- Foam facing for dusty applications
- Self-cleaning and low-maintenance
- Connect using only 2 wires
- Chemically resistant
- FM approved versions available
- Hermetically sealed

Application

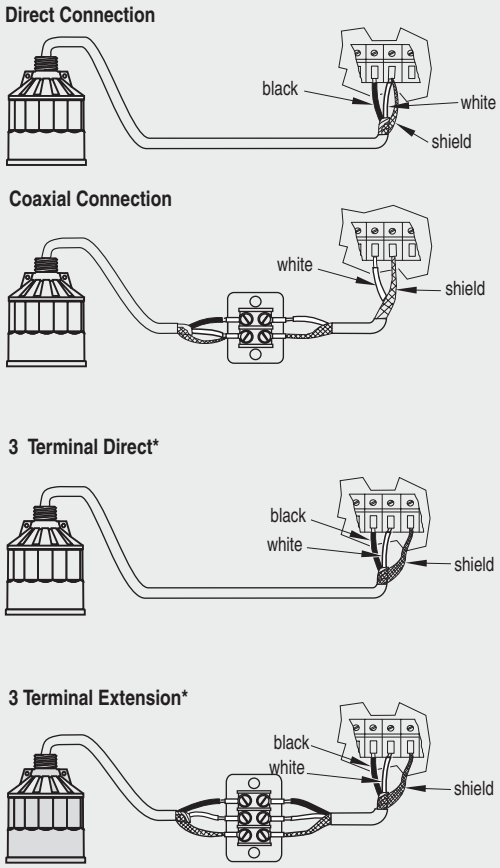
The transducers can be fully immersed, are resistant to steam and corrosive chemicals, and can be installed without flanges.

The XPS series offers versions for various measuring ranges up to 40 m (130 ft), and up to a max. temperature of 95 °C (203 °F). Two models have FM Class 1, Div. 1 approvals for applications with a measuring range up to 15 m (50 ft).

The XCT series can be used in applications at higher temperatures to measure level up to a distance of 12 m (40 ft) and at a max. temperature of 145 °C (293 °F).

During operation, the Echomax transducers emit acoustic pulses in a narrow beam. The level monitor measures the propagation time between pulse emission and its reflection (echo) to calculate the distance.

Schematics



* For SITRANS LUC500, MultiRanger 100/200, HydroRanger 200

Mounting
Make particularly sure that the radiating face of the transducer is protected from damage.
Mount the transducer so that it is above the maximum material level by at least the blanking value.
On liquid applications, the transducer must be mounted so that the axis of transmission is perpendicular to the liquid surface.
On solids applications, a Milltronics Easy Aimer should be used to facilitate aiming the transducer.
Consider the optional temperature sensor when mounting the transducer.

Interconnection
Do not route cable openly or near high voltage or current runs, contactors and SCR control drives.
For optimum isolation against electrical noise, run cable separately in a grounded metal conduit.
Seal all thread connections to prevent ingress of moisture.

XPS and XCT ultrasonic sensor connections

5

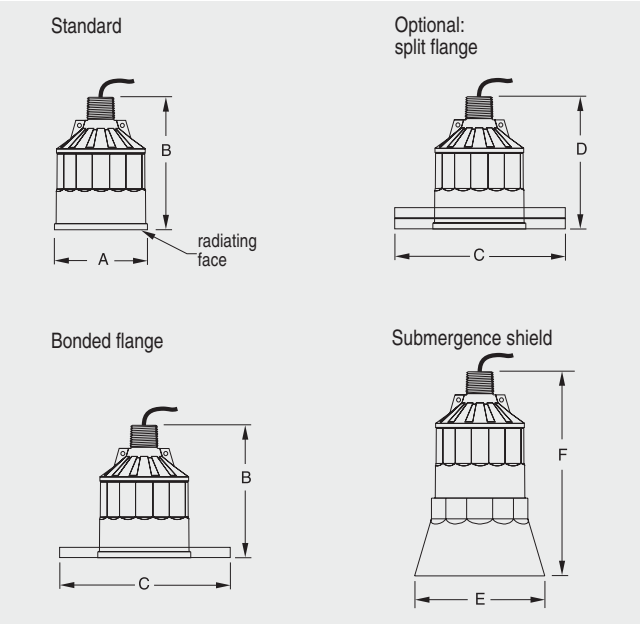
Technical specifications

Input	XPS-10 (standard and F models)	XPS-15 (standard and F models)	XPS-30	XPS-40	XCT-8 (standard and sanitary models)	XCT-12
Measuring range	0.3 to 10 m (1 to 33 ft)	Standard: 0.3 to 15 m (1 to 50 ft) F: 0.45 to 15 m (1.5 to 50 ft)	0.6 to 30 m (2 to 100 ft)	0.9 to 40 m (3 to 130 ft)	0.6 to 8 m (2 to 26 ft)	0.6 to 12 m (2 to 40 ft)
Output						
Frequency	44 kHz	44 kHz	30 kHz	22 kHz	44 kHz	44 kHz
Beam angle	12°	6°	6°	6°	12°	6°
Environmental						
Location	Indoors/outdoors					
Ambient temp.	-40 to +95 °C (-40 to 203 °F)				standard: -40 to +145 °C (-40 to 293 °F) sanitary: -40 to +125 °C (-40 to 260 °F)	-40 to +145 °C (-40 to 293 °F)
Pollution degree	4					
Pressure	8 bar (120 psi)	8 bar (120 psi)	0.5 bar (7.3 psi)	0.5 bar (7.3 psi)	4 bar (60 psi): -40 to 138 °C (-40 to 280 °F) 8 bar (120 psi): -40 to 95 °C (-40 to 203 °F	
Design						
Weight	0.8 kg (1.8 lbs)	1.3 kg (2.8 lbs) F: 2 kg (4.4 lbs)	4.3 kg (9.5 lbs)	8 kg (18 lbs)	0.8 kg (1.7 lbs)	1.3 kg (2.8 lbs)
Power supply	Operation of transducer only with approved Siemens Milltronics controllers					
Material	Standard, F: PVDF Option: PTFE face with flange	Standard, F: PVDF Option: PTFE face with flange	PVDF Option: PTFE face with flange	PVDF	Standard: PVDF Option: PTFE face with universal flange	
Color	Standard: blue F: gray	Standard: blue F: gray	blue	blue	white	
Process connection	Standard: 1" NPT or 1" BSP, F: 1" NPT	Standard: 1" NPT or 1" BSP, F: 1" NPT	1.5" universal thread (NPT or BSP)		1" NPT or 1" BSP	
Cable	2 wire twisted pair/braided and foil shielded 0.5 mm^2 (20 AWG) PVC jacket				2 wire twisted pair/braided and foil shielded 0.5 mm^2 (20 AWG) silicone jacket	
Separation	Max. 365 m (1200 ft)					
Certificates and approvals	Standard: CE, CSA, FM, ATEX II 2G F: FM Class I, Div 1, Group A, B, C and D, Class II Div 1, Group E, F and G, Class III	Standard: CE, CSA, FM, ATEX II 2G F: FM Class I, Div 1, Group A, B, C and D, Class II Div 1, Group E, F and G, Class III	CE, CSA, FM, ATEX II 2G 1D	CE, CSA, FM, ATEX II 2G 1D	Standard: CE, CSA, FM, ATEX II 2G Sanitary: CSA, 3A	CE, CSA, FM, ATEX II 2G

5

Echomax XPS and XCT

Dimensional drawings



XPS and XCT ultrasonic transducer dimensions

Version				
Dimen.	**XPS-10**	**XPS-15**	**XPS-30**	**XPS-40**
A	86 mm (3.386")	119 mm (4.685")	173 mm (6.811“)	206 mm (8.110")
B	122 mm (4.803")	132 mm (5.197")	198 mm (7.795")	229 mm (9.016")
C	According to ANSI, DIN and JIS			n/a
D	128 mm (5.039")	138 mm (5.433")	204 mm (8.031")	n/a
E	124 mm (4.882")	158 mm (6.220")	n/a	n/a
F	152 mm (5.984")	198 mm (7.795")	n/a	n/a

Version		
Dimen.	**XCT-8**	**XCT-12**
A	86 mm (3.386")	119 mm (4.685")
B	122 mm (4.803")	132 mm (5.197")
C	According to ANSI, DIN and JIS	
D	128 mm (5.039")	138 mm (5.433")
E	n/a	n/a
F	n/a	n/a

Continuous level measurement - Ultrasonic transducers

Echomax XPS and XCT

Selection and Ordering data		Order No.
Echomax® XPS-15F ultrasonic transducer High-frequency ultrasonic transducer designed for a wide variety of liquid and solid applications, for use with approved controllers. Includes integral temperature sensor. Measuring range: min. 0.3 m, max. 15 m	C)	**7ML1171-**
		0
Mounting thread and facing		
1" NPT [(Taper), ANSI/ASME B1.20.1]		**1**
Cable length		
5 m (16.40 ft)		**B**
10 m (32.81 ft)		**C**
30 m (98.43 ft)		**D**
50 m (164.04 ft)		**E**
100 m (328.08 ft)		**F**
Mounting flange, flush mount		
None		**A**
6" ASME, 150 lb, flat faced		**B**
8" ASME, 150 lb, flat faced (Note: Flange bolting patterns and facings dimensionally correspond to the applicable ASME B16.5, or EN 1092-1, or JIS B 2220 standard.)		**C**
Approvals		
FM Class I Div. 1		**1**

C) Subject to export regulations AL: N, ECCN: EAR99

Selection and Ordering data	Order code
Further designs	
Please add "**-Z**" to Order No. and specify Order code(s). Acrylic coated, stainless steel tag [13 x 45 mm Stainless steel tag [69 x 50 mm (2.71 x 1.97")]: Measuring-point number/identification (max. 16 characters) specify in plain text	**Y15**

Operating Instructions		Order No.
Quick Start guide, multi-language	C)	**7ML1998-1DU01**
Applications Guidelines, multi-language Note: The Applications Guidelines should be ordered as a separate line item on the order.	C)	**7ML1998-5HV61**
This device is shipped with the Siemens Milltronics manual CD containing the complete ATEX Quick Start and Operating Instructions library.		

Accessories	
Tag, stainless steel with hole, 12 x 45 mm (0.47 x 1.77"), one text line for fastening on sensors	**7ML1930-1BJ**
Submergence shield kit	**7ML1830-1BJ**
Universal box bracket, mounting kit	**7ML1830-1BK**
Channel bracket, wall mount	**7ML1830-1BL**
Extended channel bracket, wall mount	**7ML1830-1BM**
Channel bracket, floor mount	**7ML1830-1BN**
Extended channel bracket, floor mount	**7ML1830-1BP**
Bridge channel bracket, floor mount (see Mounting Brackets on page 5/180 for more information)	**7ML1830-1BQ**
1" NPT locknut, plastic	**7ML1830-1DS**
Easy Aimer 2, with ¾" x 1" NPT PVC coupling	**7ML1830-1AQ**
Easy Aimer 304 with stainless steel coupling	**7ML1830-1AU**

C) Subject to export regulations AL: N, ECCN: EAR99

Selection and Ordering data		Order No.
Echomax® XPS-30 ultrasonic transducer High-frequency ultrasonic transducer designed for a wide variety of liquid and solid applications, for use with approved controllers. Includes integral temperature sensor. 1½" universal thread compatible with 1½" NPT and R 1½" [(BSPT), EN 10226] Measuring range: min. 0.6 m (1.97 ft), max. 30 m (98.43 ft)	C)	**7ML1123-**
		0
Mounting thread and facing		
1½" universal thread		**0**
1½" universal thread, foam facing[1)]		**1**
1½" universal thread, PTFE facing[2)]		**2**
Cable length		
5 m (16.40 ft)		**B**
10 m (32.81 ft)		**C**
30 m (98.43 ft)		**E**
50 m (164.04 ft)		**F**
100 m (328.08 ft)		**K**
Mounting flange		
None		**A**
6" ASME, 150 lb, flat faced		**D**
8" ASME, 150 lb, flat faced		**E**
(Note: Flange bolting patterns and facings dimensionally correspond to the applicable ASME B16.5 or EN 1092-1, or JIS B 2220 standard.)		
Approvals		
ATEX II 2G 1D, FM Class I Div 2, SAA		**5**

1) Not available with flanged versions
2) Available with flanged versions only

C) Subject to export regulations AL: N, ECCN: EAR99

Selection and Ordering data	Order code
Further designs	
Please add "**-Z**" to Order No. and specify Order code(s).	
Acrylic coated, stainless steel tag [13 x 45 mm Stainless steel tag [69 x 50 mm (2.71 x 1.97")]: Measuring-point number/identification (max. 16 characters) specify in plain text	**Y15**

Operating Instructions		Order No.
Quick Start guide, multi-language	C)	**7ML1998-5QM82**
Applications Guidelines, multi-language Note: The Applications Guidelines should be ordered as a separate line item on the order.	C)	**7ML1998-5HV61**
This device is shipped with the Siemens Milltronics manual CD containing the complete ATEX Quick Start and Operating Instructions library.		

Accessories	
Tag, stainless steel with hole, 12 x 45 mm (0.47 x 1.77"), one text line for fastening on sensors	**7ML1930-1BJ**
1½" BSPT locknut, plastic	**7ML1830-1DP**
Easy Aimer 2, 1½" NPT galvanized coupling	**7ML1830-1AN**
Easy Aimer 2, 1½" NPT with stainless steel coupling	**7ML1830-1AT**
Easy Aimer 2, aluminum with M20 adapter and 1" and 1½" BSPT aluminum couplings	**7ML1830-1AX**
Easy Aimer 304, with M20 adapter and 1" and 1½" BSPT 304 SS couplings	**7ML1830-1GN**

C) Subject to export regulations AL: N, ECCN: EAR99

English

Echomax XPS/XCT Operation Manual

This manual outlines the essential features and functions of the Echomax XPS/XCT Series transducers. This manual, and the *Transducer Applictions Manual*, are also available on our website: www.siemens.com/processautomation. Printed copies are available from your local Siemens Milltronics representative.

Questions about the contents of this manual can be directed to:

Siemens Milltronics Process Instruments Inc.
1954 Technology Drive, P.O. Box 4225
Peterborough, Ontario, Canada, K9J 7B1
Email: techpubs.smpi@siemens.com

Safety Guidelines

Warning notices must be observed to ensure personal safety as well as that of others, and to protect the product and the connected equipment. These warning notices are accompanied by a clarification of the level of caution to be observed.

⚠ **WARNING: relates to a caution symbol on the product, and means that failure to observe the necessary precautions can result in death, serious injury, and/or considerable material damage.**

! **WARNING: means that failure to observe the necessary precautions can result in death, serious injury, and/or considerable material damage.**

CAUTION: means that failure to observe the necessary precautions can result in considerable material damage.

Note: means important information about the product or that part of the operating manual.

Unit Repair and Excluded Liability

- The user is responsible for all changes and repairs made to the device by the user or by the user's agent.
- All new components are to be provided by Siemens Milltronics Process Instruments Inc.
- Restrict repair to faulty components only.
- Do not reuse faulty components.

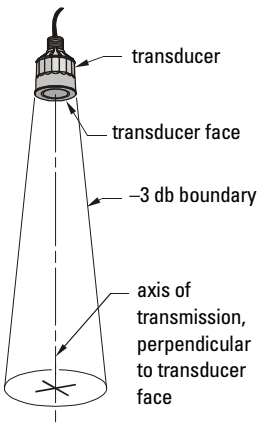
English

Introduction

The Echomax XPS/XCT series of transducers operate with Siemens Milltronics ultrasonic level monitoring products.

The transducer converts the electrical transmit pulse from the transceiver into acoustical energy. It then converts the acoustical energy of the echo back into electrical energy for the controller.

The transducer face emits acoustical energy radiating outward, decreasing in amplitude at a rate inversely proportional to the square of the distance. Maximum power radiates perpendicularly from the transducer face on the axis of transmission. Where power is reduced by half (– 3 dB), a conical boundary centered around the axis of transmission defines the sound beam, the diameter of which is the beam angle.



The XPS/XCT transducers have an integrated temperature sensor that reports the air temperature at the transducer to the controller.

General Guidelines

⚠ **WARNING:** Materials of construction are chosen based on their chemical compatibility (or inertness) for general purposes. For exposure to specific environments, check with chemical compatibility charts before installing.

XPS/XCT Series – Certificate SIRA 99ATEX5153X

This equipment may be used in hazardous areas associated with all gases with temperature classes T1, T2, T3 and T4 for the XPS series (XPS-10, XPS-15, XPS-30, and XPS-40) and T1, T2, and T3 for the XCT series (XCT-8 and XCT-12). The XPS series is only certified for use in ambient temperatures in the range of - 40 °C to 95 °C and the XCT series is only certified for use in ambient temperatures in the range of -40 °C to 145 °C. Neither should be used outside of their respective temperature ranges.

Installation shall be carried out in accordance with the applicable code of practice, and by suitably trained personnel.

These devices should only be supplied from a circuit containing a suitably-rated fuse that has a breaking capacity of 4000A. This fuse is included in Siemens Milltronics controllers.

Repair of this equipment shall be carried out in accordance with the applicable code of practice.

The certification of this equipment relies on the following materials used in their construction:

	XPS Series	XCT Series
Enclosure	Kynar® [1]710	Kynar® 710
Encapsulant	Stycast LA-9823-76	Durapot® 861-F3 & 864

1. Kynar® is a registered trademark of ELF Atochem.
Durapot® is a registered trademark of Cotronics Corporation.

For manual override, use the disconnect switch provided in the building installation of the associated controller.

XPS 30/40 Series – Certificate SIRA 01ATEX5153X

This equipment may be used in hazardous dust zones with all conductive and non-conductive dusts. The XPS-30 and XPS-40 type series transducers have a maximum surface temperature of 135 °C (275 °F) (Temperature Class T4). These units are certified for use in ambient range of -40 to 95 °C (-40 to 203 °F). The transducers should not be used outside this temperature range. The XPS-30 and XPS-40 ultrasonic transducers must be installed so the face of the transducer is not substantially subjected to light.

Installation shall be carried out in accordance with the applicable code of practice, and by suitably trained personnel. Repair of the equipment shall be carried out in accordance with the applicable code of practice and installation instructions.

These devices should only be supplied from a circuit containing a suitably rated fuse that has a breaking capacity of 4000A. This fuse is included in Siemens Milltronics controllers.

The certification of this equipment relies on the following materials used in their construction:

Enclosure:	Kynar® 710
Encapsulant:	Stycast LA-9823-76

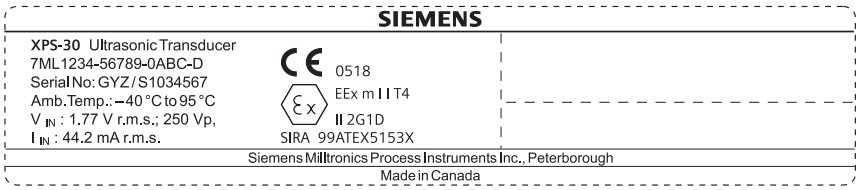
For manual override, use the disconnect switch provided in the building installation of the associated controller.

Product Marking

Note: Kynar® polyvinylidene flouride is resistant to attack from most chemicals under the described operating conditions. However, for exposure to specific environments, check with chemical compatibility charts prior to installation.

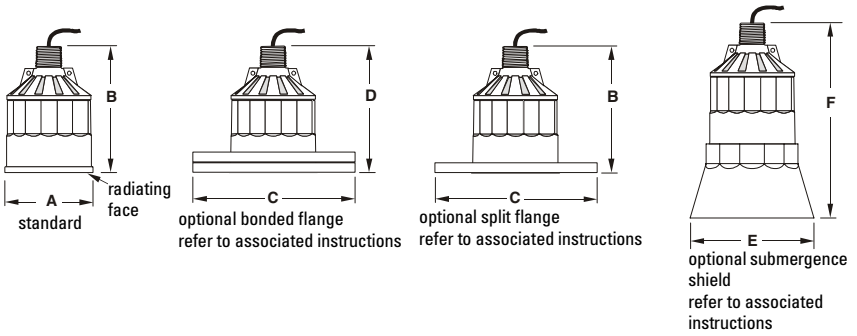
⚠ **WARNING:** This product is designated as a Pressure Accessory per Directive 97/23/EC and is <u>not</u> intended for use as a safety device.

XPS-30



English

Outline and Dimensions



Dimension	XPS 10	XPS-15	XPS-30	XPS-40	XCT-8	XCT-12
A	86 mm (3.4")	119 mm (4.7")	173 mm (6.8")	206 mm (8.1")	86 mm (3.4")	119 mm (4.7")
B	122 mm (4.8")	132 mm (5.2")	198 mm (7.8")	229 mm (9.0")	122 mm (4.8")	132 mm (5.2")
C	to suit ANSI, DIN and JIS standards					
D*	128 mm (5.0")	138 mm (5.4")	204 mm (8.0")	235 mm (9.2")	128 mm (5.0")	138 mm (5.4")
E	124 mm (4.9")	158 mm (6.2")	n / a	n / a	n / a	n / a
F	152 mm (6.0")	198 mm (7.8")	n / a	n / a	n / a	n / a

* nominal

WARNING: Optional Split Flange, Bonded Flange, and Easy Aimer configurations are not suitable for pressure applications.

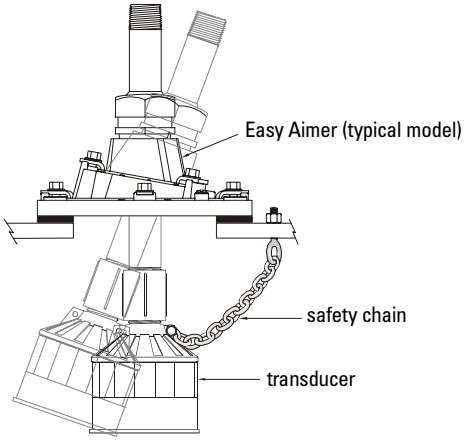
Mounting

WARNING: Special handling precautions must be taken to protect the face of the transducer from any damage.

- Mount the transducer so that it is above the maximum material level by at least the blanking value. Refer to the associated controller manual.
- On liquid applications, mount the transducer face parallel to the liquid surface. On solids applications, use a Siemens Milltronics Easy Aimer to help aim the transducer.
- Do not overtighten. Most applications require only hand tightening of the mounting hardware. Connect a safety chain from the transducer to a structural member to secure installation. Consider using the optional temperature sensor when a flanged transducer is used, when a fast temperature response is required, or in high temperature vessels.

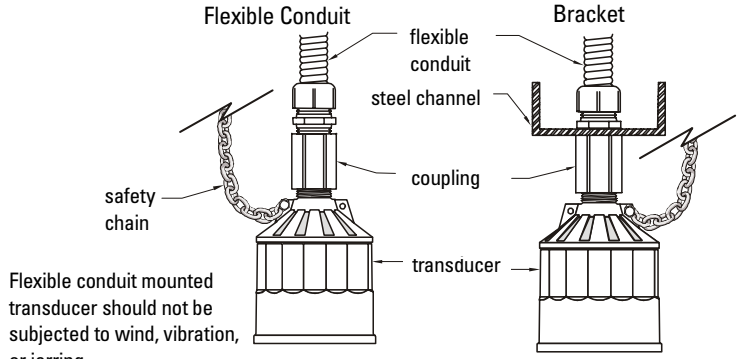
Note: For pressure tight applications, install transducers hand tight plus ½ turn to 1½ turns. PTFE tape or other appropriate sealant may be used to aid in sealing the threads for use in pressure applications.

Mounting – Solids Applications

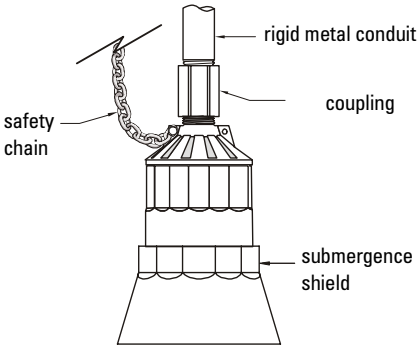


⚠ **WARNING:** Improper installation may result in loss of process pressure.

Mounting – Liquid Applications



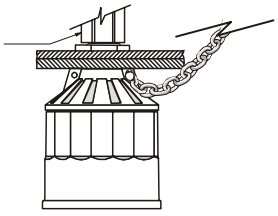
Flexible conduit mounted transducer should not be subjected to wind, vibration, or jarring.



Transducer with submergence shield, used in applications where flooding is possible.

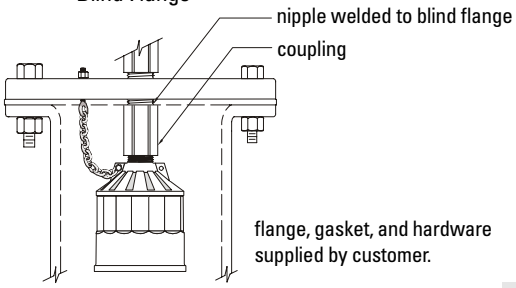
Plywood

Plywood mounting provides excellent isolation, but must be rigid enough to avoid flexing if subjected to loading.



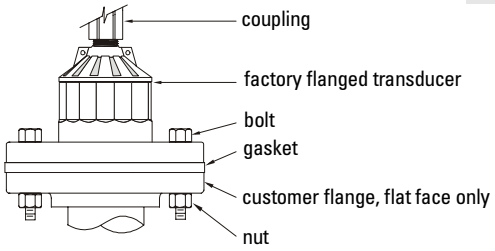
Mounting – Liquid Applications (cont'd)

Blind Flange



Note: Tighten the flange bolts evenly in order to ensure a good seal between the mating flanges. **Caution: Overtightening can cause performance degradation.**

Flanged



Customer flanged standpipe. If a metal flange must be welded to pipe, refer to Liquid Applications - Standpipes in the *Transducer Applications Manual*.

Installation

Note: Installation shall only be performed by qualified personnel and in accordance with local governing regulations.

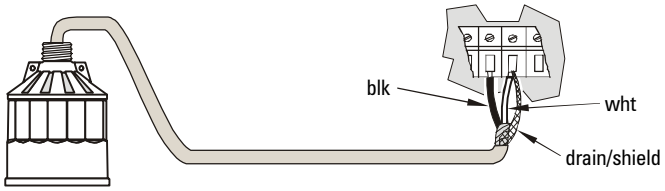
- Do not route cable openly. For optimum isolation against electrical noise, run cable separately in a grounded metal conduit. Seal all thread connections to prevent ingress of moisture.
- Do not run cable near high voltage or current runs, contactors, and SCR control drives. For pressure tight applications, install transducers hand tight plus ½ to 1½ turns.
- PTFE tape or other appropriate sealant may be used to aid in sealing the threads for use in pressure applications.

⚠ **WARNING:** Never attempt to loosen, remove, or disassemble process connection while vessel contents are under pressure.

Interconnection

Direct Connection

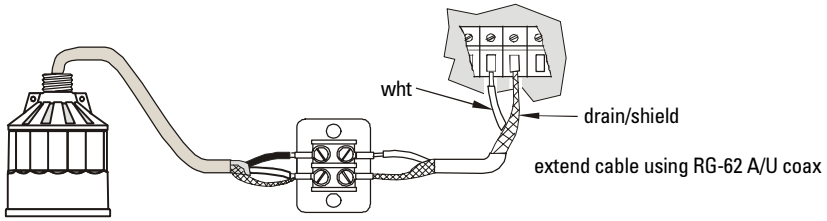
Connect the transducer directly to the Siemens Milltronics transceiver via the two conductor shielded cable.



Note: When connecting to an EnviroRanger ERS 500, a MultiRanger 100/200, or a HydroRanger 200, the white, black, and shield wires are all connected separately. DO NOT tie the white and shield wires together.

Coaxial Connection

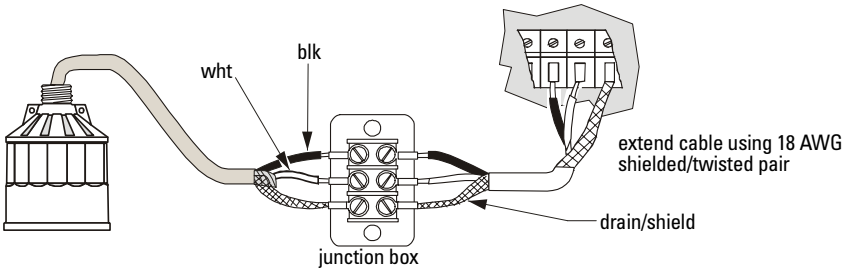
Connect the transducer to the Siemens Milltronics transceiver via a junction box and RG–62 A/U coaxial cable. This setup is effective for combined runs up to 365 m (1200 ft).



Note: When connecting to an EnviroRanger ERS 500, MultiRanger 100/200, and HydroRanger 200, do NOT use coaxial cable; see diagram below for proper procedure.

2-Wire Extension

(for EnviroRanger ERS 500, MultiRanger 100/200, and HydroRanger 200 only)



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INDUSTRIES, INC.

Transducer Installation Guidelines

Note: Installation shall only be performed by qualified personnel and in accordance with local governing regulations.

Mounting

Make particularly sure that the radiating face of the transducer is protected from damage.

Mount the transducer so that it is above the maximum water level by at least the blanking distance, which is 12 inches or at least 12 inches above the top of the channel.

The transducer must be mounted so that the vertical axis of the transducer is perpendicular to the liquid level surface.

Rigid mounting is preferred however, if a flexible conduit connection is used the transducer should not be subjected to wind, vibration or jarring.

DO NOT OVERTIGHTEN. Most applications require only hand tightening of the mounting hardware. Connect a safety chain from the transducer to a structural member to secure installation.

Interconnection

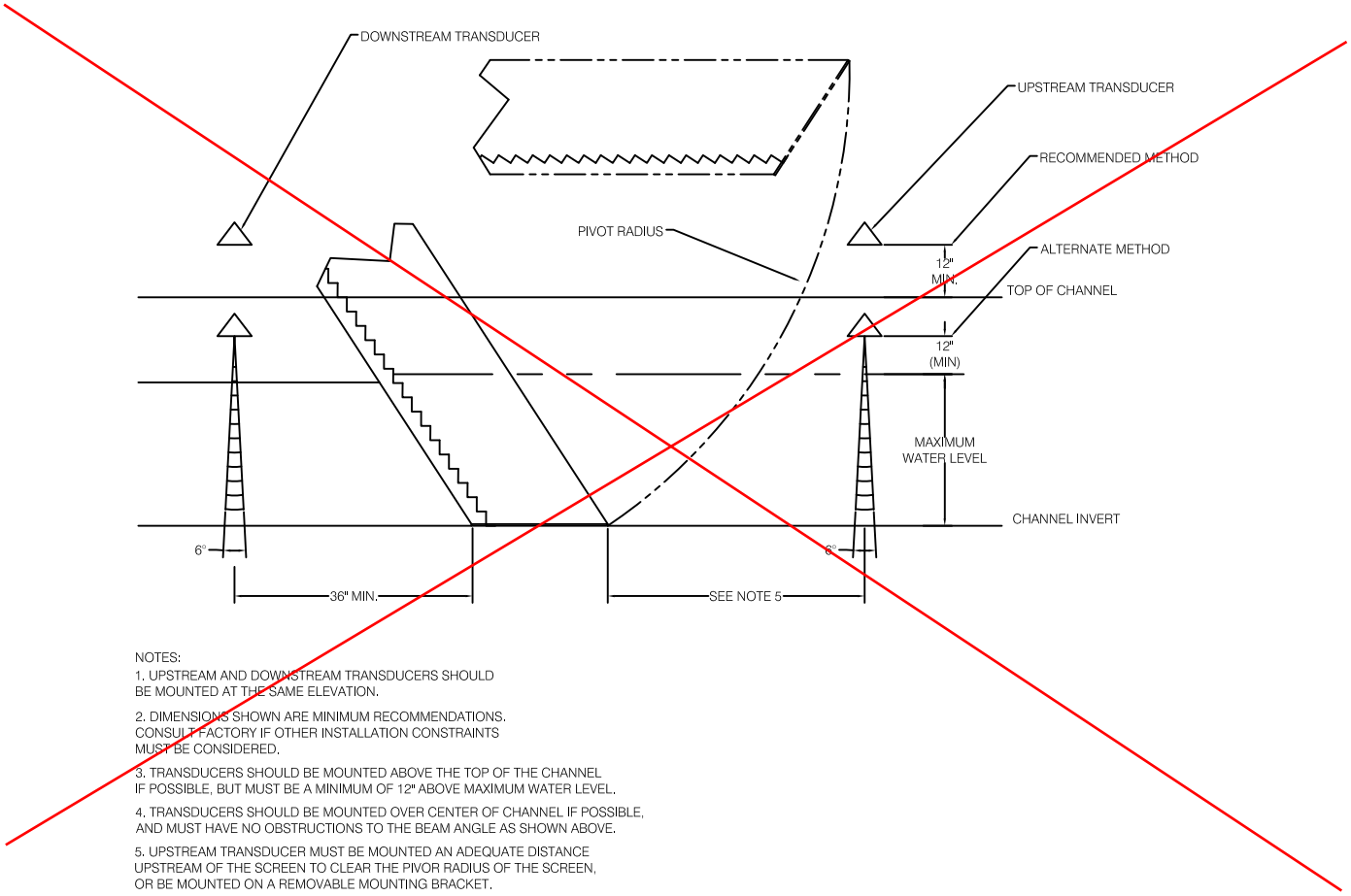
Do not route cable openly or near high voltage or current runs, contactors and SCR control drives.

If the transducer cable needs to be extended, the extension should be made with 18 AWG shielded/twisted pair cable.

For optimum isolation against electrical noise, run cable in separately grounded metal conduits.

Seal all thread connections to prevent ingress of moisture.

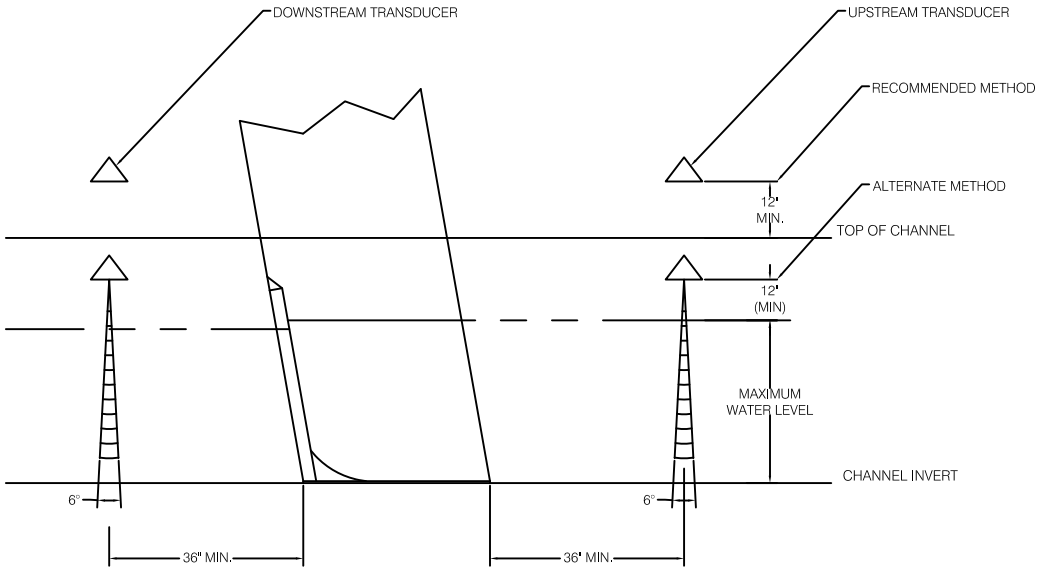
TRANSDUCER MOUNTING FOR A SCREEN THAT PIVOTS OUT OF THE CHANNEL



NOTES:

1. UPSTREAM AND DOWNSTREAM TRANSDUCERS SHOULD BE MOUNTED AT THE SAME ELEVATION.
2. DIMENSIONS SHOWN ARE MINIMUM RECOMMENDATIONS. CONSULT FACTORY IF OTHER INSTALLATION CONSTRAINTS MUST BE CONSIDERED.
3. TRANSDUCERS SHOULD BE MOUNTED ABOVE THE TOP OF THE CHANNEL IF POSSIBLE, BUT MUST BE A MINIMUM OF 12" ABOVE MAXIMUM WATER LEVEL.
4. TRANSDUCERS SHOULD BE MOUNTED OVER CENTER OF CHANNEL IF POSSIBLE, AND MUST HAVE NO OBSTRUCTIONS TO THE BEAM ANGLE AS SHOWN ABOVE.
5. UPSTREAM TRANSDUCER MUST BE MOUNTED AN ADEQUATE DISTANCE UPSTREAM OF THE SCREEN TO CLEAR THE PIVOR RADIUS OF THE SCREEN, OR BE MOUNTED ON A REMOVABLE MOUNTING BRACKET.

TRANSDUCER MOUNTING FOR A SCREEN THAT DOES NOT PIVOT OUT OF THE CHANNEL



NOTES:

1. UPSTREAM AND DOWNSTREAM TRANSDUCERS SHOULD BE MOUNTED AT THE SAME ELEVATION.
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4. TRANSDUCERS SHOULD BE MOUNTED OVER CENTER OF CHANNEL IF POSSIBLE, AND MUST HAVE NO OBSTRUCTIONS TO THE BEAM ANGLE AS SHOWN ABOVE.

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MISSOURI VALLEY, IA. 51555
712-642-2755
www.vulcanindustries.com

SCALE: NONE		DRAWN BY: SES
DATE: 5/14/07	SHEET NUMBER: 1 OF 1	REVIEWED BY: SES
TITLE: TRANSDUCER MOUNTING OPTIONS		PROJECT NUMBER: ANY
PROJECT:		DRAWING NUMBER: VI-ULD-REF

HD and HG 2-pole

H-frame

J-frame

H-frame 150 A Thermal-magnetic (600 Vac) Factory Sealed Trip Unit Suitable for Reverse Connection▲

Current Rating @ 40° C	AC Magnetic Trip Setting		D Interrupting		G Interrupting		J Interrupting		L Interrupting		Terminal Wire Range
	Hold	Trip	Catalog Number	Price	Catalog Number	Price	Catalog Number	Price	Catalog Number	Price	
2-pole, 600 Vac 50/60 Hz											
15	350	750	HDL26015	**$ 580.**	HGL26015	**$ 846.**	HJL26015	**$1039.**	HLL26015	**$1576.**	AL150HD #14–#3/0 AWG Cu or Al
20	350	750	HDL26020	**580.**	HGL26020	**846.**	HJL26020	**1039.**	HLL26020	**1576.**	
25	350	750	HDL26025	**580.**	HGL26025	**846.**	HJL26025	**1039.**	HLL26025	**1576.**	
30	350	750	HDL26030	**580.**	HGL26030	**846.**	HJL26030	**1039.**	HLL26030	**1576.**	
35	400	850	HDL26035	**580.**	HGL26035	**846.**	HJL26035	**1039.**	HLL26035	**1576.**	
40	400	850	HDL26040	**580.**	HGL26040	**846.**	HJL26040	**1039.**	HLL26040	**1576.**	
45	400	850	HDL26045	**580.**	HGL26045	**846.**	HJL26045	**1039.**	HLL26045	**1576.**	
50	400	850	HDL26050	**580.**	HGL26050	**846.**	HJL26050	**1039.**	HLL26050	**1576.**	
60	800	1450	HDL26060	**580.**	HGL26060	**846.**	HJL26060	**1039.**	HLL26060	**1576.**	
70	800	1450	HDL26070	**708.**	HGL26070	**998.**	HJL26070	**1147.**	HLL26070	**1742.**	
80	800	1450	HDL26080	**708.**	HGL26080	**998.**	HJL26080	**1147.**	HLL26080	**1742.**	
90	800	1450	HDL26090	**708.**	HGL26090	**998.**	HJL26090	**1147.**	HLL26090	**1742.**	
100	900	1700	HDL26100	**708.**	HGL26100	**998.**	HJL26100	**1147.**	HLL26100	**1742.**	
110	900	1700	HDL26110	**1381.**	HGL26110	**2039.**	HJL26110	**2966.**	HLL26110	**3689.**	
125	900	1700	HDL26125	**1381.**	HGL26125	**2039.**	HJL26125	**2966.**	HLL26125	**3689.**	
150	900	1700	HDL26150	**1381.**	HGL26150	**2039.**	HJL26150	**2966.**	HLL26150	**3689.**	
3-pole, 600 Vac 50/60 Hz											
15	350	750	HDL36015	**$ 725.**	HGL36015	**$ 995.**	HJL36015	**$1299.**	HLL36015	**$1899.**	AL150HD #14–#3/0 AWG Cu or Al
20	350	750	HDL36020	**725.**	HGL36020	**995.**	HJL36020	**1299.**	HLL36020	**1899.**	
25	350	750	HDL36025	**725.**	HGL36025	**995.**	HJL36025	**1299.**	HLL36025	**1899.**	
30	350	750	HDL36030	**725.**	HGL36030	**995.**	HJL36030	**1299.**	HLL36030	**1899.**	
35	400	850	HDL36035	**725.**	HGL36035	**995.**	HJL36035	**1299.**	HLL36035	**1899.**	
40	400	850	HDL36040	**725.**	HGL36040	**995.**	HJL36040	**1299.**	HLL36040	**1899.**	
45	400	850	HDL36045	**725.**	HGL36045	**995.**	HJL36045	**1299.**	HLL36045	**1899.**	
50	400	850	HDL36050	**725.**	HGL36050	**995.**	HJL36050	**1299.**	HLL36050	**1899.**	
60	800	1450	HDL36060	**725.**	HGL36060	**995.**	HJL36060	**1299.**	HLL36060	**1899.**	
70	800	1450	HDL36070	**885.**	HGL36070	**1134.**	HJL36070	**1399.**	HLL36070	**2099.**	
80	800	1450	HDL36080	**885.**	HGL36080	**1134.**	HJL36080	**1399.**	HLL36080	**2099.**	
90	800	1450	HDL36090	**885.**	HGL36090	**1134.**	HJL36090	**1399.**	HLL36090	**2099.**	
100	900	1700	HDL36100	**885.**	HGL36100	**1134.**	HJL36100	**1399.**	HLL36100	**2099.**	
110	900	1700	HDL36110	**1733.**	HGL36110	**2399.**	HJL36110	**3449.**	HLL36110	**4499.**	
125	900	1700	HDL36125	**1733.**	HGL36125	**2399.**	HJL36125	**3449.**	HLL36125	**4499.**	
150	900	1700	HDL36150	**1733.**	HGL36150	**2399.**	HJL36150	**3449.**	HLL36150	**4499.**	

▲ See page 6-57 for circuit breakers with field interchangeable trip units

J-frame 250 A Thermal-magnetic (600 Vac) Factory Sealed Trip Unit Suitable for Reverse Connection■

Current Rating @ 40° C	AC Magnetic Trip Setting		D Interrupting		G Interrupting		J Interrupting		L Interrupting		Terminal Wire Range
	Low	High	Catalog Number	Price	Catalog Number	Price	Catalog Number	Price	Catalog Number	Price	
2-pole, 600 Vac 50/60 Hz											
150	750	1500	JDL26150	**$1450.**	JGL26150	**$2141.**	JJL26150	**$3114.**	JLL26150	**$3874.**	AL175JD #1/0–4/0 AWG Al or Cu
175	875	1750	JDL26175	**1450.**	JGL26175	**2141.**	JJL26175	**3114.**	JLL26175	**3874.**	
200	1000	2000	JDL26200	**1450.**	JGL26200	**2141.**	JJL26200	**3114.**	JLL26200	**3874.**	AL250JD #3/0–350 kcmil Al or Cu
225	1125	2250	JDL26225	**1450.**	JGL26225	**2141.**	JJL26225	**3114.**	JLL26225	**3874.**	
250	1250	2500	JDL26250	**1992.**	JGL26250	**2834.**	JJL26250	**4150.**	JLL26250	**4796.**	
3-pole, 600 Vac 50/60 Hz											
150	750	1500	JDL36150	**$1820.**	JGL36150	**$2519.**	JJL36150	**$3621.**	JLL36150	**$4724.**	AL175JD #1/0–4/0 AWG Al or Cu
175	875	1750	JDL36175	**1820.**	JGL36175	**2519.**	JJL36175	**3621.**	JLL36175	**4724.**	
200	1000	2000	JDL36200	**1820.**	JGL36200	**2519.**	JJL36200	**3621.**	JLL36200	**4724.**	AL250JD #3/0–350 kcmil Al or Cu
225	1125	2250	JDL36225	**1820.**	JGL36225	**2519.**	JJL36225	**3621.**	JLL36225	**4724.**	
250	1250	2500	JDL36250	**2499.**	JGL36250	**3334.**	JJL36250	**4825.**	JLL36250	**5995.**	

■ See page 6-57 for circuit breakers with field interchangeable trip units.

H- and J-frame Termination Options

F = No Lugs (includes terminal nut kit)★
L = Lugs both ends
M = Lugs "ON" end Terminal Nut Kit "Off" end
P = Lugs "OFF" end Terminal Nut Kit "On" end
N = Plug-in♦
D = Drawout♦
S = Rear Connected ♦

Plug-in

Drawout

Rear Connected

I-Line®

♦ For N,D, and S pricing, add termination pricing on page 6-58 to price.
★ Add TS suffix for circuit breaker without terminal nut kit.

NEMA Sizes 00, 0, 1 Reversing Starter (Horizontal Type)

NEMA Sizes 00, 0, 1 Reversing Starter (Vertical Type)

Class 8736 Type S reversing magnetic starters are used for full-voltage starting, stopping, and reversing AC squirrel cage motors. Class 8736 starters consist of one Class 8502 contactor and one Class 8536 starter mechanically and electrically interlocked. Open type devices, Sizes 0–5, are available in either horizontal or vertical arrangements. Sizes 00, 6, and 7 are available as horizontal only. Enclosed devices use horizontally arranged components. Type S starters are designed for operation at 600 Vac, 50–60 Hz.

Overload Relays

Class 8736 Type S Size 00–6 reversing starters are provided with melting alloy thermal overload relay as standard. Interchangeable thermal units are available in standard trip Sizes 00–6, as are bimetallic overload relays. Ambient compensated and non-compensated versions are supplied with manual or automatic reset, trip current adjustment, and an alarm contact on Sizes 0–2.

Quick trip is available on Sizes 00–4, and slow trip on Sizes 00–3.

Single phase starters use one thermal unit; three phase starters use three thermal units. See page 16-116 for selection information.

Solid State Overload Relay Protection (Motor Logic™)

These ambient insensitive overload relays are available on three phase sizes 00 through 6 and standard on size 7. They provide phase loss, phase unbalance protection. To order, add Form **H10** (for Class 10), **H20** (for Class 20), or **H30** (for selectable trip class protection). For more information about Motor Logic overload relays, see page 16-83.

New! TeSys T Motor Management System (NEMA Sizes 1–6)

TeSys T is a flexible system that integrates seamlessly into your automation system through five major communication protocols. TeSys T can predict what will happen in the process, as it accurately monitors current, voltage, and power over a wide range. For additional information about TeSys T Motor Management System, see pages 16-84 to 16-88 and page 16-103.

Table 16.117:

NEMA Size	Continuous Current Ratings	Motor Voltage	Max. Hp	Open Type			NEMA 1 General Purpose Enclosure		NEMA 4 & 4X Watertight, Dusttight Brushed Stainless Steel Enclosure (Sizes 0–5)▲		NEMA 7 & 9 ♦ Hazardous Locations Class I, Groups C & D Class II, Groups E, F & G				NEMA 12/3R★ Dusttight & Driptight Industrial Use Enclosure	
				Vertical Type	Horizontal Type	$ Price	Type	$ Price	Type	$ Price	Bolted Type	$ Price	SPIN-TOP™ Type	$ Price	Type	$ Price
00	9	200 230 460 575	1-1/2 1-1/2 2 2	— — — —	SAO16■	**926.**	SAG16■	**989.**	Use Size 0		Use Size 0		Use Size 0		Use Size 0	
0	18	200 230 460 575	3 3 5 5	SBO10■	SBO4■	**1097.**	SBG4■	**1160.**	SBW14■	**1814.**	SBT49■	**3794.**	SBR9■	**4742.**	SBA4■	**1416.**
1	27	200 230 460 575	7-1/2 7-1/2 10 10	SCO7■	SCO8■	**1241.**	SCG8■	**1331.**	SCW14■	**2241.**	SCT49■	**3978.**	SCR9■	**4976.**	SCA4■	**1587.**
2	45	200 230 460 575	10 15 25 25	SDO1■	SDO2■	**2349.**	SDG2■	**2583.**	SDW11■	**4064.**	SDT43■	**6642.**	SDR3■	**8064.**	SDA1■	**3011.**
3	90	200 230 460 575	25 30 50 50	SEO1■	SEO2■	**3902.**	SEG2■	**4307.**	SEW11■	**6501.**	—	—	—	—	SEA1■	**5247.**
4	135	200 230 460 575	40 50 100 100	SFO1■	SFO3■	**9530.**	SFG3■	**10274.**	SFW11■	**14148.**	— — — —	—	— — — —	—	SFA1■	**11727.**
5	270	200 230 460 575	75 100 200 200	SGO1■	SGO3■	**18309.**	SGG3■	**22602.**	SGW11■	**25734.**	— — — —	—	— — — —	—	SGA1■	**25734.**
6	540	200 230 460 575	150 200 400 400	— — — —	SHO1■	**43205.**	SHG1■	**50331.**	SHW1■	**57452.**	— — — —	—	— — — —	—	SHA1■	**54176.**
7	810	200 230 460 575	– 300 600 600	— — — —	SJO1■	**61250.**	SJG1■	**68736.**	SJW1■	**75497.**	— — — —	—	— — — —	—	SJA1■	**72221.**

▲ NEMA 4 and 4X stainless steel enclosures (sizes 0–5) have a brushed finish. Sizes 6 and 7 are painted sheet steel and are rated NEMA 4 only.
■ Coil voltage code must be specified to order this product. Refer to standard coil voltage codes shown on page 16-47.
♦ NEMA 7 and 9 bolted are not UL listed.
★ NEMA 12 enclosure may be field modified for outdoor non-corrosive and non-service-entrance-rated application; see page 16-95 for more information.

For How to Order Information, see page 16-13.

Table 16.118: 600 Vac Maximum—50–60 Hz

Note that prices shown do not include thermal units. Standard trip thermal units are **$21.50** each. See page 16-116 for selection information.

NEMA Size	Continuous Current Ratings	Motor Voltage	Max. Hp	Type of Motor	Open Type			NEMA 1 General Purpose Enclosure		NEMA 4 & 4X Watertight, Dusttight Brushed Stainless Steel Enclosure		NEMA 7 & 9 ■ Hazardous Locations Class I, Groups C & D Class II, Groups E, F & G				NEMA 12/3R♦ Dusttight & Driptight Industrial Use Enclosure	
					Vertical Type	Horizontal Type	$ Price	Type	$ Price	Type	$ Price	Bolted Type	$ Price	SPIN TOP™ Type	$ Price	Type	$ Price
2-Pole Single Phase—1 Thermal Unit Required																	
00	9	115 230	1/3 1	Single Phase 3-Wire	— —	SAO13▲	**863.**	SAG13▲	**923.**	Use Size 0		Use Size 0		Use Size 0		Use Size 0	
0	18	115 230	1 2		SBO7▲	SBO1▲	**1034.**	SBG1▲	**1094.**	SBW11▲	**1751.**	SBT46▲	**3722.**	SBR6▲	**4656.**	SBA1▲	**1350.**
1	27	115 230	2 3		SCO1▲	SCO2▲	**1175.**	SCG2▲	**1265.**	SCW11▲	**2177.**	SCT46▲	**3909.**	SCR6▲	**4883.**	SCA1▲	**1521.**
3-Pole Single Phase—1 Thermal Unit Required																	
00	9	115 230	1/3 1	4-Wire Rep.-Ind.	— —	SAO14▲	**891.**	SAG14▲	**953.**	Use Size 0		Use Size 0		Use Size 0		Use Size 0	
		115 230	1/3 1	4-Wire Split Ph.	— —	SAO15▲	**594.**	SAG15▲	**635.**	Use Size 0		Use Size 0		Use Size 0		Use Size 0	
0	18	115 230	1 2	4-Wire Rep.-Ind.	SBO8▲	SBO2▲	**1062.**	SBG2▲	**1124.**	SBW12▲	**1778.**	SBT47▲	**3752.**	SBR7▲	**4692.**	SBA2▲	**1380.**
		115 230	1 2	4-Wire Split Ph.	SBO9▲	SBO3▲	**1062.**	SBG3▲	**1124.**	SBW13▲	**1778.**	SBT48▲	**3752.**	SBR8▲	**4692.**	SBA3▲	**1380.**
1	27	115 230	2 3	4-Wire Rep.Ind.	SCO3▲	SCO4▲	**1205.**	SCG4▲	**1295.**	SCW12▲	**2205.**	SCT47▲	**3942.**	SCR7▲	**4932.**	SCA2▲	**1551.**
		115 230	2 3	4-Wire Split Ph.	SCO5▲	SCO6▲	**1205.**	SCG6▲	**1295.**	SCW13▲	**2205.**	SCT48▲	**3942.**	SCR8▲	**4932.**	SCA3▲	**1551.**
4-Pole Polyphase—2 Thermal Units Required																	
0	18	200 230 460 575	3 3 5 5	2 Phase 4-Wire	SBO11▲	SBO5▲	**1382.**	SBG5▲	**1443.**	SBW15▲	**2100.**	Consult Schneider Electric CCC at (1-888-778-2733)		SBR10▲	**5133.**	SBA5▲	**1670.**
1	27	200 230 460 575	7-1/2 7-1/2 10 10		SCO9▲	SCO10▲	**1566.**	SCG10▲	**1629.**	SCW15▲	**2541.**	Consult Schneider Electric CCC at (1-888-778-2733)		SCR10▲	**5396.**	SCA5▲	**1886.**
2	45	200 230 460 575	10 15 25 25		—	SDO4▲	**2948.**	SDG4▲	**3182.**	SDW12▲	**4748.**	Consult Schneider Electric CCC at (1-888-778-2733)		SDR4▲	**9248.**	SDA2▲	**3609.**
3	90	200 230 460 575	25 30 50 50		—	SEO4▲	**4886.**	SEG4▲	**5318.**	SEW12▲	**7482.**	—	—	—	—	SEA2▲	**6228.**
4	135	200 230 460 575	40 50 100 100		—	SFO4▲	**12207.**	SFG4▲	**12981.**	SFW12▲	**16883.**	—	—	—	—	SFA2▲	**14462.**

▲ Coil voltage code must be specified to order this product. Refer to standard coil voltage codes shown below.
■ NEMA 7 and 9 bolted are not UL listed.
♦ NEMA 12 enclosure may be field modified for outdoor non-corrosive and non-service-entrance-rated application; see page 16-95 for more information.

Table 16.119: Coil Voltage Codes

Voltage		Code	$ Price Adder
60 Hz	50 Hz		
24▼★	—	V01	No Charge
120▼	110	V02	No Charge
208	—	V08	No Charge
240	220	V03	No Charge
277	—	V04	No Charge
480	440	V06	No Charge
600	550	V07	No Charge
Specify	Specify	V99	35.60

★ 24 V coils are not available on Sizes 4–7. On Sizes 00–3, where 24 V coils are available, **Form S** (separate control) must be specified (i.e., order as 8736SCO1U01S).
▼ These voltage codes must include **Form S** (supplied at no charge) (i.e., order as 8736SBO7V02S).
Note: For voltage codes used with control transformers, see page 16-101.
Form S (separate control) is used when a separate source of power is available for the control (coil) voltage. Form S is supplied at no charge.

For How to Order Information, see page 16-13.

Table 16.265: Full Voltage Controllers Only

Classes 8502, 8536, 8538, 8539, 8702, 8736, 8738, 8739, 8810, 8811 and 8812														
Factory Modifications		Enclosure Type	Form	NEMA Size 00	0	1	2	3	4	5	6	7	
Overload Relays	**Non-Compensated Bimetallic Overload Relays** **Single Phase:** Types SB–SD (Sizes 0–2)■	Any	B1	—	35.60	35.60	35.60	—	—	—	—	—	
	Polyphase: **Two Element**—For 2 Phase Only Types SB–SD (Sizes 0–2)	Any	B1	—	35.60	35.60	35.60	—	—	—	—	—	
	Three Element Types SB–SD (Sizes 0–2) Type SG (Size 5) Type SH (Size 6)	Any Any Any	B2 B2 B2	— — —	35.60 — —	35.60 — —	35.60 — —	— — —	— — —	— 35.60 —	— — 35.60	— — —	 ▲
	Ambient Compensated Bimetallic Overload Relays **Three Element** Types SB–SD (Sizes 0–2) Types SE–SF (Sizes 3 & 4) Type SG (Size 5) Type SH (Size 6)	1, 4, 7, 9, 12 Any Any Any	B Y59 B B	— — — —	64.00 — — —	64.00 — — —	64.00 — — —	— 64.00 — —	— 64.00 — —	— — 64.00 —	— — — 64.00	— — — —	 ▲
	Overload Relays—General Modify Size 3 Type SE starters with melting alloy overload relays to accept Type FB quick trip or SB slow trip thermal units	Any	Y81	—	—	—	—	N/C	—	—	—	—	
	Substitute 9999 SO4 isolated alarm contact (N.O.) on melting alloy overload relay	Any	Y342	179.00	179.00	179.00	179.00	179.00	179.00	179.00♦	179.00	—	▲
	Substitute 9999 SO5 isolated alarm contact (N.C.) on melting alloy overload relay	Any	Y344	179.00	179.00	179.00	179.00	179.00	179.00	179.00♦	179.00	—	▲

▲ Size 7 uses a solid state overload relay as standard. See Class 8536 for complete details.
■ Single phase bimetallic overload relays for Type S Sizes 0–2 require **two** (2) thermal units per starter.
♦ For Classes 8736, 8738 and 8739 Type SG, consult Schneider Electric CCC at (1-888-778-2733).

Accessories available on page 16-111.

Solid State Overload Relay Factory Modifications (Forms)

The solid state overload relay is available on NEMA Size 00–7.
For Class 8536, 8538, 8539, 8736, 8738, 8739 and 8810 devices.

H # # #

Form Description

Type S Starter with MOTOR LOGIC™ Solid State Overload Relay
1—MOTOR LOGIC, Base Unit, Trip Class 10
2—MOTOR LOGIC, Base Unit, Trip Class 20
3—MOTOR LOGIC, Feature Unit

0—No additional modifications
1—N.O. Auxiliary Contact (Field Convertible to N.C.)

Special Overload/Contactor Size Combinations (Base Unit & Feature Units):
(Must Be Specified On Size 00 Starter Orders)
Blank—Overload Matched to Starter Size (i.e., Size 1 contactor & 3-27 A overload)
0—A 6–18 A overload on a starter size as indicated by the Starter Catalog Number
1—A 9–27 A overload on a starter size as indicated by the Starter Catalog Number
2—A 15–45 A overload on a starter size as indicated by the Starter Catalog Number
3—A 30–90 A overload on a starter size as indicated by the Starter Catalog Number
4—A 45–135 A overload on a starter size as indicated by the Starter Catalog Number
8—A 1.5–4.5 A overload on a starter size as indicated by the Starter Catalog Number (only offered on Feature Units)
9—A 3–9 A overload on a starter size as indicated by the Starter Catalog Number

SPECIAL NOTE for Class 8810 devices:
You MUST SPECIFY TWO SEPARATE FORM NUMBERS TO GET MOTOR LOGIC OVERLOADS ON TWO SPEED STARTERS. The catalog number will be alphanumeric.
EXAMPLE: Open Style, Size 4 Two Speed Starter with MOTOR LOGIC Overload Relays Required.
Single Winding, 460 V, Constant or Variable Torque
High Speed FLA = 96 A
Low Speed FLA = 27 A (use Size 2 Overload)
Catalog Number to Order: 8810SF01V02H20H202S
Where: Form H20 is a Size 4 Contactor with a 45-135 A MOTOR LOGIC Overload Relay for the High Speed and form H202 is a 15–45 A MOTOR LOGIC Overload Relay on the low speed contactor.

Table 16.266: Classes 8536, 8538, 8539, 8736, 8738, 8739 and 8810

Factory Modifications		Form	NEMA Size (Overload Current Range) 00 3–9 A	0 6–18 A	1 9–27 A	2 15–45 A	3 30–90 A	4 45–135 A	5 90–270 A	6 180–540 A	7 270–810 A
Motor Logic Solid State Overload Relay	Base Unit, Trip Class 10	H10	64.00	64.00	64.00	64.00	64.00	64.00	64.00	—	—
	Base Unit, Trip Class 20	H20	64.00	64.00	64.00	64.00	64.00	64.00	64.00	—	—
	Feature Unit	H30	93.00	93.00	93.00	102.00	116.00	131.00	215.00	215.00	Std.
Motor Logic Solid State Overload Relay with Auxiliary Contact	Base Unit, Trip Class 10	H11	122.00	122.00	122.00	122.00	122.00	122.00	122.00	—	—
	Base Unit, Trip Class 20	H21	122.00	122.00	122.00	122.00	122.00	122.00	122.00	—	—
	Feature Unit	H31	149.00	149.00	149.00	161.00	171.00	188.00	270.00	270.00	56.00

Table 16.267: Special Starter Combinations with Motor Logic Overload Relay Protection

NEMA Contactor Size	Solid State Overload Relay Size 00_B	00_C	0	1	2	3	4
00	★	Std					
0	★	★	Std				
1	★	★	★	Std			

NEMA Contactor Size	Solid State Overload Relay Size 00_B	00_C	0	1	2	3	4
2	★	★	★	★	Std		
3	n/a	n/a	n/a	n/a	n/a	Std	
4	n/a	n/a	n/a	n/a	n/a	★	Std

★ Possible factory starter combinations available.

Motor Logic—Class 9999

Isolated Auxiliary Contacts for Motor Logic Overload Relays

Overload relay auxiliary contacts are available factory installed or in kit form for field installation on Motor Logic overload relays. These contacts may be used for isolated alarm contact applications.

Table 16.353: Isolated Auxiliary Contacts for Motor Logic Overload Relays

For Use With		Parts Kit Description	Class 9999 Type
Class & Type	NEMA Size *[9]*		
8536 SA-SJ	00B through 7	N.O. or N.C. Auxiliary Contact (Field Convertible)	AC04
9065 SS, SR, SF, ST	00B through 7		

DIN Adapter

The DIN adapter provides a method to mount the Motor Logic overload relay to a 35 mm DIN rail.

Table 16.354: DIN Adapter

For Use With		Parts Kit Description	Class 9999 Type
Class & Type	NEMA Size*[9]*		
9065 SS or SF	00B, 00C, 0, and 1	DIN Adapter	DA01

Lug-Lug and Lug-Extender Kits

A Class 9999 LL0 Lug-Lug Kit can be field installed on separately mounted overload relays. The standard Size 00B, 00C, 0, and 1 Class 9065 Type SS and SF overload relays are supplied without lugs. A Class 9999 LB0 Lug-Extender Kit is designed for Size 00B, 00C, 0, and 1 Retrofit Starter Applications. This kit allows the lugs to be in the same location as the Class 9065 melting alloy overload relay, eliminating the need for additional wire length.

Table 16.355: Lug-Lug and Lug-Extender Kits

For Use With		Parts Kit Description	Class 9999 Type
Class & Type	NEMA Size*[9]*		
9065 SS or SF	00B, 00C, 0, and 1	Lug-Lug Kit for separate mounting	LL0
9065 SS or SF	00B, 00C, 0, and 1	Lug-Extender Kit for retrofitting existing NEMA S starters	LB0

Remote Reset Module

The Remote Reset Module can be easily field installed on solid-state overload relays. This module will allow the overload relay to be reset from a remote location.

Table 16.356: Remote Reset Module

For Use With		Parts Kit Description	Class 9999 Type
Class and Type	NEMA Size*[9]*		
536 SA-SJ	00B through 7	Remote Reset Module	RR04*[10]*
9065 SS, SR, SF, ST	00B through 7		
8536 SE-SF	3 and 4	Top Mounting Bracket	RB34*[10][11]*
9065 SS, SR, SF, ST	3 and 4		

Class 9999 Type SB6
Single Power Pole Adder

Class 9999 Type SB9
Double Power Pole Adder

Power Pole Adders

One single- or double-circuit power pole kit can be field added to a basic two- or three-pole Type S contactor or starter Sizes 0, 1 and 2, or lighting contactors 30–60 A. See Table 16.357 for selection. The ratings for these power pole adders correspond to the NEMA contact ratings found on page 16-120. A two- or three-pole contactor or starter accepts only one single- or double-circuit unit. A power pole cannot be used on four- or five-pole devices, or on devices that are mechanically interlocked.

When adding a power pole to a Size 0 or 1 device, remove the return springs according to the instructions that come with the device.

When adding a power pole to a Size 2 or 60 A device, a coil change is required. Select a four- or five-pole coil from page 16-120, or specify Form Y118 as noted in the footnote below.

When adding Size 0–2 power pole kits to a Size 3–7 or 100–800 A device, an adapter bracket (9999 SBT1) is required. The Class 9999 Types SB6–SB15 power pole kits are suitable for copper wire only. Types SB21–SB25 come with lugs suitable for copper or aluminum wire.

Table 16.357: Power Pole Adders—Selection

For Use With		Power Pole Adder Kit	
Type	Size	Description	Class 9999 Type
SB, SC, and SM	0, 1, and 30 A	One N.O. power pole adder	SB6
SD	2		SB11 *[12]*
SP	60 A		SB21 *[12]*
SB, SC, and SM	0, 1, and 30 A	One N.C. power pole adder	SB7
SD	2		SB12 *[12]*
SP	60 A		SB22 *[12]*
SB, SC, and SM	0, 1, and 30 A	One N.O. and one N.C. power pole adder	SB8
SD	2		SB13 *[12]*
SP	60 A		SB23 *[12]*
SB, SC, and SM	0, 1, and 30 A	Two N.O. power pole adders	SB9
SD	2		SB14 *[12]*
SP	60 A		SB24 *[12]*
SB, SC, and SM	0, 1, and 30 A	Two N.C. power pole adders	SB10
SD	2		SB15 *[12]*
SP	60 A		SB25 *[12]*
SE–SJ and SQ–SZ and SJ	3–7 and 100–800 A	Adapter bracket	SBT1

[9] Size 00B and 00C are not actual NEMA sizes. These designations are used to differentiate the lower FLA of these devices from the NEMA Size 00 Motor Logic solid-state overload relay.
[10] 120 Vac power required.
[11] For mounting the remote reset module on the top of the overload relay.
[12] To order a Size 2 or 60 A power pole kit complete with a new starter coil, specify **Form Y118,** the voltage, and the frequency (for example, Class 9999 Type SB11 **Y118,** 120 V, 60 Hz).

Type T transformers are designed with low impedance windings for excellent voltage regulation and can accommodate the high inrush current associated with contactors, starters, solenoids, and relays. Type T transformers are manufactured using the most advanced insulating materials and are the best choice if size and cost are of concern.

Type TF transformers include factory-installed primary and secondary fuse blocks. Type TF transformers consist of two primary fuse blocks and one secondary fuse block. The primary includes rejection-style clips to increase the AIC ratings for the fuses. Since the fuse blocks are mounted on the top of the transformer, Type TF transformers are interchangeable with Type T transformers except for their increased height.

Table 14.27: Type T and TF Transformers

VA UL/CSA/NOM	VA CE	Type T Transformers Catalog No.	Type T Transformers $ Price	Type TF Transformers Catalog No.	Type TF Transformers $ Price	Weight (lbs)
240 V x 480 V Primary, 120 V Secondary; 230 V x 460 V Primary, 115 V Secondary; 220 V x 440 V Primary, 110 V Secondary						
25	25	9070T25D1	**111.00**	9070TF25D1	**160.00**	2.5
50	50	9070T50D1	**116.00**	9070TF50D1	**165.00**	2.5
75	75	9070T75D1	**138.00**	9070TF75D1	**185.00**	3.8
100	100	9070T100D1	**155.00**	9070TF100D1	**201.00**	3.8
150	150	9070T150D1	**165.00**	9070TF150D1	**213.00**	5.5
200	200	9070T200D1	**204.00**	9070TF200D1	**255.00**	5.5
250	160	9070T250D1	**239.00**	9070TF250D1	**287.00**	7.1
300	200	9070T300D1	**264.00**	9070TF300D1	**312.00**	8.5
350	250	9070T350D1	**281.00**	9070TF350D1	**330.00**	10.5
500	300	9070T500D1	**350.00**	9070TF500D1	**395.00**	11.9
750	500	9070T750D1	**483.00**	9070TF750D1	**531.00**	11.0
1000	630	9070T1000D1	**585.00**	9070TF1000D1	**639.00**	20.6
1500	1000	9070T1500D1	**837.00**	9070TF1500D1	**884.00**	34.0
2000	1500	9070T2000D1	**1017.00**	9070TF2000D1	**1065.00**	47.0
3000	2000	9070T3000D1	**1412.00**	—	—	60.0
5000	3000	9070T5000D1	**2373.00**	—	—	89.0
208 V Primary, 120 V Secondary						
50	50	9070T50D3	**135.00**	9070TF50D3	**185.00**	2.5
75	75	9070T75D3	**162.00**	9070TF75D3	**230.00**	3.8
100	100	9070T100D3	**182.00**	9070TF100D3	**276.00**	3.8
150	150	9070T150D3	**230.00**	9070TF150D3	**287.00**	5.5
200	200	9070T200D3	**293.00**	9070TF200D3	**347.00**	5.5
250	160	9070T250D3	**363.00**	9070TF250D3	**417.00**	7.1
300	200	9070T300D3	**372.00**	9070TF300D3	**426.00**	8.5
350	250	9070T350D3	**432.00**	9070TF350D3	**522.00**	10.5
500	300	9070T500D3	**471.00**	9070TF500D3	**696.00**	11.9
750	500	9070T750D3	**665.00**	9070TF750D3	**716.00**	11.0
1000	630	9070T1000D3	**837.00**	9070TF1000D3	**906.00**	20.6
1500	1000	9070T1500D3	**1170.00**	9070TF1500D3	**1221.00**	34.0
2000	1500	9070T2000D3	**1358.00**	9070TF2000D3	**1409.00**	47.0
3000	2000	9070T3000D3	**1914.00**	—	—	60.0
5000	3000	9070T5000D3	**3015.00**	—	—	89.0
600 V Primary, 120 V Secondary; 575 V Primary, 115 V Secondary; 550 V Primary, 110 V Secondary						
50	50	9070T50D5	**135.00**	9070TF50D5	**185.00**	2.5
75	75	9070T75D5	**162.00**	9070TF75D5	**230.00**	3.8
100	100	9070T100D5	**182.00**	9070TF100D5	**276.00**	3.8
150	150	9070T150D5	**230.00**	9070TF150D5	**287.00**	5.5
200	200	9070T200D5	**293.00**	9070TF200D5	**347.00**	5.5
250	160	9070T250D5	**363.00**	9070TF250D5	**417.00**	7.1
300	200	9070T300D5	**372.00**	9070TF300D5	**426.00**	8.5
350	250	9070T350D5	**432.00**	9070TF350D5	**522.00**	10.5
500	300	9070T500D5	**471.00**	9070TF500D5	**696.00**	11.9
750	500	9070T750D5	**665.00**	9070TF750D5	**716.00**	11.0
1000	630	9070T1000D5	**837.00**	9070TF1000D5	**906.00**	20.6
1500	1000	9070T1500D5	**1170.00**	9070TF1500D5	**1221.00**	34.0
2000	1500	9070T2000D5	**1358.00**	9070TF2000D5	**1409.00**	47.0
3000	2000	9070T3000D5	**1914.00**	—	—	60.0
5000	3000	9070T5000D5	**3015.00**	—	—	89.0
277 V Primary, 120 V Secondary						
50	50	9070T50D4	**135.00**	—	—	2.5
75	75	9070T75D4	**162.00**	—	—	3.8
100	100	9070T100D4	**182.00**	—	—	3.8
150	150	9070T150D4	**230.00**	—	—	5.5
200	200	9070T200D4	**293.00**	—	—	5.5
250	160	9070T250D4	**363.00**	—	—	7.1
300	200	9070T300D4	**372.00**	—	—	8.5
350	250	9070T350D4	**432.00**	—	—	10.5
500	300	9070T500D4	**471.00**	—	—	11.9
750	500	9070T750D4	**665.00**	—	—	11.0
1000	630	9070T1000D4	**837.00**	—	—	20.6
1500	1000	9070T1500D4	**1170.00**	—	—	34.0
2000	1500	9070T2000D4	**1358.00**	—	—	47.0
3000	2000	9070T3000D4	**1914.00**	—	—	60.0
5000	3000	9070T5000D4	**3015.00**	—	—	89.0

VA UL/CSA/NOM	VA CE	Type T Transformers Catalog No.	Type T Transformers $ Price	Type TF Transformers Catalog No.	Type TF Transformers $ Price	Weight (lbs)
240 V x 480 V Primary, 120/240 V Secondary; 230 V x 460 V Primary, 115/230 V Secondary; 220 V x 440 V Primary, 110/220 V Secondary						
50	50	9070T50D31	**188.00**	9070TF50D31	**372.00**	2.5
75	75	9070T75D31	**197.00**	9070TF75D31	**384.00**	3.8
100	100	9070T100D31	**207.00**	9070TF100D31	**394.00**	3.8
150	150	9070T150D31	**273.00**	9070TF150D31	**452.00**	5.5
200	200	9070T200D31	**353.00**	9070TF200D31	**498.00**	5.5
250	160	9070T250D31	**381.00**	9070TF250D31	**564.00**	7.1
300	200	9070T300D31	**435.00**	9070TF300D31	**570.00**	8.5
350	250	9070T350D31	**455.00**	9070TF350D31	**630.00**	10.5
500	300	9070T500D31	**509.00**	9070TF500D31	**638.00**	11.9
750	500	9070T750D31	**710.00**	9070TF750D31	**795.00**	11.0
1000	630	9070T1000D31	**837.00**	9070TF1000D31	**920.00**	20.6
1500	1000	9070T1500D31	**1224.00**	9070TF1500D31	**1524.00**	34.0
2000	1500	9070T2000D31	**1854.00**	9070TF2000D31	**2154.00**	47.0
3000	2000	9070T3000D31	**2741.00**	—	—	60.0
5000	3000	9070T5000D31	**3368.00**	—	—	89.0
600 V Primary, 120/240 V Secondary; 575 V Primary, 115/230 V Secondary						
50	50	9070T50D37	**135.00**	9070TF50D37	**372.00**	2.5
75	75	9070T75D37	**162.00**	9070TF75D37	**384.00**	3.8
100	100	9070T100D37	**182.00**	9070TF100D37	**394.00**	3.8
150	150	9070T150D37	**230.00**	9070TF150D37	**452.00**	5.5
200	200	9070T200D37	**293.00**	9070TF200D37	**498.00**	5.5
250	160	9070T250D37	**363.00**	9070TF250D37	**564.00**	7.1
300	200	9070T300D37	**372.00**	9070TF300D37	**570.00**	8.5
350	250	9070T350D37	**432.00**	9070TF350D37	**630.00**	10.5
500	300	9070T500D37	**471.00**	9070TF500D37	**638.00**	11.9
750	500	9070T750D37	**665.00**	9070TF750D37	**795.00**	11.0
1000	630	9070T1000D37	**837.00**	9070TF1000D37	**920.00**	20.6
1500	1000	9070T1500D37	**1170.00**	9070TF1500D37	**1524.00**	34.0
2000	1500	9070T2000D37	**1358.00**	9070TF2000D37	**2154.00**	47.0
3000	2000	9070T3000D37	**1914.00**	—	—	60.0
5000	3000	9070T5000D37	**3015.00**	—	—	89.0
380/400/415 V Primary, 115/230 V Secondary						
50	50	9070T50D33	**188.00**	9070TF50D33	**372.00**	2.5
75	75	9070T75D33	**197.00**	9070TF75D33	**384.00**	3.8
100	100	9070T100D33	**207.00**	9070TF100D33	**394.00**	3.8
150	150	9070T150D33	**273.00**	9070TF150D33	**452.00**	5.5
200	200	9070T200D33	**353.00**	9070TF200D33	**498.00**	5.5
250	160	9070T250D33	**381.00**	9070TF250D33	**564.00**	7.1
300	200	9070T300D33	**435.00**	9070TF300D33	**570.00**	8.5
350	250	9070T350D33	**455.00**	9070TF350D33	**630.00**	10.5
500	300	9070T500D33	**509.00**	9070TF500D33	**638.00**	11.9
750	500	9070T750D33	**710.00**	9070TF750D33	**795.00**	11.0
1000	630	9070T1000D33	**837.00**	9070TF1000D33	**920.00**	20.6
1500	1000	9070T1500D33	**1224.00**	9070TF1500D33	**1524.00**	34.0
2000	1500	9070T2000D33	**1854.00**	9070TF2000D33	**2154.00**	47.0
3000	2000	9070T3000D33	**2741.00**	—	—	60.0
5000	3000	9070T5000D33	**3368.00**	—	—	89.0

Switching Repeater Field Circuit Ex i
Series 9170

06528E00

- Intrinsically safe input [Ex ia] IIC
- Galvanic isolation between input, output and power supply
- Open-circuit / short-circuit monitoring and messaging (can be switched off)
- Inversion of output signal can be set
- Transmission frequency up to 10 kHz
- For use up to SIL 2 (IEC 61508)

A3

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Basic function: binnary / digital input, 1and 2 channels.
The switching repeaters are suitable typically for intrinsically safe operation of contacts, proximity switches to EN 60947-5-6 (NAMUR), optocoupler outputs etc.

The version 9170/.1-14-12 LFT is characterised by line fault transparency. This function makes it possible to signal cable faults directly to the control level via the signal channel. The output of the switching repeater behaves acc. to EN 60947-5-6 (NAMUR).

	ATEX / IECEx					
Zone	0	1	2	20	21	22
Ex i interface	x	x	x	x	x	x
Installation in			x*)			x*)

	NEC 505 Class I			NEC 506		
Zone	0	1	2	20	21	22
Ex i interface	x	x	x			
Installation in			x*)			x*)

	NEC 500					
	Class I		Class II		Class III	
Division	1	2	1	2	1	2
Ex i interface	x	x	x	x	x	x
Installation in		x*)		x*)		x*)

*) Restrictions see table explosion protection

Special versions with UL approval on request

WebCode 9170A

Selection Table

Output version (control)	Channels	Power supply	Output / channel	Order number	Tech. data see page
Signal relay (125 V / 1 A)	1	24 V DC	2 change-over contacts	**9170/11-11-11s**	A3/3
		120 ... 230 V AC	2 change-over contacts	**9170/11-11-21s**	
	2	24 V DC	1 change-over contact	**9170/21-10-11s**	
			2 NO	**9170/21-11-11s**	
		120 ... 230 V AC	2 NO	**9170/21-11-21s**	
Power relay (250 V / 4 A)	1	24 V DC	1 change-over contact	**9170/11-12-11s**	A3/8
		120 ... 230 V AC	1 change-over contact	**9170/11-12-21s**	
			2 change-over contacts	**9170/11-13-21s**	
	2	24 V DC	1 change-over contact	**9170/21-12-11s**	
		120 ... 230 V AC	1 change-over contact	**9170/21-12-21s**	
Electronic (35 V / 50 mA)	1	24 V DC	1 electronic output	**9170/11-14-11s**	A3/13
			1 Elektronikausgang LFT	**9170/11-14-12s**	A3/17
	2	24 V DC	1 electronic output	**9170/21-14-11s**	A3/13
			1 Elektronikausgang LFT	**9170/21-14-12s**	A3/17
Note	The order numbers listed in the table are for devices equipped with screw terminals. For devices equipped with springclamp terminals, replace the ending "s" for screw terminals with "k" for spring clamp terminals.				
	LFT - line fault transparency, device signals line fault on field side to the control directly via the signal output.				

Explosion Protection		
Version	**24 V DC 9170/.1-11-11., 9170/21-10-11.**	**120 ... 230 V AC 9170/.1-11-21., 9170/21-10-21.**
Global (IECEx)		
Gas and dust	IECEx BVS 09.0041X Ex nA nC [ia Ga] IIC T4 Gc [Ex ia Da] IIIC	IECEx BVS 09.0041X [Ex ia Ga] IIC [Ex ia Da] IIIC
Europe (ATEX)		
Gas and dust	DMT 02 ATEX E 195 X Ⓔx II 3 (1) G Ex nA nC [ia Ga] IIC T4 Gc Ⓔx II (1) D [Ex ia Da] IIIC	DMT 02 ATEX E 195 X Ⓔx II (1) G [Ex ia Ga] IIC Ⓔx II (1) D [Ex ia Da] IIIC
Certifications and certificates		
Certificates	IECEx, ATEX, Brazil (INMETRO), Canada (cFM), Kazakhstan (TR), Korea (KCs), Russia (TR), USA (FM), Belarus (TR)	IECEx, ATEX, Brazil (INMETRO), Canada (cFM), Kazakhstan (TR), Korea (KCs), Russia (TR), USA (FM), Belarus (TR)
Ship approval	DNV GL	DNV GL

Explosion Protection		
Safety data		
Inputs (channels individually)		
Max. voltage U_o	9.6 V	
Max. current I_o	10 mA	
Max. power P_o	24 mW	
Max. connectable capacitance C_o		
IIC	3,6 µF	
IIB	26 µF	
I	99 µF	
Max. connectable inductance L_o		
IIC	350 mH	
IIB	1000 mH	
I	1000 mH	
Internal capacitance C_i	2.42 nF	
Internal inductance L_i	negligible	
Safety-related maximum voltage	253 V	

Explosion Protection		
Version	**24 V DC 9170/.1-11-11., 9170/21-10-11.**	**120 ... 230 V AC 9170/.1-11-21., 9170/21-10-21.**
Further parameters		
Installation	in Zone 2, Div. 2 and in the safe area	in safe area
Further information	see respective certificate and operating instructions	

Explosion Protection		
Version	**24 V DC 9170/.1-11-11., 9170/21-10-11.**	**120 ... 230 V AC 9170/.1-11-21., 9170/21-10-21.**
Functional safety (IEC 61508)		
Test report	Exida STAHL 09/03-52 R019	
Max. SIL	2	
Further information	siehe Safety Manual und Prüfbericht	

Technical Data

Electrical data		
Version	**24 V DC 9170/.1-11-11., 9170/21-10-11.**	**120 ... 230 V AC 9170/.1-11-21., 9170/21-10-21.**
Auxiliary power		
Nominal voltage U_N	24 V DC	120 ... 230 V AC
Voltage range	18 ... 31.2 V	96 ... 253 V
Residual ripple	< 3.26 V_{SS}	– –
Frequency range		48 ... 62 Hz
Nominal current at U_N		
1 channel	33 mA	12 mA
2 channels	55 mA	18 mA
Power consumption at U_N		
1 channel	0.8 W	120 V AC : 1.4 VA 230 V AC : 1.8 VA
2 channels	1.3 W	120 V AC : 2.2 VA 230 V AC : 2.8 VA
Power dissipation		
1 channel	0.8 W	120 V AC: 1.0 W 230 V AC: 1.3 W
2 channels	1.3 W	120 V AC: 1.6 W 230 V AC: 2.0 W
Polarity reversal protection	yes	– –
Operation indication	LED green „PWR“	LED green „PWR“
Undervoltage monitoring	yes (no faulty module / output states)	yes (no faulty module / output states)
Galvanic separation		
Test voltages		
acc. to standard	EN 60079-11	EN 60079-11
Ex i input to output	1.5 kV AC	1.5 kV AC
Ex i input to auxiliary power	1.5 kV AC	1.5 kV AC
Ex i inputs interconnected	500 V AC	500 V AC
Ex i input to error message contact	1.5 kV AC	1.5 kV AC
acc. to standard	EN 50178	EN 50178
Output to auxiliary power	1.1 kV AC	1.1 kV AC
Outputs interconnected	1.1 kV AC	1.1 kV AC
Error contact to power supply	350 V AC	350 V AC
Error contact to outputs	1.1 kV AC	1.1 kV AC
Ex i input		
Input signal	acc. to EN 60947-5-6 (NAMUR)	acc. to EN 60947-5-6 (NAMUR)
Current for ON / OFF		
ON	≥ 2.1 mA	≥ 2.1 mA
OFF	≤ 1.2 mA	≤ 1.2 mA
Hysteresis	approx. 0.2 mA	approx. 0.2 mA
Open-circuit voltage	8.2 V	8.2 V
Short-circuit current	≤ 8.2 mA	≤ 8.2 mA
Internal resistance	1000 Ω	1000 Ω

Technical Data

Version	24 V DC 9170/.1-11-11., 9170/21-10-11.	120 ... 230 V AC 9170/.1-11-21., 9170/21-10-21.
Output		
Minimum load	1 V / 100 µA	1 V / 100 µA
Maximum load DC	125 V / 1 A	125 V / 1 A
Maximum load AC	125 V / 1 A	125 V / 1 A
Max. switching capacity	25 W / 50 VA	25 W / 50 VA
Electrical service life		
Resistive load	5 x 10^5 cycles at 24 V / 1 A	5 x 10^5 cycles at 24 V / 1 A
Mechanical service life	1 x 10^8 cycles	1 x 10^8 cycles
Recommended back-up fuses	≤ F 1 A AC / DC	≤ F 1 A AC / DC
Max. switching frequency	15 Hz	15 Hz
Switching delay ON / OFF	5 ms	5 ms
Switching delay OFF / ON	5 ms	5 ms
Settings (switch INV)	Inversion of operating mode	Inversion of operating mode
Indication	LED yellow „OUT“ per channel	LED yellow „OUT“ per channel
Error detection Ex i input		
Open circuit	I_{in} < 0.05 ... 0.35 mA according to EN 60947-5-6	
Short circuit	R_{in} < 100 ... 360 Ω according to EN 60947-5-6	
Behaviour of the output	OFF	
Settings (switch LF)	activated / deactivated	
Error detection	LED red "LF" each channel	
Message of line fault and auxiliary power failure	- contact (30 V / 100 mA), closed to ground in case of fault *) - pac-Bus, floating contact (30 V / 100 mA) *) *) not at 9170/.1-1.-21.	
Electromagnetic compatibility	Tested under the following standards and regulations: EN 61326-1 (can be used in industrial environment) NAMUR NE 21	
Ambient conditions		
Ambient temperature		
Single device	-20 ... +70 °C	
Group assembly	-20 ... +65 °C The installation conditions affect the ambient temperature. Observe the "Cabinet installation guide"	
Storage temperature	-40 ... +80 °C	
Relative humidity (no condensation)	≤ 95 %	
Use at the height of	< 2000 m	

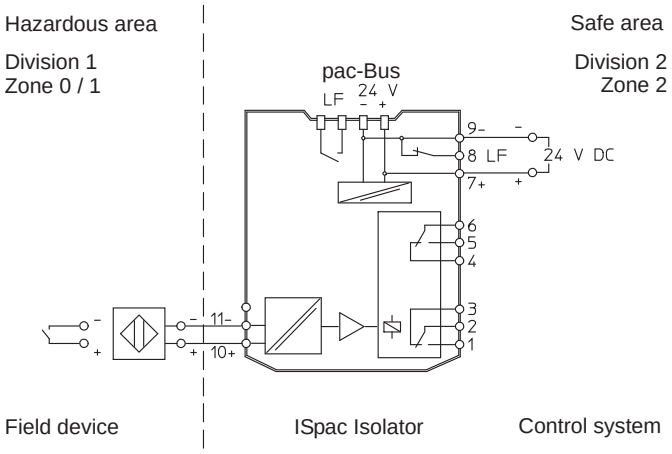
Technical Data

Electrical connection

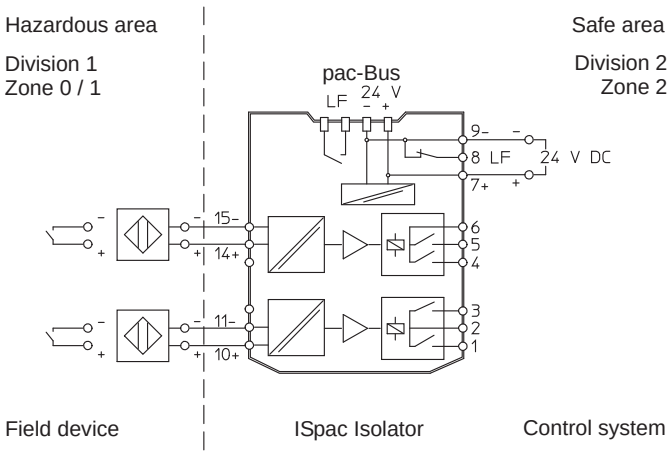
Connection diagram

24 V DC

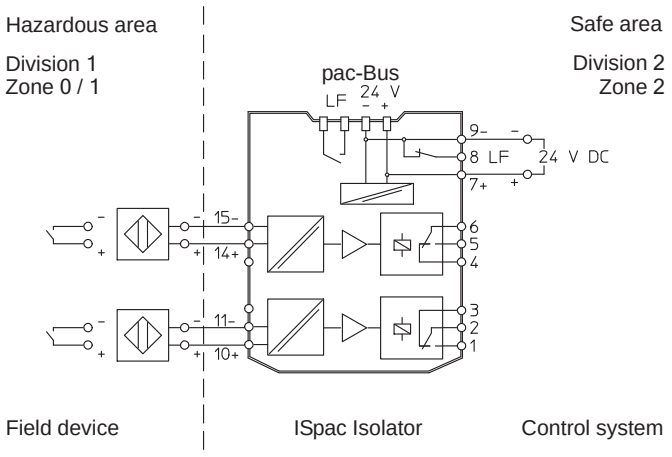
1 channel
9170/11-11-11



2 channels
9170/21-11-11



2 channels
9170/21-10-11



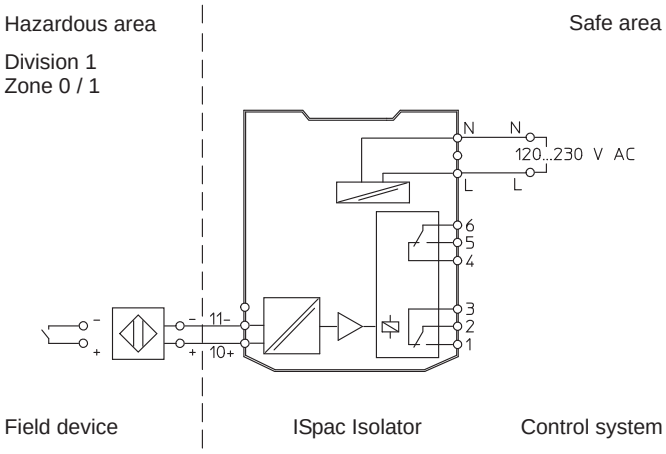
Technical Data

Electrical connection

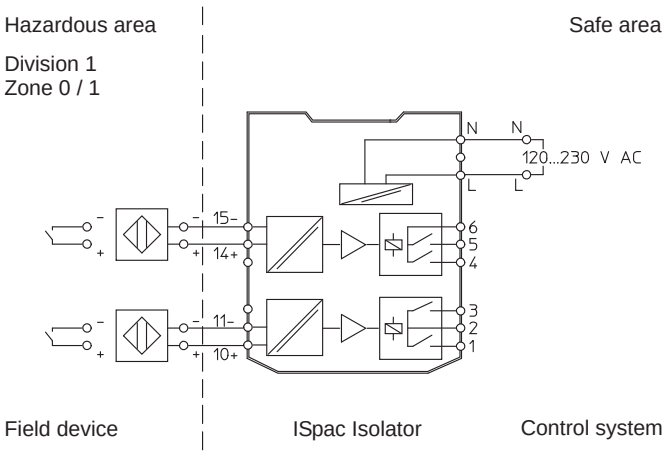
Connection diagram

120 V / 230 V AC

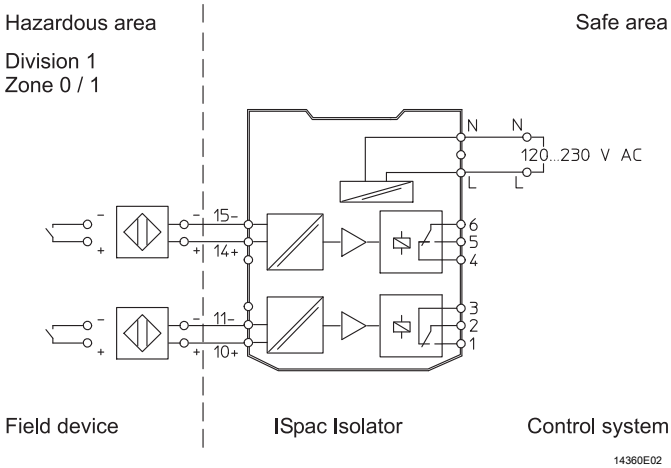
1 channel
9170/11-11-21



2 channels
9170/21-11-21



2 channels
9170/21-10-21



Explosion Protection		
Version	**24 V DC 9170/.1-12-11.**	**120 ... 230 V AC 9170/.1-1.-21.**
Global (IECEx)		
Gas and dust	IECEx BVS 09.0041X [Ex ia Ga] IIC [Ex ia Da] IIIC	IECEx BVS 09.0041X [Ex ia Ga] IIC [Ex ia Da] IIIC
Europe (ATEX)		
Gas and dust	DMT 02 ATEX E 195 X Ⓔx II (1) G [Ex ia Ga] IIC Ⓔx II (1) D [Ex ia Da] IIIC	DMT 02 ATEX E 195 X Ⓔx II (1) G [Ex ia Ga] IIC Ⓔx II (1) D [Ex ia Da] IIIC
Certifications and certificates		
Certificates	IECEx, ATEX, Brazil (INMETRO), Canada (cFM), Kazakhstan (TR), Korea (KCs), Russia (TR), Ukraine (TR), USA (FM), Belarus (TR)	IECEx, ATEX, Brazil (INMETRO), Canada (cFM), Kazakhstan (TR), Korea (KCs), Russia (TR), Ukraine (TR), USA (FM), Belarus (TR)
Ship approval	DNV GL	DNV GL

Explosion Protection	
Safety data	
Inputs (channels individually)	
Max. voltage U_o	9.6 V
Max. current I_o	10 mA
Max. power P_o	24 mW
Max. connectable capacitance C_o	
IIC	3,6 µF
IIB	26 µF
I	99 µF
Max. connectable inductance L_o	
IIC	350 mH
IIB	1000 mH
I	1000 mH
Internal capacitance C_i	2.42 nF
Internal inductance L_i	negligible
Safety-related maximum voltage	253 V

Explosion Protection	
Further parameters	
Installation	in safe area
Further information	see respective certificate and operating instructions

Explosion Protection	
Functional safety (IEC 61508)	
Test report	Exida STAHL 09/03-52 R019
Max. SIL	2
Further information	siehe Safety Manual und Prüfbericht

Technical Data

Electrical data

Version	24 V DC 9170/.1-12-11.	120 ... 230 V AC 9170/.1-1.-21.
Auxiliary power		
Nominal voltage U_N	24 V DC	120 ... 230 V AC
Voltage range	18 ... 31.2 V	96 ... 253 V
Residual ripple	< 3.26 V_{SS}	– –
Frequency range		48 ... 62 Hz
Nominal current at U_N		
1 channel	33 mA	12 mA
2 channels	55 mA	18 mA
Power consumption at U_N		
1 channel	0.8 W	120 V AC : 1.4 VA 230 V AC : 1.8 VA
2 channels	1.3 W	120 V AC : 2.2 VA 230 V AC : 2.8 VA
Power dissipation		
1 channel	0.8 W	120 V AC: 1.0 W 230 V AC: 1.3 W
2 channels	1.3 W	120 V AC: 1.6 W 230 V AC: 2.0 W
Polarity reversal protection	yes	– –
Operation indication	LED green „PWR“	LED green „PWR“
Undervoltage monitoring	yes (no faulty module / output states)	yes (no faulty module / output states)
Galvanic separation		
Test voltages		
acc. to standard	EN 60079-11	EN 60079-11
Ex i input to output	1.5 kV AC	1.5 kV AC
Ex i input to auxiliary power	1.5 kV AC	1.5 kV AC
Ex i inputs interconnected	500 V AC	500 V AC
Ex i input to error message contact	1.5 kV AC	1.5 kV AC
acc. to standard	EN 50178	EN 50178
Output to auxiliary power	1.1 kV AC	1.1 kV AC
Outputs interconnected	1.1 kV AC	1.1 kV AC
Error contact to power supply	350 V AC	350 V AC
Error contact to outputs	1.1 kV AC	1.1 kV AC
Ex i input		
Input signal	acc. to EN 60947-5-6 (NAMUR)	acc. to EN 60947-5-6 (NAMUR)
Current for ON / OFF		
ON	≥ 2.1 mA	≥ 2.1 mA
OFF	≤ 1.2 mA	≤ 1.2 mA
Hysteresis	approx. 0.2 mA	approx. 0.2 mA
Open-circuit voltage	8.2 V	8.2 V
Short-circuit current	≤ 8.2 mA	≤ 8.2 mA
Internal resistance	1000 Ω	1000 Ω

Technical Data

Version	24 V DC 9170/.1-12-11.	120 ... 230 V AC 9170/.1-1.-21.
Output		
Minimum load	12 V / 100 µA	12 V / 100 µA
Maximum load DC	250 V / 2 A	250 V / 2 A
Maximum load AC	250 V / 4 A	250 V / 4 A
Max. switching capacity	50 W / 1000 VA	50 W / 1000 VA
Electrical service life		
Resistive load	1 x 10^5 cycles at 250 V / 4 A	1 x 10^5 cycles at 250 V / 4 A
Mechanical service life	15 x 10^6 cycles	15 x 10^6 cycles
Recommended back-up fuses	≤ F 4 A AC / 2 A DC	≤ F 4 A AC / 2 A DC
Max. switching frequency	6 Hz	6 Hz
Switching delay ON / OFF	10 ms	10 ms
Switching delay OFF / ON	10 ms	10 ms
Settings (switch INV)	Inversion of operating mode	Inversion of operating mode
Indication	LED yellow „OUT“ per channel	LED yellow „OUT“ per channel
Error detection Ex i input		
Open circuit	I_{in} < 0.05 ... 0.35 mA according to EN 60947-5-6	
Short circuit	R_{in} < 100 ... 360 Ω according to EN 60947-5-6	
Behaviour of the output	OFF	
Settings (switch LF)	activated / deactivated	
Error detection	LED red "LF" each channel	
Message of line fault and auxiliary power failure	- contact (30 V / 100 mA), closed to ground in case of fault *) - pac-Bus, floating contact (30 V / 100 mA) *) *) not at 9170/.1-1.-21.	
Electromagnetic compatibility	Tested under the following standards and regulations: EN 61326-1 (can be used in industrial environment) NAMUR NE 21	
Ambient conditions		
Ambient temperature		
Single device	-20 ... +70 °C	
Group assembly	-20 ... +65 °C The installation conditions affect the ambient temperature. Observe the "Cabinet installation guide"	
Storage temperature	-40 ... +80 °C	
Relative humidity (no condensation)	≤ 95 %	
Use at the height of	< 2000 m	

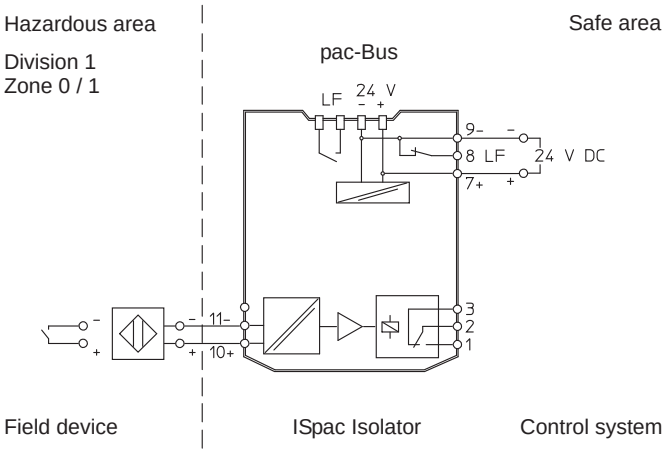
Technical Data

Electrical connection

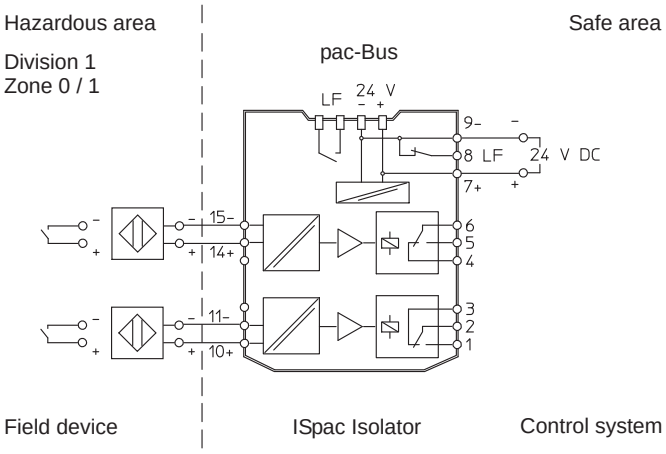
Connection diagram

24 V DC

1 channel
9170/11-12-11



2 channels
9170/21-12-11



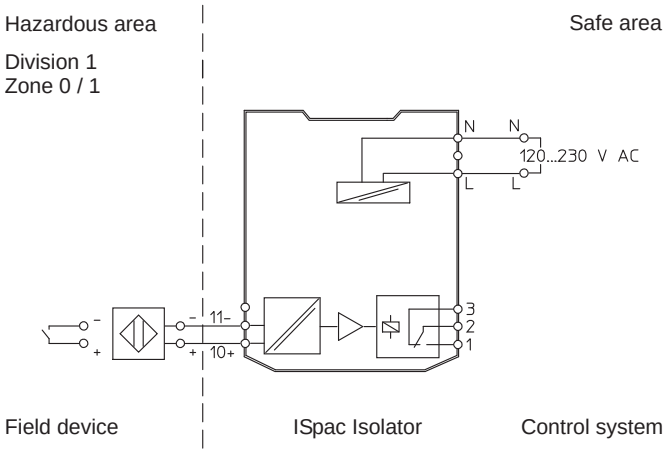
Technical Data

Electrical connection

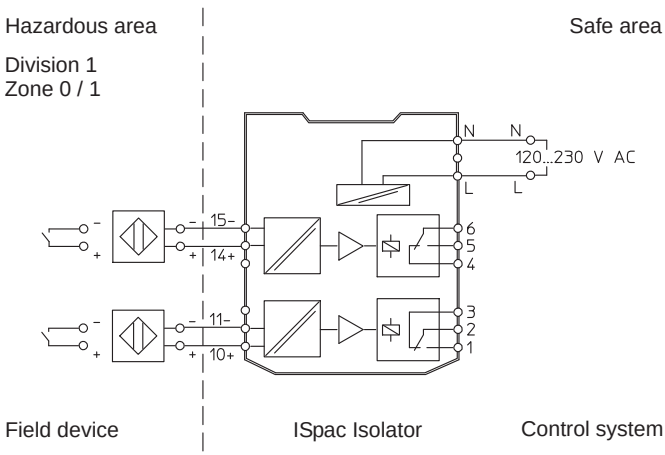
Connection diagram

120 V / 230 V AC

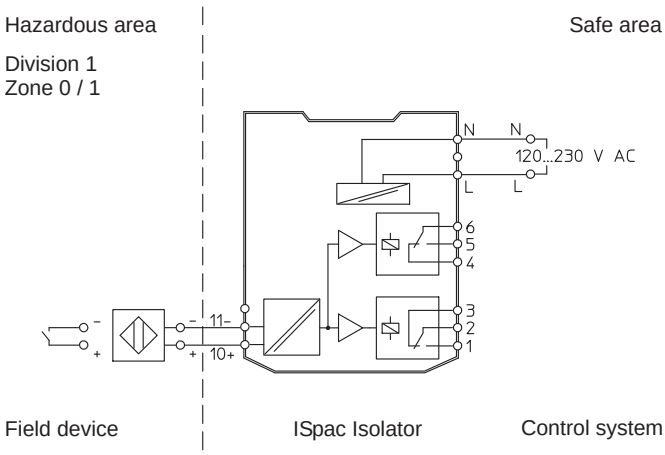
**1 channel,
1 changeover
9170/11-12-21**



**2 channels
9170/21-12-21**



**1 channel,
2 changeover
9170/11-13-21**



Explosion Protection	
Global (IECEx)	
Gas and dust	IECEx BVS 09.0041X Ex nA nC [ia Ga] IIC T4 Gc [Ex ia Da] IIIC
Europe (ATEX)	
Gas and dust	DMT 02 ATEX E 195 X Ⓔx II 3 (1) G Ex nAc nCc [ia] IIC T4 Ⓔx II (1) D [Ex ia] IIIC
Certifications and certificates	
Certificates	IECEx, ATEX, Brazil (INMETRO), Canada (cFM), Kazakhstan (TR), Korea (KCs), Russia (TR), USA (FM), Belarus (TR)
Ship approval	DNV GL
Explosion Protection	
Safety data	
Inputs (channels individually)	
Max. voltage U_o	9.6 V
Max. current I_o	10 mA
Max. power P_o	24 mW
Max. connectable capacitance C_o	
IIC	3,6 µF
IIB	26 µF
I	99 µF
Max. connectable inductance L_o	
IIC	350 mH
IIB	1000 mH
I	1000 mH
Internal capacitance C_i	2.42 nF
Internal inductance L_i	negligible
Safety-related maximum voltage	253 V
Explosion Protection	
Further parameters	
Installation	in Zone 2, Div. 2 and in the safe area
Further information	see respective certificate and operating instructions
Explosion Protection	
Functional safety (IEC 61508)	
Test report	Exida STAHL 09/03-52 R019
Max. SIL	2
Further information	siehe Safety Manual und Prüfbericht

Technical Data

Electrical data	
Auxiliary power	
Nominal voltage U_N	24 V DC
Voltage range	18 ... 31.2 V
Residual ripple	< 3,26 V_{SS}
Nominal current at U_N	
1 channel	26 mA
2 channels	36 mA
Power consumption at U_N	
1 channel	0.6 W
2 channels	1.9 W
Power dissipation	
1 channel	0.6 W
2 channels	0.9 W
Polarity reversal protection	yes
Operation indication	LED green „PWR“
Undervoltage monitoring	yes (no faulty module / output states)
Galvanic separation	
Test voltages	
acc. to standard	EN 60079-11
Ex i input to output	1.5 kV AC
Ex i input to auxiliary power	1.5 kV AC
Ex i inputs interconnected	500 V AC
Ex i input to error message contact	1.5 kV AC
acc. to standard	EN 50178
Output to auxiliary power	1.1 kV AC
Outputs interconnected	1.1 kV AC
Error contact to power supply	350 V AC
Error contact to outputs	1.1 kV AC
Ex i input	
Input signal	acc. to EN 60947-5-6 (NAMUR)
Current for ON / OFF	
ON	≥ 2.1 mA
OFF	≤ 1.2 mA
Hysteresis	approx. 0.2 mA
Open-circuit voltage	8.2 V
Short-circuit current	≤ 8.2 mA
Internal resistance	1000 Ω

Technical Data	
Output	
Maximum load DC	35 V / 50 mA DC
Maximum load AC	– –
Max. switching capacity	1.75 W
Overload protected	yes
Voltage drop	< 2 V
Electrical service life	
Resistive load	> 10^9 cycles at 35 V / 50 mA
Max. switching frequency	10 kHz
Switching delay ON / OFF	15 µs
Switching delay OFF / ON	30 µs
Settings (switch INV)	Inversion of operating mode
Indication	LED yellow „OUT“ per channel
Error detection Ex i input	
Open circuit	I_{in} < 0.05 ... 0.35 mA
	according to EN 60947-5-6
Short circuit	R_{in} < 100 ... 360 Ω
	according to EN 60947-5-6
Behaviour of the output	OFF
Settings (switch LF)	activated / deactivated
Error detection	LED red "LF" each channel
Message of line fault and auxiliary power failure	- contact (30 V / 100 mA), closed to ground in case of fault - pac-Bus, floating contact (30 V / 100 mA)
Electromagnetic compatibility	Tested under the following standards and regulations: EN 61326-1 (can be used in industrial environment) NAMUR NE 21
Ambient conditions	
Ambient temperature	
Single device	-20 ... +70 °C
Group assembly	-20 ... +65 °C
	The installation conditions affect the ambient temperature.
	Observe the "Cabinet installation guide"
Storage temperature	-40 ... +80 °C
Relative humidity (no condensation)	≤ 95 %
Use at the height of	< 2000 m

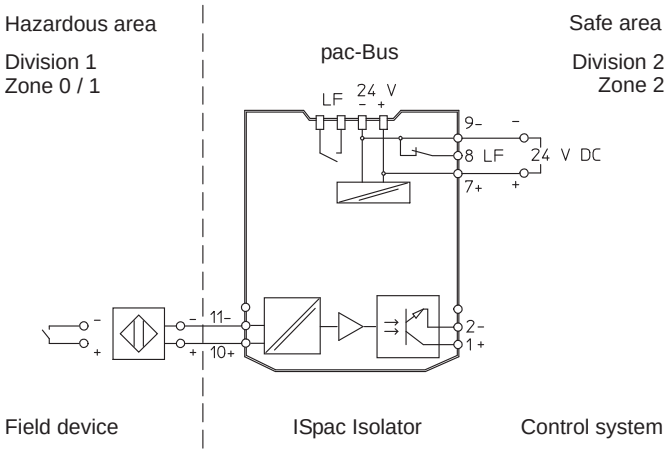
Technical Data

Electrical connection

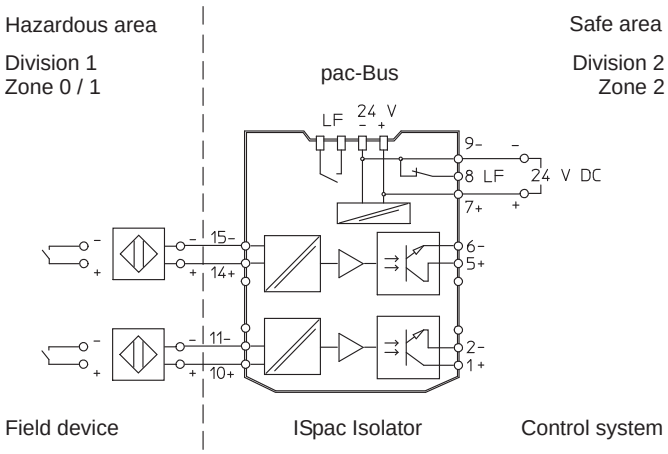
Connection diagram

24 V DC

1 channel
9170/11-14-11



2 channels
9170/21-14-11



Explosion Protection	
Global (IECEx)	
Gas and dust	IECEx BVS 09.0041X Ex nAc nCc [ia] IIC T4, [Ex ia] IIIC [Ex ia Da] IIIC
Europe (ATEX)	
Gas and dust	DMT 02 ATEX E 195 X Ⓔx II 3 (1) G Ex nA nC [ia Ga] IIC T4 Gc Ⓔx II (1) D [Ex ia Da] IIIC
Certifications and certificates	
Certificates	IECEx, ATEX, Brazil (INMETRO), Canada (cFM), Kazakhstan (TR), Korea (KCs), Russia (TR), USA (FM), Belarus (TR)
Ship approval	DNV GL
Explosion Protection	
Safety data	
Inputs (channels individually)	
Max. voltage U_o	9.6 V
Max. current I_o	10 mA
Max. power P_o	24 mW
Max. connectable capacitance C_o	
IIC	3,6 µF
IIB	26 µF
I	99 µF
Max. connectable inductance L_o	
IIC	350 mH
IIB	1000 mH
I	1000 mH
Internal capacitance C_i	2.42 nF
Internal inductance L_i	negligible
Safety-related maximum voltage	253 V
Explosion Protection	
Further parameters	
Installation	in Zone 2, Div. 2 and in the safe area
Further information	see respective certificate and operating instructions
Explosion Protection	
Functional safety (IEC 61508)	
Test report	Exida STAHL 09/03-52 R019
Max. SIL	2
Further information	siehe Safety Manual und Prüfbericht

Technical Data

Electrical data	
Auxiliary power	
Nominal voltage U_N	24 V DC
Voltage range	18 ... 31.2 V
Residual ripple	< 3,26 V_{SS}
Nominal current at U_N	
1 channel	26 mA
2 channels	36 mA
Power consumption at U_N	
1 channel	0.6 W
2 channels	1.9 W
Power dissipation	
1 channel	0.6 W
2 channels	1.9 W
Polarity reversal protection	yes
Operation indication	LED green „PWR“
Undervoltage monitoring	yes (no faulty module / output states)
Galvanic separation	
Test voltages	
acc. to standard	EN 60079-11
Ex i input to output	1.5 kV AC
Ex i input to auxiliary power	1.5 kV AC
Ex i inputs interconnected	500 V AC
Ex i input to error message contact	1.5 kV AC
acc. to standard	EN 50178
Output to auxiliary power	1.1 kV AC
Outputs interconnected	1.1 kV AC
Error contact to power supply	350 V AC
Error contact to outputs	1.1 kV AC
Ex i input	
Input signal	acc. to EN 60947-5-6 (NAMUR)
Current for ON / OFF	
ON	≥ 2.1 mA
OFF	≤ 1.2 mA
Hysteresis	approx. 0.2 mA
Open-circuit voltage	8.2 V
Short-circuit current	≤ 8.2 mA
Internal resistance	1000 Ω

Technical Data

Output	
Maximum load DC	35 V / 50 mA DC
Maximum load AC	– –
Max. switching capacity	1.75 W
Overload protected	yes
Electrical service life	
Resistive load	> 10^9 cycles at 35 V / 50 mA
Max. switching frequency	10 kHz
Switching delay ON / OFF	15 µs
Switching delay OFF / ON	30 µs
Electronic output closed	R = 2.4 k Ω
Electronic output opened	R > 13 k Ω
In case of error (signalisation contact open)	R > 100 k Ω
Settings (switch INV)	Inversion of operating mode
Indication	LED yellow „OUT“ per channel
Error detection Ex i input	
Open circuit	I_{in} < 0.05 ... 0.35 mA
	according to EN 60947-5-6
Short circuit	R_{in} < 100 ... 360 Ω
	according to EN 60947-5-6
Behaviour of the output	OFF
Settings (switch LF)	activated / deactivated
Error detection	LED red "LF" each channel
Message of line fault and auxiliary power failure	- Contact in the output circuit (35 V / 50 mA) opens in case of fault - Contact (30 V / 100 mA) close to ground in case of fault - pac-Bus, floating contact (30 V / 100 mA)
Electromagnetic compatibility	Tested under the following standards and regulations: EN 61326-1 (can be used in industrial environment) NAMUR NE 21

Ambient conditions

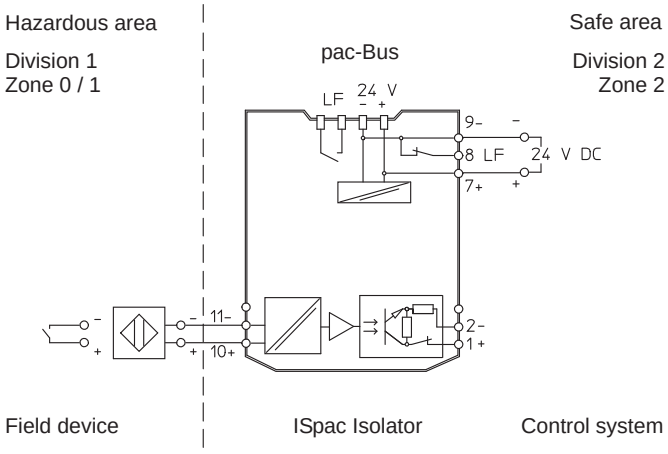
Ambient temperature	
Single device	-20 ... +70 °C
Group assembly	-20 ... +65 °C
	The installation conditions affect the ambient temperature.
	Observe the "Cabinet installation guide"
Storage temperature	-40 ... +80 °C
Relative humidity (no condensation)	≤ 95 %
Use at the height of	< 2000 m

Technical Data

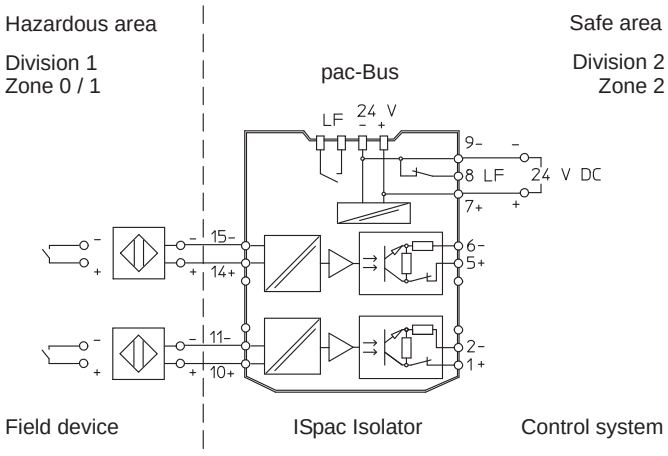
Electrical connection

Connection diagram

1 channel
9170/11-14-12. LFT



2 channels
9170/21-14-12. LFT

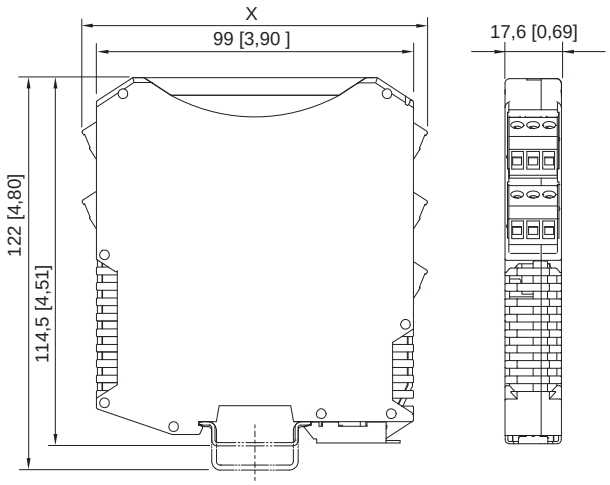


Technical Data

Mechanical data

		Screw terminals	Spring clamp terminals
Connection			
	Single-wire connection		
	- rigid	0.2 ... 2.5 mm²	0.2 ... 2.5 mm²
	- flexible	0.2 ... 2.5 mm²	0.2 ... 2.5 mm²
	- flexible with core end sleeves (without / with plastic sleeve)	0.25 ... 2.5 mm²	0.25 ... 2.5 mm²
	two-wire connection		
	- rigid	0.2 ... 1 mm²	–
	- flexible	0.2 ... 1.5 mm²	–
	- flexible with core end sleeves	0.25 ... 1 mm²	0.5 ... 1 mm²
Weight	approx. 160 g		
Mounting type	on top hat rail (NS35/15, NS35/7.5) or in pac-Carrier		
Mounting orientation	horizontal or vertical		
Enclosure	IP30		
Terminals	IP20		
Enclosure material	PA 6.6		
Fire resistance (UL-94)	V0		

Dimensional Drawings (All Dimensions in mm [inches]) - Subject to Alterations



	Dimension X
Screw-type terminals	108 mm / 4,25″
Spring-cage terminals	128 mm / 5,04″

Accessories and Spare Parts

Designation	Description	Art. no.
Resistance coupling element	Connection of additional contacts in the Ex area as well, in order to enable short circuit and open circuit detection.	**105944**

We reserve the right to make alterations to the technical data, dimensions, weights, designs and products available without notice. The illustrations cannot be considered binding.

U.S. Tsubaki Power Transmission, LLC.
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Wheeling, IL 60090

Phone: 800.323.7790
Fax: 847.459.9515
Email: sales@ustsubaki.com
Website: www.ustsubaki.com

Item # TSBSB05, TSBSB Shock Relay for Overload Protection

TSBSB Shock Relay series – Overload protection has built-in reset button, test button, fail-safe contacts with manual and automatic reset feature TSBSB Shock Relay senses the problem before downtime, maintenance, and equipment damage occur, saving you time and money. Install it on a line, set the overload parameters, and Shock Relay takes care of the rest. If an overload is detected, the Shock Relay can send a warning or shut down the line – quick and reliably.

+ more

Specifications −

Motor HP 230 VAC	1/8 to 1 hp
Motor HP 460 VAC	1/4 to 3 hp
Operation Power	24 to 240 V AC/DC +/- 10%, 50/60 Hz
Maximum Motor Voltage	600 VAC at 50/60 Hz
Load Current Setting Range	0.5 to 6 A
Trip Output Relay Status - Energized/Fail Safe to Open	Manual Setting
Trip Output Relay Status - Energized/Fail Safe Close	Automatic Setting
Trip Output Relay Contact Rating	3A Load

Start Time Setting Range	0.2 to 10 s
Shock Time Setting Range	0.2 to 5 s
Allow. Input Voltage Fluctuation (Full Scale)	10 %
Output Contact	3A/250 VAC, Resistive
Test Button	Yes
Test Function	Built In
Withstanding Voltage	2000 VAC, 5 mA at 60 Hz for 1 min. between terminal and enclosure
Weight	0.440 lb 0.20 kg
Shock Relay Power Supply	90 to 240 VAC
Power Consumption (or less)	2 W
Operating Temperature Range	-4 to 140 ºF -20 to 60 ºC
Max. Elevation	2000 m 6500 ft
Operating Humidity	45 to 85% R.H. with no condensation
Atmosphere	Free of corrosive gas and dust. Pollution degree 3 or below when installed in control box
Protection Rating	IP20
Construction Material	Material Upper Housing - PA6 Material Lower Housing - PA66 Terminal Cover - PA6
Certifications	CE Marking - Europe RoHS Compliant CCC - China UL/cUL - North America
Mounting	35 mm DIN Rail or Mounting Plate
Storage Temperature Range	-22 to 158 ºF -30 to 70 ºC

U.S. Tsubaki Power Transmission, LLC.
301 E. Marquardt Dr.
Wheeling, IL 60090

Phone: 800.323.7790
Fax: 847.459.9515
Email: sales@ustsubaki.com
Website: www.ustsubaki.com

Item # TSBSB30, TSBSB Shock Relay for Overload Protection

TSBSB Shock Relay series – Overload protection has built-in reset button, test button, fail-safe contacts with manual and automatic reset feature TSBSB Shock Relay senses the problem before downtime, maintenance, and equipment damage occur, saving you time and money. Install it on a line, set the overload parameters, and Shock Relay takes care of the rest. If an overload is detected, the Shock Relay can send a warning or shut down the line – quick and reliably.

+ more

Specifications −

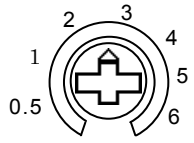
Motor HP 230 VAC	5 to 7 hp
Motor HP 460 VAC	7 to 15 hp
Operation Power	24 to 240 V AC/DC +/- 10%, 50/60 Hz
Maximum Motor Voltage	600 VAC at 50/60 Hz
Load Current Setting Range	3 to 30 A
Trip Output Relay Status - Energized/Fail Safe to Open	Manual Setting
Trip Output Relay Status - Energized/Fail Safe Close	Automatic Setting
Trip Output Relay Contact Rating	3A Load

Start Time Setting Range	0.2 to 10 s
Shock Time Setting Range	0.2 to 5 s
Allow. Input Voltage Fluctuation (Full Scale)	10 %
Output Contact	3A/250 VAC, Resistive
Test Button	Yes
Test Function	Built In
Withstanding Voltage	2000 VAC, 5 mA at 60 Hz for 1 min. between terminal and enclosure
Weight	0.440 lb 0.20 kg
Shock Relay Power Supply	90 to 240 VAC
Power Consumption (or less)	2 W
Operating Temperature Range	-4 to 140 ºF -20 to 60 ºC
Max. Elevation	2000 m 6500 ft
Operating Humidity	45 to 85% R.H. with no condensation
Atmosphere	Free of corrosive gas and dust. Pollution degree 3 or below when installed in control box
Protection Rating	IP20
Construction Material	Material Upper Housing - PA6 Material Lower Housing - PA66 Terminal Cover - PA6
Certifications	CE Marking - Europe RoHS Compliant CCC - China UL/cUL - North America
Mounting	35 mm DIN Rail or Mounting Plate
Storage Temperature Range	-22 to 158 ºF -30 to 70 ºC

13. Volume Setting Step

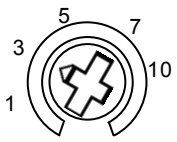
13.1 Setup before operation

・Current set volume



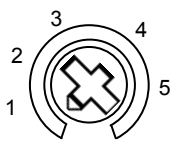
Set to motor rate current

・Start time set volume



Set to 3 seconds

・Shock time set volume



Set to the minimum

13.2 Start Time volume setting

①Start motor. In case that Shock Relay does not operate but motor operates, turn volume counterclockwise by slow degrees and set to the minimum.

②In case that Shock Relay operates, turn volume clockwise by slow degrees, prolong Start Time sequentially until motor operates, and set to the position where Shock Relay does not operate at the starting.

③ For settings beyond the scale, check operating time with TEST button.

13.3 Current volume setting

Turn volume counterclockwise until Shock Relay activates. Turn volume back (about 20～30%) clockwise to set.

13.4 Shock Time volume setting

Set Shock Time volume to the position at which Shock Relay will not trip due to instantaneous overload.

Preferably, set Shock Time to the minimum in accordance with the device property.

14. Troubleshooting

Trouble	Check	Result	Solution
Mon does not light	A1, A2 wiring	Incorrect wiring	Wire correctly
	A1, A2 voltage	Not between 24～240V	Supply 24～240V
Does not trip at current volume MIN.	Wiring of CT	Incorrect wiring	Wire correctly
	Press and hold TEST	Does not trip	Change Shock Relay
Instantly trip after startup.	Start Time setting	Set too short	Set properly
	Current setting	Set too low	Set properly
Trip at instantaneous overload.	Current setting	Set too low	Set properly
	Shock Time setting	Set too short	Set properly
Does not trip at overload	Current setting	Set too high	Set properly
	Shock Time setting	Set too long	Set properly
	Press and hold TEST	Does not trip	Change Shock Relay

If above contents are not applicable or the replacement of Shock Relay is necessary, please contact our sales office.

15. Maintenance

Maintenance and check must be performed in accordance with the following matters.

①To prevent an accident, keep the surrounding area clean and safe.

②Power off before the installation / connection of Shock Relay

③Comply with the 2-1-1 General Standard of “Ordinance on Labor Safety and Hygiene “.

16. Daily check

MON lamp (green) lights when Shock Relay is power on.

17. Periodic check

(1) Check whether there is any looseness in the installation of the Shock Relay and current transformer. (Every six months)

(2) Check relay output function by pressing the TEST button until it trips. (Every six months)

(3) Check relay output function by dialing CURRENT volume counterclockwise during motor operation. (Every six months)

(4) In the megger test, DC500V needs to be applied on the earth connection and circuit.
In the external circuit withstand voltage test, do not apply test voltage on Shock Relay. Same is with CT.

(5) The typical life span of electrolytic capacitor is about 10 years at an average ambient temperature of 30℃. It is recommended to overhaul or exchange for a new one before trouble occurs.

18. Warranty: Tsubaki E&M Co.: hereinafter referred to as "Seller" Customer: hereinafter referred to as "Buyer" Goods sold or supplied by Seller to Buyer: hereinafter referred to as Goods.

18.1 Warranty period without charge

Effective 18 months from the date of shipment or 12 months from the first use of Goods, including the installation of the Goods to the Buyer's equipment or machine – whichever comes first.

18.2 Warranty coverage

Should any damage or problem with the Goods arise within the warranty period, given that the Goods were operated and maintained according to the instructions provided in the manual, the Seller will repair and replace at no charge once the Goods are returned to the Seller.

This warranty does not include the following:

(1) Any costs related to removal of Goods from the Buyer's equipment or machine to repair or replace parts.
(2) Cost to transport Buyer's equipment or machines to the Buyer's repair shop.
(3) Costs to reimburse any profit loss due to any repair or damage and consequential losses caused by the Buyer.

18.3 Warranty with charge

Seller will charge for any investigation and repair of Goods caused by

(1) Improper installation by failing to follow the instruction manual.
(2) Insufficient maintenance or improper operation by the Buyer.
(3) Incorrect installation of the Goods to other equipment or machines.
(4) Any modifications or alterations of Goods by the Buyer.
(5) Any repair by engineers other than the Seller or those designated by the Seller.
(6) Operation in an environment not specified in the manual.
(7) Force Majeure or forces beyond the Seller's control such as natural disasters and injustices inflicted by a third party.
(8) Secondary damage or problems incurred by the Buyer's equipment or machines.
(9) Defective parts supplied or specified by the Buyer.
(10) Incorrect wiring or parameter settings by the Buyer.
(11) The end of life cycle of the Goods under normal usage.
(12) Losses or damages not liable to the Seller.

18.4 Dispatch service.

The service to dispatch a Seller's engineer to investigate, adjust or trial test the Seller's Goods is at the Buyer's expense.

Multi-Rake Screen Electrical Troubleshooting

Caution: Follow all lockout/tagout procedures before performing any electrical troubleshooting.

Symptom	Cause	Action
No control power available.	1. Control panel disconnect turned "Off. 2. Supply voltage to control panel turned "Off" 3. Control Power switch turned "Off" 4. Control power fuse blown.	1. Turn control panel disconnect to the "On" position. 2. Turn the supply voltage source to the "On" position. 3. Turn Control Power switch to the "On" position. 4. Replace control power fuse. Check for short circuit.
Control power available. Screen will not run.	1. Emergency Stop button pushed. 2. Hand-Off-Auto switch in the "Off" position. 3. Overcurrent condition present. (Fault Light) Due to high current draw on the drive motor. 5. Motor temperature. (Fault Light) Due to high motor temperature during operation.	1. Pull Emergency Stop button out. 2. Place the Hand-Off-Auto switch in the Auto position. 3. Rake has encounter large object in channel. Manually reverse rake, remove obstruction, press Fault Reset push button. Resume automatic operation. 5. Press Fault Reset push button to reset. Investigate conditon of the drive motor. Consult factory for guidance.
Screen runs continuously.	1. High level present. 2. H/O/A switch is in "Hand" and F/O/R switch is in "Forward". 3. PLC based frequency and duration timers have lost their program set points.	1. If high channel level upstream present this is not a problem. If not present check operation of level detector and selector switch positions. Observe operation. 2. Place the H/O/A switch or the F/O/R switch in the "Off" position. 3. Re-enter set points in timers. Observe operation.
Fault light "On".	1. Variable frequency drive has encounter high current draw.	1. Check for large debris on the front of the screen. Remove debris. Check for binding of a rake or rakes. Adjust as needed. Press Fault Reset push button to reset.

Screw Conveyor Electrical Troubleshooting

Caution: Follow all lockout/tagout procedures before performing any electrical troubleshooting.

Symptom	Cause	Action
No control power available.	1. Control panel disconnect turned "Off. 2. Circuit breaker turned "Off" 3. Control power switch turned "Off" 4. Transformer primary fuse blown. 5. Transformer secondary fuse blown.	1. Turn control panel disconnect to the "On" position. 2. Turn circuit breaker to the "On" position. 3. Turn control power switch to the "On" position. 4. Replace transformer primary fuse. 5. Replace transformer secondary fuse.
Control power available. Screw Conveyor will not run.	1. E-Stop tripped. 2. H/O/A switch in the "Off" position. 3. Screw Conveyor in overtorque condition. 4. Solid state motor overload tripped.	1. Reset E-Stop. 2. Place the H/O/A switch in the Auto position. 3. Investigate and correct cause. Push Fault Reset push button to reset. 4. Press Fault Reset push button to reset.
Overtorque pilot light "On".	1. Current sensing relay tripped.	1. Check for large debris in hopper. Remove debris. Press Fault Reset push button to reset.
Motor Overload pilot light "On".	1. Solid-state motor overload tripped.	1. Investigate and correct cause of condiiton. Press Fault Reset push button to reset.

Compactor Electrical Troubleshooting

Caution: Follow all lockout/tagout procedures before performing any electrical troubleshooting.

Symptom	Cause	Action
No control power available.	1. Control panel disconnect turned "Off. 2. Compactor circuit breaker turned "Off" 3. Control power switches turned "Off" 4. Transformer primary fuse blown. 5. Transformer secondary fuse blown.	1. Turn control panel disconnect to the "On" position. 2. Turn Compactor circuit breaker to the "On" position. 3. Turn Control power switch to the "On" position. 4. Replace transformer primary fuse. 5. Replace transformer secondary fuse.
Control power available. Compactor will not run.	1. Compactor E-Stop button pushed. 2. Compactor H/O/A switch in the "Off" position. 3. Compactor in Fault condition. 4. Compactor solid state motor overload tripped.	1. Pull Compactor E-Stop button out. 2. Place the Compactor H/O/A switch in the Auto position. 3. Investigate and correct cause. Push Fault Reset push button. 4. Push Compactor Reset push button to reset condition.
Compactor not running, water running into press.	1. Foreign material in solenoid valve. 2. Solenoid valve failed.	1. Use ball valve to isolate affected valve. Disassemble valve, clean & inspect valve, reassemble valve. 2. Replace valve with valve of same rating.
Compactor Fault pilot light "On".	1. Current sensing relay tripped. Motor overload tripped	1. Check for large debris hopper. Manually reverse press. Remove debris. Push Compactor Fault push button to reset condition.

8 Project Data

Section 8
Project Data

8.1 Warranty
(See the following pages)

Warranty

VULCAN INDUSTRIES, warrants all equipment of its own manufacture to be free of defects caused by faulty material or workmanship and shall, of its option, exchange or repair without charge, F.O.B. its factory, such part or parts thereof that prove defective under normal use within twenty-four (24) months from date of actual start-up. **VULCAN INDUSTRIES** obligation under this warranty is limited to the above and does not apply to replacement or repairs which are required as the result of improper installation, misuse, maladjustment, abnormal operating conditions, or lack of routine maintenance. Nor does the warranty include the furnishing of service for maintenance or problems arising from the foregoing causes. No claims for labor or other expenses will be recognized. This warranty is in lieu of and to the exclusion of all other warranties expressed or implied, statutory or otherwise.

VULCAN INDUSTRIES shall not be liable for any claims, losses, labor, expenses or damages, direct or consequential, resulting directly or indirectly from the use of, or the inability to use, its products, or for other consequential loss or damage of any nature arising from any cause.

THIS WARRANTY IS THE SOLE WARRANTY OF VULCAN INDUSTRIES AND ANY OTHER WARRANTIES EXPRESS, IMPLIED IN LAW, IMPLIED IN FACT, INCLUDING WARRANTIES OR MERCHANTABILITY AND FITNESS FOR USE, ARE HEREBY SPECIFICALLY EXCLUDED.

PROJECT: Wichita, KS

PROJECT NO. 19177

8.2 Project Specifications
(See the following pages)

Job Location: Wichita, KS
Job No. 19177

MULTIPLE RAKE BAR SCREEN
MODEL #VMR-48

PART 1 GENERAL

1.01 DESCRIPTION

A. Vulcan Industries, Inc. shall furnish four (4) fully automatic multiple rake bar screens for collecting and removing debris from the incoming wastewater flow.

B. The multiple rake bar screens shall be provided complete with all accessories, spare parts, mounting, anchor bolts and other appurtenances as specified and as may be required for a complete and operating installation.

C. It shall be the Contractor's responsibility to insure that the multiple rake bar screens and appurtenances furnished and installed shall be compatible with and have the necessary operating clearances to the structural elements and associated equipment shown on the Contract Drawings.

1.02 REFERENCES

A. American Gear Manufacturers Association (AGMA)

B. National Electrical Manufacturers Association (NEMA)

C. American Federation of Bearing Manufacturers Association (AFBMA)

D. American Society for Testing and Materials (ASTM)

E. American Welding Society (AWS)

F. Steel Structures Painting Council, American National Standards Institute (SSPC)

G. Underwriters Laboratory (UL)

1.03 QUALITY ASSURANCE

A. The materials covered by these specifications are intended to be standard equipment of proven reliability and as manufactured by Vulcan Industries, Inc. The equipment furnished shall be designed and constructed in accordance with the best practices and methods and shall operate satisfactorily when installed as shown on the Contract Drawings and operated per the manufacturer's recommendations.

B. The manufacturer shall have designed and manufactured rake type bar screens for a minimum of ten (10) years.

1.04 DESIGN REQUIREMENTS

Number of Units	Four (4)
Average Daily Flow	25.0 MGD each
Peak Hourly Flow	40.0 MGD each
Flow Channel Width	4'-0"
Flow Channel Depth	22'-0"
Discharge Height EL.	1287.55'
Operating Floor EL.	1282.02'
Top of Bar Rack EL.	1272.02'
Invert EL.	1260.02'
Bar Rack Spacing	½" clear spacing
Setting Inclination	85 degrees from horizontal

1.05 STORAGE AND HANDLING OF EQUIPMENT

A. The CONTRACTOR shall store and temporarily support equipment prior to installation in strict accordance with the Manufacturer's recommendations and instructions. Protect all exposed surfaces. Keep records of the storage parameters and the dates that storage procedures were performed. The CONTRACTOR shall be responsible for work, equipment, and materials until inspected, tested and finally accepted.

B. Protect the equipment from being contaminated by dust, dirt, vibration and moisture.

C. Temporarily connect equipment with built in space heaters to a power source and keep heaters in operation. Rotate all shafts that have bearings on at least a monthly basis.

D. The unit shall be erected and lubricated in strict accordance with the installation instructions.

PART 2 PRODUCTS

2.01 GENERAL

A. The equipment furnished shall positively clean and remove debris from the incoming wastewater by means of a bar rack, installed in a concrete channel designed to retain debris. A traveling chain and raking mechanism removes and elevates the debris to a discharge scraper mechanism. The bar rack shall be cleaned by multiple rakes engaging the upstream side bar rack from the bottom of the channel and removing the debris. The debris shall be lifted above the top of the channel and discharged through the downstream side to a screenings conveyor.

B. The mechanically cleaned multiple rake bar screen system shall be fully automatic and shall consist of the following components:

Bar Rack	Frame, Supports and Guides
Dead Plate	Drive Machinery
Discharge Chute	Anchor Bolts
Wiper Assembly	Rake & Chain Assembly

Electrical Controls and Control Panel

In addition, any other components required to provide a system, which will be capable of fully performing the functions specified.

C. The design shall be such to ensure that all manufacturer recommended preventive maintenance to the bar screen can be accomplished at the operating floor level.

D. The equipment shall be designed and built for 24-hour intermittent service and for moderate shock without overheating, excessive vibration or strain.

2.02 FRAME ASSEMBLY

A. The side frames shall be formed from plate with engineered bends and provided with bracing to form a rigid assembly capable of withstanding all operating forces when installed in accordance with manufacturer’s instructions.

B. The frame shall be manufactured of 316 stainless steel plate, having a minimum thickness of 1/4-inch. The frame shall have a minimum width of 28-inches and extend fully from the bottom of the channel to the top of the bar screen assembly.

C. Each side frame shall include chain guides attached to the frame to

align the rake teeth into the screen bars and maintain engagement in the bar rack. The chain guides shall assist in deflecting flow and solids away from the chain and lower guides to minimize materials from collecting on the guides and chain. The chain guides shall be manufactured of 316 stainless steel.

2.03 RAKE & CHAIN ASSEMBLY

A. The rake and chain assembly shall consist of multiple rakes attached to the roller links of the roller chain. The roller chain shall engage onto adjustable upper sprockets and fixed lower guides on each side of the screen.

B. The upper sprockets shall be key mounted onto a drive shaft. The sprockets shall be of the pitch and width to match the roller chain and shall have a 316 stainless steel hub and sprocket teeth.

C. The lower guides shall be bolted to the side frames and shall provide positive engagement of the rake teeth into the bar rack. The lower guide rail bearing assembly shall consist of a field replaceable stainless steel hub with an integral abrasion resistant polymeric bearing surface. The lower guides shall be a self-lubricating design. The lower guides will be replaceable without removing the screen from the channel.

D. Rake drive chains shall be 125mm pitch, 70mm roller diameter and 6mm link plates rated for a maximum of 24,000 lbs. operating force. Link plates shall be 316 stainless steel. Rollers and bushings shall be heat treated 17-4PH series stainless steel.

E. The rake teeth shall be precision cut from ½-inch thick plate in the shape to properly engage the clear space openings in the bar rack. The rake teeth shall engage the bar rack a minimum of 50 percent of the bar depth. The rake teeth shall be made in removable / replaceable sections and attach to the rake shelf. The rake teeth and rake shelf shall be 316 stainless steel.

2.04 DRIVE ASSEMBLY

A. The bar screen shall be provided with an integrated drive assembly consisting of a Class 1, Division 1, Group D explosion-proof electric motor and helical worm gear reducer. The drive motor and gear reducer shall be mounted on the drive shaft and the frame. The drive shaft shall operate in a grease-able bearing mounted on the external side of the frame. The entire drive assembly will be

supported by adjustable jacking plates mounted on the exterior of the frames to provide rake alignment and proper chain tension.

B. The electric motor shall be close-coupled to the reducer. The motor shall be 3 horsepower with a service factor of 1.0. Electrical characteristics shall be 230/460 volt, 3-phase, 60 Hertz, Class F/B rise insulation, 40 degree C Ambient, inverter duty.

C. The gear reducer shall be of the helical worm gear type and shall be capable of elevating the weight of the rake and chain assembly plus its maximum calculated debris load.

D. Gear reducers shall have ball or roller bearings throughout with all moving parts immersed in oil.

E. Helical gears shall be of alloy steel with threads precision ground and polished after casehardening.

F. The worm gear shall be high strength alloy bronze.

G. Gear shafts shall be of high strength alloy steel ground to required tolerances.

H. All ball or roller bearings shall be rated and manufactured by a member of the Antifriction Bearing Manufacturer's Association. At least one bearing on each shaft shall be of the combined radial and thrust type.

I. Gear reducer units shall meet the standards of the AGMA for such equipment under moderate shock, 24-hour service with a minimum service factor of 1.25.

J. The output capacity of the gear reducer shall be equal to the motor horsepower less reducer losses at the rated service factor.

2.05 BAR RACK

A. The bar screen shall be provided with a removable bar rack. The bar rack shall consist of equally spaced, parallel bars having 1/2-inch clear spacing between each bar. The bars shall be straight and inclined at 85 degrees above the horizontal plane.

B. The bottom of the bars shall be curved and attached to a flush bottom, base plate. The bar rack shall extend from the base plate to the connection point on the dead plate.

C. The raking mechanism shall engage the bottom most portion of the bar rack prior to reaching the inclined section of the rack.

D. Bar racks shall not require a recess in the bottom of the flow channel.

E. The inclined section of the bar rack shall consist of trapezoidal bars that shall be 5/16-inches thick by 3/16-inches thick by 1 1/2-inches deep. The bars shall extend 12-feet 0-inches above the channel invert.

F. The bar rack shall be manufactured of 316 stainless steel.

2.06 DEAD PLATE

A. The bar screen shall be provided with a fixed dead plate extending from the upper portion of the bar rack connection to the screenings discharge point.

B. The plate shall be flat without undulation so that the rake head teeth will ride no closer than 1/16-inch from the dead plate and no further than 1/4-inch from the dead plate. It shall be securely fastened to the side frames.

C. The dead plate shall be manufactured of 316 stainless steel having a minimum thickness of 1/4-inch.

2.07 DISCHARGE CHUTE

A. The rakes shall be designed to reach a predetermined discharge height above the floor elevation. A directing (discharge) chute positioned a minimum 45 degrees from horizontal and located at the top of the dead plate shall be a part of each bar screen.

B. A full discharge chute enclosure shall be provided. The enclosure shall be manufactured of 10-gauge 316 stainless steel and shall be provided with an access door to facilitate wiper inspection and replacement.

2.08 WIPER ASSEMBLY

A. A pivoting wiper mechanism will be positioned at the point of discharge and shall have a replaceable ultra-high molecular weight polyethylene (UHMW) wiper blade.

B. During each cycle, the wiper blade shall contact the rake heads at its inner surface during upward travel and shall scrape the debris off

the end of the rake head and through the discharge chute. The entire wiper mechanism including the wiper arms shall be fully contained inside the framework of the bar screen.

C. The wiper mechanism, excluding the wiper blade, shall be manufactured of 316 stainless steel. No moving parts shall extend beyond the framework or the discharge chute.

D. The design shall be such that the rake repositions the wiper mechanism. The wiper mechanism design shall allow the rake assembly to be operated in reverse, through the wiper mechanism, without the need to manually lift the wiper assembly.

E. The grease fittings for the wiper arms shall be extended and secured to the side frames in an area where they can be easily accessed by plant personnel.

F. Shock absorbers shall be provided to cushion the release of the wiper.

2.09 FRAME ENCLOSURES

A. The bar screen shall be provided with removable enclosure panels on the upstream portions of the bar screen above the operating floor.

B. The removable enclosure panels shall be provided with engineered bends. The panels shall be manufactured of 20-gauge 316 stainless steel held in place by latches. Each panel shall be provided with two (2) handles for panel removal / replacement. All handles and latches shall be 316 stainless steel.

2.10 FASTENERS

A. All fasteners shall be 316 stainless steel unless otherwise indicated in this specification. All threaded fasteners shall be coated with a nickel based anti-seize thread lubricant prior to assembly.

2.12 ANCHOR BOLTS

A. All anchor bolts shall be 316 stainless steel unless otherwise indicated in this specification. Anchor bolts shall be ample size and strength for the purpose intended and as shown on the Contract Drawings.

2.13 CONTROLS / INSTRUMENTATION

A. The control system description, Sequence of Operation, wiring diagrams and list of components can be found in submittal Section 5

or operation manual Section 7.

2.15 LUBRICATION

A. The manufacturer shall state in the operating manual the amount of and specification for any lubricant required.

2.16 PROTECTIVE COATINGS

A. Stainless steel and plastic components shall not be painted. The stainless steel structural components shall be passivated after fabrication to remove embedded iron, surface rust and weld burn.

B. All other surfaces shall be solvent cleaned to remove dirt, oil and foreign materials. Cleaned surfaces shall be shop primed with one (1) coat of TNEMEC Series N69-1212 primer, or equal, to attain a minimum dry film thickness of 2.5 mils.

C. The motor and gear reducer shall be finish coated with two (2) coats TNEMEC Series 1074 Endura-Shield, or equal, to attain a total minimum dry mil thickness of 5 mils.

D. Non-stainless steel controls panels shall have manufacturer's standard paint finish.

2.17 SPARE PARTS

A. The Manufacturer shall furnish the following spare parts as the total amount of spare parts for this specification section.

1. Four (4) wiper blades
2. Four (4) 5-foot sections of drive chain
3. Four (4) proximity switches

B. All spare parts shall be properly packaged, labeled and stored where directed by the Owner or Engineer.

PART 3 EXECUTION

3.01 TESTING

A. The screen shall be factory assembled and factory run tested for a minimum of 8 hours. The main control shall also be factory tested.

B. The screen shall also be field tested after erection in the presence of the Owner and Engineer to confirm and verify the structural and mechanical

compliance to the specification. The field acceptance test shall include demonstrating that the rake teeth properly engage the bar rack along the length of the bar rack and that the screen can be run continuous for 4-hours without overheating.

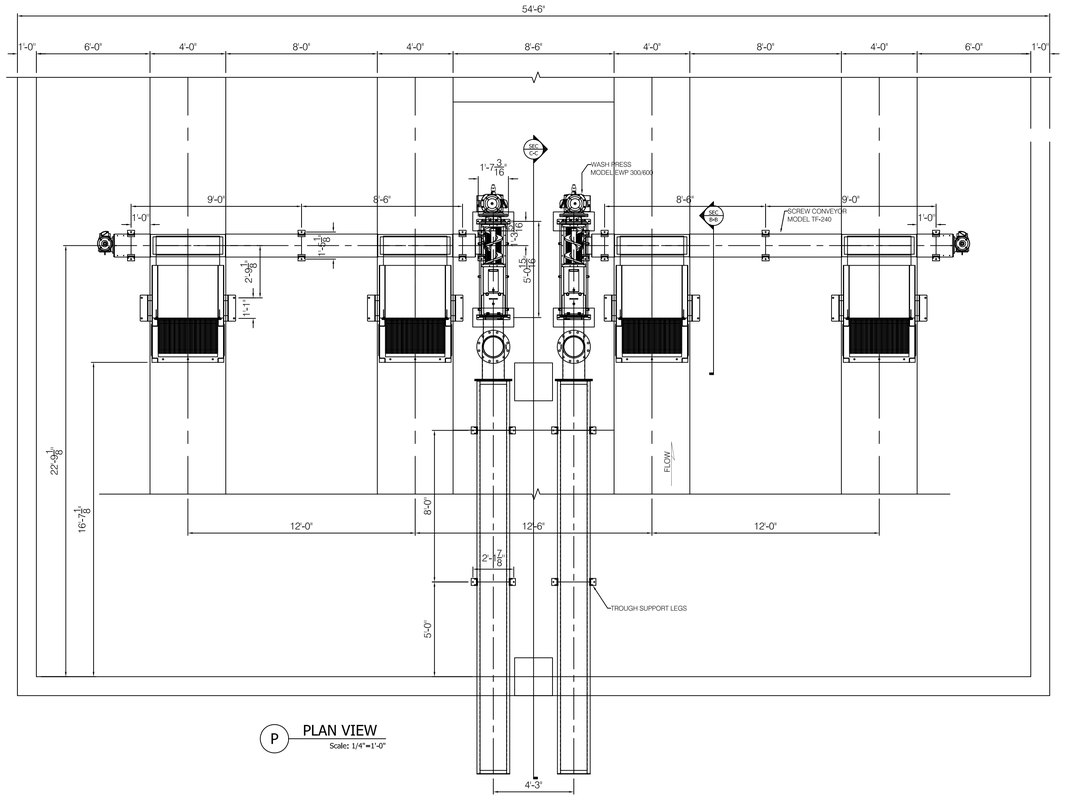
3.02 INITIAL START-UP AND TRAINING

A. The services of a factory-employed service technician shall be provided to inspect the installation, test the equipment furnished under this Contract and instruct the Owner’s operating personnel in its maintenance and operation. The services of the technician shall be provided as follows:

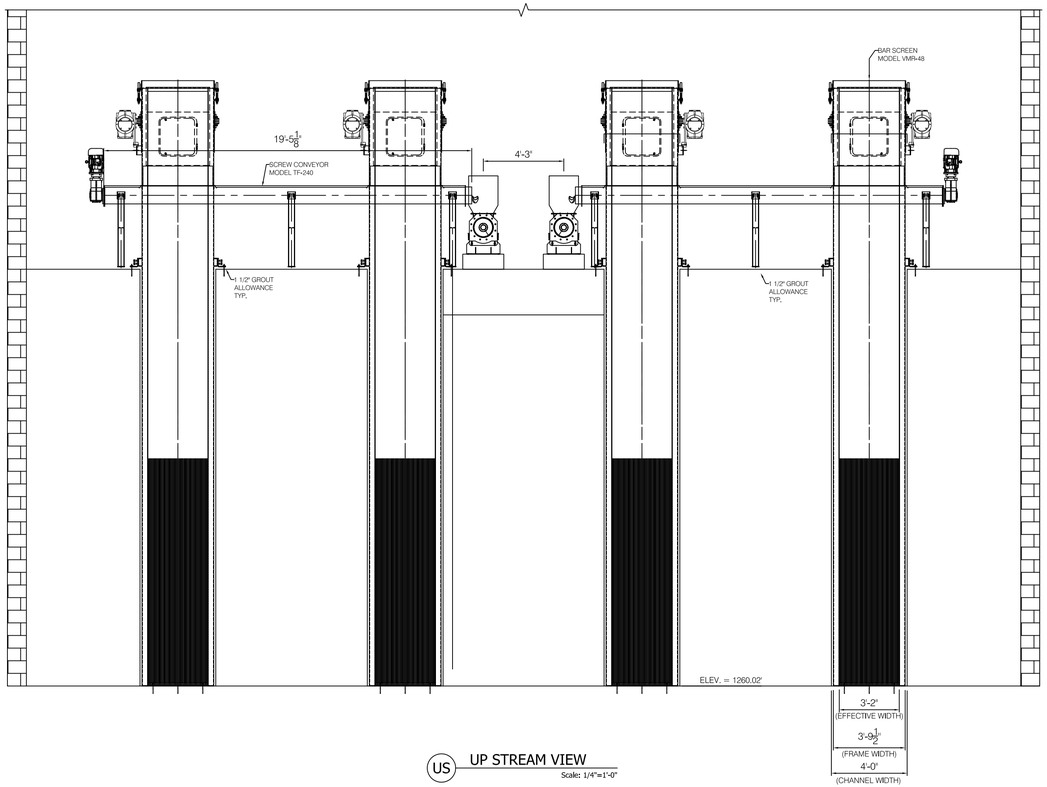
1. Two (2) trips, total of three (3) 8-hour days of service to inspect and certify the installation prior to startup and provide Owner's personnel in proper operation and maintenance of the equipment.

2. Start-up service and training for the bar screen will be combined with the service for the washing presses and conveyors.

8.3 General Arrangement Drawing
(See the following pages)



P PLAN VIEW
Scale: 1/4"=1'-0"



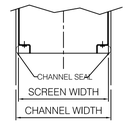
US UP STREAM VIEW
Scale: 1/4"=1'-0"

C VMR FRAME COMPONENTS
Scale: N.T.S

W VMR WIPER COMPONENTS
Scales: N.T.S

AS-BUILT

DATE: 5/5/2020 BY: JDF



PLAN VIEW
CHANNEL CLOSEOUT

APPROXIMATE SHIPPING WEIGHTS:

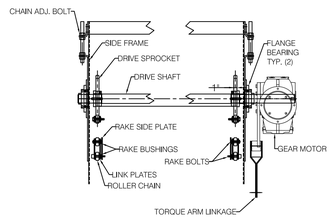
MULTI-RAKE SCREEN: 9,000 LB. EACH

EWP 300/600- WASH PRESS : 2,050 LB.

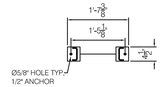
WASH PRESS DISCHARGE PIPING 1,000 LB.

** ALL DIMENSIONS AND ELEVATIONS ON THIS DRAWING TO BE VERIFIED.

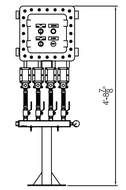
CC VMR CHANNEL CLOSEOUT
Scale: N.T.S

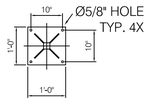


D VMR DRIVE COMPONENTS
Scale: N.T.S

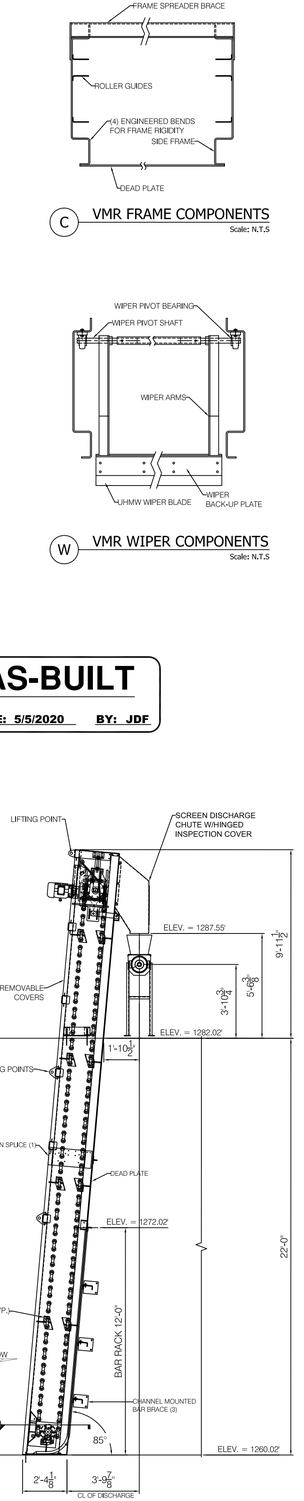


CS CONVEYOR ANCHOR SUPPORT DETAIL
Scale: 1/2"=1'-0"





WP WASH PRESS VALVE STAND
Scale: 1/2"=1'-0"



B-B ELEVATION SECTION
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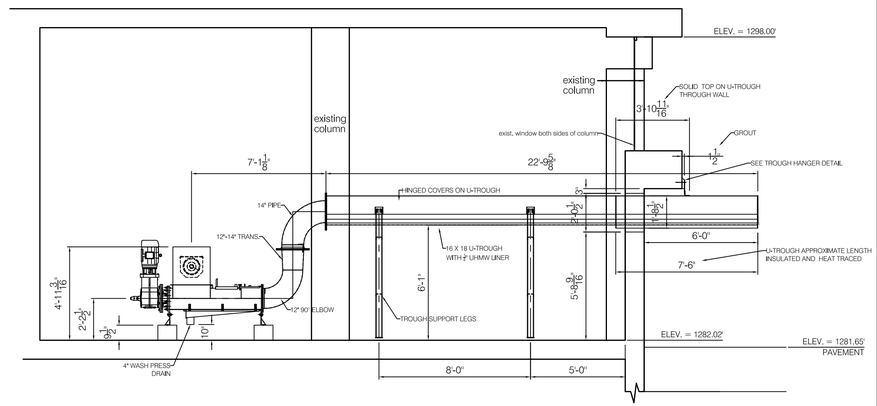
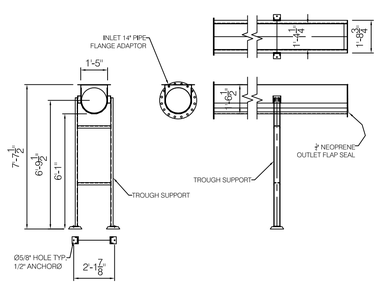
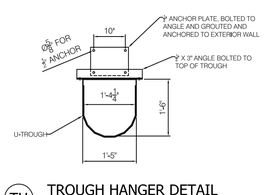


C-C WASH PRESS ELEVATION VIEW
Scale: 1/4"=1'-0"



UT U-TROUGH DETAILS (TYP.)
Scale: 1/4"=1'-0"



TH TROUGH HANGER DETAIL
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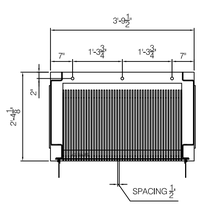


A-A SCREEN BASE DETAIL
Scale: 1/2"=1'-0"

REV	DATE	BY	DESCRIPTION

Vulcan
THE PLANET OF SCREEN CRAFT
212 SOUTH KIRLIN STREET
MISSOURI VALLEY, IA. 51555
712-642-2755
www.vulcanindustries.com

SCALE: 1/4"=1'-0"			DRAWN BY: THR
DATE: 7/15/2019	SHEET NUMBER: 1 OF 1		REVIEWED BY: JDF
TITLE: GENERAL ARRANGEMENT			PROJECT NUMBER: 19177
PROJECT: WICHITA, KS			DRAWING NUMBER: 19177-GA

8.4 Start-up Documents

To be inserted by Contractor after Installation
(See the following pages)

212 S. KIRLIN ST. MISSOURI VALLEY, IA. 51555
(712) 642-2755 or fax (712) 642-4256
Email www.vulcanindustries.com

SERVICE REPORT

DATE:	4/30/20

Representative:	Ray Lindsey Company	Job Name:	Wichita, KS
Contractor:	Wildcat Construction	Job No.:	19177
Engineering Firm:	Professional Engineering Consultants	Equip SN #:	2-VMR-450-1&435-2 /TF
Service Technician:	Ward Hayden		177-450-7/ EWP-450-5

Reason for call:

- ☐ PRE-GROUT INSPECTION
- X START UP
- ☐ WARRANTY WORK
- ☐ SERVICE

Material Provided:

Comments:

I arrived on 4/28/20 at 7 a.m. I did installation and electrical checks per check lists on all equipment. I checked motor rotation and test ran.

I arrived on 4/29/20 at 7:30 a.m. and worked with Jay Zimmer, Vulcan Industries, Inc., on programming changes. I test ran with flow. I found flow is very fast due to low wet well. I informed plant personnel that differential will not work under those conditions. They agreed and raised wet well level. I ran it for 3 hours and shut down it for the night.

I arrived on 4/30/20 at 7 a.m. I trained plant personnel. I started the system with flow and made setting adjustments. I worked with Jay Zimmer to change screen #2 to #3 on HMI per plant request. I added programming to alternate between screens.

Return Trip Required: NO

Material Needed (if any):

90 deg elbow for wash press pan can be sent on next start up trip.

Vulcan Industries person of contact:

Mark Hoffman
General Manager
712-642-2755

Job site person(s) of contact: **Phone #'s:**

_____ _____
_____ _____

JOB SITE HOURS:

Date:	4/28/20	From:	7:00 a.m.	To:	4:00 p.m.	From		To:	
Date:	4/29/20	From:	7:30 a.m.	To:	3:30 p.m.	From:		To:	
Date:	4/30/20	From:	7:00 a.m.	To:	4:15 p.m.	From:		To:	
Date:		From:		To:		From:		To:	
Date:		From:		To:		From:		To:	

<u>As a minimum, ONE of the following signatures required when conducting pre-grout inspection, start-up and warranty repairs:</u>

_____ Phone #: _____
Contractor Representative Fax #: _____

_____ Phone #: _____
Engineering Representative Fax #: _____

<u>Following signatures are required when conducting requested service repairs</u>:

_____ Phone #: _____
Plant Manager / Maintenance Manager Fax #: _____

_____
Service Technician

(<u>Signatures of Contractor/Plant Manager Constitutes Agreement of Above Hours</u>)

Start Up
Electrical Check Out

Device No. 4 of 4
Job No. 19177
Job Name Wichita KS
Equipment Type 2-UMR 1-EWP 1-TF
Equipment Tag No. 450-1/435-2/450-5/450-7
Equipment Serial No.

Start Up Date 4/30/20

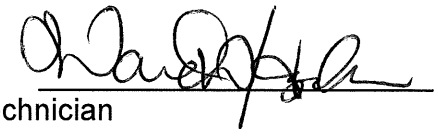
Start Up Check List	Yes	No	Comments
Electrical Checkout			
All high voltage wire connections are tight.	✓		
All terminal connections are tight.	✓		
Wires are not spliced in the panel.	✓		
In coming voltage matches control panel.	✓		
Motor rotation is correct.	✓		
Control power indicator operating	✓		
Run indicators operating properly (list all in comments box)	✓		
Over torque indicators operating properly	✓		
Over rotate indicator operating properly	✓		
Motor overload indicators operating properly	✓		
Other indicators not listed above operating properly (list all in comments box)	✓		
Reset push buttons operating properly (list all in comments box)	✓		

Start Up Check List	Yes	No	Comments
Operator interface set and operating properly	✓		
Hour meter working	✓		
Alarm horn(s) operating properly (list all in comments box)		✓	N/A
Alarm light(s) operating properly (list all in comments box)	✓		
Alarm silence push button operating properly		✓	N/A
Time clock set and operating properly	✓		
Motor over loads set	✓		
Current sensitive relay set and operating properly	✓		
All time delays set	✓		
Repeat cycle timer set and operating properly	✓		
Frequency timer set	✓		
Duration timer/counter set	✓		
Float switch circuit operating properly	✓		
Ultrasonic level system set and operating properly	✓		
Level measurement on Miltonic's display matches HMI display	✓		

Start Up Check List	Yes	No	Comments
Park limit/proximity switch set and operating properly	✓		
Over rotate limit/proximity switch set and operating properly		✓	N/A
Limit switch arm/ roller arm/magnet tight	✓		
Uninterruptible power supply operating properly		✓	N/A
Heat trace circuit(s) operating properly		✓	N/A
Enclosure Air Conditioner installed and operating properly		✓	N/A
Enclosure heater installed and operating properly		✓	N/A
Enclosure ventilation fan installed and operating properly		✓	N/A
Maintenance outlet installed and operating properly		✓	N/A
Enclosure interior light(s) installed and operating properly		✓	N/A
Emergency stop switches operating properly (list all in comments box)	✓		
Hand off Auto switches operating properly (list all in comments box)	✓		
Forward off Reverse switches operating properly (list all in comments box)	✓		
Check all dry contacts	✓		
Correct IP addresses are set in PLC and HMI	✓		

Start Up
Electrical Check Out

Start Up Check List	Yes	No	Comments
Communication with Plant SCADA system is working properly	✓		
Date and Time set on HMI	✓		
Auxiliary inputs (remote start/stop etc.) functions	✓		
All cables/wiring neatly bundled	✓		
Panduit covers in place	✓		
GFCI outlet functions		✓	N/A
Photos			
Photos have been taken of control panel.	✓		

Signature 
Service Technician

Vulcan
THE PROVEN SCREEN CHOICE

Equipment Training Sign-in Sheet **Date:** 4 ~~29~~ 30 /20

Project: Wichita Ks #19177

Equipment: 2-UMR 1-EWP 1-TF

Name	Agency
SEAN FRANCISCO	
Carlos Botello	
Jimmy Lane	
DAVID C. FIRSCHING	
D. Martin	

Vulcan
THE PROVEN SCREEN CHOICE

Equipment Training Sign-in Sheet **Date:** 4/30/20

Project: Wichita HS

Equipment: 2-UMR 1-EWP 1-TF

Name	Agency
James E Weber	COW
Troy L. Pagel	C.O.W
[illegible]	C.O.W
[illegible]	C.O.W.
[illegible]	
[illegible]	C.O.W.
[illegible]	
Fidel Rosas-Aguilar	C.O.W
Jay Cheatum	C.O.W.
Tim Butler	COW

Vulcan
THE PROVEN SCREEN CHOICE

Start Up
EWP Check Out

Device No. 1 of 1
Job No. 19177
Job Name Wichita Ks
Equipment Model EWP 300/600
Equipment Tag No. 19177-450-5
Equipment Serial No.

Start Up Date 4/30/20

Start Up Check List	Yes	No	Comments
INSTALLATION CHECKS			
Wash press is free from Damage caused during shipping and or installing	✓		
Verify press is level and plumb	✓		
Press foundation sufficient to bear weigh	✓		
Location not subject to freezing without applied heat trace or designed space heating	✓		
When installed behind a stair screen, press does not interfere with screen rotation		✓	N/A
Unobstructed removal of all removable covers	✓		
Gear box vent plug installed and rubber removed	✓		
Gear reducer oil at proper level	✓		
Thrust bearing greased	✓		
All anchors are properly installed	✓		
Inventory spare parts and see that they are properly stored and protected from weather	✓		
OPERATIONAL CHECKS			

Start Up Check List	Yes	No	Comments
All water supply lines and electrical conduit installed without straining the press	✓		
Verify that solenoid valve bank properly plumbed to the appropriate solenoid	✓		
Wash press supply water pressure is adequate. (50 PSI plus)	✓		
The supply water is considered "clean water" and/or a water filter is installed ahead of the wash water manifold system	✓		
ELECTRICAL CHECKS			
Control panel was properly stored and protected from weather prior to installing	✓		
All components are dry, no standing water found in panel	✓		
All external connections to control panel made with appropriate fittings	✓		
All terminal connections are tight and wires are not spliced in the pane	✓		
All electrical components operate properly, and all alarms were tested	✓		
Check all control communication equipment (i.e. Ethernet, dry contacts, etc.)	✓		
Proper motor rotation was established	✓		
All wash solenoids are working properly with sufficient flow	✓		
Press Reverses on overtorque	✓		

Start Up
EWP Check Out

Start Up Check List	Yes	No	Comments
Safety devices (I.e. current sensitive relay, emergency stop,etc.)	✓		
Photos			
Photos have been taken of Equipment	✓		
Training			
Was training provided to plant personnel	✓		

Signature _____
Service Technician

#1

Milltronics Hydroranger 200 Programming

Settings may be in the OIT

Parameters		Index	Function		Field setting Index 1	Field setting Index 2
P001	Operation	1	Differential	4	4	XXXX
P002	Material	1	Liquid	1	1	XXXX
P003	Process Speed	1&2	Fast	3	3	
P004	Transducer Type*	1&2	XPS-15	104	104	104
P005	Unit	1	Inches	5	4	XXXX
P006	Empty Distance	1&2	ft		19.271	19.308
P007	Span	1&2			18.200	18.200

Relay #1		Index #	Field setting	Relay #2		Index #	Field setting
P110		1	1	P110		2	
P111		1	0	P111		2	
P112	Relay on	1	—	P112	Relay on	2	
P113	Relay off	1	—	P113	Relay off	2	
P118		1	2	P118		2	

Relay #3		Index #	Field setting	Relay #4		Index #	Field setting
P110		3		P110		4	
P111		3		P111		4	
P112	Relay on	3		P112	Relay on	4	
P113	Relay off	3		P113	Relay off	4	
P118		3		P118		4	

Relay #5		Index #	Field setting	Relay #6		Index #	Field setting
P110		5		P110		6	
P111		5		P111		6	
P112	Relay on	5		P112	Relay on	6	
P113	Relay off	5		P113	Relay off	6	
P118		5		P118		6	

Parameters		Index	Default Value	Function		
P070	Failsafe Timer	1	10.00 min	TIMER	0.01	XXXX
P071	Failsafe Level	1-4	HOLD	LAST READING	HI	HI
P129	Failsafe Operation	1-4	OFF	OFF	EN	EN
P200	mA Output Range	1&2	2	4 to 20 mA		
P201	mA Output Function	1&2	0	OFF		
P202	mA Output Allocation	1&2	1	Point 1		
P211	mA Output Setpoint	1&2	1	Point 1		

Notes

#2

Milltronics Hydroranger 200 Programming

Settings may be in the OIT

Parameters		Index	Function		Field setting Index 1	Field setting Index 2
P001	Operation	1	Differential	4	4	XXXX
P002	Material	1	Liquid	1	1	XXXX
P003	Process Speed	1&2	Fast	3	3	3
P004	Transducer Type*	1&2	XPS-15	104	104	104
P005	Unit	1	Inches	5	4	XXXX
P006	Empty Distance	1&2	ft		19.258	19.392
P007	Span	1&2			18.354	18.354

Relay #1		Index #	Field setting	Relay #2		Index #	Field setting
P110		1	1	P110		2	
P111		1	0	P111		2	
P112	Relay on	1	~	P112	Relay on	2	
P113	Relay off	1	~	P113	Relay off	2	
P118		1	2	P118		2	

Relay #3		Index #	Field setting	Relay #4		Index #	Field setting
P110		3		P110		4	
P111		3		P111		4	
P112	Relay on	3		P112	Relay on	4	
P113	Relay off	3		P113	Relay off	4	
P118		3		P118		4	

Relay #5		Index #	Field setting	Relay #6		Index #	Field setting
P110		5		P110		6	
P111		5		P111		6	
P112	Relay on	5		P112	Relay on	6	
P113	Relay off	5		P113	Relay off	6	
P118		5		P118		6	

Parameters		Index	Default Value	Function		
P070	Failsafe Timer	1	10.00 min	TIMER	0.01	XXXX
P071	Failsafe Level	1-4	HOLD	LAST READING	HI	HI
P129	Failsafe Operation	1-4	OFF	OFF	EN	EN
P200	mA Output Range	1&2	2	4 to 20 mA		
P201	mA Output Function	1&2	0	OFF		
P202	mA Output Allocation	1&2	1	Point 1		
P211	mA Output Setpoint	1&2	1	Point 1		

Notes

Job# 19177 Technician Ward Hayden Date: 4-28-20

Start Up Set Points

	Equipment Tag No. K177-450-5	Equipment Tag No.	Equipment Tag No.
		Screen	Screen
	300/600	Wash Press	Wash Press
		Other	Other
Equipment Hours	8.5		
		Screen Angle	Screen Angle
	11	Starter Over Load Amps	Starter Over Load Amps
Current Sensing Relay			
	11	Over Current	Over Current
	3	Start up Delay	Start up Delay
	3	Shock Delay	Shock Delay
VFD Settings			
		Over Current 1	Over Current 1
		Trip Delay	Trip Delay
		Over Current 2	Over Current 2
		Trip Delay	Trip Delay
Motor Amp Draw			
	5.1	T1	T1
	5.2	T2	T2
	4.6	T3	T3
Volts to Ground			
	282.5	T1	T1
	281.1	T2	T2
	279.3	T3	T3

Settings may be in the OIT

Wash Press Set Points		Wash Press Set Points		Wash Press Set Points	
19	Count to start		Count to start		Count to start
6	Wash Cycles		Wash Cycles		Wash Cycles
3	Step #2 Timer		Step #2 Timer		Step #2 Timer
3	Step #4 Timer		Step #4 Timer		Step #4 Timer
22	Step #8 Timer		Step #8 Timer		Step #8 Timer
20	Step #9 Timer		Step #9 Timer		Step #9 Timer

Timers may be in the OIT

Time Delays

TD1	TD6	TD11
TD2	TD7	TD12
TD3	TD8	TD13
TD4	TD9	TD14
TD5	TD10	TD15

Frequency and Duration Timers

FT 1	FT 3	FT 5
DT 1	DT 3	DT 5
FT 2	FT 4	FT 6
DT 2	DT 4	DT 6

Repeat Cycle Timers

RCT 1	RCT 3	RCT 5
On Time	On Time	On Time
Off Time	Off Time	Off Time
RCT 2	**RCT 4**	**RCT 6**
On Time	On Time	On Time
Off Time	Off Time	Off Time

Job# 19177 Technician Ward Hawkins Date: 4-28-20

Start Up Set Points

Equipment Tag No.	19177-450-1	19177-435-2	TF177-450-7
	VMR-48	VMR-48	
Screen			
Wash Press			
Other			TF-240
Equipment Hours	9.1	9.6	9.1
Screen Angle	95	95	
Starter Over Load Amps			3.5
Current Sensing Relay			
Over Current			3.4
Start up Delay			3
Shock Delay			3
VFD Settings			
Over Current 1	2.92	2.92	
Trip Delay	20	20	
Over Current 2	4.15	2.00	
Trip Delay	50	.50	
	Rev time 45 sec	Rev time 45 sec	
Motor Amp Draw			
T1	~~.45~~ 2.0	~~1.9~~ 2.0	1.4
T2	~~.47~~ 2.0	2.0	1.3
T3	~~.48~~ 2.1	2.0	1.2
Volts to Ground			
T1	282.7	282.8	282.5
T2	281.4	281.2	281.2
T3	278.9	279.1	279.5

Settings may be in the OIT

Wash Press Set Points	Wash Press Set Points	Wash Press Set Points
☐ Count to start	☐ Count to start	☐ Count to start
☐ Wash Cycles	☐ Wash Cycles	☐ Wash Cycles
☐ Step #2 Timer	☐ Step #2 Timer	☐ Step #2 Timer
☐ Step #4 Timer	☐ Step #4 Timer	☐ Step #4 Timer
☐ Step #8 Timer	☐ Step #8 Timer	☐ Step #8 Timer
☐ Step #9 Timer	☐ Step #9 Timer	☐ Step #9 Timer

Timers may be in the OIT

Time Delays

☐ TD1	☐ TD6	☐ TD11
☐ TD2	☐ TD7	☐ TD12
☐ TD3	☐ TD8	☐ TD13
☐ TD4	☐ TD9	☐ TD14
☐ TD5	☐ TD10	☐ TD15

Frequency and Duration Timers

☐ FT 1	☐ FT 3	☐ FT 5
☐ DT 1	☐ DT 3	☐ DT 5
☐ FT 2	☐ FT 4	☐ FT 6
☐ DT 2	☐ DT 4	☐ DT 6

Repeat Cycle Timers

RCT 1	RCT 3	RCT 5
☐ On Time	☐ On Time	☐ On Time
☐ Off Time	☐ Off Time	☐ Off Time
RCT 2	**RCT 4**	**RCT 6**
☐ On Time	☐ On Time	☐ On Time
☐ Off Time	☐ Off Time	☐ Off Time

Vulcan
THE PROVEN SCREEN CHOICE

Start Up
TF Check Out

Device No. 1 of 1
Job No. 19177
Job Name Wichita Ks
Equipment Model TF ~~177~~ 240
Equipment Tag No. TF 177-450-2
Equipment Serial No.

Start Up Date 4/30/20

Start Up Check List	Yes	No	Comments
INSTALLATION CHECKS			
Conveyor is free from Damage caused during shipping and or installing	✓		
Verify Conveyor is level and plumb	✓		
Conveyor foundation sufficient to bear weigh	✓		
Location not subject to freezing without applied heat trace or designed space heating	✓		
Unobstructed removal of all removable covers	✓		
Gear box vent plug installed and rubber removed	✓		
Gear reducer oil at proper level	✓		
All anchors are properly installed	✓		
Inventory spare parts and see that they are properly stored and protected from weather	✓		
OPERATIONAL CHECKS			
All water supply lines and electrical conduit installed without straining the conveyor	✓		

Start Up Check List	Yes	No	Comments
Verify that solenoid valve bank properly plumbed to the appropriate solenoid (where applicable)		✓	N/A
Wash press supply water pressure is adequate. (50 PSI plus)		✓	N/A
The supply water is considered "clean water" and/or a water filter is installed ahead of the wash water manifold system		✓	N/A
ELECTRICAL CHECKS			
Control panel was properly stored and protected from weather prior to installing	✓		
All components are dry, no standing water found in panel	✓		
All external connections to control panel made with appropriate fittings	✓		
All terminal connections are tight and wires are not spliced in the pane	✓		
All electrical components operate properly, and all alarms were tested	✓		
Check all control communication equipment (i.e. Ethernet, dry contacts, etc.)	✓		
Proper motor rotation was established	✓		
All solenoids are working properly with sufficient flow	✓		
Safety devices (I.e. current sensitive relay, emergency stop,etc.)	✓		

Start Up Check List	Yes	No	Comments
Photos			
Photos have been taken of Equipment	✓		
Training			
Was training provided to plant personnel	✓		

Signature _____
Service Technician

Start Up
VMR Check Out

Device No. 1 of 2 Start Up Date 4/30/20
Job No. 19177
Job Name Wichita KS
Equipment Model VMR ~~19177-450-1~~ 48
Equipment Tag No. 19177-456-1
Equipment Serial No.

Start Up Check List	Yes	No	Comments
INSTALLATION CHECKS			
Bar screen is free from damage caused during shipping and or installing	✓		
Channel is not tapered or bowed causing unwanted strain on the frame	✓		
Screen side frames are level to each other	✓		
Drive and lower sprockets (or shoes) are within 1/8" of square over length of screen	✓		
Proper side frame opening is maintained at the point of anchoring	✓		
Shipping braces (if supplied) were in place prior to anchoring	✓		
All anchor brackets are properly installed	✓		
Angle of incline check	✓		
Gear box vent plug installed and rubber removed	✓		
Gear reducer oil at proper level	✓		
Inventory spare parts and see that they are properly stored and protected from weather	✓		
OPERATIONAL CHECKS			

Start Up Check List	Yes	No	Comments
Rake to dead plate is adjusted properly		✓	N/A
Wiper operates smoothly without binding or unusual noise	✓		
Rakes does not rub the frames or crossovers while operating	✓		
Rakes engage the bars smooth without catching the bar base	✓		
Overall travel is smooth, free of any grinding noise	✓		
Drive chains engage sprockets properly with no binding or unusual noise	✓		
ELECTRICAL CHECKS			
Control panel was properly stored and protected from weather prior to installing	✓		
All components are dry, no standing water found in panel	✓		
All external connections to control panel made with appropriate fittings	✓		
All terminal connections are tight and wires are not spliced in the pane	✓		
All electrical components operate properly, and all alarms were tested	✓		
Check all control communication equipment (i.e. Ethernet, dry contacts, etc.)	✓		
Proper motor rotation was established	✓		
Screen reverses on Overtorque	✓		

Start Up
VMR Check Out

Start Up Check List	Yes	No	Comments
Safety devices (I.e. Overtorque in VFD & PLC emergency stop,etc.)	✓		
Photos			
Photos have been taken of Equipment	✓		
Training			
Was training provided to plant personnel	✓		

Signature _____
Service Technician

Vulcan
THE PROVEN SCREEN CHOICE

Start Up
VMR Check Out

Device No. 2 of 2
Job No. 19177
Job Name Wichita KS
Equipment Model VMR 4/8
Equipment Tag No. 19177-435-2
Equipment Serial No.

Start Up Date 4/30/20

Start Up Check List	Yes	No	Comments
INSTALLATION CHECKS			
Bar screen is free from damage caused during shipping and or installing	✓		
Channel is not tapered or bowed causing unwanted strain on the frame	✓		
Screen side frames are level to each other	✓		
Drive and lower sprockets (or shoes) are within 1/8" of square over length of screen	✓		
Proper side frame opening is maintained at the point of anchoring	✓		
Shipping braces (if supplied) were in place prior to anchoring	✓		
All anchor brackets are properly installed	✓		
Angle of incline check	✓		
Gear box vent plug installed and rubber removed	✓		
Gear reducer oil at proper level	✓		
Inventory spare parts and see that they are properly stored and protected from weather	✓		
OPERATIONAL CHECKS			

Start Up Check List	Yes	No	Comments
Rake to dead plate is adjusted properly	✓		
Wiper operates smoothly without binding or unusual noise	✓		
Rakes does not rub the frames or crossovers while operating	✓		
Rakes engage the bars smooth without catching the bar base	✓		
Overall travel is smooth, free of any grinding noise	✓		
Drive chains engage sprockets properly with no binding or unusual noise	✓		
ELECTRICAL CHECKS			
Control panel was properly stored and protected from weather prior to installing	✓		
All components are dry, no standing water found in panel	✓		
All external connections to control panel made with appropriate fittings	✓		
All terminal connections are tight and wires are not spliced in the pane	✓		
All electrical components operate properly, and all alarms were tested	✓		
Check all control communication equipment (i.e. Ethernet, dry contacts, etc.)	✓		
Proper motor rotation was established	✓		
Screen reverses on Overtorque	✓		

Start Up
VMR Check Out

Start Up Check List	Yes	No	Comments
Safety devices (I.e. Overtorque in VFD & PLC emergency stop,etc.)	✓		
Photos			
Photos have been taken of Equipment	✓		
Training			
Was training provided to plant personnel	✓		

Signature _____
Service Technician

Operation and Maintenance Manual

Project Name: Plant 1 PS Screens

Project Location: Wichita, KS

Washing Presses
EWP 300/600

Contractor:
Wildcat Construction
3219 West May Street
Wichita, KS 67213
316-945-9408

Engineer:
Professional Engineering Consultants
303 South Topeka
Wichita, KS 67202
316-262-2691

Manufacturer:
Vulcan Industries, Inc.
212 S. Kirlin St.
Missouri Valley, IA 51555
712-642-2755, FAX 712-642-4256

Manufacturer's Representative:
Ray Lindsey Company
17221 Bel Ray Place
Belton, MO 64012
816-388-7440

Vulcan Job No. 19177

Prepared by: Joel Fredericksen
joel@vulcanindustries.com

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1 General Safety Instructions

1.1 Operator's Responsibilities

This machine was designed and built to operate within all applicable safety guidelines. In practice, however, this safety can only be achieved if all the necessary measures are taken. It is the responsibility of the owner and/or operator to ensure these measures are taken and to monitor their performance.

The operator must ensure that:

- The machine is used only as directed in this manual.
- The machine is in good working condition and the safety devices are checked regularly for their operability.
- The required personal safety gear for operating, maintenance and repair is available and is used.
- The operating instructions are available in legible condition and in complete form.
- Only adequately qualified and authorized personnel operate, maintain and repair the machine.
- All the safety and warning signs attached to the machine are in place and remain legible.
- All doors, panels, covers, and guards are closed or secured in place.

1.2 Safety Measures

A. Keep Information Available

Keep these operating instructions in an easily accessible location. Ensure that everyone working on the machine can access the operating instructions at all times.

Keep all safety signs and instruction plates on the machine in legible condition. Immediately replace signs that have become damaged or unreadable.

B. Bio-hazardous Materials

When operating the machine, especially when performing maintenance and upkeep, it is imperative that you comply with applicable instructions and guidelines on safety, occupational medicine and hygiene. The medium processed by the machine falls under the category of:

"Biologically Hazardous Material"!

C. Before Switching the Machine On

Familiarize yourself with the following:

- The operating and control elements of the machine.
- Machine equipment.
- The mode of operation of the machine.
- The immediate surroundings of the machine.
- The safety devices on the machine.
- Emergency measures.

Then perform the following:

- Check and ensure that all safety devices are attached and functioning.
- Check the machine for visible damage. Immediately rectify defects or report them to supervising personnel. Operate the machine only when it is in good working condition.
- Ensure that only authorized personnel remain the in the area of the machine and no one might be injured when the machine is activated.

Caution: Automatic Equipment! When the machine is activated, it can run in automatic mode. It can start automatically at any time.

D. During Normal Operation

Do not remove or deactivate any safety device while the machine is running.

Do not operate the machine with guards, doors, panels or covers removed.

E. During Maintenance

Perform the maintenance work prescribed in the operating instructions – adjustment, cleaning, lubrication, upkeep and inspection – within the suggested maintenance schedule.

Take note of special requirements for individual components in these operating instructions.

Before performing maintenance work:

- Disconnect the power supply. Follow all Lock-Out/Tag-Out procedures in place for the worksite. Note that control panels may have more than one source of power.
- Ensure that all parts of the drive have cooled down to room temperature.
- Ensure that appropriate hoisting gear and load suspension devices are available when large machine parts have to be replaced.
- Bar access to the work area of the machine and ensure that no unauthorized people remain in it.
- Replace machine parts that are not in good working condition.

- Use only genuine replacement parts from the manufacturer.
- Ensure that suitable collection containers are available for all substances that are hazardous to ground water (oils, coolants, etc.).

After maintenance work is completed and before switching on the machine:

- Check that all bolted joints previously loosened are securely fastened.
- Check whether all safeguards and covers previously removed are properly installed.
- Ensure that all tools, materials and other equipment used have been removed from the work area.
- Clean the work area and remove liquids that might have spilled.
- Ensure that all safety devices of the machine are functioning properly.

F. Working on Electrical Equipment

Only trained electricians should perform work on electrical equipment of the machine.

Regularly check electrical equipment:

- Reattach loose connections.
- Immediately replace damaged wires or cables.

Always keep the control panel and all electrical supply units closed. Access is allowed only by authorized personnel.

Never clean electrical equipment with water or similar liquids.

G. Environmental Protection

When performing work on the machine, follow the protocol for waste prevention and proper recycling or waste disposal.

Ensure that hazardous substances such as grease, oils, coolants, solvent-containing cleaning fluids, etc. are collected and disposed of in a safe manor and as prescribed by environmental laws.

H. Equipment Modifications

For safety reasons, do not perform any unauthorized modifications to the machine. This also applies to welding work on load-bearing parts.

Vulcan Industries, Inc. must approve all modifications in writing.

Use only genuine replacement parts from the manufacturer. Parts manufactured from a third-party do not conform to the manufacturers design standards. The use of third-party parts and special equipment on the machine could result in catastrophic failures and void the warranty.

1.3 Requirements for Operating Personnel

Warning: All operating and maintenance personnel must read and understand these operating instructions before operating and/or performing maintenance to this machine.

A. Operating Personnel

Only personnel who are trained, instructed and authorized to operate the machine may do so. These personnel must be familiar with the operating instructions. In addition, the following qualifications are needed for the following activities:

- Only electricians may perform work on electrical equipment.
- Only trained personnel may perform maintenance, upkeep and repair work.

1.4 Other Dangers

A. Risk of Injury

Do not impede the operating sequence of the machine. Injury from the moving components can occur. Lock-out the machine before performing any kind of inspection or maintenance activities.

Warning: Do not reach into automatic equipment without first shutting down the machine! The machinery can start at any time.

B. Build-up of Hazardous Gasses

Because of the nature of the treatment process, hazardous gasses may form and lead to a deadly atmosphere.

Always take appropriate precautions when operating and/or maintaining equipment in a classified area.

Warning: There is risk of explosion or detonation.

1.5 Safety Symbols

The following are pictures and an explanation of all the safety stickers that are used on Vulcan equipment. Some of these may or may not pertain to your particular machine.

A spreader bar must be used when lifting this machine.

Contractor, make sure that the seal off fitting is potted before you close out the job.

Be careful of moving parts when working on the machine. Use proper Lock-Out/Tag-Out procedures.

This part of the machine is not meant to be used as a step. Injury to persons or damage to machinery can result.

Section 1
General Safety Instructions

Grease point for maintenance reference.

Grease point for maintenance reference.

Watch for an open pit.

Equipment in Automatic mode may start if sensors are triggered. Make sure the machine is properly locked-out

Section 1
General Safety Instructions

Do not operate the machine with covers removed.

Take care in not getting caught in the exposed screw or other moving parts.

2 Receiving, Storage & Transporting

2.1 Receiving

A. Suggested Receiving Practices

Upon receipt of the equipment, locate the packing slip and verify completeness of the shipment. The packing list will clearly indicate the items that have shipped, contents of containers and component weights. Contact Vulcan Industries, Inc. immediately if the received items are not as indicated on the packing slip.

No claims for missing components will be honored if not identified at the time of receipt of the shipment.

Components are generally shipped on skids or pallets, though occasionally they are shipped loose inside the equipment. Do not remove the equipment from the shipping skids or pallets, except as required to inspect the components, and check the scope of supply. Inventory all loose items identified on the packing list.

The skids must be placed on a smooth, level surface. When stored outside suitable cribbing must be arranged to support the skids and their associated weight.

Care must be taken when unloading the equipment from the carrier. Prior to attempting to off-load the equipment:

- Inspect lifting points, rigging and equipment.
- Confirm lifting capacities for all rigging and equipment.

Before unloading and accepting any equipment from the shipping company, thoroughly inspect the equipment and/or packaging for signs of damage. If damage to the packaging is discovered, immediately check the contents for damage.

Immediately show any damage to the shipping company and have it confirmed by their representatives.

2.2 Storage

A. Short Term Storage

The equipment, if possible, should be stored inside in a climate controlled environment.

The major pieces of equipment are shipped on skids or pallets. Do not remove the equipment from the shipping skids or pallets, except as required to inspect the components and check the scope of supply.

The skids must be placed on a smooth, level surface. If stored outside a suitable cribbing must be arranged to support the skids and their associated weight.

The equipment should be covered with a tarp to protect it from moisture, dust, or other harmful elements.

B. Long Term Storage

If the equipment is to be stored outside for more than one month, the following storage procedures must be followed:

- Drain gear cases completely and refill completely full with a compatible gear oil. Lubrication recommendations may be found in Section 5 of the Operation and Maintenance manual. The gear is normally shipped with a plug installed in the breather port. Make sure the plug is installed and not the breather. Tag the gear “Check Oil Level Before Operating”.
- After storage and before installing the equipment, the following procedures must be followed:
    1. Uncover all electrical components and inspect for corrosion.
    2. The equipment should be washed down completely and thoroughly dried. Inspect for any signs of corrosion.
    3. Drain the gear cases down to the normal fill level. (Note: Some equipment may need to be installed prior to performing this step.)
    4. Follow all lubrication instructions as outlined in Section 5 of the Operation and Maintenance manual.

Follow the normal installation procedures as outlined in Section 3 of the Operation and Maintenance manual.

2.3 Transporting the Equipment

A. Safety Precautions for Transportation

When transporting the machine the following precautions must be taken into account:

- Protruding edges may lead to cuts.
- Suspended loads may fall thus causing mortal danger.

Caution: Never stand under suspended loads!

- Parts that have been stacked too high may tumble.
- Using load suspension devices other than those indicated here could severely damage the machine.
- Flammable packaging material is a fire hazard. Keep away from open flames and do not smoke around this material.

B. Ground Transportation

Transport the machine only in the original packaging using suitable ground transportation designed for the load and size of the machine. Shipping weights will vary from the equipment weights listed in this manual. Refer to the packing slip for actual shipping weights of the equipment.

Do not place any objects on the machine while it is being transported.

During transport protect the machine against:

- Overturning
- Violent action from the outside
- Mechanical jolts and vibrations
- Humidity
- Effects of heat

C. Suspended Transportation

Transport the machine only in the original packaging while using suitable hoisting equipment designed for the load and size of the machine. Shipping weights will vary from the equipment weights listed in this manual. Refer to the packing slip for actual shipping weights of the equipment.

Use load suspension devices and slings with cross braces as lifting devices.
See Figure 2.3.C

The use of chokers and slings is strictly prohibited!

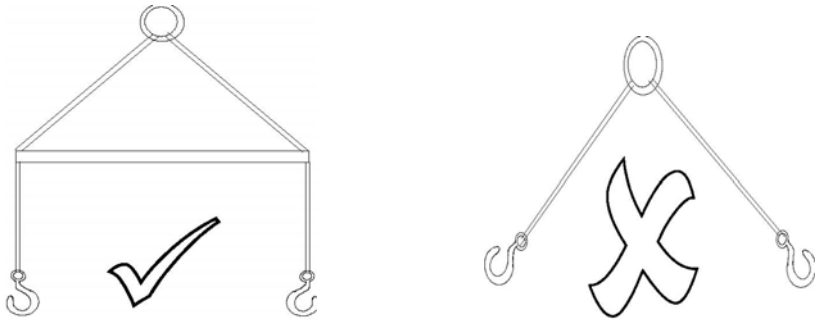


Figure 2.3.C

Place lifting straps as shown in Fig. 2.3.D. Place straps through clevis connections bolted through the discharge flange and around the thrust bearing. Never lift with the straps around the motor/gearbox, drain pan, mounting feet or inlet hopper as this can damage the machine upon lifting.

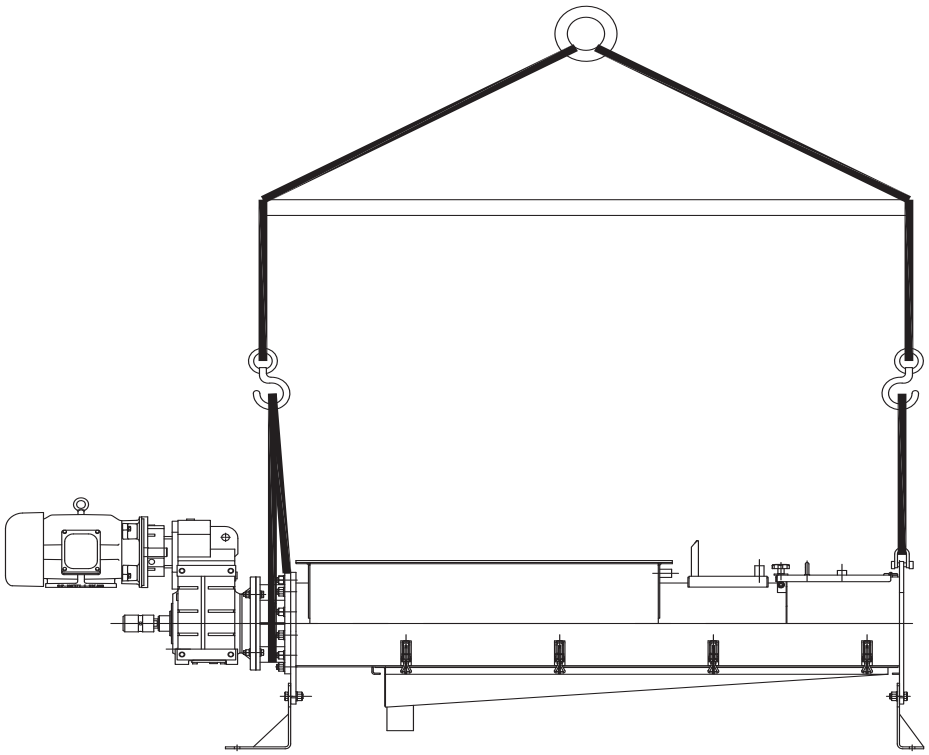


Fig. 2.3.D

3 Installation & Start-up

3.1 Installation Instructions

Experienced personnel trained in the installation and operation of this type of equipment must be employed to perform the installation of this equipment. Any questions regarding the installation should be directed to Vulcan Industries, Inc. Installation and Service department. The following steps must be performed in order:

- Inspect and identify components
- Inspect the location
- Machine placement
- Inspect the Wash Water Supply
- Plumb the Valve Manifold
- Mount the gearbox housing vent
- Start-up

Important! Vulcan Industries, Inc. uses all stainless steel hardware and anchor bolts for the assembly and anchoring of the equipment. Vulcan strongly recommends the use of an anti-seize lubricant specifically formulated for use with stainless steel on assembly hardware. Unlubricated hardware has a tendency to seize and cannot be properly tightened. Seized bolts must be replaced.

Bolt Torque:
3/8" 15 Ft. Lb.
1/2" 35 Ft. Lb.
5/8" 50 Ft. Lb.
3/4" 80 Ft. Lb

A. Standard Erecting Practices

All fabricated equipment manufactured by Vulcan Industries is shop assembled and tested prior to shipping and should not present any abnormal erection problems. Due to varying field conditions, a reasonable amount of fit-up is considered standard erection practice. The use of such tools as "come-a-longs", jacks, drifts, and reamers is to be expected. The equipment should be assembled and installed according to the AISC "Code of Standard Practice". Section 7.12 of that code states:

> "Normal erection operations include the correction of minor misfits by moderate amounts of reaming, chipping, welding, or cutting, and the drawing of elements into line through the use of drift pins. Errors which cannot be corrected by the foregoing means or which require major changes in member configuration are reported immediately to the owner and fabricator by the erector, to enable whoever is responsible either to correct the error or to approve the most efficient and economic means of correction to be used by others."

If an erection problem is traceable to Vulcan Industries, Inc. we will work to resolve the problem. If field modifications are done by others to correct the problem, they must be approved in writing by Vulcan Industries, Inc. No back charges will be accepted by Vulcan Industries, Inc. unless the deficiencies are documented and the remedy is approved in writing by Vulcan Industries, Inc.

B. "As Built" Drawings

Vulcan Industries, Inc. provides detailed "AS-BUILT" installation drawings. Drawings should be thoroughly reviewed prior to installing any Vulcan equipment.

IMPORTANT! Always verify the detailed drawing is marked "AS-BUILT". Drawings not marked "AS-BUILT" may not reflect contract changes to the approved shop drawings required during manufacturing and therefore may be incorrect.

3.2 Inspect and Identify Components

Within the standard scope of delivery, the EWP type wash press consists of the following components:

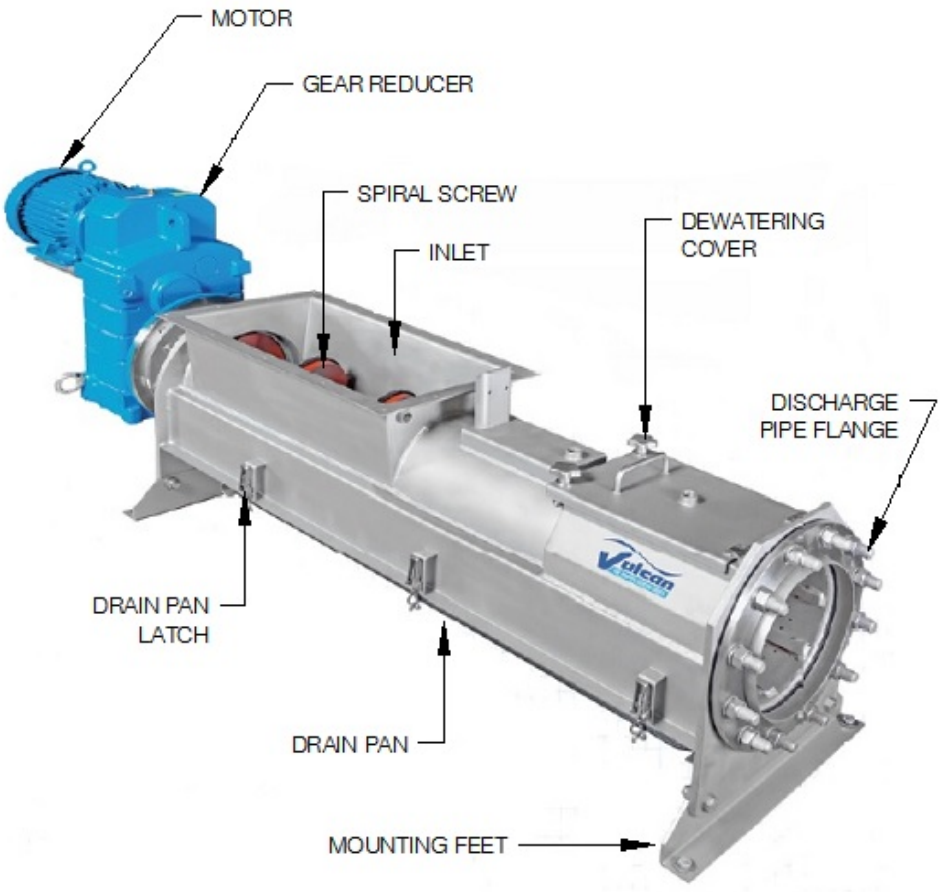


Fig 3.2.A

Inspect the scope of delivery based on the Bill of Lading and the Packing List. Report any discrepancies immediately to Vulcan Industries, Inc.

3.3 Inspect the Location

Inspect Location

Check the measurements of the location against the General Arrangement drawings and specifications in Section 8 of this document. Also check the following:

- Check that the location where the press is to be located is level and flat.
- Check that the foundation on which the equipment is to be set is sufficient to bear the service weight of the equipment. (This is required when the equipment feet rest on grating or other channel coverings.)
- The motor and especially its ventilation openings should have a suitable distance (> 4 in.) from other objects.
- Location must not be subject to freezing (unless protective heat tracing has been supplied).
- Location should be sufficiently ventilated.

3.4 Machine Placement

The positioning of the wash press is crucial in that the wash press typically interfaces with other machinery in receiving their discharge material. Improper wash press location can cause interference with moving parts or the inability to properly collect droppings from the machine feeding the wash press. Take the following precautions when installing the wash press:

- Position the wash press per the dimensions shown on the General Arrangement drawing.
- The wash press is generally supplied with mounting feet. Insure that the feet are resting fully on the equipment base, and that the press does not tip or rock. Shim as required to establish a plumb and level state, then anchor the plates to the equipment base.
- Ensure there is adequate clearance for removing the drain pan and opening the dewatering cover.
- Ensure that the spiral can be easily removed from the machine. There must be adequate clearance (length of the wash press not including motor and gearbox) in order to slide the spiral fully out of the drive-end of the machine.
- All flange connections have a mating gasket used to seal the connection. Make sure not to misplace these gaskets.

A. Place and Anchor the Valve Stand (If Supplied)

The valve stand comes with the valve solenoids pre-wired and hose connections from the manifold to the valves attached. As stated in section 3.7, the main water supply connection needs to be made to the ¾" inlet on the manifold, and the controls on the valve stand need to be wired to the main control panel, refer to Section 7 for the schematics on wiring the valve stand. Follow these guidelines when placing and installing the valve stand:

- Ensure the valve stand will not obstruct the removal of the spiral.
- The valve stand should be anchored within a few feet of the wash press, clear of any walkways and without interfering with any moving equipment. Position the stand so the controls can be easily accessible. Valve stands positioned too far from the machine may not have enough hose length to reach all connections.

- Route the hoses from the valve stand to the wash press so they are not lying on the floor and crossing over access points or moving components. Make sure the hoses are not crimped and are as straight as possible in their route.
- Make sure the hoses are cut with ample length to avoid being in tension and prevent crimping at the barb connection.

B. Installing Drain Pipe

The drain pipe from the drain pan can be allowed to drain directly into the channel or is plumbed into a drain pipe to be carried off to a basin in a different location. Refer to the General Arrangement drawing to see what type of drain system is being used.

If the drain pipe on the wash press is to be connected to a pipeline the following items should be considered when plumbing the drain pipe:

- Use a coupler to connect the wash press drain to the drain pipe in the floor in order to facilitate drain pan removal.
- Drain piping must be installed with at least a 3º slope to ensure complete draining of wash water and avoid sedimentation of fine sand and fecal matter.

C. Mounting Feet Adjustment

The wash press mounting feet have slotted holes to allow for slight vertical adjustment in raising and leveling the wash press. Properly support the wash press housing as described in Section 2 before loosening the bolts on the mounting feet.

D. Installation of Solids Discharge Pipe

Assemble and install the discharge pipe per the General Arrangement drawing. Locate and anchor any included pipe supports in the approximate area shown on the General Arrangement drawing where the supports will not interfere with any machinery or walkways and can be properly anchored.

If pipe supports are not supplied by Vulcan Industries, Inc. within the project scope, the following criteria should be followed when fabricating supports:

- Pipe supports should clamp the discharge piping securely to keep the discharge pipe from shaking.
- Pipe supports should be anchored securely to the floor or a sound structural member.
- Pipe supports should be strong enough to prevent deflection in the pipe when under a loaded condition.

In installations where freezing can occur, the discharge piping must be heat traced. When installing insulation with electric heat tracing care must be taken to insure that the screenings are not overly heated. Heat tracing must be self-regulating to maintain a temperature between 40 and 60 degrees Fahrenheit.

E. Installation of Inlet Hopper

If supplied by Vulcan Industries, Inc., install the inlet hopper according to the General Arrangement drawing. The hopper will mate up to the inlet opening on the wash press housing by a bolted flange connection.

If the scope of the project does not include a supplied inlet hopper, the following must be incorporated into the design of the hopper:

- The inlet hopper must be designed so that no debris can adhere to the sides.
- The sides should be smooth, water tight, and stand at no less than 50º to horizontal.
- Internal joints must be ground smooth.
- The hopper must act as a guard for the spiral.
- The hopper must follow local, state and federal guidelines for protective guards.
- The hopper should be made as large as feasible to avoid plugging or bridging of screened material.

Contact Vulcan Industries, Inc. for additional questions regarding hopper design.

3.5 Wash Water Supply

Potable or non-potable water may be used for the wash water system. If non-potable wash water is used, it must be free of algae. A Y-strainer with a minimum 180 micron (80 mesh) screen is recommended to prevent particles from clogging the spray wash system. Check and clean the strainer screen after initial start-up and periodically during operation to remove screened particles. Wash water should have a neutral PH. Acidic or basic water is excluded from use. If the wash press supply water comes from a drinking water supply, appropriate back flow devices must be employed to prevent contamination of the water supply. Follow all applicable local, state, and federal codes when designing the anti-backflow system.

To avoid plugging the washing nozzles, the machine must not be operated without an adequate supply of wash water. The water supply must be connected to the manifold as described in Section 3.6. The connection will be a single female NPT connection. The water pressure should be according to the project specifications. If the inlet pressure is higher than the specification, a pressure regulator should be installed on the inlet side of the manifold.

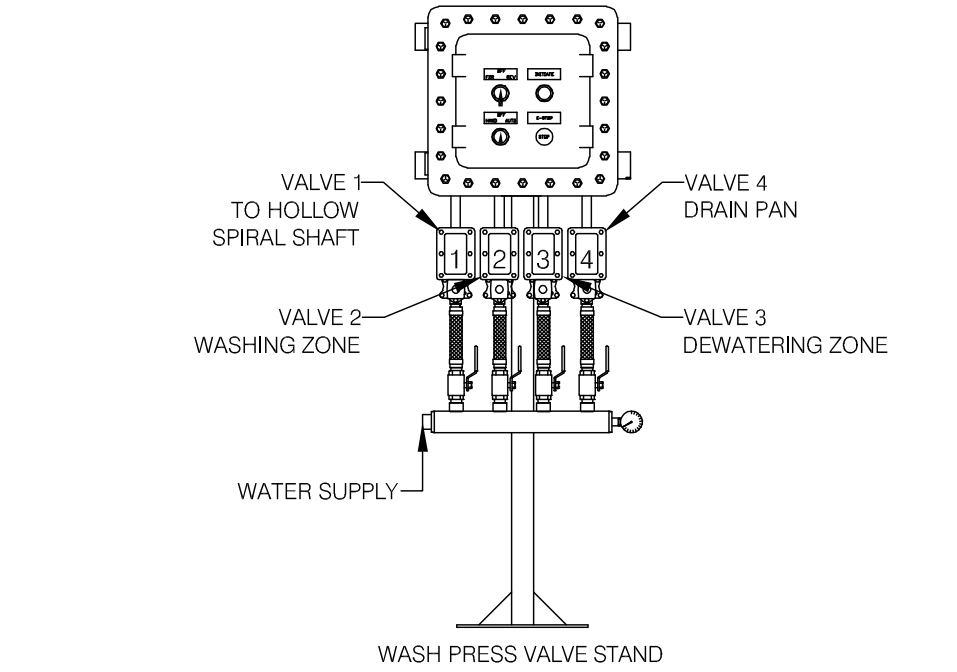
Make all connections (wash water, drain piping, inlet hopper, electrical conduits etc.) without putting strain on the press housing. The frame is not designed to support such piping.

3.6 Plumbing the Valve Manifold

Once the water connection is made to the manifold on the valve stand, the water line connections from the valve manifold to the wash press can be made. There are two common configurations of valve manifolds for the Vulcan wash press; four valves (most common) and two valves. Examples are explained in more detail below in this section. Each point of connection from the valve manifold to the washing press is labeled as shown in Figure 3.6.A.

A. Four Valve Manifold

Figure 3.6.A shows a typical four valve wash press and valve stand configuration. Valve one on the valve stand labeled (V1) is plumbed to the hollow spiral shaft. Valve two (V2) is plumbed to the washing zone, valve three (V3) is connected to the dewatering zone, and valve four (V4) is connected to the drain pan. Refer to the valve stand drawing in Section 7 for specific hose routing for your wash press.


VALVE 1
TO HOLLOW
SPIRAL SHAFT
VALVE 4
DRAIN PAN
1
2
3
4
VALVE 2
WASHING ZONE
VALVE 3
DEWATERING ZONE
WATER SUPPLY
WASH PRESS VALVE STAND

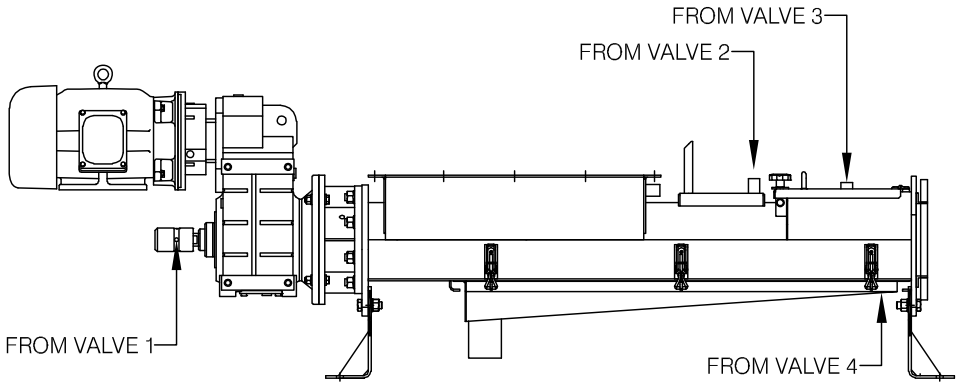
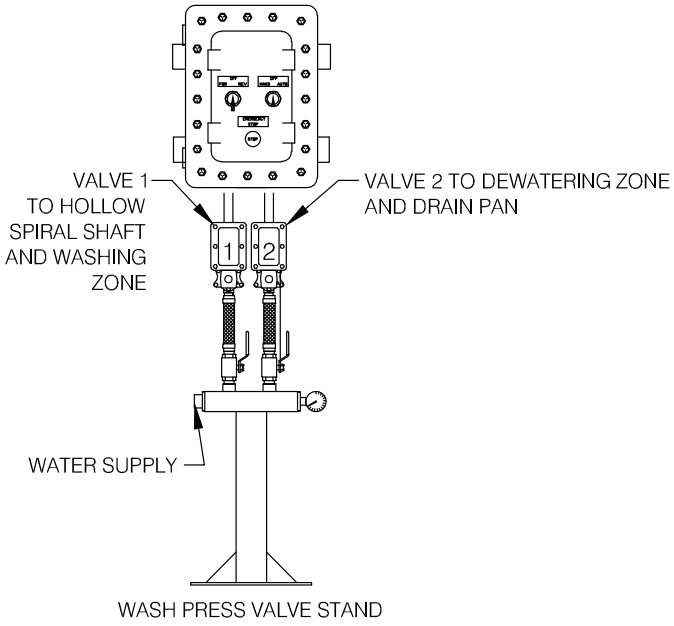

FROM VALVE 3
FROM VALVE 2
FROM VALVE 1
FROM VALVE 4

Fig. 3.6.A

B. Two valve Manifold

Figure 3.6.B shows a typical two valve manifold stand and wash press configuration. Valve one (V1) is plumbed to a tee for the hollow spiral shaft and the wash zone labeled on the wash press. Valve two (V2) will connect to the dewatering zone and the drain pan, also through a tee located on the wash press. Refer to the valve stand drawing in Section 7 for specific hose routing for your wash press.



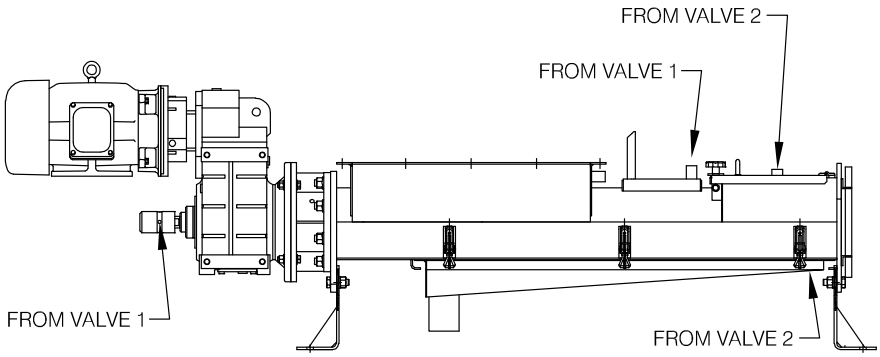


Fig. 3.6.B

3.7 Mounting the Gearbox Housing Vent

The gearbox of the driving unit is filled with oil at the factory. To be sure the oil does not leak during transportation, the vent plug is removed from the gearbox housing and the tapped hole is closed with a plug.

After the screen is set in its final installed position, the plug must be removed and the vent plug must be installed. Please save the removed plug for future use. Check the gearbox for proper oil level.

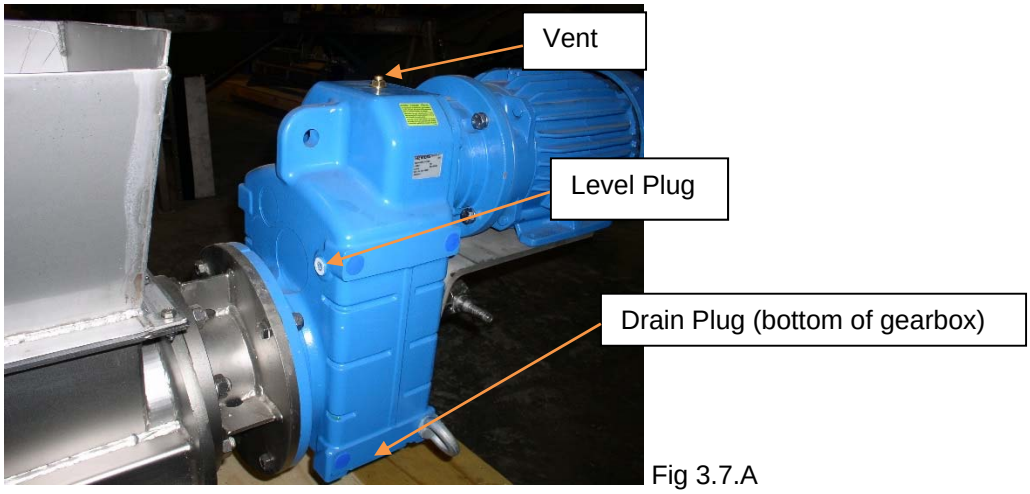


Fig 3.7.A

Figure 3.7.A shows vent and plug configuration for the most common parallel gearbox mounting configuration; the H01. (See Section 6 for motor and gear data and mounting configurations.)

Figure 3.7.B shows vent and plug configuration for the most common right-angle gearbox mounting configuration; the H03.

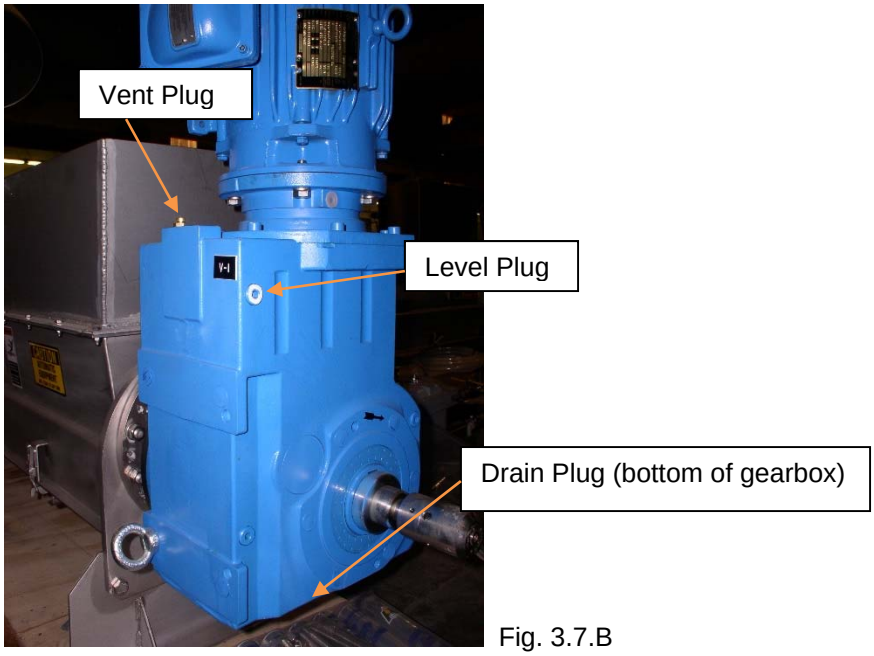


Fig. 3.7.B

3.8 Start-up

Initial start-up is only to be performed by a factory-trained technician. The technician must inspect the installation and provide the client with a certificate of proper installation. Only after the client has such a certificate in hand, may the equipment be started.

Starting the machine for functional check, test run or commissioning is only to be carried out or arranged by a factory-trained technician.

The field connection between the control panel and the wash press local controls must be made in accordance with local, state, and federal electric codes. Consult the Electrical Drawings in Section 7 of this manual for inner-connecting wiring requirements.

Licensed electricians must make the electrical connections.

The following steps must be observed when starting for the first time:

- Check all fasteners for tightness.
- Insure that all packing materials have been removed from the wash press.
- Remove construction debris and other non-typical debris from the screen and channel.
- Install all protective coverings and guards.
- Check that all electrical protection devices (fuses, safety stops, motor starter relay, and current relay) are adjusted and activated.
- Check the oil level in the gear motor. The proper level and type may be found in Section 5 of this manual, according to mounting position and service requirements.
- Check the rotation of the motor. If the direction of rotation is correct, the spiral flank moves towards the discharge area.
- Check for the quality and availability of the wash water and the operability of the wash water valves.

After completion of the above mentioned points the machine may be started.

The operator should check for bulky foreign bodies arriving at the wash press via the wastewater, which could bind up the screw. The wash press must not be exposed to direct frost.

4 Operating Procedure

Reference Section 7 for project specific control devices and functions.

4.1 Normal Operation

The wash press can be operated manually or in automatic mode.

Starting:

- Insure power is available to control panel.
- Make certain that there are no other personnel working on this unit.
- Establish material flow from the channel screen.
- Place the (Hand/Off/Auto switch or HOA for short) in the desired mode.
- Place the (Forward/Off/Reverse switch or FOR for short) controller into desired position.

Stopping:

- Shut down the operation of the infeed equipment.
- Place the HOA mode controller to "OFF" position.

A. Hand Operation

Hand operation should mainly be used for maintenance purposes. The press can be run by setting the HOA controller to “Hand”.

In manual mode, the screw will run in forward or reverse, depending on the position of the FOR selector switch on the local control panel. The forward position is maintained. The reverse condition is momentary unless physically held in the “On” position. The machine should never be run for long periods in reverse. Doing so could force debris past the screw into the bearing housing.

Quick Manual Start-up

The wash press can be run manually by:

- At main control panel, switch disconnect to “on”.
- At main control panel, switch wash press control power to “on”.
- At local control panel, reset emergency stop device**.**
- At local control panel, switch hand-off-auto to “hand”.
- At local control panel, switch for-off-rev to “for” for forward or “rev” for reverse.
  Note: Local control switches may be incorporated into the main control panel. See “Device Functions” in Section 7 for complete electrical sequenced operation and switch locations.

Shut-down

- The wash press can be stopped at any time by pressing the emergency stop device at the local control panel or by turning the HOA to “off”.

B. Automatic Operation

Automatic operation is used as the primary operating mode. The wash press cycle is initiated by a signal from the main control panel by counting the adjoining machine cycles. The wash press will complete a series of running the screw forward and reverse while cycling the solenoid valves during the washing and compacting of the screenings.

A batch mode cycle can be started any time by pressing the “initiate” pushbutton at the local control panel. This function is convenient for evaluating press performance, wash water delivery, timing sequences, and drain conditions.

Quick Automatic Start-up

The wash press can be run through a complete cycle by:

- At main control panel, switch disconnect to “on”.
- At main control panel, switch control power to “on”.
- At local control panel, switch for-off-rev to “off”.
- At local control panel, reset emergency stop device.
- At local control panel, switch hand-off-auto to “auto”.
- At local control panel, press the “initiate” pushbutton to initiate the cycle.
  Note: Local control switches may be incorporated into the main control panel. See “Device Functions” in Section 7 for complete electrical sequenced operation and switch locations.

Shut-down

- The screen can be stopped at any time by activating the emergency stop device, or by turning the HOA to “off”.

For long periods of shut down, the discharge pipe should be purged of screenings, which could harden in the pipe and cause blockage when the equipment is restarted. The pipe can be purged by running ice through the press until all the screenings are purged. The ice in the pipe will melt and go down the drain.

4.2 System Regulating and Control Procedures

Wash water to each solenoid is regulated by manual ball valves located ahead of the solenoid valves. The valves should normally be run “fully open” unless the water pressure and flow are very high. The ball valves can be used to throttle the flow to each valve.

The machine is protected from operational damage by a current sensing relay incorporated into the main control panel. The relay monitors motor current. If the current reaches the pre-set level, the machine will stop, reverse, stop and continue with the cycle. This sequence will repeat for three cycles if necessary. If the obstruction is not cleared within the three cycles, the wash press will stop and an over-torque alarm will be generated.

The timing of the wash cycle is automatic and controlled by the internal PLC at the main control panel. The functions of the cycle that are adjustable are noted in Section 7. The adjustable functions are accessed through the operator interface on the front of the main control panel.

4.3 Protective Devices

A. Common Protective Devices (See Section 7 for supplied devices)

- High Torque Protection: A Current Sensing Relay (CSR) is used to monitor two phases of the three-phase motor circuit. When the motor has exceeded the CSR set point, the CSR will de-energize the motor starter, thus stopping the motor. The CSR is adjusted at the factory.
- Solid State Motor Overload Device: The motor starter utilizes solid-state circuitry for three-phase motor protection from things like phase-loss, short circuiting, etc.
- Motor Thermals (If supplied): The motor has heat sensing thermals imbedded in the windings. When any of the thermals overheat the motor starter is de-energized, stopping the equipment.
- Fuses and Breakers: Used to provide short circuit protection
- Emergency Stop Devices:
    1. E-stop push buttons: are located on the local control panel and/or the main control panel. Pushing the button in will shut down the equipment, whether in “hand” or “auto” mode. To reset the e-stop, the button must be manually pulled out.
    2. E-stop cables: A continuous cable is drawn around the perimeter of the equipment and connected back to the control box mounted on the machine housing. The cable is in tension and any force on the cable will cause the E-stop switch to activate. To reset the E-stop, the actuator arm must be pushed in and rotated back into position.

4.4 Emergency Stop/Restart

Activate the E-Stop during an emergency situation to immediately stop the machine from operating. Restart the machine by:

- Reset the E-Stop device.
- Restart the machine in the proper operating mode.

5 Machine Maintenance

5.1 Safety Precautions

Vulcan Industries, Inc. will not be responsible for any harm or injury that may result from the improper operation of this equipment or guarantee this equipment if improperly operated or operated without the designed safety features. For your safety when working on this machine, please follow these suggested precautions.

- Only fully trained and authorized personnel should be permitted to enter owner defined boundaries around, within or on any equipment or components that present a potential for injury through a lack of knowledge concerning proper safety precautions.
- Warning signs and labels shall not be removed or obscured at any time.
- Material handled by this equipment may come under the scope of materials classified as "**Bio-Hazardous Material**". Appropriate precautions must be taken to protect personnel from exposure.
- Protective guards and covers must be in place before operating this equipment.
- Control panels may have more than one source of power. Make sure all potential power sources are locked out prior to performing any maintenance or repair.
- Before attempting removal or repair of the spiral, thrust bearing or motor, the drive assembly must be secured against possible movement.

5.2 Inspections and Preventative Maintenance Schedule

DANGER! To prevent injury or death, do not perform any of the following maintenance functions that require reaching into the machine while the machine is under power. Follow proper Lock-Out/Tag-Out procedures first. Then perform maintenance functions.

A. Daily

When checking machine operability, always look for damaged parts. Damaged components can jeopardize the safety of personnel and equipment. Replace any damaged parts immediately!

- During operation try to observe the following:
  1. Any unusual noises heard as the machine is running.
  2. Any oil leakage from the gearbox.
  3. The motor runs abnormally hot.

- Check obstructions at the inlet due to oversized materials.

- Check the water flow at all water outlets. Check for adequate supply water and adequate flushing. If sediments are found to be hindering the flow, the drain pan must be removed and flushed manually.

- Record hours of run time.

B. Weekly (After 30 Operating Hours)

- Clean the machine. Avoid cleaning electrical components with a water jet to reduce the risk of electrical shock.
  1. Wash off the outside of the machine with a suitable cleaning device. Avoid spraying directly or excessive overspray onto the electric motor.

- Flush the de-watering sieve and the drain pan. (See Figure 5.2.A).
  1. If there is an extraordinary amount of grease in the screenings, more frequent cleaning may be necessary. Dirty screenings are an indication of a plugged de-watering head.

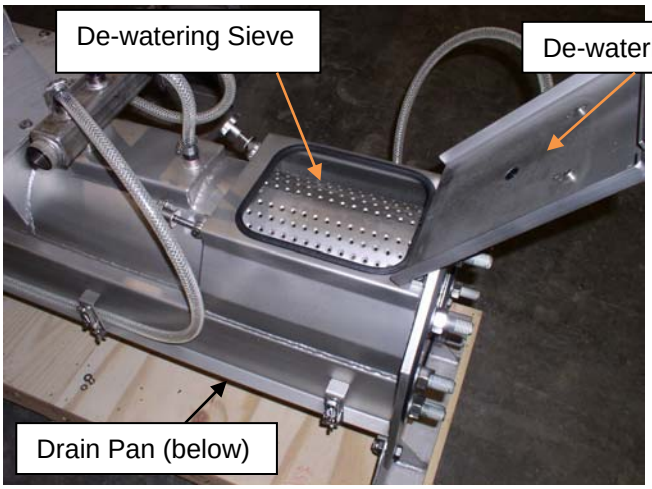


Fig. 5.2.A

B. Monthly (After 100 Operating Hours)

- Lubricate the thrust bearing/seal assembly. (See Fig. 5.2.B).
  The bearing should be lubricated using a manual grease gun. Pressurized grease fillers are not recommended and their use could damage the seals. Fill the grease chamber until you feel a light resistance. Run the machine for several revolutions “forward” in manual mode. Try to add more grease until you feel resistance again.

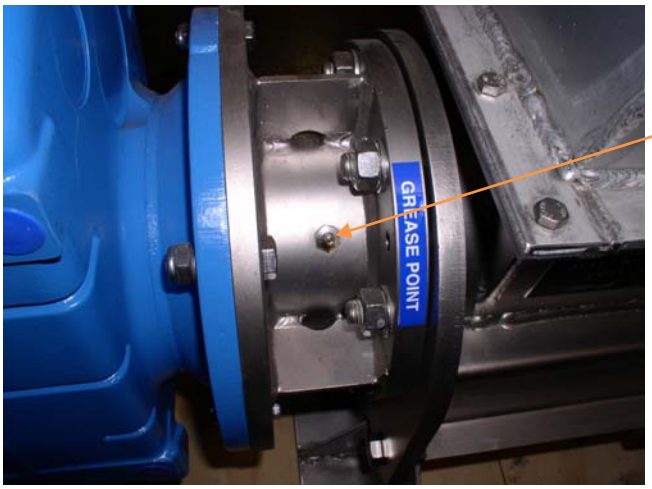


Fig. 5.2.B

CAUTION! Do not overfill the bearing housing. Too much pressure from the grease can damage the seals.

- Check spiral and bearing unit rotation for vibration and noise. If the spiral is found to be rubbing on the slot sieve or rifle bars, it must be adjusted as described in Section 5.6.D.
- Visually inspect the slot sieve at the bottom of the press for deformation or blockage.
- Check cleaning brush on the spiral for wear. Replace the brush as described in Section 5.7.
- Check all safety devices. (See Section 7)

C. Semi-annually (After 600 Operating Hours)

- Check all fasteners for tightness. Tighten all loose fasteners.
- Check all electrical connections for cleanliness and secure fits. Secure all loose connections.
- Visually evaluate the conveying and compacting performance. Make adjustments or repairs to the following items if there is a notable decrease in performance.
- Observe the performance of the water pressure:
  1. Verify that all solenoids are functioning properly.
  2. Verify that the water supply to the valve manifold is adequate. Refer to the machine specs in Section 8 for the recommended water pressure.
  3. Check for leaks in hoses and connections.
  4. Make sure all nozzles are not obstructed. Clean if necessary.
  5. Make sure the dewatering sieve and drain pan are cleaned. Refer to Section 5.2.B for instructions on cleaning the sieve and drain pan.
- Observe the screw press compaction.
  1. If there is material build up on the sieve or between the rifle bars, the spiral may be out of alignment or the spiral brush may be worn. Refer to Section 5.7 for replacing the brush or Section 5.6.D for realigning the spiral.
  2. If there is wear on the top surface of the spiral, the spiral is out of alignment. Refer to section 5.6.D on realigning the spiral.
- Check gearbox oil level and consistency:
  For this inspection refer to Figures 5.2.C (parallel motor arrangement) or 5.2.D (right angle motor arrangement).
  1. Lock-out the machine.
  2. Open the drain plug and check the oil for consistency. The oil should smell fresh and not burnt or dirty. The oil should look clear or transparent and not black or gray.
  3. Remove the oil level plug.
  4. Observe the oil level. It should be even with the bottom of the view-hole and readily visible. If oil is not visible from the view-hole, the machine is low and oil needs to be added. Refer to Section 6 for prescribed oils to use. If oil seeps from the view-hole, there is too much and oil must be drained. Allow the excess oil to drain from the view-hole into an appropriate waste oil container until it is level with the view-hole.

- Clean drive and gearbox ventilation
  1. Remove the gearbox vent and clean with air or cleaning solvent. Replace the vent when cleaned.

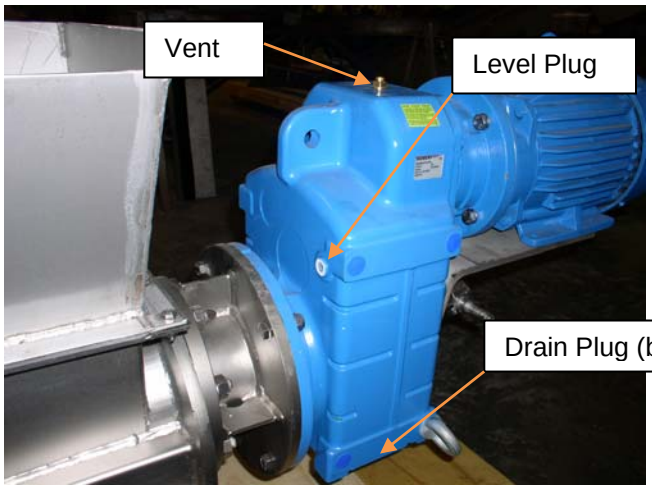


Fig. 5.2.C

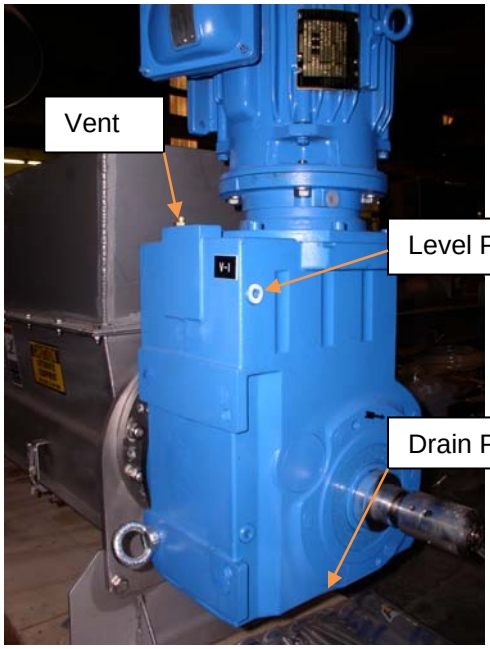


Fig. 5.2.D

5.3 Maintenance /Lubrication Schedule

Occurance	Inspection	Activity
Daily	Entire Machine	Check operability, leaks
	Motor & Reducer	Check motor temperature
	Water Supply	Check for proper supply water and flushing
	Records	Record run time hours
Weekly (30 hrs)	Dewatering Sieve and Drain Pan	Flush out any build up
	Entire Machine	Clean the outside
Monthly (100 hrs)	Thrust Bearing	Lubricate
	Spiral Bearing	Check for noise and vibration
	Slot Sieve	Check for deformation or blockage
	Spiral Brush	Check for wear
	Safety Devices	Check for operability
Semi-annually (600 hrs)	Fastener connections	Check for secure fit, tighten loose connections
	Electric connections	Check for secure fit, tighten loose connections
	Evaluate Performance	Observe water pressure loss and screw press wear
	Gearbox	Check oil quality
		Clean vents
As recommended by manufacturer	Drive unit	Change oil

5.4 Required Tools

The following is a categorized list of tools to have available when working on this machinery.

Hand Tools:

- Standard maintenance tools (i.e. screwdrivers, allen wrenches, socket, open-end and box-end wrenches up to 1-1/2" and if possible, metric up to 32mm, punches, etc.)
- 18" crescent wrench
- Channel lock pliers
- Tape measure
- Feeler gauge set
- Metric allen wrench set
- Torque wrench with a minimum rating of 100 ft/lbs.
- Voltage / Amp meter

Lifting Devices:

- Lifting device sufficient enough to lift the machine from the channel
- Heavy duty ¼" cable come-along
- Nylon or cable lifting straps

Safety Devices:

- Lock-out Tag-out as required by local policy
- Hazardous gas detector
- Appropriate work attire and gloves

5.5 Lubrication Instructions

A. Recommended Lubricant Types

These recommendations are not intended to be the only types/brands of lubricants that may be used on this type of equipment. (Lubricants of the same characteristics may be supplemented.)

Manufacturer / Brand

GEAR REDUCER OILS:	
❑ Shell Omala 220 (provided with units, recommended by mfg.)	Petroleum
❑ Mobil Mobilgear 600 XP220	Petroleum
❑ Shell Omala HD220	Synthetic
❑ Mobil SHC 630	Synthetic

GREASES (multi-purpose)	
❑ Mega Blue LC-500, EP-2 (used by Vulcan Industries)	Petroleum
❑ Mobil Mobilith AW-2	Petroleum
❑ Or equivalent AW-2 or EP-2	Petroleum
❑ Mobil FM-102	Food grade

B. Lubrication Points

The thrust bearing is located between the gearbox and press housing.

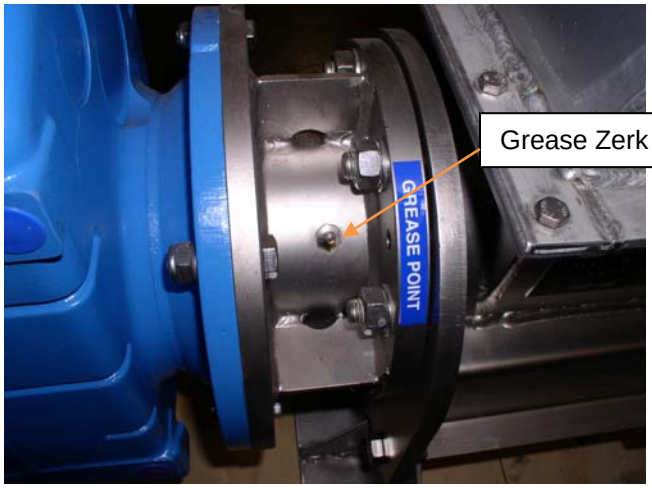


Fig. 5.5.A

5.6 Removing and Installing the Spiral, Drive Motor and Thrust Bearing Unit

A. Before Removing the Spiral, Drive Motor and Thrust Bearing Unit:

Refer to Section 1 for proper safety procedures. Perform proper Lock Out/Tag Out procedures before proceeding.

Remember the equipment is controlled automatically and may start at any time. Follow your local "Lock-Out /Tag-Out" procedures to ensure power is disconnected from the equipment before proceeding.

Remove all covers and thoroughly wash the machine with clean water and disinfect all components.

Open the junction box at the motor (see Figure 5.6.A) and disconnect the power leads. Refer to the Electrical Schematic in Section 7. Record the connections for reconnecting the power during reassembly. Cover loose wire ends with wire nuts or other types of insulators. Close the junction box cover.

Fig. 5.6.A

Remove the spiral wash water connection. (See Figure 5.6.B).

Fig. 5.6.B

Support the motor with a lifting device before removing any bolted connections.

CAUTION! The motor, gearbox and thrust bearing are very heavy when handling. Use a lifting device to help assist in lifting any of these items.

B. Removing the Drive Motor

- Remove the bolts on the flange connection that hold the gearmotor to the thrust bearing unit. (See Figure 5.6.C).

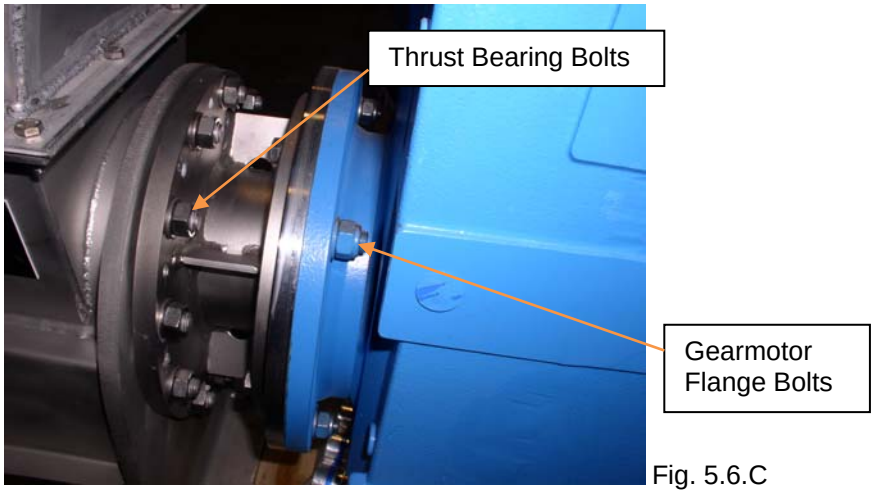


Fig. 5.6.C

C. Removing the Thrust Bearing Unit and Spiral

- Remove the flange bolts that hold the gearmotor to the thrust bearing unit. (See Fig. 5.6.C).

- Remove the flange bolts that hold the thrust bearing unit to the wash press housing. (See Figure 5.6.C).
- Remove the thrust bearing unit along with the spiral.
- Remove the bearing unit from the spiral. The spiral slides off of the thrust bearing unit. Clean the spiral thoroughly to prevent damage to the seals of the bearing unit.
- Check the spiral for wear. Replace brushes that are worn down to the spiral diameter. Replace spirals that are worn down past 5/16-inch of the nominal spiral diameter. (See Section 5.7 for brush maintenance).
- Remove the shaft seals and thrust bearing from the bearing housing. Inspect the bearings for wear and replace as needed. Replace all seals.

D. Installing the Spiral, Drive Motor and Thrust Bearing Unit:

- The thrust bearing unit should be ready to be installed with new seals in place and new bearings (if necessary).
- Install the spiral into the housing. The shaft on the spiral mates with the thrust bearing and should be orientated towards the motor-end of the machine.
- Slide the bearing unit onto the shaft and bolt it to the housing. Do not tighten the mounting bolts, leave them snug. (See Figure 5.6.C).
- Install the gearmotor onto the shaft and bolt it to the thrust bearing unit. Tighten the bolts to 45-56 ft. lbs. of torque. (See Figure 5.6.C).
- Open the junction box at the motor and reconnect all the leads. (Refer to the wiring diagram in Section 7 and any notes that were made at tear-down.) (See Figure 5.6.A).
- Set the operating switch at the main control panel to “Local-Manual”. Make sure that the machine cannot be switched on automatically. Set the “F/O/R” switch to “Forward”. Jog the motor for a few seconds to determine if the screw rotates in the proper direction. The screw should rotate clockwise when looking from the drive end towards the discharge end of the machine. If not, the leads to the motor are reversed and need to be switched (refer to Section 7 for the wiring schematic.)
- Run the press forward a few turns to check for unobstructed rotation. The spiral should not touch the slot sieve or rifle bars but have at least 1/8 inch of clearance all around.

 **CAUTION! Only a few rotations are needed to check for interference. The bearing housing has not been filled with grease at this time.**

- If the spiral does not run freely, the axial alignment of the spiral must be corrected. Loosen the mounting bolts on the thrust bearing unit and then turn the adjusting screws as necessary to align the spiral. (See Figure 5.6.D.)
- Tighten the mounting bolts once the spiral is properly aligned.

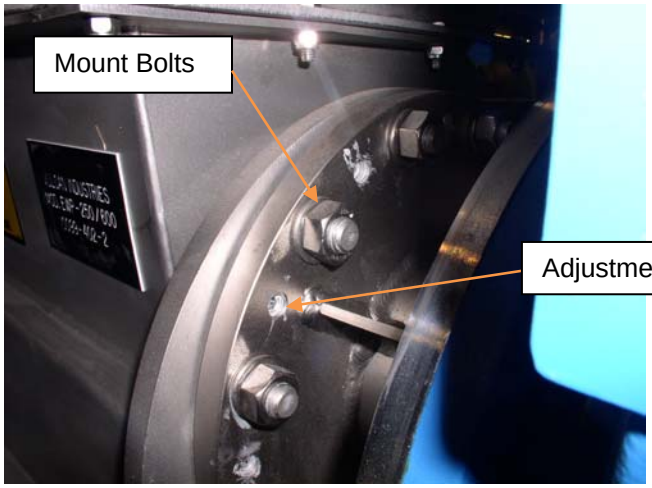


Fig. 5.6.D

- Lubricate the thrust bearing/seal assembly. (See Figure 5.5.B).
  The bearing should be lubricated using a manual grease gun. Pressurized grease fillers are not recommended and their use could damage the seals. Fill the grease chamber until you feel a light resistance. Run the machine for several revolutions “forward” in manual mode. Try to add more grease until you feel resistance again.

CAUTION! Do not overfill the bearing housing. Too much pressure from the grease can damage the seals.

- Reconnect the wash water hose to the valve for the spray shaft on the spiral.
- Attach all covers and secure them completely. Check all bolted connections for tightness as well.
- Set the wash press to resume normal “automatic” operations.
- After approximately 20 operating hours, check all bolted connections again.

5.7 Replacing the Spiral Brush

If build up of material is found on the slot sieve and around the rifle bars the spiral brushes may need replacing. Also, any time the spiral is being replaced the brush should be replaced as well.
Another indicator of the spiral brush needing to be replaced is when there is an 1/8 inch or less of brush remaining above the top edge of the spiral.

Perform the following steps when replacing the brush: (See Figure 5.7.A)

- Perform the steps in Section 5.6 for removing the spiral from the machine.
- Loosen the set screws in the finger clamps that hold the brush against the spiral.
- Remove the old brush.
- Install the new brush. Start at the drive end of the spiral and wrap the brush around the full length of the spiral, seating the brush in the finger clamps as you go. IMPORTANT: Make sure the brush is seated firmly in the finger clamps.
- Cut off the brush at the discharge end of the spiral about 3/8 inch from the last finger clamp.

- Tighten the set screws in the finger clamps.
- Reassemble the spiral as stated in Section 5.6.D.

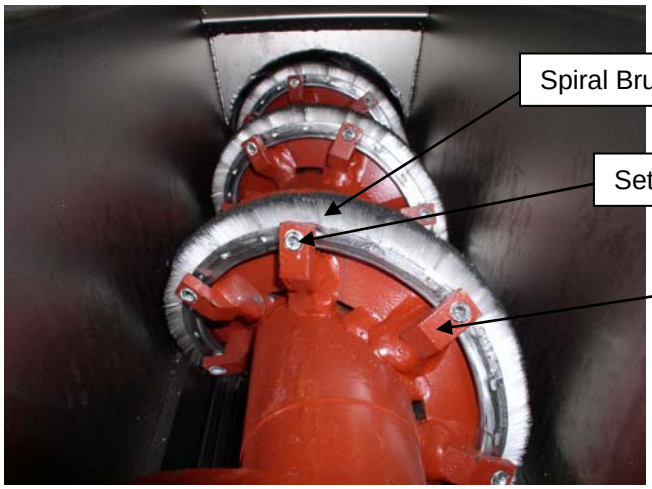


Fig. 5.7.A

5.8 Mechanical Troubleshooting Reference

The following table is a list of possible common machine faults, symptoms, and remedies for fixing. These items listed here are only for mechanical issues. For issues with the control system or electrical malfunctions, refer to Section 7.

Problem	Possible Cause	Solution
Machine won't start, motor not running	Loss of power	Check incoming power to the control panel*
		Check for control power (110 VAC) out of the control power transformer*
		Check fuses and disconnects*
	E-Stop(s) engaged	Check overload devices, safety switches , reset as required*
Power available, machine won't start in "Auto", motor not running	No signal to main control panel	Try "Hand" operation. IF machine operates in "Hand", check start signal input devices.*
Power available, machine won't start in "Hand", motor not running	E-Stop(s) engaged, Motor Bad	Check E-stop device(s)*
		Check and replace the motor
Power available, machine won't start in "Hand", motor running	Breakdown in Power Transmission	Check drive components; isolate faulty component and repair/ replace as required.
Screenings are wet or dirty	Not enough wash cycles	Increase number of wash cycles.*
	Plugged dewatering cylinder	Remove access cover and drain pan, flush and clean all areas.
	Clogged drain line	Clean out drain line.
Motor trips out on "Overload" while pressing	Current sensing relay set too low	Increase setting on relay, but not to exceed motor full load amps.*
	Screenings plug stuck in discharge pipe	Tap on pipe to determine location of plug, disassemble piping where necessary and unplug piping.
	Motor Starter overload set too low	Increase setting on starter, but not to exceed motor full load amps.*

*Refer to SECTION 7 for more detailed information on this subject.

6 Parts Lists & Vendor Data

At Vulcan Industries, Inc. we do our best to service all our machinery in the most expedited manner. If you require replacement parts for your machine, you can contact our service department at:

Vulcan Industries, Inc.
212 S. Kirlin St.
Missouri Valley, IA 51555
712-642-2755
www.vulcanindustries.com

Or email at service@vulcanindustries.com

Normal hours of operation are Monday-Friday 8 A.M. to 5 P.M. CST.

Make sure to provide the following information located on the cover page of this manual:

- The Vulcan Job Number.
- The project or facility name.
- The project or facility location (city & state).
- Machine Model Number.

Also provide any drawing numbers that you are referencing for your part numbers. If you are using the assembly drawings provided on the following pages, use the section heading for drawing reference.

All of this information will help us expedite the correct parts for your machine.

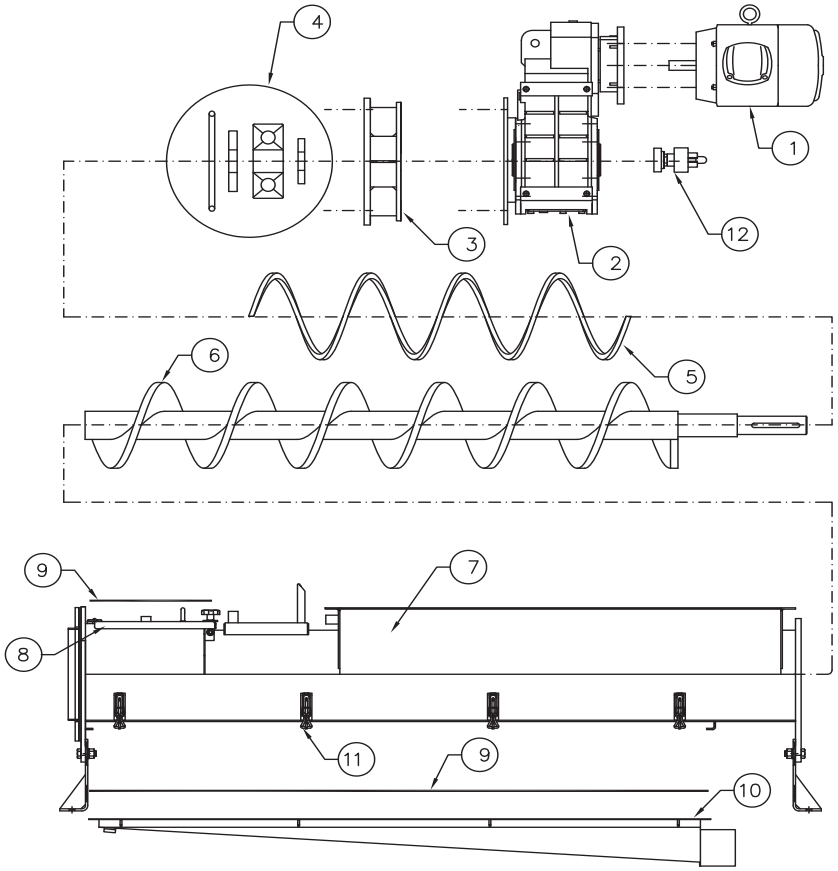
6.1 Assembly Drawings

The following drawings reference the working components of the Wash Press and are to be used when ordering replacement parts.

Section 6
Parts Lists & Vendor Data

A. Wash Press Assembly

PARTS DIAGRAM
WASHING COMPACTING SCREW TYPE PRESS



ITEM #	DESCRIPTION	PART NUMBER
1	MOTOR	Consult Factory
2	GEAR REDUCER	
3	THRUST BEARING HOUSING	
4	THRUST BEARING & SEALS	
5	SPIRAL BRUSH	
6	CONVEYOR SPIRAL	
7	WASH PRESS HOUSING	
8	DEWATERING COVER	
9	COVER SEAL	
10	DRAIN PAN	
11	LATCH	
12	SWIVEL JOINT	

Vulcan Industries Inc.
212 South Kirlin St.
Missouri Valley, IA 51555
Ph. 712 642 2755
Fax 712 642 4256

When ordering parts:
Reference Factory No.
and Model No.

6.2 Drive Motor and Gear Data

VULCAN INDUSTRIES, INC.

Quality Control Document

Form #: 4.4.11

Device 1

Job No.	**19177**
Job Name	**Wichita KS.**
Equipment Type	**EWP 300/600**
Equipment Serial No.	**19177-450-5**
	Tagged WC-1

Date of test: **1/3/2020**

Description of test: **In Shop Factory Test**

Motor Nameplate Data

Mfg.	**Baldor-Reliance**			
Serial No.	**F1908275487**			
CAT No.				
Spec. #	**07J475X790G1**			
No.	**D61008984**			
Frame	Type	Code	Design	Class
213TC	**C1/D1**	**J**	**A**	**F**
Encl.	H.P.	PH.	HZ	RPM
	7.5	**3**	**60**	**1770**
S.F.	VOLTS		AMPS	
1.15	**230 / 460**		**19 / 9.5**	
DE brg	**6307**			
ODE brg	**6206**			

Reducer Nameplate Data

Mfg.	**Siemens**
Serial No.	**FDU1909/2501040 001**
Type	**KAF129-K5-(210)**
Mount	**M4-B**
Oil Capacity	**20.0 liter**
T_2 =	**3479 Nm**
N_2 =	
I (ratio) =	**114.06**
SF	

Brake Nameplate Data

Mfg.	
Serial No.	
Model No.	
Ft lbs torque	
Voltage	

Testing Equipment:

Test Device 1:	Serial No.	Date of Calibration
Fluke 333 Clamp Meter	79610273	7/24/2020
Test Device 2:	Serial No.	Date of Calibration
Fluke 65 Thermometer	95600311	7/13/2020

Test Remarks			
Reducer vent plug installed	**Y**	N
Oil level confirmed	**Y**	N
All lubrication completed	**Y**	N
Adjustment required	Y	**N**
Operated with designed controls	**Y**	N
Video taped operation	Y	**N**
Control panel verified	**Y**	N
8 hr run test completed	**Y**	N
Screen hour meter start / finish	**0.4**	**8.4**

Voltage Reading Phase to Phase:

L1-L2	L1-L3	L2-L3
482	**474**	**486**
Motor Amp Reading		
T1	T2	T3
4.3	**5.2**	**4.8**

Motor Temp. Rise		Reducer Temp. Rise
66	**at start up**	**66**
72	**15 min.**	**73**
78	**30 min**	**80**
90	**1 hr.**	**86**
99	**2 hr.**	**95**
102	**3 hr.**	**100**
102	**4 hr.**	**105**
103	**5 hr.**	**107**
104	**6 hr**	**109**
105	**7 hr.**	**112**
105	**8 hr.**	**112**

TEST REMARKS:

Went over control panel operation with technician, verifying complete operation.
Connected control panel to equipment and verified operation between the two pieces of equipment
Ran equipment for period of 8 hours monitoring amps, voltage, and temperature of both motor and gear box.

VULCAN INDUSTRIES, INC.

Quality Control Document

Form #: 4.4.11

Device 1

Job No.	**19177**
Job Name	**Wichita KS.**
Equipment Type	**EWP 300/600**
Equipment Serial No.	**19177-450-6**
	Tagged WC-2

Date of test: **1/21/2020**

Description of test: **In Shop Factory Test**

Motor Nameplate Data

Mfg.	**Baldor-Reliance**			
Serial No.	**F1908275488**			
CAT No.				
Spec. #	**07J475X790G1**			
No.	**D61008985**			
Frame	Type	Code	Design	Class
213TC	**C1/D1**	**J**	**A**	**F**
Encl.	H.P.	PH.	HZ	RPM
	7.5	**3**	**60**	**1770**
S.F.	VOLTS		AMPS	
1.15	**230 / 460**		**19 / 9.5**	
DE brg	**6307**			
ODE brg	**6206**			

Reducer Nameplate Data

Mfg.	**Siemens**
Serial No.	**FDU1909/2500958 001**
Type	**KAF129-K5-(210)**
Mount	**M4-A**
Oil Capacity	**20.0 liter**
T_2 =	**3479 Nm**
N_2 =	
I (ratio) =	**114.06**
SF	

Brake Nameplate Data

Mfg.	
Serial No.	
Model No.	
Ft lbs torque	
Voltage	

Test Remarks			
	Reducer vent plug installed	**Y**	N
	Oil level confirmed	**Y**	N
	All lubrication completed	**Y**	N
	Adjustment required	Y	**N**
	Operated with designed controls	**Y**	N
	Video taped operation	Y	**N**
	Control panel verified	**Y**	N
	8 hr run test completed	**Y**	N
	Screen hour meter start / finish	**0.3**	**8.4**

Testing Equipment:

Test Device 1:	Serial No.	Date of Calibration
Fluke 333 Clamp Meter	79610273	7/24/2020
Test Device 2:	Serial No.	Date of Calibration
Fluke 65 Thermometer	95600311	7/13/2020

Voltage Reading Phase to Phase:

L1-L2	L1-L3	L2-L3
478	**487**	**489**
Motor Amp Reading		
T1	T2	T3
4.4	**4.8**	**5.3**

Motor Temp. Rise		Reducer Temp. Rise
66	**at start up**	**65**
76	**15 min.**	**73**
80	**30 min**	**79**
87	**1 hr.**	**86**
98	**2 hr.**	**92**
101	**3 hr.**	**98**
102	**4 hr.**	**102**
102	**5 hr.**	**104**
105	**6 hr**	**108**
105	**7 hr.**	**108**
105	**8 hr.**	**108**

TEST REMARKS:

Went over control panel operation with technician, verifying complete operation.
Connected control panel to equipment and verified operation between the two pieces of equipment
Ran equipment for period of 8 hours monitoring amps, voltage, and temperature of both motor and gear box.

BALDOR
A MEMBER OF THE ABB GROUP

BALDOR • RELIANCE

Product Information Packet

DXP INDUSTRIES

07J475X790G1

7.5HP,1770RPM,3PH,60HZ,213TC,0735M,XPFC

Part Detail

Revision:	-	**Status:**	PRD/A	**Change #:**		**Proprietary:**	No
Type:	AC	**Prod. Type:**	0735M	**Elec. Spec:**	07WGX790	**CD Diagram:**	
Enclosure:	XPFC	**Mfg Plant:**		**Mech. Spec:**	07J475	**Layout:**	
Frame:	213TC	**Mounting:**	F1	**Poles:**	04	**Created Date:**	08-13-2013
Base:	RG	**Rotation:**	R	**Insulation:**	F	**Eff. Date:**	08-15-2013
Leads:	9#14	**Literature:**		**Elec. Diagram:**		**Replaced By:**	

Nameplate NP0977XPSL

NO.		**CC**	010A				
SER.		**TEMP CODE**	T3C				
SPEC.	07J475X790G1						
CAT.NO.							
HP	7.5						
VOLTS	230/460						
AMPS	19/9.5						
RPM	1770	**MOTOR WEIGHT**	230 LBS				
HERTZ	60	**PH**	3	**CL**	F	**DE BRG**	6307
SER.F.	1.15	**DES**	A	**CODE**	J	**ODE BRG**	6206
FRAME	213TC	**GREASE**	POLYREX EM				
RATING	50C AMB-CONT						
USABLE AT 208V		**NEMA-NOM-EFF**	91.7	**PF**	81		

Parts List

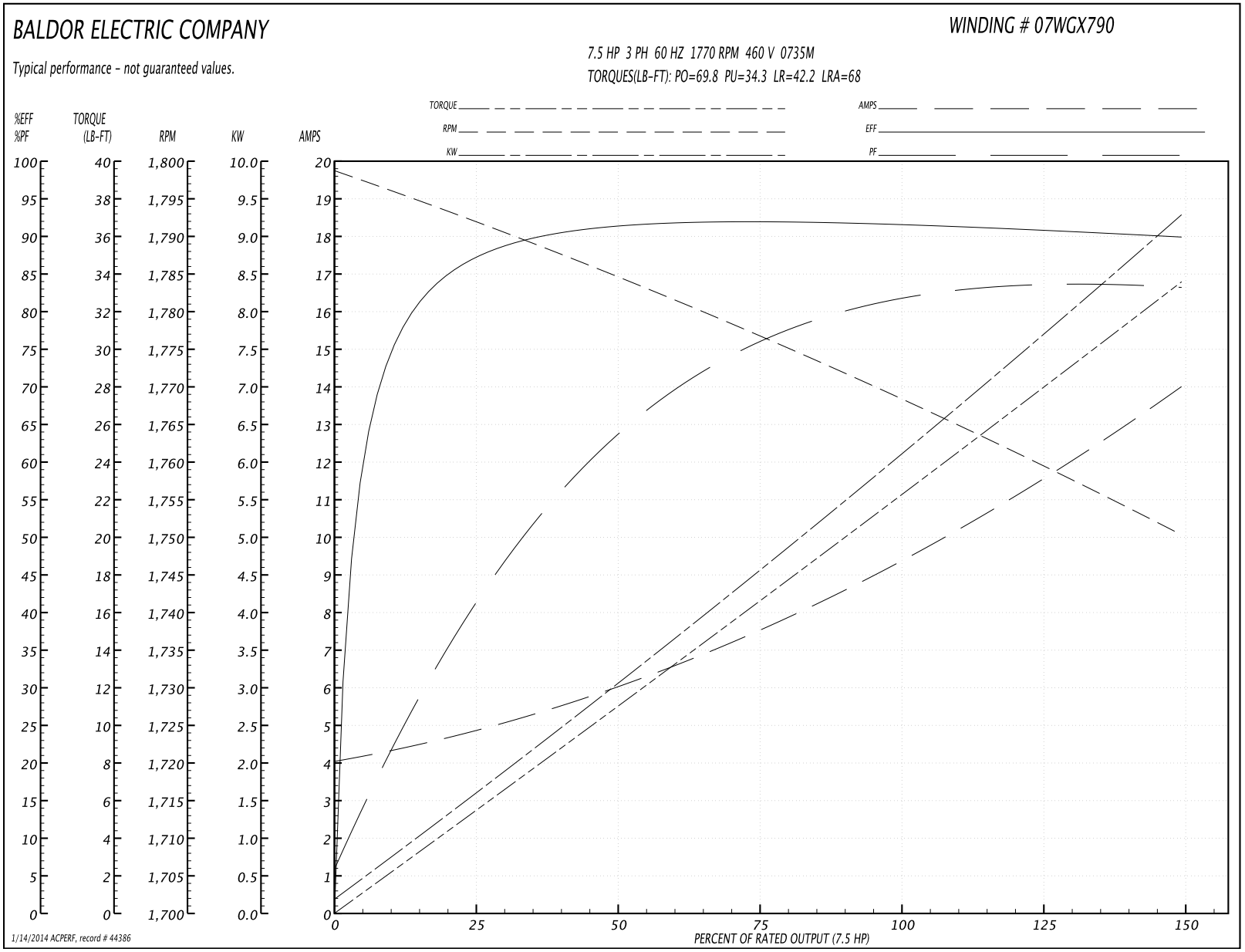
Part Number	Description	Quantity
SA267518	SA 07J475X790G1	1.000 EA
RA254190	RA 07J475X790G1	1.000 EA
37FN3002C01	EXFN, PLASTIC, 6.00 OD, 1.155 ID	1.000 EA
HA3210E08	.250X 7/8 PIN 312-57	1.000 EA
HW3201A05	3/8-16 EYEBOLT	1.000 EA
07CB1000A01	CONDUIT BOX MACH	1.000 EA
10XN3118A16	5/16-18X1 HEX HD CAP	4.000 EA
HW1001A31	LOCKWASHER 5/16, ZINC PLT.591 OD, .319 I	4.000 EA
11XW1032G06	10-32 X .38, TAPTITE II, HEX WSHR SLTD U	1.000 EA
WD1000B17	T&B CX35TN TERMINAL	1.000 EA
07EP1707A11	FRONT ENDPLATE EXPLOSION PROOF-W/DRAINS	1.000 EA
HW4500A19	1/4-28X1/4 SLOTTED PLUG F/S	2.000 EA
HW4506A02	BREATHER/DRAIN-EXP PROOF-.125-27 NPTF AI	1.000 EA
HW3022E05	.125 DIA X .500 ROLLED SPRING PIN	1.000 EA
10XN3816K28	3/8-16 X 1.75 HEX HD CAP SCREW, GRADE 5	4.000 EA
HW1001A38	LOCKWASHER 3/8, ZINC PLT .688 OD, .382 I	4.000 EA
HW5100A06	W2420-025 WVY WSHR (WB)	1.000 EA
07EP1708A01	STANDARD FACE MOUNTED ENDPLATE EXPLOSEIO	1.000 EA
HW4500A19	1/4-28X1/4 SLOTTED PLUG F/S	2.000 EA
10XN3816K28	3/8-16 X 1.75 HEX HD CAP SCREW, GRADE 5	4.000 EA
HW1001A38	LOCKWASHER 3/8, ZINC PLT .688 OD, .382 I	4.000 EA
10XN2520A32	1/4 X 2 HEX HEAD CAP SCR,GRADE 2	4.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	4.000 EA
07FH1003A09	307 EXPLOSION PROOF FAN HOUSING FOR DRIP	1.000 EA

Parts List (continued)

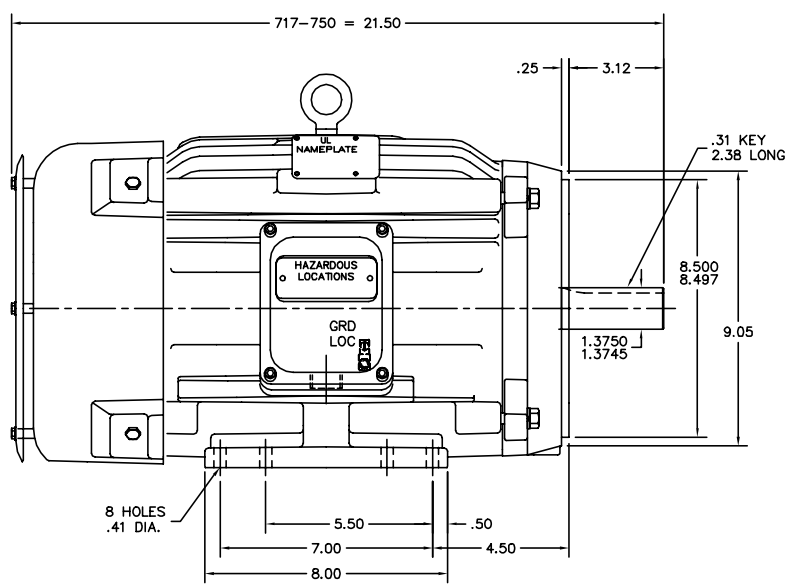
Part Number	Description	Quantity
10XN2520A12	O1/4-20X 3/4 HEX HEAD CAP	4.000 EA
37FH4500A04	DRIPCOVER, STAMPED	1.000 EA
12XN1032A16	10-32X1 HEX HD SLTD X	4.000 EA
HA2001A05	SPACER, .218 ID X .500 LG	4.000 EA
07CB1502A01	CONDUIT BOX LID MACH (DUCTILE IRON)	1.000 EA
84XN2520J16	1/4-20 X 1 SOC HD CAP SCREW	4.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	4.000 EA
HW2501F21	KEY, 5/16 SQ X 2.375	1.000 EA
HA7000A02	KEY RETAINER RING, 1 1/8 DIA, 1 3/8 DIA	1.000 EA
85XU0407S04	4X1/4 U DRIVE PIN STAINLESS	6.000 EA
LB1081	ALUM XP CAUTION LABEL	1.000 EA
LB1115	LABEL,LIFTING DEVICE	1.000 EA
MJ1000A75	GREASE, POLYREX EM EXXON	0.050 LB
51XB1214A16	12-14X1.00 HXWSSLD SERTYB	1.000 EA
MG1025Z20	ACTIVATOR WILKOFAST 060.32	0.010 GA
MG1025G29	DARK CHARCOAL METALLIC GREY 789.205	0.036 GA
LB1119	WARNING LABEL	1.000 EA
LB1172A01	CUSTOM MTR CARTON LABEL LASER PRINTER	1.000 EA
LC0145B01	CONNECTION LABEL	1.000 EA
LB1506	LABEL "AMERICAN MADE" 1.50 X 1.00	1.000 EA
NP0977XPSL	SS XP UL CSA CC CL-I GP-C&D	1.000 EA
07PA1011	PKG GRP, 07 CAST IRON PK1181	1.000 EA

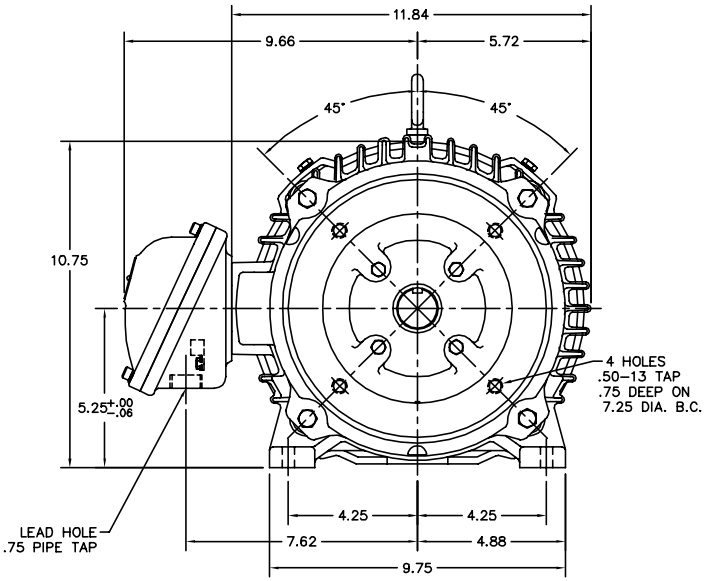
Performance Data at 460V, 60Hz, 7.5HP (Typical performance - Not guaranteed values)							
General Characteristics							
Full Load Torque:	22.2 LB-FT			**Start Configuration:**		DOL	
No-Load Current:	4.18 Amps			**Break-Down Torque:**		69.8 LB-FT	
Line-line Res. @ 25°C.:	1.43 Ohms A Ph / 0.0 Ohms B Ph			**Pull-Up Torque:**		34.3 LB-FT	
Temp. Rise @ Rated Load:	42 C			**Locked-Rotor Torque:**		42.2 LB-FT	
Temp. Rise @ S.F. Load:	52 C			**Starting Current:**		68.0 Amps	
Load Characteristics							
% of Rated Load	**25**	**50**	**75**	**100**	**125**	**150**	**S.F.**
Power Factor:	43.0	65.0	76.0	81.0	83.0	84.0	82.0
Efficiency:	86.6	91.1	91.9	91.9	90.9	89.9	91.3
Speed:	1792.0	1784.0	1777.0	1769.0	1760.0	1750.0	1764.0
Line Amperes:	4.68	5.93	7.53	9.44	11.6	13.9	10.7

Performance Graph at 460V, 60Hz, 7.5HP Typical performance - Not guaranteed values

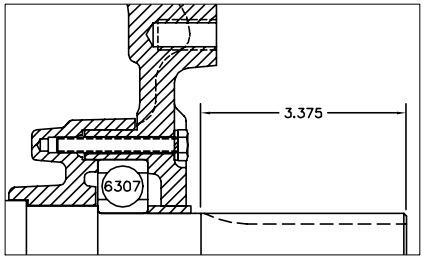


07LYJ475





FRONT ENDPLATE DRAIN ASSEMBLY



PULLEY END DETAIL

CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT MOTOR PERFORMANCE IS SUITABLE IN THE APPLICATION.

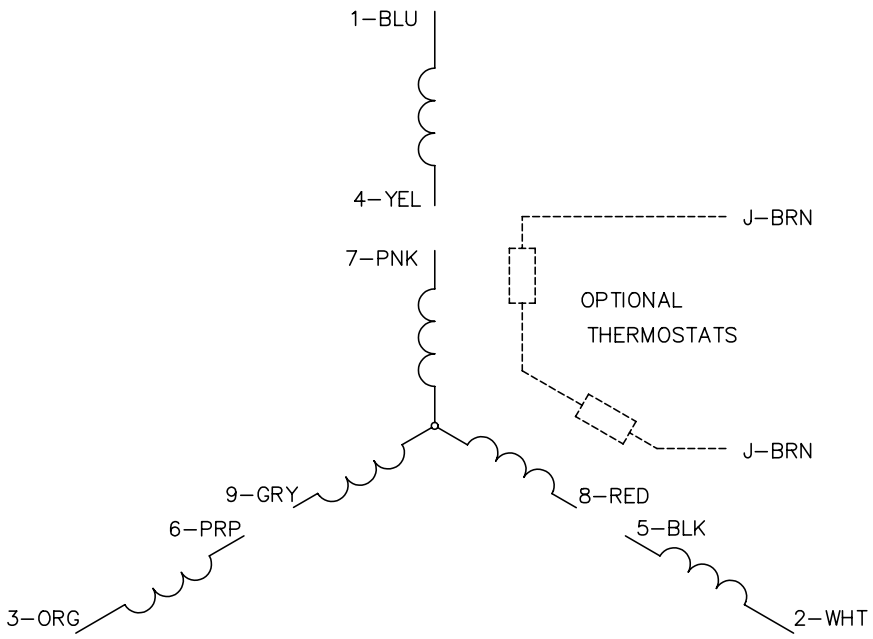
REV. DESC: CHG HW4501A02 TO HW4506A02 & HW3022E05			
REV. LTR: A	BY: JF	REVISED: 06:39:31 10/31/2003	TDR: 315895
FILE: AAA00086400			REF: 07LYJ475
MTL: –			

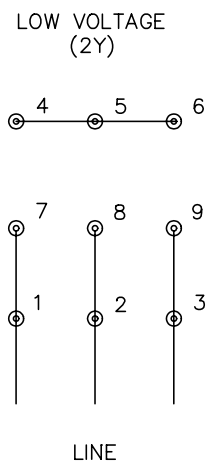
BALDOR ELECTRIC Co.

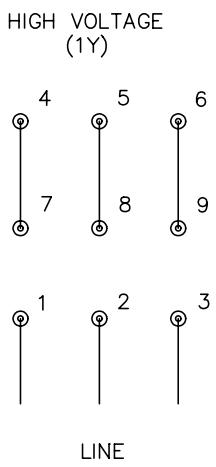
HORZ 213–5TC XPFC CL–I GP–C&D W/ DRIP COVER (DRILL RIG MOTOR

07LYJ475

CD0005







NOTES:

1. INTERCHANGE ANY TWO LINE LEADS TO REVERSE ROTATION.
2. OPTIONAL THERMOSTATS ARE PROVIDED WHEN SPECIFIED.
3. ACTUAL NUMBER OF INTERNAL PARALLEL CIRCUITS MAY BE A MULTIPLE OF THOSE SHOWN ABOVE.
4. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

CD0005

REV. DESC: REVISE TO SHOW OPTIONAL COLORS			BALDOR ELECTRIC Co.
REV. LTR: E	BY: JLP	REVISED: 01/19/99 10:15	TDR: 0171435
CD0005		FILE: AAA00005140	MDL: –
		MTL: –	3PH, DV, 9 LEADS

BALDOR
A MEMBER OF THE ABB GROUP

AC Induction Motor Performance Data

Record # 44386

Typical performance - not guaranteed values

Winding: 07WGX790	**Type:** 0735M	**Enclosure:** XPFC

Nameplate Data				General Characteristics at 460 V, 60 Hz: Single Volt Motor	
Rated Output (HP)	7.5			Full Load Torque	22.2 LB-FT
Volts	230/460			Start Configuration	DOL
Full Load Amps	19/9.5			Break Down Torque	69.8 LB-FT
R.P.M.	1770			Pull-Up Torque	34.3 LB-FT
Hz	60	Phase	3	Locked-rotor Torque	42.2 LB-FT
NEMA Design Code	A	KVA Code	J	Starting Current	68 Amps
Service Factor	1.15			No-load Current	4.18 Amps
NEMA Nom. Eff.	91.7	P.F.	81	Line-line Res. @ 25°C.	1.43 Ohms
Rating - Duty	50C AMB-CONT			Temp. Rise @ Rated Load	42°C
S.F. Amps				Temp. Rise @ S.F. Load	52°C

Load Characteristics at 460 Volts, 60 Hz

% of Rated Load	25	50	75	100	125	150	S.F.
Power Factor	43	65	76	81	83	84	82
Efficiency	86.6	91.1	91.9	91.9	90.9	89.9	91.3
Speed	1792	1784	1777	1769	1760	1750	1764
Line Amperes	4.68	5.93	7.53	9.44	11.6	13.9	10.7

SIEMENS

Link to other documents

0.19.60

Datasheet for SIMOGEAR Geared Motors

MLFB-Ordering data: **2KJ3512-5DA05-0FB2-Z**
D14+H09+K06+K41+L03+L50+Y00

{Y00:*AND@1770*|*ANL@5.59*}

Client order no.:
Order no.:
Offer no.:

Item no.:
Consignment no.:
Project:

Geared motor basic data

Type designation:	SIMOGEAR KAF129-K5-(210)
Gearbox type:	Bevel gearbox
Installation size(s):	129
Application:	Standard
Light-duty sector acc. VDI 3643:	-
Transmission ratio:	114.06
Relation of number of teeth:	56462 // 495
Service factor:	-
Nominal torque:	4400 Nm
Output torque:	-
Output speed:	-
Environment temperature:	-15 ... +40°C
Specification:	CE (Europe / other countries)
Oil quantity:	20.00 l
Weight without oil:	199.4 kg
Adapter:	K5 Short adapter for NEMA motors
Permissible input torque:	95 Nm

General options

Surface treatments:	painted
Coating:	[L03] Coating for low environmental stress C2
RAL Color:	[L50] 5015 sky blue
Pretreatment:	-
Coating on Flange:	-
Conservation:	-
Rating Plate stainless steel:	-
Second rating plate:	[K41] second rating plate supplied loose
Packaging:	Standard packing
Fast lane:	-
Enclosed documentation:	-
Additional documentation (E-Mail):	-

Adapter options

Backstop:	-
Condensation drain hole:	-
Input Shaft w/o Feather Key:	-
Rotation output shaft:	-
Slip clutch with proximity switch:	-
Slip torque is set:	-
Rotating direction:	-

Gearbox options

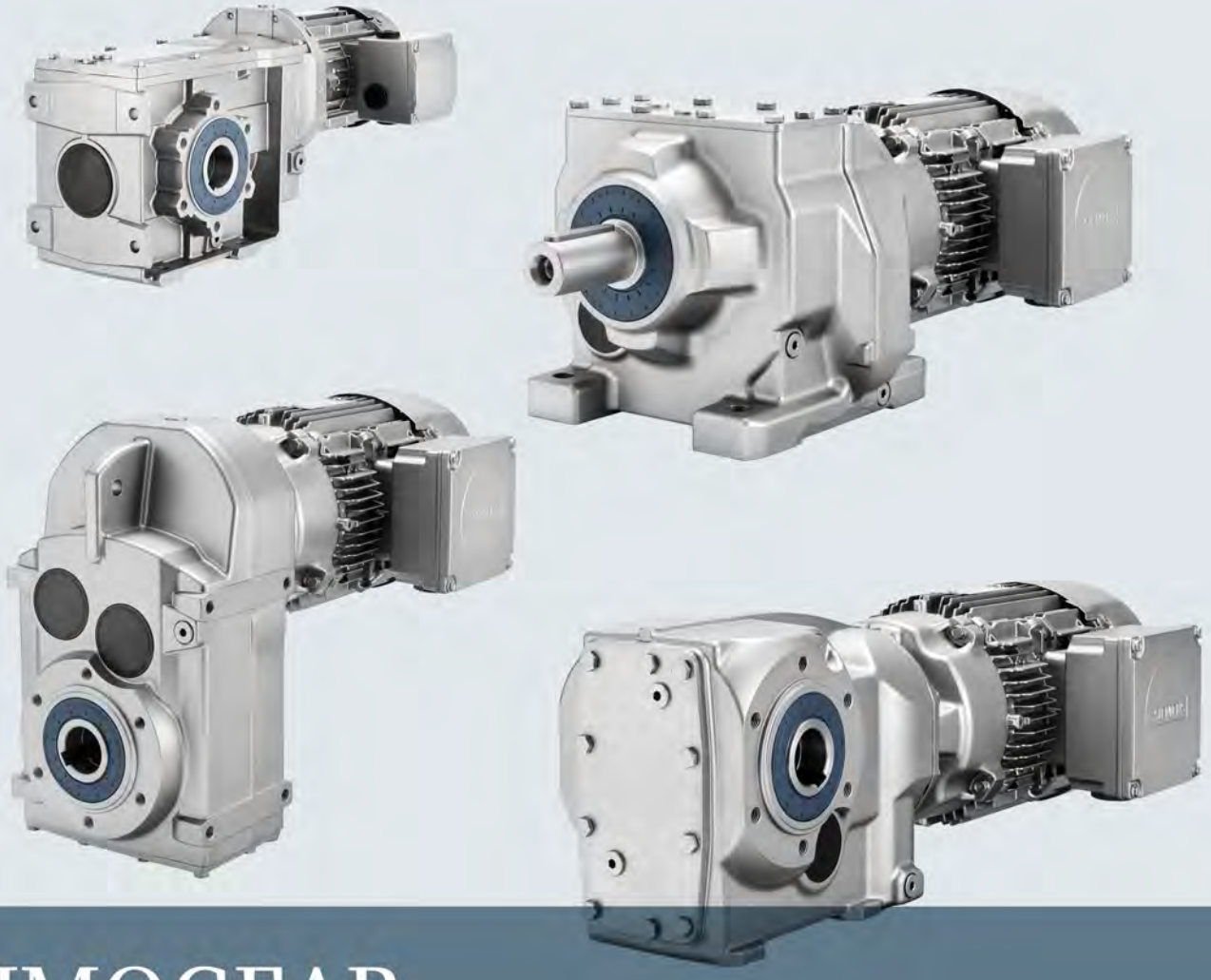
Mounting position:	[D14] M4 output side A
Special installation (Angle):	-
Permissible mount. position deviation:	-
Mount. pos. deviation (Angle):	-
Mounting type:	Flange-mounted design
Position of torque arm:	-
Flange diameter:	450
Output flange tightened:	-
Output shaft:	H70
Output shaft bearing:	Standard bearing
Hollow shaft cover:	Sealing cap
Gear oil:	[K06] Mineral oil CLP VG220
Output shaft sealing:	Standard sealing
Gearbox breather:	Pressure breather valve
Oil level control:	Oil level screw
Electr. oil temperature monitoring:	-
Disconnector unit, 24 V param.:	-
Adapter cable USB/jacks:	-
Oil level gauge:	-
Separation switch gear:	-

Oil drain:	Oil drain plug
Housing material:	Cast iron
Backlash Design:	-
Relubrication:	-
Drywell:	-
24 V Drywell switch disconnector:	-
Flange-Figure:	-

Performance data motor

Input speed (Info):	1770 rpm
Motor power (Info):	5.59 kW

SIEMENS



SIMOGEAR

Gearbox

BA 2030

Operating instructions

Edition 04/2016

Answers for industry.

4.5 Gearbox with flange fastening

Note

Siemens AG recommends an anaerobic adhesive to enhance the friction lock between flange and mounting surface.

Table 4- 3 Thread size of the fastening bolt

Thread size	Flange	Helical gearbox D/Z	Parallel shaft gearbox F	Bevel gearbox B, K	Helical worm gearbox C
		Size			
M6	A120	19, 29, 39	29	B29	29
M8	A140, A160	19, 29, 39, 49, 59	29, 39	B29, B39, K39	39
M10	A200	39, 49, 59, 69	49	B39, B49, K49	49, 69
M12	A250, A300	59, 69, 79, 89	69, 79, 89	K69, K79, K89	89
M16	A350	89, 109, 129	109	K109	-
M16	A450	109, 129, 149, 169	129, 149	K129, K149	-
M16	A550	169, 189	169	K169	-
M20	A660	189	189	K189	-

Use screws / nuts of strength class 8.8 for gearboxes with a flange-mounted design.

Note the following exceptions:

Table 4- 4 Strength class of the fastening bolt for FF/FAF and KF/KAF

Gearbox size	Flange	Strength class for motor size										
		90	100	112	132	160	180	200	225	250	280	315
39	A160	10.9	10.9	-	-	-	-	-	-	-	-	-
49	A200	8.8	10.9	10.9	10.9	-	-	-	-	-	-	-
69	A250	8.8	8.8	8.8	10.9	-	-	-	-	-	-	-
79	A250	8.8	8.8	8.8	10.9	10.9	-	-	-	-	-	-
89	A300	8.8	10.9	10.9	10.9	10.9	10.9	-	-	-	-	-
109	A350	8.8	8.8	8.8	8.8	10.9	10.9	10.9	10.9	-	-	-
129	A450	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	-	-	-
149	A450	-	8.8	8.8	8.8	8.8	8.8	10.9	10.9	10.9	-	-
169	A550	-	-	8.8	8.8	8.8	10.9	10.9	10.9	10.9	10.9	-
189	A660	-	-	8.8	8.8	8.8	8.8	8.8	8.8	10.9	10.9	10.9

4.9 Installing and removing the shaft-mounted gearbox

4.9.1 General information on installing the shaft-mounted gearbox

NOTICE
Damage to shaft sealing rings caused by solvent
Avoid any contact of solvent or benzine with the shaft sealing rings.

NOTICE
Subjecting stress to the hollow shaft causes bearing failure
Skewing or stressing the hollow shaft increases the loading. This can cause bearing failure.
The hollow shaft must be flush with the machine shaft to avoid misalignment.
Do not subject the hollow shaft to axial and radial stress.

NOTICE
For shrink disks: **Lubricants in the area between the hollow shaft and machine shaft impair torque transmission**
Keep the bore in the hollow shaft and the machine shaft completely grease-free.
Do not use impure solvents and soiled cleaning cloths.

Note

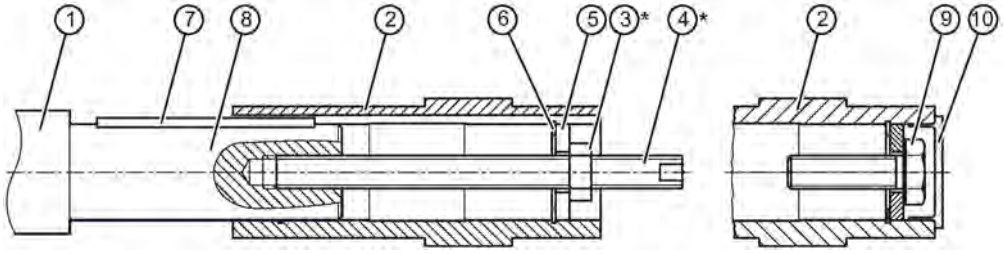
Coat the contact surfaces with the mounting paste supplied with the product or any suitable lubricant to prevent frictional corrosion.

Note

Observe the permissible concentricity tolerance of the cylindrical shaft extension of the machine shaft to the housing axle according to DIN 42955.

4.9.2 Hollow shaft with parallel key

4.9.2.1 Mounting the hollow shaft with parallel key



* Not included in scope of supply

①	Machine shaft	⑥	Circlip
②	Hollow shaft	⑦	Parallel key
③	Hexagon nut	⑧	Mounting paste
④	Threaded spindle	⑨	Bolt
⑤	Disk	⑩	Sealing caps

Image 4-4 Mounting the hollow shaft with parallel key

Instead of the nut and threaded spindle shown in the diagram, other types of equipment such as hydraulic lifting equipment may be used.

Procedure

1. Using benzine or a solvent, remove the anti-corrosion protection from the shaft ends and flanges.
2. Check the seats or edges of the hollow and machine shafts for damage. Contact Technical Support if you notice any damage.
3. Apply the mounting paste provided ① to the machine shaft ⑧. Apply the paste uniformly.
4. Fit the gearbox using the disk ⑤, threaded spindle ④ and nut ③. Support is provided by the hollow shaft ②.
5. Replace the nut ③ and the threaded spindle ④ with a screw ⑨. Tighten the bolts ⑨ to the specified torque.
6. Close the open hollow shaft end using a sealing cap ⑩.

You have mounted the hollow shaft with feather key.

Table 4- 6 Tightening torque for the screw

Thread size	M5	M6	M8	M10	M12	M16	M20	M24	M30
Tightening torque [Nm]	5	8	8	14	24	60	120	200	400

4.9.2.2 Removing the hollow shaft with parallel key

⚠ WARNING

Inadequately secured gearbox or geared motors can free themselves

Before driving out the machine shaft, fasten a suitably dimensioned means of absorbing load to the gearbox.

Slightly pretension the pulling equipment so that the gearbox does not drop onto it when the insert shaft is released.

NOTICE

Subjecting stress to the hollow shaft causes bearing failure

It is essential to prevent misalignment when removing the unit.

NOTICE

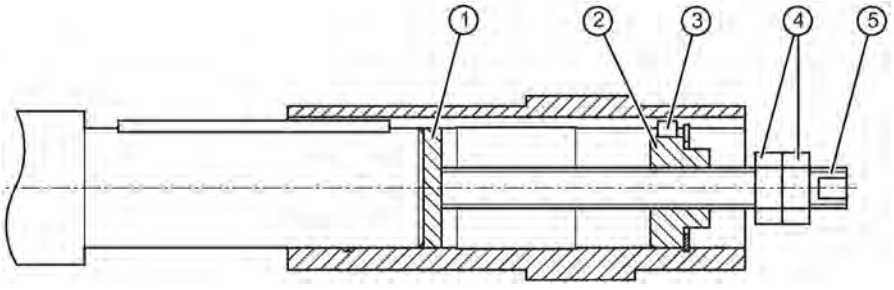
Excessive forces during removal

Excessive forces can occur during removal of the hollow shaft via the housing.

Stresses in the hollow shaft can lead to bearing failure and damage to the gearbox housing.

Note

If frictional corrosion has occurred on the seat surfaces, use rust solvent to facilitate the removal of the gearbox. Allow an adequately long time for the rust solvent to take effect.



Items ① to ⑤ are not included in the scope of supply.

① Disk
② Threaded block
③ Parallel key
④ Hexagon nut
⑤ Leadscrew

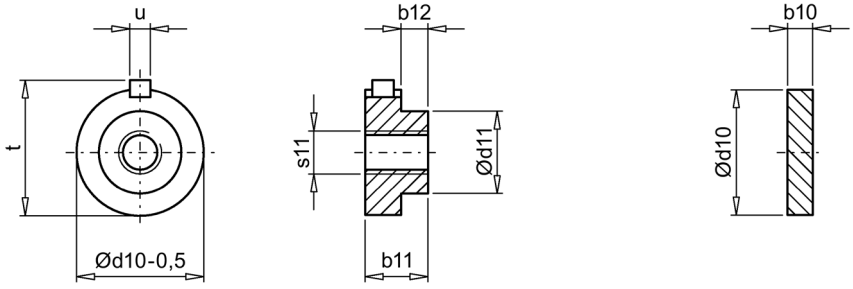
Image 4-5 Removing the hollow shaft with parallel key

Procedure

1. Remove the axial locking element from the hollow shaft.
2. Drive out the machine shaft using the disk ①, threaded block ②, feather key ③, threaded spindle ⑤ and hexagon nuts ④.

You have now removed the hollow shaft with parallel key.

Design suggestion for threaded block and disk



Gearbox	Size	Hollow shaft Ø	b10	b11	b12	d10	d11	s11	t_{max}	u
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
B	19	20	3	15	10	19.9	10	M6	22.5	6
B, C	29	20	3	15	10	19.9	10	M6	22.5	6
B, F	29	25	3	15	10	24.9	16	M10	28	8
C	39	25	3	15	10	24.9	16	M10	28	8
B, K, F, C		30	6	15	10	29.9	18	M10	33	8
B		35	6	15	10	34.9	24	M12	38	10
B		40	6	15	10	39.9	28	M16	43	12
C	49	30	6	15	10	29.9	18	M10	33	8
K, F, C		35	6	15	10	34.9	24	M12	38	10
B		40	6	15	10	39.9	28	M16	43	12
K, F, C	69	40	6	20	9	39.9	28	M16	43	12
C		45	6	20	9	44.9	36	M16	48	14
K, F	79	40	6	20	9	39.9	28	M16	43	12
K, F, C	89	50	7	20	10	49.9	36	M16	53.5	14
C		60	7	20	10	59.9	45	M20	64	18
K, F	109	60	10	24	14	59.9	45	M20	64	18
K, F	129	70	10	24	14	69.9	54	M20	74.5	20
K, F	149	90	10	24	14	89.9	72	M20	95	25
K, F	169	100	10	30	15	99.9	80	M24	106	28
K, F	189	120	10	30	15	109.9	80	M24	127	32

8.2 Checking and changing lubricants

8.2.1 General safety notes

⚠ WARNING

Danger of scalding from the hot oil emerging from the unit

Before starting any work wait until the oil has cooled down to below +30 °C.

⚠ WARNING

Risk of slipping on oil

Remove any oil spillage immediately with an oil-binding agent in compliance with environmental requirements.

NOTICE

Damage to the gearbox caused by incorrect oil quantities

The oil quantity and the position of the sealing elements are determined by the mounting position.

After removing the oil level screw, the oil level may not be below the specified fill level.

NOTICE

Damage to the gearbox due to open oil holes

Dirt and damaging atmosphere can penetrate through open oil holes.

Close the gearbox immediately after checking the oil level or changing the oil.

Note

Information about oil

Refer to the rating plate for the type of oil, oil viscosity and quantity of oil required.

For oil compatibility, see Recommended lubricants (Page 74).

Note

Gearbox sizes 19 and 29

Gearbox sizes 19 and 29 are lubricated for life. There is no opening to check the oil level. An oil change is not required.

In mounting positions M2 and M4 the gearboxes are equipped with a breather valve.

C29 has a breather valve in all mounting positions.

Note

Tandem gearbox - intermediate helical gearbox

- In a horizontal operating position the bulging part of the housing of the intermediate helical gearbox generally faces vertically downwards.
- The oil quantity is specified for every individual gearbox and is valid for the standard mounting position.
- Perform the following work for each individual gearbox:
  - Check the oil level.

    On the main gearboxes D/Z, F, K it is not possible to check the oil level in mounting position M4. The oil level is above the oil level bore so that the bearings above it are lubricated.
  - Check the oil quality.
  - Change the oil.
  - Fill in oil and top it up.

Note

Gearbox in special mounting position

The gearbox is intended for a specific rotation angle and is delivered with the correct quantity of oil for this purpose.

It is not possible to check the oil level. You will find information regarding oil quantity and type of oil on the rating plate.

When draining the oil a higher residual quantity of oil may remain in the gearbox. When you carry out an oil change remove any residual oil.

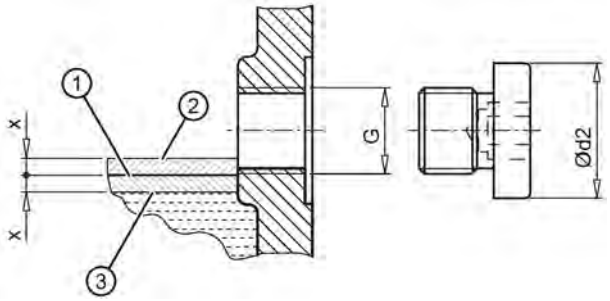
8.2.2 Checking the oil level

NOTICE

The volume of gearbox oil changes with temperature

If the temperature rises, the volume increases. Where temperature differences and filling quantities are significant, the volume difference can amount to several liters.

The oil level must therefore be checked while still slightly warm, approximately 30 minutes after switching off the drive unit.



① Specified oil level
② Maximum oil level
③ Minimum oil level

Image 8-1 Oil level in the gearbox housing

Table 8- 2 Minimum and maximum fill levels x

Oil level hole	Ød2	Fill level x	Tightening torque
	[mm]	[mm]	[Nm]
G 1/8"	14	2.5	10
G 1/4"	18	3	10
G 3/8"	22	4	25
G 3/4"	32	7	50

Procedure

1. Switch off the power supply to the drive unit.
2. Unscrew the oil level screw, see Mounting positions (Page 87). Oil escapes if the maximum fill level is above the plug hole.
3. Check the oil level. Observe the fill level x.
4. Top up the oil level if necessary and check it again.
5. Check the state of the sealing ring on the sealing element. If the sealing ring is damaged, replace the sealing element with a new one.
6. After checking, seal the gearbox immediately using the sealing element.

You have now checked the oil level in the gearbox housing.

8.2.3 Checking the oil level using the oil sight glass (optional)

If there is an oil sight glass to check the oil level ①, the oil must be visible in the center of the sight glass when the oil is cool. When the oil is hot, the oil level ① is above the center of the sight glass. The oil level ① of cold oil is below the center of the sight glass.

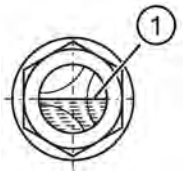


Image 8-2 Oil level in the oil sight glass

Top up the oil level ① if necessary, and check it again.

8.2.4 Checking the oil quality

Visible signs show effects on the oil. Fresh oil is clear to the eye, and has a typical smell and a specific product color. Clouding or a flocculent appearance indicates water and / or contamination. A dark or black color indicates residue, serious thermal decomposition or contamination.

Observe the symbols in the diagrams of the Mounting positions (Page 87):

Venting

Oil level

Procedure

1. Allow the geared motor to run for a short time. Wear and contaminant particles are visible in the oil shortly after shutting down.
2. Switch off the power supply to the drive unit.
3. Unscrew the sealing element at one of the points marked with the symbols listed above.
4. Remove some oil, using a suction pump and a flexible hose, for example.
5. Check the state of the sealing ring on the sealing element. When required, replace the sealing ring.
6. Seal the gearbox with the sealing element.
7. Check the oil for abnormalities. Change the oil immediately if you determine any abnormalities, see Changing the oil (Page 67).

You have now checked the oil quality.

8.2.5 Changing the oil

8.2.5.1 General safety notes for changing the oil

NOTICE

Impermissible mixing of oils leads to damage

Impermissible mixing of oils leads to:

- Darkening
- Sediment
- Foam formation
- Change of the viscosity or reduced corrosion protection
- Wear protection.

When changing oil of the same type, the residual volume of oil in the gearbox should be kept as low as possible. Generally speaking, a small residual volume will cause no particular problems.

Gear oils of different types and by different manufacturers must not be mixed. Have the manufacturer confirm that the new oil is compatible with the remaining volume of used oil.

If very different types of oil or oils with very different additives are changed, always flush out the gearbox with the new oil. When changing from mineral oil to polyglycol oil (PG) or vice versa, it is vital to flush the gearbox twice. All traces of old oil must be completely removed from the gearbox.

NOTICE

Contaminations of the oil impair the lubricity

Do not mix the gearbox oil with other substances.

Do not flush with paraffin or other solvents, as traces of these substances will always remain inside the gearbox.

Note

The oil must be warm because insufficient viscosity caused by oil that is too cold impairs correct emptying.

If necessary, run the gearbox for 15 to 30 minutes to become warm.

8.2.5.2 Draining the oil

Observe the symbols in the diagrams of the Mounting positions (Page 87):


Venting


Oil level


Oil drain

Procedure

1. Switch off the power supply to the drive unit.
2. Unscrew the vent plug.
3. Place a suitable and sufficiently large receptacle underneath the oil drain plug.
4. Remove the oil drain plug. Drain all the oil into the receptacle.
5. Check the state of the sealing ring on the sealing element. If the sealing ring is damaged, replace the sealing element with a new one.
6. After draining the oil, seal the gearbox immediately using the sealing element.

You have now drained the oil from the gearbox.

8.2.5.3 Flushing the gearbox when changing between incompatible oils

⚠ WARNING

Impermissible mixing of oils leads to damage

Residual quantities of original oil can impair the specific properties of the new oil.

A flushing process is required with biodegradable and physiologically safe oils.

The residual corrosion protection oil must amount to no more than 1% of the operating oil volume.

Note

Polyglycol oil has a higher density than mineral oil. Therefore, it sinks down towards the oil drain and the mineral oil floats on top.

This makes the required complete draining of mineral oil from the gearbox extremely difficult.

Note

After the second flush, we recommend that an appropriate analysis institute checks the quality of the flushed fluid.

Observe the symbols in the diagrams of the Mounting positions (Page 87):

Venting

Oil drain

Procedure

1. After the oil has been drained, wipe the gearbox clean of any remaining mineral oil using a cloth.
2. Unscrew the vent plug.
3. Fill the gearbox with a flushing oil, using a filter (filter mesh max. 25 µm). For the flushing oil, use either the new oil or one that is compatible with the new oil and is less expensive.
4. Operate the gearbox for 15 to 30 minutes under a low load.
5. Place a suitable and sufficiently large receptacle underneath the oil drain plug.
6. Remove the oil drain plug. Drain all the oil into the receptacle.
7. After flushing, immediately seal the gearbox using the sealing element.
8. Repeat this step for the second flushing.

You have now flushed the gearbox twice and can pour in the new oil.

8.2.5.4 Filling in oil

NOTICE
Mixing of different oils impairs the lubricity
When adding oil, use the same oil type and viscosity. If changing mutually incompatible oils, see Flushing the gearbox (Page 68).

Observe the symbols in the diagrams of the Mounting positions (Page 87):

Venting

Procedure

1. Unscrew the vent plug.
2. Fill the gearbox with fresh oil. Use a filler filter with mesh of max. 25 µm.
3. Check the oil level.
4. Top up the oil level if necessary and check it again.
5. Check the state of the sealing ring on the sealing element. If the sealing ring is damaged, replace the sealing element with a new one.
6. After filling with oil, seal the gearbox immediately using the sealing element.

You have now filled up the gearbox with oil.

8.2.6 Topping up with oil

If the mounting position of the gearbox is changed or oil lost because of leakage, check the oil level. If you notice oil escaping, locate the leak and seal the affected area. Top up and check the oil level.

At the time of going to print, the following types of oil are being used when the gearbox is filled for the first time:

CLP ISO VG220: Castrol Alpha SP 220

CLP ISO PG VG220: Castrol Tribol / Optigear Synthetic 1300/220

CLP ISO PG VG460: Castrol Tribol / Optigear Synthetic 1300/460

CLP ISO PAO VG68: Addinol Eco Gear 68S-T

CLP ISO PAO VG220: Addinol Eco Gear 220S

CLP ISO E VG220: Fuchs Plantogear Bio 220S

CLP ISO H1 VG100: Klüber Klübersynth UH1 6 100

CLP ISO H1 VG460: Castrol Tribol Foodproof / Optilep GT 1800/460

If, following agreement, the gearbox is filled at the factory with special lubricant for the special applications referred to above, the lubricant must be shown on the rating plate.

8.2.7 Change the roller bearing grease

The roller bearings are lubricated in the factory with the greases listed in the table.

Renew the grease quantify for grease-lubricated bearings with each oil change.

Clean the bearing before filling it with fresh lubricant.

In the case of bearings on the output shaft or intermediate shafts, the grease quantity must fill 2/3, and in the case of bearings on the input side, 1/3 of the space between the rolling elements.

Table 8- 3 Roller-bearing and shaft-sealing-ring grease

Fields of application	Ambient temperature	Manufacturer	Type
Standard	-40 °C to +80 °C	Klüber	Petamo GHY 133 N
Foodstuff-compatible for the food industry	-30 °C to +40 °C	Castrol	Obeen UF F2 NSF H1 / Optileb GR UF 2 NSF H1
Biologically degradable, for agriculture, forestry and water industries	-35 °C to +40 °C	BP	Biogrease EP 2

8.2.8 Service life of the lubricants

Note

In case of ambient conditions deviating from normal conditions, e.g. high ambient temperatures, high relative humidity, aggressive ambient media, the intervals between changes should be shorter. In such cases, contact Technical Support for assistance in determining the individual lubricant change interval.

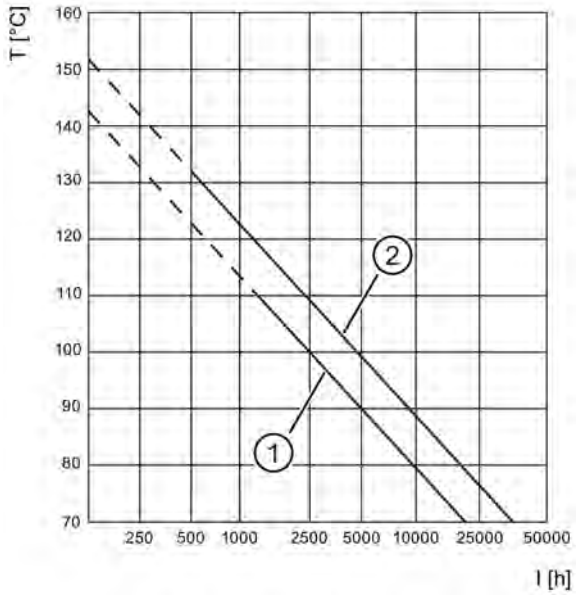
Note

Oil sump temperatures above +80 °C can reduce service life. A temperature increase by 10 K halves the service life by the amount as shown in the figure titled "Guide values for oil change intervals".

For a +80 °C oil sump temperature, the following service life can be expected when observing the properties specified by Siemens AG:

Table 8- 4 Service life of the oils

Type of oil	Service life
Mineral oil	10 000 operating hours or 2 years
Biodegradable oil	
Physiologically safe oil according to USDA-H1/-H2	
Synthetic oil	20 000 operating hours or 4 years



① Mineral oil
② Synthetic oil
T Oil-bath steady-state temperature [°C]
I Oil change interval in operating hours [h]

Image 8-3 Guide values for oil change intervals

Grease service life of roller bearing greases

Roller bearings and the clearance in front are filled with sufficient grease.

Under approved operating conditions and ambient temperatures, no regreasing is required.

We recommend that the grease in the bearings is also renewed when the oil or shaft sealing rings are replaced.

8.2.9 Recommended lubricants

⚠ DANGER

Used lubricants only have conditional approval

The used lubricants are not or only conditionally approved for use in the foodstuff or pharmaceutical industry.

Use only lubricants with USDA (United States Department of Agriculture) H1 / H2 approval for deployment in the foodstuff or pharmaceutical industry.

The released and recommended lubricants are listed in the T 7300 Operating Instructions.

NOTICE

Incorrect operating temperatures impair the lubricity of the gearbox oil

Operating temperatures outside the permitted range impair the lubricating property of the gearbox oil.

The temperature ranges are listed in the T 7300 Operating Instructions, Gearbox Lubrication. If you are working outside the specified temperature ranges, please contact Technical Support for advice on which oil to use.

If the housing temperature exceeds a value of +80 °C, please contact Technical Support.

Note

As standard, the lubricants and shaft seals are harmonized and coordinated with one another corresponding to the prevailing operating conditions.

Contact Technical Support for:

- Change of the operating conditions
- Change in oil grade
- Deployment of new shaft seals.

Note

The lubricants used are not at all or only conditionally biodegradable. If biologically degradable lubricants are required, use only gearbox lubricants with the appropriate classification listed in the T 7300 Operating Instructions.

Note

These recommendations are not a guarantee of the lubricant quality provided by your supplier. All lubricant manufacturers are responsible for the quality of their own products.

The oil viscosity is decisive for the oil selection (ISO VG class). The viscosity is specified on the rating plate of the gearbox. The viscosity class indicated applies for the contractually agreed operating conditions.

In the case of different operating conditions, please contact Technical Support.

If, following agreement, the gearbox is filled at the factory with special lubricant for the special applications referred to above, the lubricant is shown on the rating plate.

The quality of the oil used must comply with the requirements laid down in the BA 7300 Operating Instructions; otherwise, the Siemens warranty is null and void. We recommend the use of an approved gearbox lubricant specified in the T 7300 (http://support.automation.siemens.com/WW/view/en/44231658) Operating Instructions. These oils have been tested appropriately and satisfy the requirements.

The oils listed in the operating instructions are subject to continuous testing. It is possible that the oils recommended in the operating instructions are at a later point in time removed or replaced by oils that have been further developed.

We recommend that you regularly check as to whether the selected lubricating oil is still recommended by Siemens. Otherwise change the product.

8.3 Replace bearings

The bearing service life depends greatly on the operating conditions and so cannot be calculated reliably. In the operating conditions specified by the operator, bearing life can be calculated and indicated on the rating plate. If no information is given, changes in vibration and noise pattern can serve as an indicator that an immediate bearing replacement is necessary.

10.5 Mounting positions

10.5.1 General notes on mounting positions

Only operate the gearbox in the mounting position specified on the rating plate. This ensures that the correct quantity of lubricant is provided. The symbols are shown for the standard mounting position.

Note

Gearbox sizes 19 and 29

Gearbox sizes 19 and 29 are lubricated for life. There is no opening to check the oil level.

In mounting positions M2 and M4 the gearboxes are equipped with a breather valve.

C29 has a breather valve in all mounting positions.

Description of the symbols:

Venting

Oil level

Oil drain

A, B Position of insert shaft / solid shaft

* On opposite side

② Two-stage gearbox

③ Three-stage gearbox

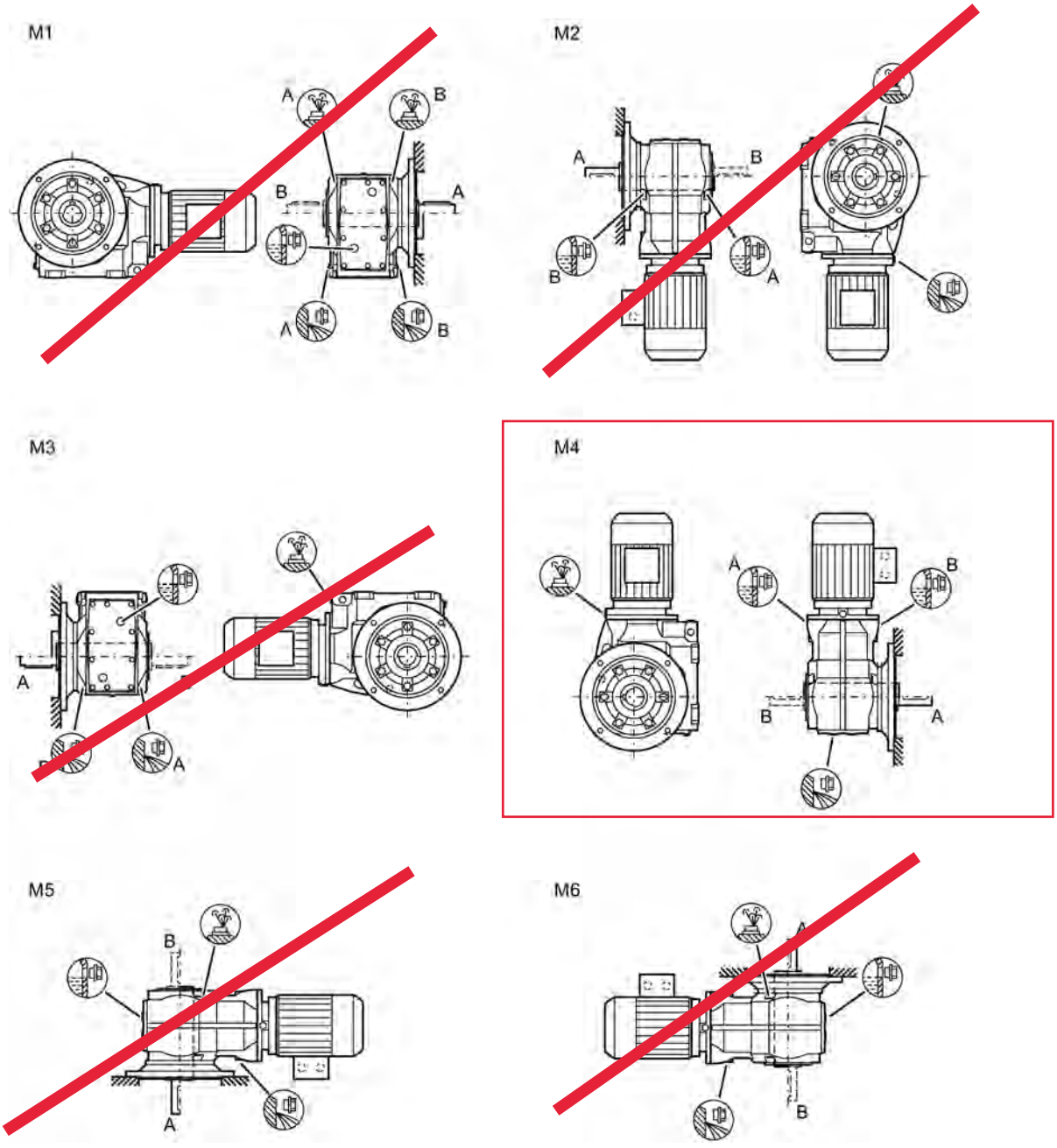


Image 10-23 Mounting positions for bevel gearbox K.F flange-mounted design and KAZ with housing flange, sizes 39 - 189

10.6.2 Parallel shaft gearbox

Table 10- 4 Oil quantities [l] for FD/Z, FD/ZZ, FD/ZA., FD/ZAF., FD/ZAZ., FD/ZAD., sizes 29 - 189

Type	Mounting position					
	M1	M2	M3	M4	M5	M6
FD.29	0.6	0.8	0.35	0.6	0.45	0.45
FD.39	0.95	1.1	0.7	1.2	0.8	0.8
FD.49	2.1	2.3	1.5	2.3	1.5	1.5
FD.69	2.2	2.7	1.6	2.7	1.8	1.8
FD.79	3	3.8	2.7	3.9	2.6	2.7
FD.89	5.6	7.6	5.9	7.8	5.1	5.2
FD.109	9.5	13	9.2	11.8	8.5	8.5
FD.129	16.1	20	16.3	23.5	14.9	15
FD.149	24.5	32.5	23	34	21.5	22
FD.169	39	50	37	54	34.5	35.5
FD.189	64	74	48	77	51.5	52
FZ.29	0.6	0.9	0.4	0.7	0.5	0.45
FZ.39	0.95	1.3	0.8	1.4	0.9	0.85
FZ.49	1.6	2.5	1.6	2.5	1.6	1.6
FZ.69	2.2	2.8	1.6	2.9	1.9	1.9
FZ.79	2.8	4.1	2.9	4.2	2.7	2.9
FZ.89	4.9	7.7	5.9	8.4	5.2	5.5
FZ.109	9.1	13.7	9.4	13.1	9	9.3
FZ.129	15.6	21.5	16.7	25	15.6	16.3
FZ.149	23.5	34	24	37	22.5	24
FZ.169	38	54	37.5	59	36.5	38.5
FZ.189	57	77	50	80	52.5	54

Table 10- 5 Oil quantities [l] for FD/ZF, sizes 29 - 189

Type	Mounting position					
	M1	M2	M3	M4	M5	M6
FDF29	0.6	0.8	0.35	0.6	0.45	0.45
FDF39	1	1.2	0.75	1.3	0.8	0.85
FDF49	2.2	2.3	1.5	2.4	1.6	1.5
FDF69	2.4	2.8	1.6	2.9	1.9	1.9
FDF79	3.1	3.9	2.7	4	2.7	2.6
FDF89	5.8	7.6	5.8	8	5.2	5.2
FDF109	9.7	13	9.2	12	8.6	8.6
FDF129	16.4	20	16.3	23.5	15.1	15.2
FDF149	25	32.5	23	35	22	22.5
FDF169	40.5	50	37	56	35.5	36.5

Type	Mounting position					
	M1	M2	M3	M4	M5	M6
FDF189	60	74	48	79	5[illegible]	53
FZF29	0.6	0.9	0.4	0.7	0.5	0.45
FZF39	1	1.4	0.85	1.[illegible]	0.95	0.9
FZF49	1.8	2.4	1.5	2.6	1.6	1.6
FZF69	2.4	2.9	1.[illegible]	3.1	2	2
FZF79	2.9	4.2	2.9	4.3	2.9	2.8
FZF89	5.1	7.7	5.8	8.6	5.3	5.4
FZF109	9.2	13.7	9.4	13.3	9.1	9.4
FZF129	16	21.5	16.7	25.5	15.[illegible]	16.5
FZF149	24	34	24	38	23	24.5
FZF1[illegible]9	39.5	54	37.5	61	37.5	39.[illegible]
FZF189	60	77	50	82	53.5	55

10.6.3 Bevel gearbox

Table 10- 6 Oil quantities [l] for B., sizes 19 - 49

Type	Mounting position					
	M1	M2	M3	M4	M5	M6
B.19	0.15	0.3	0.4	0.5	0.3	0.[illegible]3
B.29	0.[illegible]25	0.55	0.7	0.85	0.55	0.5
B.39	0.5	0.95	1.3	1.6	0.95	0.9
B.49	1	1.7	2.4	3.1	1.[illegible]	1.5

Table 10- 7 Oil quantities [l] for K, KA, KAS, KAT, sizes 39 - [illegible]89

Type	Mounting position					
	M1	M2	M3	M4	M5-A M6-B	M6-A M5-B
K.39	0.35	0.85	1.1	1.[illegible]2	0.85	0.9
K.49	0.55	1.4	1.8	1.9	1.5	1.6
K.69	0.75	2	2.5	2.7	2.2	2.2
K.79	1	2.2	2.9	3.4	2.7	2.5
K.89	1.9	4.5	6	6.8	5	5.3
K.109	3	7.2	9.2	10.5	7.1	7.5
K.129	5.2	13.4	16.6	19.5	13.2	13.6
K.149	9.3	21	28	33	21.5	22.[illegible]
K.16[illegible]	17	31	47	57.5	35.5	38.5
K.189	24.5	53	73	87	53.5	59

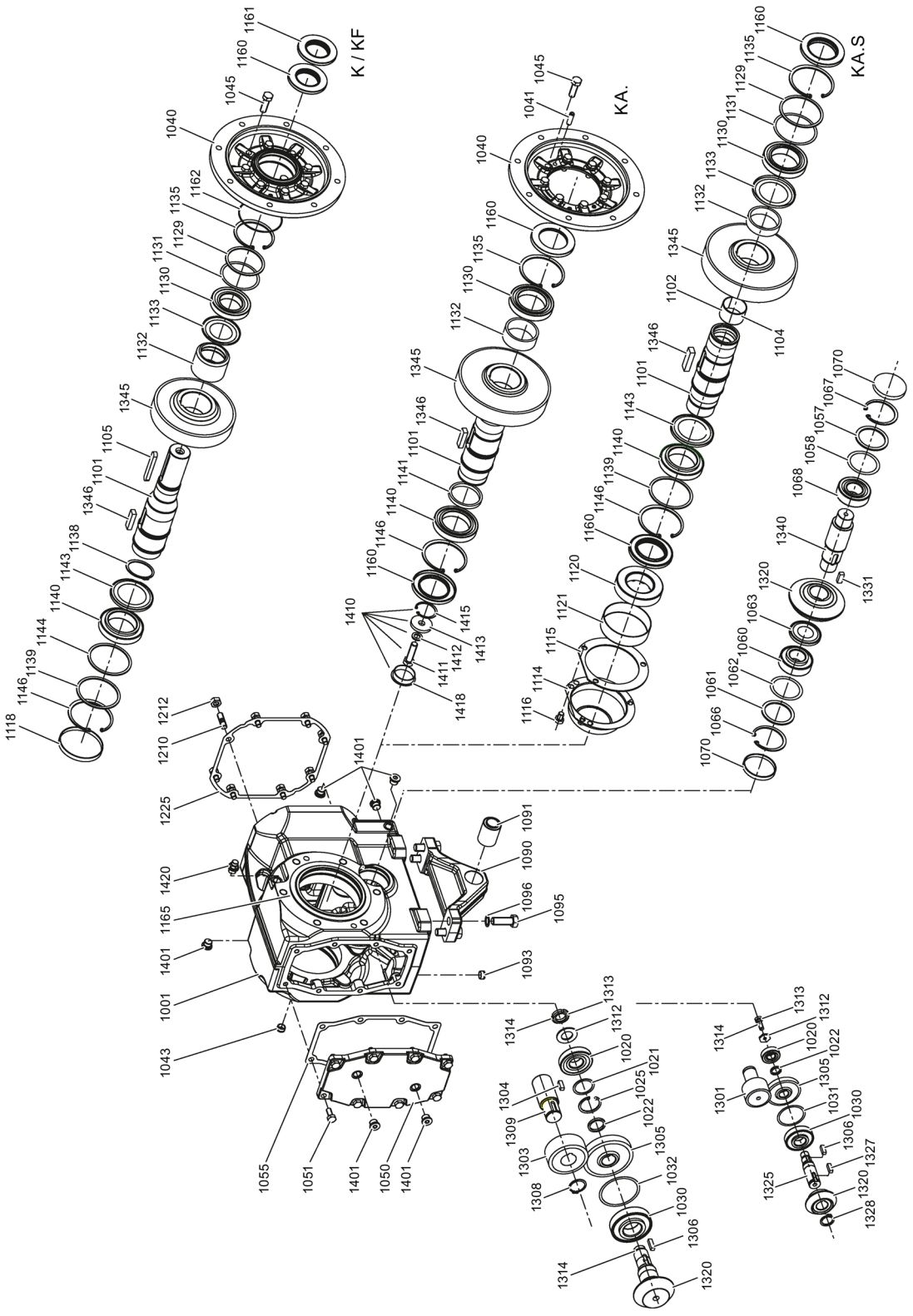
Table 10- 8 Oil quantities [l] for KZ, KAF., KAZ., KAD., sizes 39 - 189

Type	Mounting position					
	M1	M2	M3	M4	M5-A M6-B	M6-A M5-B
K.39	0.4	0.9	1.2	1.3	0.95	0.95
K.49	0.65	1.5	1.9	2.2	1.6	1.6
K.69	0.85	2.1	2.8	3.2	2.4	2.5
K.79	1.1	2.4	3.1	3.7	2.5	2.7
K.89	2.2	4.7	6.2	7.3	5.3	5.6
K.109	3.7	7.4	9.6	11.7	7.6	8.2
K.129	6.5	13.5	17.5	20.5	13.8	14.2
K.149	9.6	21.5	29	34.5	22.5	23.5
K.169	17	31	47	57.5	35.5	38.5
K.189	24.5	53	73	87	53.5	59

Table 10- 9 Oil quantities [l] for KF, sizes 39 -189

Type	Mounting position					
	M1	M2	M3	M4	M5-A M6-B	M6-A M5-B
KF39	0.35	0.9	1.2	1.3	0.95	1
KF49	0.6	1.4	2	2.2	1.6	1.7
KF69	0.85	2	2.8	3.1	2.4	2.4
KF79	1.2	2.3	3.1	3.8	3	2.5
KF89	2.1	4.6	6.5	7.6	5.6	5.5
KF109	3.6	7.4	9.8	11.7	8.1	7.8
KF129	6.7	13.9	18.1	21.5	14.4	14.8
KF149	9.7	22	30.5	36	23	24
KF169	16.9	30.5	48.5	59.5	36.5	39
KF189	24.5	54	76	90	56	60

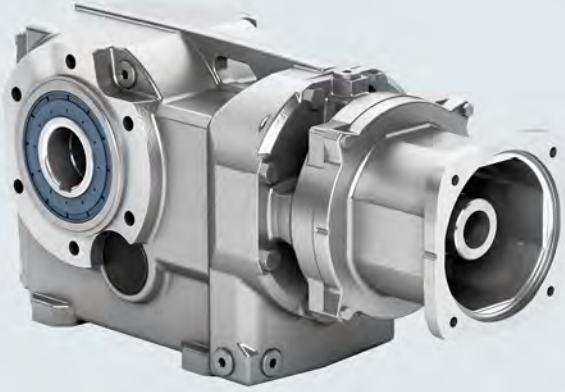
11.2.4 Bevel gearbox K, sizes 39 - 189



1001 Gearbox housing
1020 Bearing
1021 Supporting disk / shim
1022 Supporting disk / shim
1025 Locking ring
1030 Bearing
1031 Supporting disk
1032 Shim
1040 Output flange
1041 Pin
1043 Plug
1045 Bolt
1050 Housing cover
1051 Bolt
1055 Seal
1057 Supporting disk
1058 Shim
1060 Tapered roller bearing
1061 Supporting disk
1062 Shim
1063 NILOS ring
1066 Locking ring
1067 Locking ring
1068 Tapered roller bearing
1070 Sealing cap
1090 Torque arm
1091 Rubber bush
1093 Plug
1095 Bolt
1096 Screw lock
1101 Output shaft
1102 Bushing
1104 Seal
1105 Parallel key
1114 Cover NDE
1115 Seal
1116 Bolt
1118 Plug / sealing cap
1120 Shrink disk
1121 Protective cap
1129 Supporting disk
1130 Bearing
1131 Shim
1132 Supporting disk / shim
1133 NILOS ring
1135 Locking ring
1138 Locking ring
1139 Supporting disk
1140 Bearing
1141 Supporting disk / shim
1143 NILOS ring
1144 Supporting disk / shim
1146 Locking ring
1160 Shaft sealing ring
1161 Shaft sealing ring
1162 O ring
1165 Seal
1210 Bolt
1212 Nut
1225 Seal
1301 Plug-in pinion
1303 Slip-on pinion
1304 Parallel key
1305 Helical
1306 Parallel key
1308 Locking ring
1309 Seal
1312 Disk
1313 Screw / nut
1314 Screw lock
1320 Bevel gear pair
1325 Pinion shaft
1327 Parallel key
1328 Locking ring
1331 Parallel key
1340 Pinion shaft
1345 Helical
1346 Parallel key
1401 Screw plug
1410 Mounting accessories
1411 Bolt
1412 Locking ring
1413 Disk
1415 Locking ring
1418 Sealing cap
1420 Vent filter

Image 11-5 Bevel gearbox K, sizes 39 - 189

SIEMENS



SIMOGEAR

Adapter for gearbox

BA 2039

Operating instructions

Edition 04/2016

Answers for industry.

3.3 Thread sizes and tightening torques for fastening bolts

The general tolerance for the tightening torque is 10 %. The tightening torque is based on a friction coefficient of μ = 0.14.

Table 3- 1 Tightening torques for fastening bolts

Thread size	Tightening torque for strength class		
	8.8	10.9	12.9
	[Nm]	[Nm]	[Nm]
M4	3	4	5
M5	6	9	10
M6	10	15	18
M8	25	35	41
M10	50	70	85
M12	90	120	145
M16	210	295	355
M20	450	580	690
M24	750	1 000	1 200
M30	1 500	2 000	2 400
M36	2 500	3 600	4 200

3.4 Mounting an input or output element on the gearbox shaft

⚠ WARNING

Risk of burns caused by hot parts

Do not touch the gearbox without protection.

NOTICE

Damage to shaft sealing rings caused by solvent

Avoid any contact of solvent or benzine with the shaft sealing rings.

NOTICE

Damage to shaft sealing rings caused by heating

Use thermal shields to protect shaft sealing rings from heating above 100 °C due to radiant heat.

3.5.2 Mount the standard motor to the K4 or K5 short adapter

ATEX version gearboxes

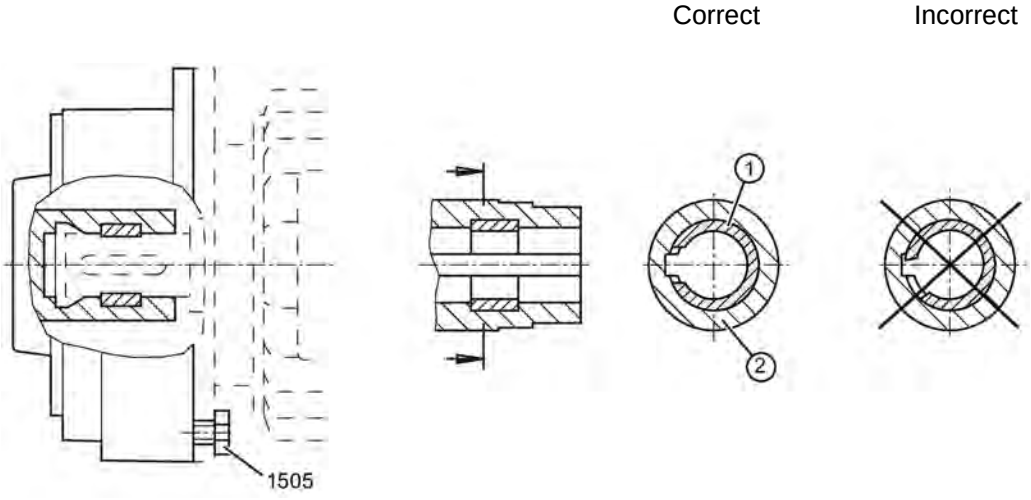
Impacts can cause sparks.

Apply adhesive (medium strength, e.g. Loctite 243) to the bolts 1505.

Note

Ensure that the plastic ring ① is located in the correct position.

The plastic ring ① prevents fretting rust. It does not need to be greased.



① Plastic ring
② Shaft
1505 Bolt

Image 3-4 Plastic ring for K4 and K5

Procedure

1. Check the correct position of the plastic ring ① in the shaft. Correct the position if required.
2. Align the position of the motor shaft so that you can insert it in the shaft ②. The shafts do not need to be greased.
3. Apply adhesive (medium strength, e.g. Loctite 243) to the bolts 1505.
4. Fasten the motor with the bolts 1505 with the prescribed torque. See Thread sizes and tightening torques for fastening bolts (Page 17).

You have mounted the standard motor on the K4 or K5 adapter.

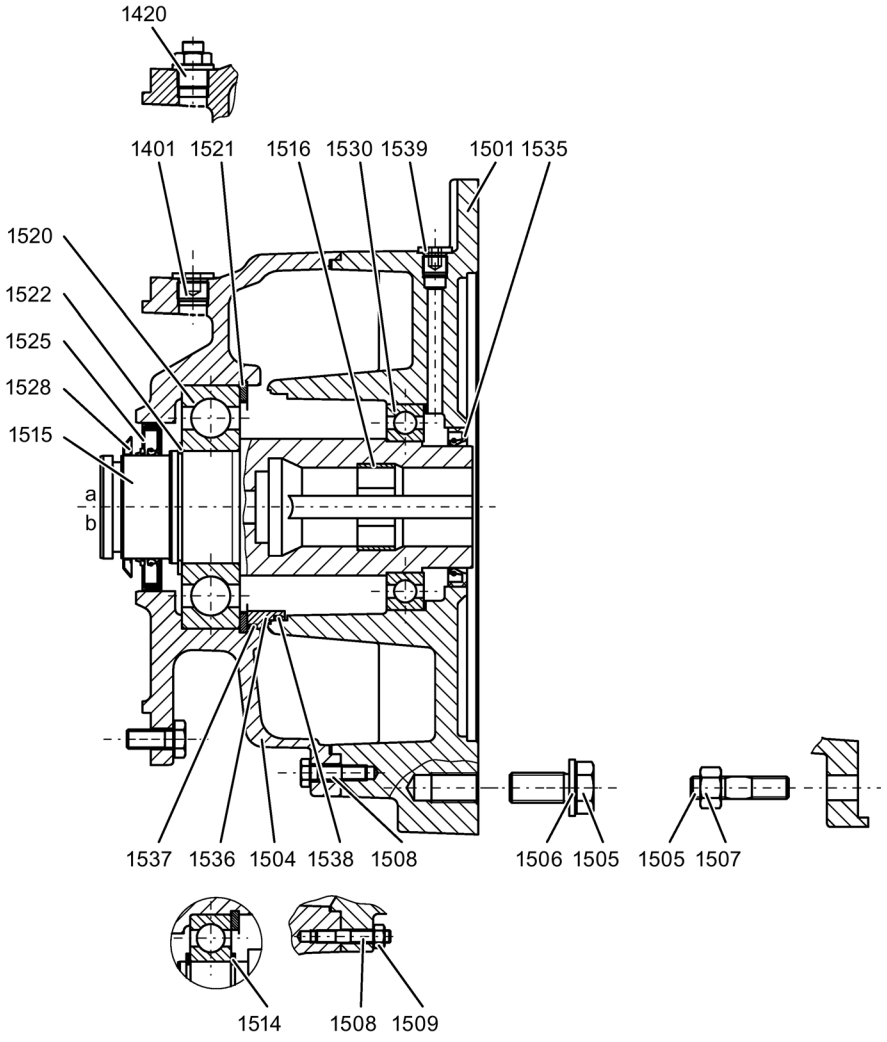
Table 3- 4 Adapter K4

Coupling size	**63**	**71**	**80**	**90**	**100**	**112**	**132**	**160**	**180**	**200**	**225**	**250**
Bolt 1505	M8	M8	M10	M10	M12	M12	M12	M16	M16	M16	M16	M16

Table 3- 5 Adapter K5

Coupling size	**56**	**140**	**180**	**210**	**250**	**280**	**320**	**360**
Bolt 1505	3/8"	3/8"	1/2"	1/2"	1/2"	1/2"	5/8"	5/8"
T_A for 1505 [Nm]	31	31	75	75	75	75	150	150

6.2.2 K4 and K5 short adapters with plug-in connection



1401	Screw plug	1520	Bearing
1420	Vent filter	1521	Locking ring
1501	Adapter	1522	Locking ring
1504	Bearing shield	1525	Shaft sealing ring
1505	Bolt	1528	Disk
1506	Plate / locking ring	1530	Bearing
1507	Nut	1535	Shaft sealing ring
1508	Bolt	1536	Intermediate ring
1509	Nut	1537	O-ring
1514	Locking ring	1538	O-ring
1515	Shaft	1539	Screw plug
1516	Bush		

Image 6-4 K4 and K5 short adapters with clamp connection

6.3 Anchor Bolt Data

Attached are page(s) from the 2014 Hilti North American Product Tech Guide. For complete details on this product, including data development, product specifications, general suitability, installation, corrosion, and spacing and edge distance guidelines, please refer to the Technical Guide, or contact Hilti.

Hilti, Inc.
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Tulsa, OK 74146

1-800-879-8000
www.hilti.com

3.2.3 HIT-HY 200 Adhesive Anchoring System

HIT-HY 200-A

HIT-HY 200-R

Listings/Approvals

ICC-ES (International code council)
ESR-3187

Independent code evaluation

IBC®/IRC® 2009
IBC®/IRC® 2006
IBC®/IRC® 2003

LEED® Credit 4.1-Low Emitting Materials

The Leadership in Energy and Environmental Design (LEED®) Green Building Rating system™ is the nationally accepted benchmark for the design, construction and operation of high performance green buildings.

3.2.3.1 Product description

Hilti HIT-HY 200 adhesive is an injectable, two-component, hybrid adhesive. The two components are separated by means of a dual-cylinder foil pack attached to a manifold. The two components combine and react when dispensed through a static mixing nozzle attached to the manifold.

Hilti HIT-HY 200 adhesive is available in two options, Hilti HIT-HY 200-A, and Hilti HIT-HY 200-R. Both options utilize the same technical data. Hilti HIT-HY 200-A will have shorter working times and curing times than Hilti HIT-HY 200-R. The packaging for each is different which helps the user distinguish between the two adhesives.

Hilti HIT-HY 200 adhesive comes with three hole cleaning options:

- The traditional hole cleaning method uses steel wire brushes and compressed air
- The self-cleaning method uses the Hilti TE-CD or TE-YD Hollow Drill Bits in conjunction with a Hilti vacuum to remove the dust as you drill. The hole is clean and ready for anchor installation.
- The no-cleaning method requires the use of Hilti HIT-Z and HIT-Z-R threaded anchor rods. If the base material temperature is less than 41° F (5° C) or if diamond core drilling is used, then the drilled hole must be cleaned.

Elements that are suitable for use with this system are threaded steel rods, Hilti HIS-(R)N steel internally threaded inserts, steel reinforcing bars and Hilti HIT-Z and HIT-Z-R threaded rods.

Product features

- Two great products with equal performance data
- User can select product gel time suitability based on temperature of the base material and jobsite time requirements
- No hole cleaning requirement when installed SafeSet™ hollow drill bit technology
- No hole cleaning requirement when installing HIT-Z rods in dry conditions
- ICC-ES approved for cracked concrete and seismic service
- May be installed in diamond cored holes when addition cleaning steps are employed

Guide specifications

Injectable adhesive shall be used for installation of threaded rods (rebar) (inserts) into existing concrete. Adhesive shall be furnished in containers which keep component A and component B separate. Containers shall be designed to accept static mixing nozzle which thoroughly blends component A and component B and allows injection of the mixed adhesive directly into the drilled hole. Only injection tools and static mixing nozzles supplied by the manufacturer may be used. Injection adhesive shall be formulated to include the resin and hardener to provide optimal curing speed, high strength and stiffness. Injection adhesive anchor system shall be Hilti HIT-HY 200 installed using Hilti Safe Set™ Technology. HIT-HY 200 System shall be supplied by Hilti.

3.2.3.3 Hilti HIT-HY 200-AR Adhesive with Hilti HAS threaded rod

Figure 9 -HAS threaded rod installation conditions

Permissible concrete conditions		Permissible drilling method	
Uncracked concrete	Dry concrete	Hammer drilling with carbide tipped drill bit	
Cracked concrete	Water saturated concrete	Hilti TE-CD or TE-YD Hollow Drill Bit	

Table 38 - HAS threaded rod specifications

Setting information		Symbol	Units	Nominal rod diameter						
				3/8	1/2	5/8	3/4	7/8	1	1-1/4
Nominal bit diameter		d_o	in.	7/16	9/16	3/4	7/8	1	1-1/8	1-3/8
Standard effective embedment		$h_{ef,std}$	in.	3-3/8	4-1/2	5-5/8	6-3/4	7-7/8	9	11-1/4
			(mm)	(86)	(114)	(143)	(171)	(200)	(229)	(286)
Effective embedment	minimum	$h_{ef,min}$	in.	2-3/8	2-3/4	3-1/8	3-1/2	3-1/2	4	5
			(mm)	(60)	(70)	(79)	(89)	(89)	(102)	(127)
	maximum	$h_{ef,max}$	in.	7-1/2	10	12-1/2	15	17-1/2	20	25
			(mm)	(191)	(254)	(318)	(381)	(445)	(508)	(635)
Fixture hole diameter	through-set		in.	1/2	5/8	13/16[1]	15/16[1]	1-1/8[1]	1-1/4[1]	1-1/2[1]
Fixture hole diameter	preset		in.	7/16	9/16	11/16	13/16	15/16	1-1/8	1-3/8
Installation torque		T_{inst}	ft-lb	15	30	60	100	125	150	200
			(Nm)	(20)	(40)	(80)	(136)	(169)	(203)	(271)

1 Install using (2) washers. See Figure 11.

Figure 10 - HAS threaded rods

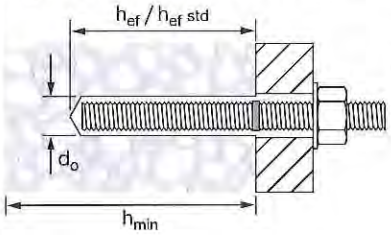


Figure 11 - Installation with (2) washers

HAS-E carbon steel threaded rod specifications

Carbon steel rods conform to ISO 898 class 5.8 with a minimum tensile strength of 72.5 ksi (500 MPa) and a minimum yield strength of 58 ksi (400 MPa).

HAS-E nuts conform to SAE J995 Grade 5.

HAS-E washers conform to ASTM F884, HV, and ANSI B18.22.1 Type A Plain.

HAS-E rod, nut and washer has an electroplated zinc coating conforming to ASTM B633, SC 1.

HAS Super high strength threaded rod specifications

Carbon steel rods manufactured from ASTM A193, Grade B7, with a minimum tensile strength of 125 ksi (862 MPa) and a minimum yield strength of 105 ksi (724 MPa).

HAS Super nuts conform to SAE J995 Grade 5.

HAS Super washers conform to ASTM F884, HV, and ANSI B18.22.1 Type A Plain.

HAS Super rods, nuts and washers, except the 7/8-in. diameter, have an electroplated zinc coating conforming to ASTM B633, SC1.

7/8-in. HAS Super rods, nuts and washers are hot-dip galvanized in accordance with ASTM A153.

HAS-R 304 stainless steel

3/8-, 1/2- and 5/8-in. rods manufactured from AISI Type 304 stainless steel with a minimum tensile strength of 100 ksi (689 MPa) and a minimum yield strength of 65 ksi (448 MPa).

3/4-, 1- and 1 1/4-in. rods are manufactured from AISI Type 304 stainless steel conforming to ASTM F593 Condition CW or cold worked.

AISI Type 304 stainless steel nuts conform to ASTM F594.

AISI Type 304 stainless steel washers conform to ASTM A240 and ANSI B18.22.1 Type A Plain.

HAS-R 316 stainless steel

3/8-, 1/2- and 5/8-in. rods manufactured from AISI Type 316 stainless steel with a minimum tensile strength of 100 ksi (689 MPa) and a minimum yield strength of 65 ksi (448 MPa).

3/4-, 1- and 1 1/4-in. rods are manufactured from AISI Type 316 stainless steel conforming to ASTM F593 Condition CW.

AISI Type 316 stainless steel nuts conform to ASTM F594.

AISI Type 316 stainless steel washers conform to ASTM A240 and ANSI B18.22.1 Type A Plain.

3.2.3 HIT-HY 200 Adhesive Anchoring System

Table 39 - Hilti HIT-HY 200 adhesive design strength with concrete / bond failure for threaded rod in uncracked concrete [1,2,3,4,5,6,7,8]

Nominal anchor diameter in.	Effective embedment in. (mm)	Tension — ΦN_n or N_r				Shear — ΦV_n or V_r			
		f'_c = 2500 psi (17.2 Mpa) lb (kN)	f'_c = 3000 psi (20.7 Mpa) lb (kN)	f'_c = 4000 psi (27.6 Mpa) lb (kN)	f'_c = 6000 psi (41.4 Mpa) lb (kN)	f'_c = 2500 psi (17.2 Mpa) lb (kN)	f'_c = 3000 psi (20.7 Mpa) lb (kN)	f'_c = 4000 psi (27.6 Mpa) lb (kN)	f'_c = 6000 psi (41.4 Mpa) lb (kN)
3/8	2-3/8 (60)	2,855 (12.7)	3,125 (13.9)	3,415 (15.2)	3,620 (16.1)	3,075 (13.7)	3,370 (15.0)	3,680 (16.4)	3,900 (17.3)
	3-3/8 (86)	4,835 (21.5)	4,855 (21.6)	4,855 (21.6)	5,150 (22.9)	10,415 (46.3)	10,460 (46.5)	10,460 (46.5)	11,085 (49.3)
	4-1/2 (114)	6,475 (28.8)	6,475 (28.8)	6,475 (28.8)	6,865 (30.5)	13,945 (62.0)	13,945 (62.0)	13,945 (62.0)	14,785 (65.8)
	7-1/2 (191)	10,790 (48.0)	10,790 (48.0)	10,790 (48.0)	11,440 (50.9)	23,245 (103.4)	23,245 (103.4)	23,245 (103.4)	24,640 (109.6)
1/2	2-3/4 (70)	3,555 (15.8)	3,895 (17.3)	4,500 (20.0)	5,510 (24.5)	7,660 (34.1)	8,395 (37.3)	9,690 (43.1)	11,870 (52.8)
	4-1/2 (114)	7,445 (33.1)	8,155 (36.3)	8,635 (38.4)	9,150 (40.7)	16,035 (71.3)	17,570 (78.2)	18,595 (82.7)	19,710 (87.7)
	6 (152)	11,465 (51.0)	11,510 (51.2)	11,510 (51.2)	12,200 (54.3)	24,690 (109.8)	24,795 (110.3)	24,795 (110.3)	26,280 (116.9)
	10 (254)	19,185 (85.3)	19,185 (85.3)	19,185 (85.3)	20,335 (90.5)	41,320 (183.8)	41,320 (183.8)	41,320 (183.8)	43,800 (194.8)
5/8	3-1/8 (79)	4,310 (19.2)	4,720 (21.0)	5,450 (24.2)	6,675 (29.7)	9,280 (41.3)	10,165 (45.2)	11,740 (52.2)	14,380 (64.0)
	5-5/8 (143)	10,405 (46.3)	11,400 (50.7)	13,165 (58.6)	14,300 (63.6)	22,415 (99.7)	24,550 (109.2)	28,350 (126.1)	30,795 (137.0)
	7-1/2 (191)	16,020 (71.3)	17,550 (78.1)	17,985 (80.0)	19,065 (84.8)	34,505 (153.5)	37,800 (168.1)	38,740 (172.3)	41,065 (182.7)
	12-1/2 (318)	29,975 (133.3)	29,975 (133.3)	29,975 (133.3)	31,775 (141.3)	64,565 (287.2)	64,565 (287.2)	64,565 (287.2)	68,440 (304.4)
3/4	3-1/2 (89)	5,105 (22.7)	5,595 (24.9)	6,460 (28.7)	7,910 (35.2)	11,000 (48.9)	12,050 (53.6)	13,915 (61.9)	17,040 (75.8)
	6-3/4 (171)	13,680 (60.9)	14,985 (66.7)	17,305 (77.0)	20,590 (91.6)	29,460 (131.0)	32,275 (143.6)	37,265 (165.8)	44,350 (197.3)
	9 (229)	21,060 (93.7)	23,070 (102.6)	25,900 (115.2)	27,455 (122.1)	45,360 (201.8)	49,690 (221.0)	55,785 (248.1)	59,130 (263.0)
	15 (381)	43,165 (192.0)	43,165 (192.0)	43,165 (192.0)	45,755 (203.5)	92,975 (413.6)	92,975 (413.6)	92,975 (413.6)	98,550 (438.4)
7/8	3-1/2 (89)	5,105 (22.7)	5,595 (24.9)	6,460 (28.7)	7,910 (35.2)	11,000 (48.9)	12,050 (53.6)	13,915 (61.9)	17,040 (75.8)
	7-7/8 (200)	17,235 (76.7)	18,885 (84.0)	21,805 (97.0)	26,705 (118.8)	37,125 (165.1)	40,670 (180.9)	46,960 (208.9)	57,515 (255.8)
	10-1/2 (267)	26,540 (118.1)	29,070 (129.3)	33,570 (149.3)	37,365 (166.2)	57,160 (254.3)	62,615 (278.5)	72,300 (321.6)	80,485 (358.0)
	17-1/2 (445)	57,100 (254.0)	58,755 (261.4)	58,755 (261.4)	62,280 (277.0)	122,990 (547.1)	126,545 (562.9)	126,545 (562.9)	134,140 (596.7)
1	4 (102)	6,240 (27.8)	6,835 (30.4)	7,895 (35.1)	9,665 (43.0)	13,440 (59.8)	14,725 (65.5)	17,000 (75.6)	20,820 (92.6)
	9 (229)	21,060 (93.7)	23,070 (102.6)	26,640 (118.5)	32,625 (145.1)	45,360 (201.8)	49,690 (221.0)	57,375 (255.2)	70,270 (312.6)
	12 (305)	32,425 (144.2)	35,520 (158.0)	41,015 (182.4)	48,805 (217.1)	69,835 (310.6)	76,500 (340.3)	88,335 (392.9)	105,120 (467.6)
	20 (508)	69,765 (310.3)	76,425 (340.0)	76,740 (341.4)	81,345 (361.8)	150,265 (668.4)	164,605 (732.2)	165,285 (735.2)	175,205 (779.3)
1-1/4	5 (127)	8,720 (38.8)	9,555 (42.5)	11,030 (49.1)	13,510 (60.1)	18,785 (83.6)	20,575 (91.5)	23,760 (105.7)	29,100 (129.4)
	11-1/4 (286)	29,430 (130.9)	32,240 (143.4)	37,230 (165.6)	45,595 (202.8)	63,395 (282.0)	69,445 (308.9)	80,185 (356.7)	98,205 (436.8)
	15 (381)	45,315 (201.6)	49,640 (220.8)	57,320 (255.0)	70,200 (312.3)	97,600 (434.1)	106,915 (475.6)	123,455 (549.2)	151,200 (672.6)
	25 (635)	97,500 (433.7)	106,805 (475.1)	119,905 (533.4)	127,100 (565.4)	210,000 (934.1)	230,045 (1023.3)	258,260 (1148.8)	273,755 (1217.7)

1 See section 3.1.7 for explanation on development of load values.
2 See section 3.1.7.3 to convert design strength (factored resistance) value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 42 - 55 as necessary. Compare to the steel values in table 41. The lesser of the values is to be used for the design.
5 Data is for temperature range A: Max. short term temperature = 104° F (40° C), max. long term temperature = 75° F (24° C).
For temperature range B: Max. short term temperature = 176° F (80° C), max. long term temperature = 122° F (50° C) multiply above value by 0.80.
For temperature range C: Max. short term temperature = 248° F (120° C), max. long term temperature = 162° F (72° C) multiply above value by 0.70.
Short term elevated concrete temperatures are those that occur over brief intervals, e.g., as a result of diurnal cycling. Long term concrete temperatures are roughly constant over significant periods of time.
6 Tabular values are for dry concrete conditions. For water saturated concrete multiply design strength (factored resistance) by 0.85.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see section 3.1.7.5.
8 Tabular values are for normal weight concrete only. For lightweight concrete, multiply design strength (factored resistance) by λ_a as follows:
For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_a = 0.45.

HIT-HY 200 Adhesive Anchoring System 3.2.3

Table 40 - Hilti HIT-HY 200 adhesive design strength with concrete / bond failure for threaded rod in cracked concrete [1,2,3,4,5,6,7,8,9]

Nominal anchor diameter in.	Effective embedment in. (mm)	Tension — ΦN_n or N_r				Shear — ΦV_n or V_r			
		f'_c = 2500 psi (17.2 Mpa) lb (kN)	f'_c = 3000 psi (20.7 Mpa) lb (kN)	f'_c = 4000 psi (27.6 Mpa) lb (kN)	f'_c = 6000 psi (41.4 Mpa) lb (kN)	f'_c = 2500 psi (17.2 Mpa) lb (kN)	f'_c = 3000 psi (20.7 Mpa) lb (kN)	f'_c = 4000 psi (27.6 Mpa) lb (kN)	f'_c = 6000 psi (41.4 Mpa) lb (kN)
3/8	2-3/8 (60)	1,900 (8.5)	1,900 (8.5)	1,900 (8.5)	2,015 (9.0)	2,045 (9.1)	2,045 (9.1)	2,045 (9.1)	2,165 (9.6)
	3-3/8 (86)	2,700 (12.0)	2,700 (12.0)	2,700 (12.0)	2,860 (12.7)	5,810 (25.8)	5,810 (25.8)	5,810 (25.8)	6,160 (27.4)
	4-1/2 (114)	3,600 (16.0)	3,600 (16.0)	3,600 (16.0)	3,815 (17.0)	7,750 (34.5)	7,750 (34.5)	7,750 (34.5)	8,215 (36.5)
	7-1/2 (191)	5,995 (26.7)	5,995 (26.7)	5,995 (26.7)	6,355 (28.3)	12,915 (57.4)	12,915 (57.4)	12,915 (57.4)	13,690 (60.9)
1/2	2-3/4 (70)	2,520 (11.2)	2,760 (12.3)	2,950 (13.1)	3,130 (13.9)	5,425 (24.1)	5,945 (26.4)	6,355 (28.3)	6,735 (30.0)
	4-1/2 (114)	4,830 (21.5)	4,830 (21.5)	4,830 (21.5)	5,120 (22.8)	10,400 (46.3)	10,400 (46.3)	10,400 (46.3)	11,025 (49.0)
	6 (152)	6,440 (28.6)	6,440 (28.6)	6,440 (28.6)	6,825 (30.4)	13,870 (61.7)	13,870 (61.7)	13,870 (61.7)	14,700 (65.4)
	10 (254)	10,730 (47.7)	10,730 (47.7)	10,730 (47.7)	11,375 (50.6)	23,115 (102.8)	23,115 (102.8)	23,115 (102.8)	24,500 (109.0)
5/8	3-1/8 (79)	3,050 (13.6)	3,345 (14.9)	3,860 (17.2)	4,470 (19.9)	6,575 (29.2)	7,200 (32.0)	8,315 (37.0)	9,625 (42.8)
	5-5/8 (143)	7,370 (32.8)	7,590 (33.8)	7,590 (33.8)	8,045 (35.8)	15,875 (70.6)	16,345 (72.7)	16,345 (72.7)	17,325 (77.1)
	7-1/2 (191)	10,120 (45.0)	10,120 (45.0)	10,120 (45.0)	10,725 (47.7)	21,790 (96.9)	21,790 (96.9)	21,790 (96.9)	23,100 (102.8)
	12-1/2 (318)	16,865 (75.0)	16,865 (75.0)	16,865 (75.0)	17,875 (79.5)	36,320 (161.6)	36,320 (161.6)	36,320 (161.6)	38,500 (171.3)
3/4	3-1/2 (89)	3,620 (16.1)	3,965 (17.6)	4,575 (20.4)	5,605 (24.9)	7,790 (34.7)	8,535 (38.0)	9,855 (43.8)	12,070 (53.7)
	6-3/4 (171)	9,690 (43.1)	10,615 (47.2)	10,980 (48.8)	11,635 (51.8)	20,870 (92.8)	22,860 (101.7)	23,645 (105.2)	25,065 (111.5)
	9 (229)	14,640 (65.1)	14,640 (65.1)	14,640 (65.1)	15,515 (69.0)	31,530 (140.3)	31,530 (140.3)	31,530 (140.3)	33,420 (148.7)
	15 (381)	24,395 (108.5)	24,395 (108.5)	24,395 (108.5)	25,860 (115.0)	52,550 (233.8)	52,550 (233.8)	52,550 (233.8)	55,700 (247.8)
7/8	3-1/2 (89)	3,620 (16.1)	3,965 (17.6)	4,575 (20.4)	5,605 (24.9)	7,790 (34.7)	8,535 (38.0)	9,855 (43.8)	12,070 (53.7)
	7-7/8 (200)	12,210 (54.3)	12,665 (56.3)	12,665 (56.3)	13,425 (59.7)	26,300 (117.0)	27,275 (121.3)	27,275 (121.3)	28,910 (128.6)
	10-1/2 (267)	16,885 (75.1)	16,885 (75.1)	16,885 (75.1)	17,900 (79.6)	36,370 (161.8)	36,370 (161.8)	36,370 (161.8)	38,550 (171.5)
	17-1/2 (445)	28,140 (125.2)	28,140 (125.2)	28,140 (125.2)	29,830 (132.7)	60,615 (269.6)	60,615 (269.6)	60,615 (269.6)	64,250 (285.8)
1	4 (102)	4,420 (19.7)	4,840 (21.5)	5,590 (24.9)	6,845 (30.4)	9,520 (42.3)	10,430 (46.4)	12,040 (53.6)	14,750 (65.6)
	9 (229)	14,920 (66.4)	16,340 (72.7)	16,615 (73.9)	17,610 (78.3)	32,130 (142.9)	35,195 (156.6)	35,785 (159.2)	37,930 (168.7)
	12 (305)	22,150 (98.5)	22,150 (98.5)	22,150 (98.5)	23,480 (104.4)	47,710 (212.2)	47,710 (212.2)	47,710 (212.2)	50,575 (225.0)
	20 (508)	36,920 (164.2)	36,920 (164.2)	36,920 (164.2)	39,135 (174.1)	79,520 (353.7)	79,520 (353.7)	79,520 (353.7)	84,290 (374.9)
1-1/4	5 (127)	6,175 (27.5)	6,765 (30.1)	7,815 (34.8)	9,570 (42.6)	13,305 (59.2)	14,575 (64.8)	16,830 (74.9)	20,610 (91.7)
	11-1/4 (286)	20,850 (92.7)	22,840 (101.6)	26,130 (116.2)	27,700 (123.2)	44,905 (199.7)	49,190 (218.8)	56,285 (250.4)	59,660 (265.4)
	15 (381)	32,095 (142.8)	34,840 (155.0)	34,840 (155.0)	36,935 (164.3)	69,135 (307.5)	75,045 (333.8)	75,045 (333.8)	79,545 (353.8)
	25 (635)	58,070 (258.3)	58,070 (258.3)	58,070 (258.3)	61,555 (273.8)	125,075 (556.4)	125,075 (556.4)	125,075 (556.4)	132,580 (589.7)

1 See section 3.1.7 for explanation on development of load values.
2 See section 3.1.7.3 to convert design strength (factored resistance) value to ASD value.
3 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
4 Apply spacing, edge distance, and concrete thickness factors in tables 42 - 55 as necessary. Compare to the steel values in table 41. The lesser of the values is to be used for the design.
5 Data is for temperature range A: Max. short term temperature = 104° F (40° C), max. long term temperature = 75° F (24° C).
For temperature range B: Max. short term temperature = 176° F (80° C), max. long term temperature = 122° F (50° C) multiply above value by 0.80.
For temperature range C: Max. short term temperature = 248° F (120° C), max. long term temperature = 162° F (72° C) multiply above value by 0.70.
Short term elevated concrete temperatures are those that occur over brief intervals, e.g., as a result of diurnal cycling. Long term concrete temperatures are roughly constant over significant periods of time.
6 Tabular values are for dry concrete conditions. For water saturated concrete multiply design strength (factored resistance) by 0.85.
7 Tabular values are for short term loads only. For sustained loads including overhead use, see section 3.1.7.5.
8 Tabular values are for normal weight concrete only. For lightweight concrete, multiply design strength (factored resistance) by λ_a as follows:
For sand-lightweight, λ_a = 0.51. For all-lightweight, λ_a = 0.45.
9 Tabular values are for static loads only. For seismic loads, multiply cracked concrete tabular values by the following reduction factors:
3/8-in to 3/4-in diameter - α_{seis} = 0.60
7/8-in to 1-1/4-in diameter - α_{seis} = 0.75
See section 3.1.7.4 for additional information on seismic applications.

3.2.3 HIT-HY 200 Adhesive Anchoring System

Table 41 - Steel design strength for Hilti HAS threaded rods [3]

Nominal anchor diameter in.	HAS-E[5]			HAS Super ASTM A193 B7[5]			HAS SS AISI 304/316 SS[5]		
	Tensile[1] ϕN_{sa} lb (kN)	Shear[2] ϕV_{sa} lb (kN)	$\alpha_{seis,V}$[4]	Tensile[1] ϕN_{sa} lb (kN)	Shear[2] ϕV_{sa} lb (kN)	$\alpha_{seis,V}$[4]	Tensile[1] ϕN_{sa} lb (kN)	Shear[2] ϕV_{sa} lb (kN)	$\alpha_{seis,V}$[4]
3/8	3,655 (16.3)	1,685 (7.5)	0.7	7,265 (32.3)	3,150 (14.0)	0.7	5,040 (22.4)	2,325 (10.3)	0.7
1/2	6,690 (29.8)	3,705 (16.5)	0.7	13,300 (59.2)	6,915 (30.8)	0.7	9,225 (41.0)	5,110 (22.7)	0.7
5/8	10,650 (47.4)	5,900 (26.2)	0.7	21,190 (94.3)	11,020 (49.0)	0.7	14,690 (65.3)	8,135 (36.2)	0.7
3/4	15,765 (70.1)	8,730 (38.8)	0.7	31,360 (139.5)	16,305 (72.5)	0.7	18,480 (82.2)	10,235 (45.5)	0.7
7/8	21,755 (96.8)	12,050 (53.6)	0.7	43,285 (192.5)	22,505 (100.1)	0.7	25,510 (113.5)	14,125 (62.8)	0.7
1	28,540 (127.0)	15,805 (70.3)	0.7	56,785 (252.6)	29,525 (131.3)	0.7	33,465 (148.9)	18,535 (82.4)	0.7
1-1/4	45,670 (203.1)	25,295 (112.5)	0.7	90,850 (404.1)	47,240 (210.1)	0.7	53,540 (238.2)	29,655 (131.9)	0.7

1 Tensile = $\phi\ A_{se,N}\ f_{uta}$ as noted in ACI 318 Appendix D
2 Shear = $\phi\ 0.60\ A_{se,N}\ f_{uta}$ as noted in ACI 318 Appendix D
3 See section 3.1.7.3 to convert design strength (factored resistance) value to ASD value.
4 Reduction factor for seismic shear only. See section 3.1.7.4 for additional information on seismic applications.
5 HAS Super rods are considered ductile steel elements. HAS standard-E and HAS SS rods are considered brittle steel elements.

3.2.3 HIT-HY 200 Adhesive Anchoring System

Table 44 - Load adjustment factors for 1/2-in. diameter threaded rods in uncracked concrete[1,2,3]

1/2-in. uncracked concrete		Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear[4] f_{AV}				Edge distance in shear: ⊥ Toward edge f_{RV}				Edge distance in shear: ∥ To edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
Embedment h_{ef}	in. (mm)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	1-3/4 (44)	n/a	n/a	n/a	n/a	0.34	0.26	0.20	0.11	n/a	n/a	n/a	n/a	0.10	0.05	0.03	0.02	0.21	0.11	0.07	0.04	n/a	n/a	n/a	n/a
	2-1/2 (64)	0.59	0.59	0.57	0.54	0.40	0.30	0.22	0.13	0.55	0.53	0.53	0.52	0.18	0.09	0.06	0.04	0.35	0.18	0.12	0.07	n/a	n/a	n/a	n/a
	3 (76)	0.61	0.61	0.58	0.55	0.45	0.32	0.24	0.14	0.56	0.54	0.53	0.52	0.23	0.12	0.08	0.05	0.45	0.24	0.15	0.09	n/a	n/a	n/a	n/a
	4 (102)	0.65	0.65	0.61	0.57	0.56	0.38	0.28	0.16	0.58	0.55	0.54	0.53	0.36	0.18	0.12	0.07	0.56	0.37	0.24	0.14	0.58	n/a	n/a	n/a
	5 (127)	0.68	0.68	0.64	0.58	0.69	0.43	0.32	0.19	0.60	0.57	0.55	0.54	0.50	0.26	0.17	0.10	0.69	0.43	0.33	0.20	0.65	n/a	n/a	n/a
	5-3/4 (146)	0.71	0.71	0.66	0.60	0.80	0.48	0.35	0.21	0.62	0.58	0.56	0.54	0.61	0.32	0.21	0.12	0.80	0.48	0.39	0.25	0.69	0.56	n/a	n/a
	6 (152)	0.72	0.72	0.67	0.60	0.83	0.49	0.36	0.21	0.63	0.58	0.56	0.54	0.65	0.34	0.22	0.13	0.83	0.49	0.40	0.26	0.71	0.57	n/a	n/a
	7 (178)	0.76	0.76	0.69	0.62	0.97	0.56	0.41	0.24	0.65	0.59	0.57	0.55	0.82	0.42	0.28	0.16	0.97	0.56	0.44	0.32	0.77	0.61	n/a	n/a
	7-1/4 (184)	0.76	0.76	0.70	0.62	1.00	0.58	0.43	0.25	0.65	0.60	0.57	0.55	0.87	0.45	0.29	0.17	1.00	0.58	0.45	0.32	0.78	0.62	0.54	n/a
	8 (203)	0.79	0.79	0.72	0.63		0.64	0.47	0.27	0.67	0.61	0.58	0.56	1.00	0.52	0.34	0.20		0.64	0.48	0.34	0.82	0.66	0.57	n/a
	9 (229)	0.83	0.83	0.75	0.65		0.72	0.53	0.31	0.69	0.62	0.59	0.56		0.62	0.40	0.24		0.72	0.53	0.36	0.87	0.70	0.60	n/a
	10 (254)	0.86	0.86	0.78	0.67		0.80	0.59	0.34	0.71	0.63	0.60	0.57		0.72	0.47	0.28		0.80	0.59	0.39	0.92	0.73	0.64	n/a
	11-1/4 (286)	0.91	0.91	0.81	0.69		0.90	0.66	0.39	0.74	0.65	0.61	0.58		0.86	0.56	0.34		0.90	0.66	0.42	0.97	0.78	0.67	0.57
	12 (305)	0.94	0.94	0.83	0.70		0.96	0.70	0.41	0.75	0.66	0.62	0.59		0.95	0.62	0.37		0.96	0.70	0.44	1.00	0.80	0.70	0.59
	14 (356)	1.00	1.00	0.89	0.73		1.00	0.82	0.48	0.79	0.69	0.64	0.60		1.00	0.78	0.47		1.00	0.82	0.49		0.87	0.75	0.63
	16 (406)			0.94	0.77			0.94	0.55	0.83	0.72	0.66	0.61			0.95	0.57			0.94	0.55		0.93	0.80	0.68
	18 (457)			1.00	0.80			1.00	0.62	0.88	0.74	0.68	0.63			1.00	0.68			1.00	0.62		0.98	0.85	0.72
	20 (508)				0.83				0.69	0.92	0.77	0.70	0.64				0.80				0.69		1.00	0.90	0.76
	22 (559)				0.87				0.76	0.96	0.80	0.72	0.66				0.92				0.76			0.94	0.79
	24 (610)				0.90				0.82	1.00	0.82	0.74	0.67				1.00				0.82			0.98	0.83
	30 (762)				1.00				1.00		0.90	0.80	0.71								1.00			1.00	0.93
	36 (914)										0.98	0.86	0.76												1.00
	>48 (1219)										1.00	0.98	0.84												

Table 45 - Load adjustment factors for 1/2-in. diameter threaded rods in cracked concrete[1,2,3]

1/2-in. cracked concrete		Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear[4] f_{AV}				Edge distance in shear: ⊥ Toward edge f_{RV}				Edge distance in shear: ∥ To edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
Embedment h_{ef}	in. (mm)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)	2-3/4 (70)	4-1/2 (114)	6 (152)	10 (254)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	1-3/4 (44)	n/a	n/a	n/a	n/a	0.49	0.49	0.45	0.41	n/a	n/a	n/a	n/a	0.10	0.06	0.04	0.03	0.21	0.12	0.09	0.05	n/a	n/a	n/a	n/a
	2-1/2 (64)	0.59	0.59	0.57	0.54	0.55	0.55	0.50	0.44	0.55	0.54	0.53	0.52	0.18	0.10	0.07	0.04	0.35	0.20	0.15	0.09	n/a	n/a	n/a	n/a
	3 (76)	0.61	0.61	0.58	0.55	0.60	0.60	0.53	0.46	0.56	0.54	0.54	0.53	0.23	0.13	0.10	0.06	0.47	0.26	0.20	0.12	n/a	n/a	n/a	n/a
	4 (102)	0.65	0.65	0.61	0.57	0.69	0.69	0.60	0.49	0.58	0.56	0.55	0.53	0.36	0.20	0.15	0.09	0.72	0.40	0.30	0.18	0.58	n/a	n/a	n/a
	5 (127)	0.68	0.68	0.64	0.58	0.79	0.79	0.67	0.53	0.61	0.57	0.56	0.54	0.50	0.28	0.21	0.13	1.00	0.56	0.42	0.25	0.65	n/a	n/a	n/a
	5-3/4 (146)	0.71	0.71	0.66	0.60	0.88	0.88	0.73	0.56	0.62	0.58	0.57	0.55	0.62	0.35	0.26	0.16		0.70	0.52	0.31	0.70	0.57	n/a	n/a
	6 (152)	0.72	0.72	0.67	0.60	0.90	0.90	0.75	0.57	0.63	0.59	0.57	0.55	0.66	0.37	0.28	0.17		0.74	0.56	0.33	0.71	0.59	n/a	n/a
	7 (178)	0.76	0.76	0.69	0.62	1.00	1.00	0.83	0.62	0.65	0.60	0.58	0.56	0.83	0.47	0.35	0.21		0.94	0.70	0.42	0.77	0.63	n/a	n/a
	7-1/4 (184)	0.76	0.76	0.70	0.62			0.85	0.63	0.65	0.60	0.59	0.56	0.88	0.49	0.37	0.22		0.99	0.74	0.44	0.78	0.64	0.59	n/a
	8 (203)	0.79	0.79	0.72	0.63			0.91	0.66	0.67	0.61	0.59	0.57	1.00	0.57	0.43	0.26		1.00	0.86	0.51	0.82	0.68	0.62	n/a
	9 (229)	0.83	0.83	0.75	0.65			1.00	0.70	0.69	0.63	0.61	0.58		0.68	0.51	0.31			1.00	0.61	0.87	0.72	0.65	n/a
	10 (254)	0.86	0.86	0.78	0.67				0.75	0.71	0.64	0.62	0.58		0.80	0.60	0.36				0.72	0.92	0.76	0.69	n/a
	11-1/4 (286)	0.91	0.91	0.81	0.69				0.81	0.74	0.66	0.63	0.59		0.95	0.71	0.43				0.81	0.97	0.80	0.73	0.62
	12 (305)	0.94	0.94	0.83	0.70				0.85	0.75	0.67	0.64	0.60		1.00	0.79	0.47				0.85	1.00	0.83	0.75	0.64
	14 (356)	1.00	1.00	0.89	0.73				0.95	0.79	0.70	0.67	0.62			0.99	0.60				0.95		0.90	0.81	0.69
	16 (406)			0.94	0.77				1.00	0.84	0.73	0.69	0.63			1.00	0.73				1.00		0.96	0.87	0.73
	18 (457)			1.00	0.80					0.88	0.76	0.71	0.65				0.87						1.00	0.92	0.78
	20 (508)				0.83					0.92	0.79	0.74	0.67				1.00							0.97	0.82
	22 (559)				0.87					0.96	0.82	0.76	0.69											1.00	0.86
	24 (610)				0.90					1.00	0.84	0.78	0.70												0.90
	30 (762)				1.00						0.93	0.86	0.75												1.00
	36 (914)										1.00	0.93	0.80												
	>48 (1219)											1.00	0.90												

1 Linear interpolation not permitted

2 Shaded area with reduced edge distance is permitted provided the installation torque is reduced to 0.30 T_{max} for 5d ≤ s ≤ 16-in. and to 0.5 T_{max} for s > 16-in.

3 When combining multiple load adjustment factors (e.g. for a four-anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318 Appendix D.

4 Spacing factor reduction in shear, f_{AV}, assumes an influence of a nearby edge. If no edge exists, then $f_{AV} = f_{AN}$.

5 Concrete thickness reduction factor in shear, f_{HV}, assumes an influence of a nearby edge. If no edge exists, then $f_{HV} = 1.0$.

Table 46 - Load adjustment factors for 5/8-in. diameter threaded rods in uncracked concrete[1,2,3]

5/8-in. uncracked concrete		Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear[4] f_{AV}				Edge distance in shear								Concrete thickness factor in shear[5] f_{HV}			
														⊥ Toward edge f_{RV}				∥ To edge f_{RV}							
Embedment h_{ef}	in. (mm)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	1-3/4 (44)	n/a	n/a	n/a	n/a	0.33	0.25	0.18	0.11	n/a	n/a	n/a	n/a	0.09	0.04	0.03	0.01	0.19	0.08	0.06	0.03	n/a	n/a	n/a	n/a
	3-1/8 (79)	0.59	0.59	0.57	0.54	0.44	0.30	0.22	0.13	0.56	0.54	0.53	0.52	0.22	0.10	0.07	0.04	0.44	0.20	0.13	0.07	n/a	n/a	n/a	n/a
	4 (102)	0.62	0.62	0.59	0.55	0.52	0.33	0.25	0.14	0.58	0.55	0.53	0.52	0.32	0.15	0.10	0.05	0.52	0.29	0.19	0.10	n/a	n/a	n/a	n/a
	4-5/8 (117)	0.63	0.63	0.60	0.56	0.59	0.36	0.27	0.16	0.59	0.55	0.54	0.53	0.40	0.18	0.12	0.06	0.59	0.36	0.24	0.13	0.60	n/a	n/a	n/a
	5 (127)	0.65	0.65	0.61	0.57	0.63	0.38	0.28	0.16	0.60	0.56	0.54	0.53	0.45	0.21	0.13	0.07	0.63	0.38	0.27	0.14	0.63	n/a	n/a	n/a
	6 (152)	0.68	0.68	0.63	0.58	0.76	0.42	0.31	0.18	0.62	0.57	0.55	0.53	0.59	0.27	0.18	0.09	0.76	0.42	0.35	0.19	0.69	n/a	n/a	n/a
	7 (178)	0.70	0.70	0.66	0.59	0.86	0.47	0.34	0.20	0.64	0.58	0.56	0.54	0.75	0.34	0.22	0.12	0.88	0.47	0.38	0.24	0.74	n/a	n/a	n/a
	7-1/8 (181)	0.71	0.71	0.66	0.60	0.87	0.47	0.35	0.20	0.64	0.58	0.56	0.54	0.77	0.35	0.23	0.12	0.90	0.47	0.38	0.24	0.75	0.57	n/a	n/a
	8 (203)	0.73	0.73	0.68	0.61	0.95	0.52	0.38	0.22	0.66	0.59	0.57	0.55	0.91	0.41	0.27	0.14	1.00	0.52	0.41	0.29	0.79	0.61	n/a	n/a
	9 (229)	0.76	0.76	0.70	0.62	1.00	0.57	0.42	0.25	0.68	0.60	0.58	0.55	1.00	0.50	0.32	0.17		0.57	0.45	0.32	0.84	0.65	0.56	n/a
	10 (254)	0.79	0.79	0.72	0.63		0.64	0.47	0.27	0.70	0.62	0.59	0.56		0.58	0.38	0.20		0.64	0.48	0.34	0.89	0.68	0.59	n/a
	11 (279)	0.82	0.82	0.74	0.65		0.70	0.52	0.30	0.72	0.63	0.60	0.56		0.67	0.43	0.23		0.70	0.52	0.36	0.93	0.71	0.62	n/a
	12 (305)	0.85	0.85	0.77	0.66		0.77	0.56	0.33	0.74	0.64	0.60	0.57		0.76	0.50	0.26		0.77	0.56	0.38	0.97	0.75	0.65	n/a
	14 (356)	0.91	0.91	0.81	0.69		0.89	0.66	0.38	0.77	0.66	0.62	0.58		0.96	0.62	0.33		0.89	0.66	0.41	1.00	0.81	0.70	0.57
	16 (406)	0.97	0.97	0.86	0.71		1.00	0.75	0.44	0.81	0.69	0.64	0.59		1.00	0.76	0.41		1.00	0.75	0.46		0.86	0.75	0.61
	18 (457)	1.00	1.00	0.90	0.74			0.84	0.49	0.85	0.71	0.66	0.60			0.91	0.49			0.84	0.50		0.91	0.79	0.64
	20 (508)			0.94	0.77			0.94	0.55	0.89	0.73	0.67	0.61			1.00	0.57			0.94	0.55		0.96	0.83	0.68
	22 (559)			0.99	0.79			1.00	0.60	0.93	0.75	0.69	0.63				0.66			1.00	0.60		1.00	0.87	0.71
	24 (610)			1.00	0.82				0.66	0.97	0.78	0.71	0.64				0.75				0.66			0.91	0.74
	26 (660)				0.85				0.71	1.00	0.80	0.73	0.65				0.84				0.71			0.95	0.77
	28 (711)				0.87				0.77		0.82	0.74	0.66				0.94				0.77			0.99	0.80
	30 (762)				0.90				0.82		0.85	0.76	0.67				1.00				0.82			1.00	0.83
	36 (914)				0.98				0.99		0.92	0.81	0.71								0.99				0.91
	>48 (1219)				1.00				1.00		1.00	0.92	0.77								1.00				1.00

Table 47 - Load adjustment factors for 5/8-in. diameter threaded rods in cracked concrete[1,2,3]

5/8-in. cracked concrete		Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear[4] f_{AV}				Edge distance in shear								Concrete thickness factor in shear[5] f_{HV}			
														⊥ Toward edge f_{RV}				∥ To edge f_{RV}							
Embedment h_{ef}	in. (mm)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)	3-1/8 (79)	5-5/8 (143)	7-1/2 (191)	12-1/2 (318)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	1-3/4 (44)	n/a	n/a	n/a	n/a	0.46	0.46	0.43	0.40	n/a	n/a	n/a	n/a	0.09	0.04	0.03	0.02	0.19	0.09	0.08	0.04	n/a	n/a	n/a	n/a
	3-1/8 (79)	0.59	0.59	0.57	0.54	0.55	0.55	0.50	0.44	0.56	0.54	0.53	0.52	0.22	0.10	0.07	0.04	0.45	0.20	0.15	0.09	n/a	n/a	n/a	n/a
	4 (102)	0.62	0.62	0.59	0.55	0.62	0.62	0.55	0.46	0.58	0.55	0.54	0.53	0.33	0.15	0.11	0.06	0.65	0.30	0.22	0.13	n/a	n/a	n/a	n/a
	4-5/8 (117)	0.63	0.63	0.60	0.56	0.66	0.66	0.58	0.48	0.59	0.55	0.54	0.53	0.40	0.18	0.13	0.08	0.81	0.37	0.27	0.16	0.60	n/a	n/a	n/a
	5 (127)	0.65	0.65	0.61	0.57	0.69	0.69	0.60	0.49	0.60	0.56	0.55	0.53	0.45	0.21	0.15	0.09	0.91	0.41	0.30	0.18	0.63	n/a	n/a	n/a
	6 (152)	0.68	0.68	0.63	0.58	0.77	0.77	0.66	0.53	0.62	0.57	0.56	0.54	0.60	0.27	0.20	0.12	1.00	0.54	0.40	0.24	0.69	n/a	n/a	n/a
	7 (178)	0.70	0.70	0.66	0.59	0.86	0.86	0.72	0.56	0.64	0.58	0.57	0.55	0.75	0.34	0.25	0.15		0.68	0.50	0.30	0.74	n/a	n/a	n/a
	7-1/8 (181)	0.71	0.71	0.66	0.60	0.87	0.87	0.73	0.56	0.64	0.58	0.57	0.55	0.77	0.35	0.26	0.15		0.70	0.51	0.31	0.75	0.58	n/a	n/a
	8 (203)	0.73	0.73	0.68	0.61	0.95	0.95	0.78	0.59	0.66	0.59	0.58	0.55	0.92	0.42	0.30	0.18		0.84	0.61	0.37	0.79	0.61	n/a	n/a
	9 (229)	0.76	0.76	0.70	0.62	1.00	1.00	0.85	0.62	0.68	0.60	0.58	0.56	1.00	0.50	0.36	0.22		1.00	0.73	0.44	0.84	0.65	0.58	n/a
	10 (254)	0.79	0.79	0.72	0.63			0.91	0.66	0.70	0.62	0.59	0.57		0.58	0.43	0.26		1.00	0.85	0.51	0.89	0.68	0.61	n/a
	11 (279)	0.82	0.82	0.74	0.65			0.98	0.69	0.72	0.63	0.60	0.57		0.67	0.49	0.29			0.98	0.59	0.93	0.72	0.64	n/a
	12 (305)	0.85	0.85	0.77	0.66			1.00	0.73	0.74	0.64	0.61	0.58		0.77	0.56	0.34			1.00	0.67	0.97	0.75	0.67	n/a
	14 (356)	0.91	0.91	0.81	0.69				0.81	0.78	0.66	0.63	0.59		0.97	0.71	0.42				0.81	1.00	0.81	0.73	0.61
	16 (406)	0.97	0.97	0.86	0.71				0.89	0.82	0.69	0.65	0.61		1.00	0.86	0.52				0.89		0.86	0.78	0.66
	18 (457)	1.00	1.00	0.90	0.74				0.97	0.85	0.71	0.67	0.62			1.00	0.62				0.97		0.92	0.82	0.70
	20 (508)			0.94	0.77				1.00	0.89	0.73	0.69	0.63				0.72				1.00		0.97	0.87	0.73
	22 (559)			0.99	0.79					0.93	0.76	0.71	0.65				0.83						1.00	0.91	0.77
	24 (610)			1.00	0.82					0.97	0.78	0.73	0.66				0.95							0.95	0.80
	26 (660)				0.85					1.00	0.80	0.75	0.67				1.00							0.99	0.84
	28 (711)				0.87						0.83	0.76	0.69											1.00	0.87
	30 (762)				0.90						0.85	0.78	0.70												0.90
	36 (914)				0.98						0.92	0.84	0.74												0.98
	>48 (1219)				1.00						1.00	0.95	0.82												1.00

1 Linear interpolation not permitted

2 Shaded area with reduced edge distance is permitted provided the installation torque is reduced to 0.30 T_{max} for 5d ≤ s ≤ 16-in. and to 0.5 T_{max} for s > 16-in.

3 When combining multiple load adjustment factors (e.g. for a four-anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318 Appendix D.

4 Spacing factor reduction in shear, f_{AV}, assumes an influence of a nearby edge. If no edge exists, then $f_{AV} = f_{AN}$.

5 Concrete thickness reduction factor in shear, f_{HV}, assumes an influence of a nearby edge. If no edge exists, then $f_{HV} = 1.0$.

3.2.3 HIT-HY 200 Adhesive Anchoring System

Table 48 - Load adjustment factors for 3/4-in. diameter threaded rods in uncracked concrete[1,2,3]

3/4-in. uncracked concrete		Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear[4] f_{AV}				Edge distance in shear: ⊥ Toward edge f_{RV}				Edge distance in shear: ∥ To edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
Embedment h_{ef}	in. (mm)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	1-3/4 (44)	n/a	n/a	n/a	n/a	0.33	0.24	0.18	0.10	n/a	n/a	n/a	n/a	0.09	0.03	0.02	0.01	0.17	0.07	0.05	0.02	n/a	n/a	n/a	n/a
	3-3/4 (95)	0.59	0.59	0.57	0.54	0.49	0.30	0.22	0.13	0.57	0.54	0.53	0.52	0.27	0.11	0.07	0.03	0.49	0.22	0.14	0.07	n/a	n/a	n/a	n/a
	4 (102)	0.60	0.60	0.57	0.54	0.51	0.31	0.23	0.13	0.57	0.54	0.53	0.52	0.29	0.12	0.08	0.04	0.51	0.24	0.16	0.08	n/a	n/a	n/a	n/a
	5 (127)	0.62	0.62	0.59	0.56	0.60	0.34	0.25	0.15	0.59	0.55	0.54	0.52	0.41	0.17	0.11	0.05	0.60	0.33	0.22	0.11	n/a	n/a	n/a	n/a
	5-1/4 (133)	0.63	0.63	0.60	0.56	0.63	0.35	0.26	0.15	0.60	0.55	0.54	0.52	0.44	0.18	0.12	0.06	0.63	0.35	0.23	0.11	0.62	n/a	n/a	n/a
	6 (152)	0.65	0.65	0.61	0.57	0.69	0.38	0.28	0.16	0.61	0.56	0.55	0.53	0.54	0.22	0.14	0.07	0.72	0.38	0.29	0.14	0.66	n/a	n/a	n/a
	7 (178)	0.67	0.67	0.63	0.58	0.76	0.41	0.30	0.18	0.63	0.57	0.55	0.53	0.68	0.28	0.18	0.09	0.84	0.41	0.34	0.18	0.72	n/a	n/a	n/a
	8 (203)	0.69	0.69	0.65	0.59	0.83	0.45	0.33	0.19	0.65	0.58	0.56	0.54	0.83	0.34	0.22	0.11	0.96	0.45	0.37	0.21	0.77	n/a	n/a	n/a
	8-1/2 (216)	0.71	0.71	0.66	0.59	0.87	0.47	0.35	0.20	0.66	0.59	0.56	0.54	0.91	0.37	0.24	0.12	1.00	0.47	0.38	0.24	0.79	0.59	n/a	n/a
	9 (229)	0.72	0.72	0.67	0.60	0.90	0.49	0.36	0.21	0.67	0.59	0.57	0.54	0.99	0.40	0.26	0.13		0.49	0.39	0.26	0.81	0.60	n/a	n/a
	10 (254)	0.74	0.74	0.69	0.61	0.98	0.53	0.39	0.23	0.68	0.60	0.58	0.55	1.00	0.47	0.31	0.15		0.53	0.42	0.30	0.86	0.64	n/a	n/a
	10-3/4 (273)	0.76	0.76	0.70	0.62	1.00	0.57	0.42	0.25	0.70	0.61	0.58	0.55		0.53	0.34	0.17		0.57	0.44	0.32	0.89	0.66	0.57	n/a
	12 (305)	0.79	0.79	0.72	0.63		0.64	0.47	0.27	0.72	0.62	0.59	0.56		0.62	0.40	0.20		0.64	0.48	0.34	0.94	0.70	0.60	n/a
	14 (356)	0.84	0.84	0.76	0.66		0.74	0.55	0.32	0.76	0.64	0.61	0.57		0.78	0.51	0.25		0.74	0.55	0.37	1.00	0.75	0.65	n/a
	16 (406)	0.89	0.89	0.80	0.68		0.85	0.62	0.37	0.79	0.66	0.62	0.58		0.96	0.62	0.30		0.85	0.62	0.40		0.80	0.70	n/a
	16-3/4 (425)	0.91	0.91	0.81	0.69		0.89	0.65	0.38	0.81	0.67	0.63	0.58		1.00	0.67	0.33		0.89	0.65	0.41		0.82	0.71	0.56
	18 (457)	0.94	0.94	0.83	0.70		0.95	0.70	0.41	0.83	0.68	0.64	0.58			0.74	0.36		0.95	0.70	0.43		0.85	0.74	0.58
	20 (508)	0.99	0.99	0.87	0.72		1.00	0.78	0.46	0.87	0.70	0.65	0.59			0.87	0.42		1.00	0.78	0.47		0.90	0.78	0.61
	22 (559)	1.00	1.00	0.91	0.74			0.86	0.50	0.91	0.72	0.67	0.60			1.00	0.49			0.86	0.50		0.94	0.82	0.64
	24 (610)			0.94	0.77			0.93	0.55	0.94	0.74	0.68	0.61				0.56			0.93	0.55		0.99	0.85	0.67
	26 (660)			0.98	0.79			1.00	0.59	0.98	0.76	0.70	0.62				0.63			1.00	0.59		1.00	0.89	0.70
	28 (711)			1.00	0.81				0.64	1.00	0.78	0.71	0.63				0.70				0.64			0.92	0.73
	30 (762)				0.83				0.68		0.80	0.73	0.64				0.78				0.68			0.95	0.75
	36 (914)				0.90				0.82		0.86	0.77	0.67				1.00				0.82			1.00	0.82
	>48 (1219)				1.00				1.00		0.99	0.86	0.73								1.00				0.95

Table 49 - Load adjustment factors for 3/4-in. diameter threaded rods in cracked concrete[1,2,3]

3/4-in. cracked concrete		Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear[4] f_{AV}				Edge distance in shear: ⊥ Toward edge f_{RV}				Edge distance in shear: ∥ To edge f_{RV}				Concrete thickness factor in shear[5] f_{HV}			
Embedment h_{ef}	in. (mm)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)	3-1/2 (89)	6-3/4 (171)	9 (229)	15 (381)
Spacing (s) / Edge distance (c_a) / Concrete thickness (h), - in. (mm)	1-3/4 (44)	n/a	n/a	n/a	n/a	0.44	0.44	0.42	0.39	n/a	n/a	n/a	n/a	0.09	0.03	0.02	0.01	0.17	0.07	0.05	0.03	n/a	n/a	n/a	n/a
	3-3/4 (95)	0.59	0.59	0.57	0.54	0.55	0.55	0.50	0.44	0.57	0.54	0.53	0.52	0.27	0.11	0.07	0.04	0.54	0.22	0.15	0.09	n/a	n/a	n/a	n/a
	4 (102)	0.60	0.60	0.57	0.54	0.57	0.57	0.51	0.44	0.57	0.54	0.53	0.52	0.30	0.12	0.08	0.05	0.59	0.24	0.16	0.10	n/a	n/a	n/a	n/a
	5 (127)	0.62	0.62	0.59	0.56	0.63	0.63	0.56	0.47	0.59	0.55	0.54	0.53	0.41	0.17	0.11	0.07	0.83	0.34	0.22	0.13	n/a	n/a	n/a	n/a
	5-1/4 (133)	0.63	0.63	0.60	0.56	0.64	0.64	0.57	0.47	0.60	0.55	0.54	0.53	0.45	0.18	0.12	0.07	0.89	0.36	0.24	0.14	0.62	n/a	n/a	n/a
	6 (152)	0.65	0.65	0.61	0.57	0.69	0.69	0.60	0.49	0.61	0.56	0.55	0.53	0.54	0.22	0.15	0.09	1.00	0.44	0.29	0.18	0.67	n/a	n/a	n/a
	7 (178)	0.67	0.67	0.63	0.58	0.76	0.76	0.65	0.52	0.63	0.57	0.55	0.54	0.69	0.28	0.19	0.11		0.56	0.37	0.22	0.72	n/a	n/a	n/a
	8 (203)	0.69	0.69	0.65	0.59	0.83	0.83	0.70	0.55	0.65	0.58	0.56	0.54	0.84	0.34	0.23	0.14		0.68	0.45	0.27	0.77	n/a	n/a	n/a
	8-1/2 (216)	0.71	0.71	0.66	0.59	0.87	0.87	0.72	0.56	0.66	0.59	0.57	0.55	0.92	0.37	0.25	0.15		0.75	0.50	0.30	0.79	0.59	n/a	n/a
	9 (229)	0.72	0.72	0.67	0.60	0.90	0.90	0.75	0.57	0.67	0.59	0.57	0.55	1.00	0.41	0.27	0.16		0.82	0.54	0.32	0.82	0.61	n/a	n/a
	10 (254)	0.74	0.74	0.69	0.61	0.98	0.98	0.80	0.60	0.69	0.60	0.58	0.55		0.48	0.32	0.19		0.95	0.63	0.38	0.86	0.64	n/a	n/a
	10-3/4 (273)	0.76	0.76	0.70	0.62	1.00	1.00	0.84	0.62	0.70	0.61	0.58	0.56		0.53	0.35	0.21		1.00	0.70	0.42	0.89	0.66	0.58	n/a
	12 (305)	0.79	0.79	0.72	0.63			0.91	0.66	0.72	0.62	0.59	0.57		0.63	0.42	0.25			0.83	0.50	0.94	0.70	0.61	n/a
	14 (356)	0.84	0.84	0.76	0.66			1.00	0.72	0.76	0.64	0.61	0.58		0.79	0.52	0.31			1.00	0.63	1.00	0.76	0.66	n/a
	16 (406)	0.89	0.89	0.80	0.68				0.78	0.80	0.66	0.62	0.59		0.97	0.64	0.38				0.77		0.81	0.70	n/a
	16-3/4 (425)	0.91	0.91	0.81	0.69				0.81	0.81	0.67	0.63	0.59		1.00	0.68	0.41				0.81		0.83	0.72	0.61
	18 (457)	0.94	0.94	0.83	0.70				0.85	0.83	0.68	0.64	0.60			0.76	0.46				0.85		0.86	0.75	0.63
	20 (508)	0.99	0.99	0.87	0.72				0.91	0.87	0.70	0.65	0.61			0.89	0.54				0.91		0.90	0.79	0.66
	22 (559)	1.00	1.00	0.91	0.74				0.98	0.91	0.72	0.67	0.62			1.00	0.62				0.98		0.95	0.82	0.70
	24 (610)			0.94	0.77				1.00	0.94	0.74	0.69	0.63				0.70				1.00		0.99	0.86	0.73
	26 (660)			0.98	0.79					0.98	0.76	0.70	0.64				0.79						1.00	0.90	0.76
	28 (711)			1.00	0.81					1.00	0.79	0.72	0.65				0.89							0.93	0.78
	30 (762)				0.83						0.81	0.73	0.66				0.99							0.96	0.81
	36 (914)				0.90						0.87	0.78	0.70				1.00							1.00	0.89
	>48 (1219)				1.00						0.99	0.87	0.76												1.00

1 Linear interpolation not permitted

2 Shaded area with reduced edge distance is permitted provided the installation torque is reduced to 0.30 T_{max} for 5d ≤ s ≤ 16-in. and to 0.5 T_{max} for s > 16-in.

3 When combining multiple load adjustment factors (e.g. for a four-anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Anchor Design software or perform anchor calculation using design equations from ACI 318 Appendix D.

4 Spacing factor reduction in shear, f_{AV}, assumes an influence of a nearby edge. If no edge exists, then $f_{AV} = f_{AN}$.

5 Concrete thickness reduction factor in shear, f_{HV}, assumes an influence of a nearby edge. If no edge exists, then $f_{HV} = 1.0$.

3.2.3.4 Installation instructions

Installation Instructions For Use (IFU) are included with each product package. They can also be viewed or downloaded online at www.us.hilti.com (US) and www.hilti.ca (Canada). Because of the possibility of changes, always verify that downloaded IFU are current when used. Proper installation is critical to achieve full performance. Training is available on request. Contact Hilti Technical Services for applications and conditions not addressed in the IFU.

Figure 14 - HIT-HY 200 adhesive cure time and working time

HIT-HY 200-A

		HAS, HIS-N, Rebar		HIT-Z	
[°C]	[°F]	t_{work}	t_{cure}	t_{work}	t_{cure}
-10...-5	14...23	1.5 h	7 h	-	-
-4...0	24...32	50 min	4 h	-	-
1...5	33...41	25 min	2 h	-	-
6...10	42...50	15 min	1.25 h	15 min	1.25 h
11...20	51...68	7 min	45 min	7 min	45 min
21...30	69...86	4 min	30 min	4 min	30 min
31...40	87...104	3 min	30 min	3 min	30 min

HIT-HY 200-R

		HAS, HIS-N, Rebar		HIT-Z	
[°C]	[°F]	t_{work}	t_{cure}	t_{work}	t_{cure}
-10...-5	14...23	3 h	20 h	-	-
-4...0	24...32	2 h	8 h	-	-
1...5	33...41	1 h	4 h	-	-
6...10	42...50	40 min	2.5 h	40 min	2.5 h
11...20	51...68	15 min	1.5 h	15 min	1.5 h
21...30	69...86	9 min	1 h	9 min	1 h
31...40	87...104	6 min	1 h	6 min	1 h

Resistance of cured Hilti HIT-HY 200 to chemicals

Chemical		Behavior
Acetic acid	10%	+
Acetone		•
Ammonia	5%	+
Benzyl alcohol		-
Chloric acid	10%	•
Chlorinated lime	10%	+
Citric acid	10%	+
Concrete plasticizer		+
De-icing salt (Calcium chloride)		+
Demineralized water		+
Diesel fuel		+
Drilling dust suspension pH 13.2		+
Ethanol	96%	
Ethylacetate		-
Formic acid	10%	+
Formwork oil		+
Gasoline		+
Glycole		•
Hydrogen peroxide	10%	•
Lactic acid	10%	+
Maschinery oil		+
Methylethylketon		•
Nitric acid	10%	•
Phosphoric acid	10%	+
Potassium Hydroxide pH 13.2		+
Sea water		+
Sewage sludge		+
Sodium carbonate 10%	10%	+
Sodium hypochlorite 2%	2%	+
Sulphuric acid	10%	+
	30%	+
Toluene		•
Xylene		•

Key: - non-resistant
+ resistant
• limited resistance

Samples of the HIT-HY 200 adhesive were immersed in the various chemical compounds for up to one year. At the end of the test period, the samples were analyzed. Any samples showing no visible damage and having less than a 25% reduction in bending (flexural) strength were classified as "Resistant." Samples that had slight damage, such as small cracks, chips, etc. or reduction in bending strength of 25% or more were classified as "Limited Resistance" (i.e. exposed for 48 hours or less until chemical is cleaned up). Samples that were heavily damaged or destroyed were classified as "Non-Resistant."

Note: In actual use, the majority of the adhesive is encased in the base material, leaving very little surface area exposed.

3.2.3 HIT-HY 200 Adhesive Anchoring System

3.2.3.5 Ordering information

Hilti HIT-Z anchor rod

Description	Bit dia. (in.)	Min. embed. (in.)	Qty
HIT-Z 3/8 x 4 3/8	7/16	2-3/8	40
HIT-Z 3/8 x 5 1/8	7/16	2-3/8	40
HIT-Z 3/8 x 6 3/8	7/16	2-3/8	40
HIT-Z 1/2 x 4 1/2	9/16	2-3/4	20
HIT-Z 1/2 x 6 ½	9/16	2-3/4	20
HIT-Z 1/2 x 8	9/16	2-3/4	20
HIT-Z 5/8 x 6	3/4	3-3/4	12
HIT-Z 5/8 x 8	3/4	3-3/4	12
HIT-Z 5/8 x 9 1/2	3/4	3-3/4	12
HIT-Z 3/4 x 8 1/2	7/8	4	6
HIT-Z 3/4 x 9 ¾	7/8	4	6

HIT-HY 200-A

HIT-HY 200-R

HIT-HY 200-A (accelerated working time)

Description	Package contents	Qty
HIT-HY 200-A (11.1 fl oz/330 ml)	Includes (1) foil pack with (1) mixer and 3/8 filler tube per pack	1
HIT-HY 200-A Master Carton (11.1 fl oz/330 ml)	Includes (1) master carton containing (25) foil packs with (1) mixer and 3/8 filler tube per pack	25
HIT-HY 200-A Combo (11.1 fl oz/330 ml)	Includes (1) master carton containing (25) foil packs with (1) mixer and 3/8 filler tube per pack and (1) HDM 500 Manual Dispenser	25
HIT-HY 200-A Master Carton (16.9 fl oz/500 ml)	Includes (1) master carton containing (20) foil packs with (1) mixer and 3/8 filler tube per pack	20
HIT-HY 200-A Combo (16.9 fl oz/500 ml)	Includes (2) master cartons containing (20) foil packs each with (1) mixer and 3/8 filler tube per pack and (1) HDM 500 Manual Dispenser	40
HIT-RE-M Static Mixer	For use with HIT-HY 200-A cartridges	1

HIT-HY 200-R (regular working time)

Description	Package contents	Qty
HIT-HY 200-R (11.1 fl oz/330 ml)	Includes (1) foil pack with (1) mixer and 3/8 filler tube per pack	1
HIT-HY 200-R Master Carton (11.1 fl oz/330 ml)	Includes (1) master carton containing (25) foil packs with (1) mixer and 3/8 filler tube per pack	25
HIT-HY 200-R Combo (11.1 fl oz/330 ml)	Includes (1) master carton containing (25) foil packs with (1) mixer and 3/8 filler tube per pack and (1) HDM 500 manual dispenser	25
HIT-HY 200-R Master Carton (16.9 fl oz/500 ml)	Includes (1) master carton containing (20) foil packs with (1) mixer and 3/8 filler tube per pack	20
HIT-HY 200-R Combo (16.9 fl oz/500 ml)	Includes (2) master cartons containing (20) foil packs each with (1) mixer and 3/8 filler tube per pack and (1) HDM 500 manual dispenser	40
HIT-RE-M Static Mixer	For use with HIT-HY 200-R cartridges	1

TE-CD Hollow Drill Bits

Order Description	Working length (in.)
Hollow Drill Bit TE-CD 1/2-13	8
Hollow Drill Bit TE-CD 9/16-14	9-1/2
Hollow Drill Bit TE-CD 5/8-14	9-1/2
Hollow Drill Bit TE-CD 3/4-14	9-1/2
Hollow Drill Bit TE-CD 16-A (Replacement collar)	

TE-YD Hollow Drill Bits

Order Description	Working Length (in.)
Hollow Drill Bit TE-YD 3/4-24	15-1/2
Hollow Drill Bit TE-YD 7/8-24	15-1/2
Hollow Drill Bit TE-YD 1-24	15-1/2
Hollow Drill Bit TE-YD 1 1/8-24	15-1/2
Hollow Drill Bit TE-YD 25-A (Replacement collar)	

HIT-HY 200 Adhesive Anchoring System 3.2.3

Threaded anchors for Hilti chemical anchor systems[1]

HAS-E Rods 5.8 steel			HAS Super A193, B7 high strength steel		HAS-R 304 stainless steel		HAS-R 316 stainless steel	
Description	**Qty**	**Qty**	**Description**	**Qty**	**Description**	**Qty**	**Description**	**Qty**
3/8 x 4-3/8	10	240	-	-	-	-	-	-
3/8x 5-1/8	20	200	**3/8 x 5-1/8**	20	**3/8 x 5-1/8**	20	**3/8 x 5-1/8**	20
3/8 x 8	10	160	-	-	**3/8 x 8**	10	-	-
3/8 x 12	10	90	-	-	-	-	**3/8 x 8**	10
1/2 x 3-1/8	10	240	-	-	-	-	-	-
1/2 x 4-1/2	10	160	-	-	-	-	-	-
1/2 x 6-1/2	20	160	**1/2 x 6-1/2**	20	**1/2 x 6-1/2**	20	**1/2 x 6-1/2**	20
1/2x 8	10	120	-	-	**1/2 x 8**	10	**1/2 x 8**	10
1/2 x 10	10	120	-	-	**1/2 x 10**	10	**1/2 x 11**	10
1/2 x 12	10	80	-	-	-	-	**1/2 x 12**	10
5/8 x 8	20	80	**5/8 x 7-5/8**	20	**5/8 x 7-5/8**	20	**5/8 x 7-5/8**	20
5/8 x 9	10	60	-	-	**5/8 x 10**	10	**5/8 x 9**	10
5/8 x 12	10	60	-	-	-	-	**5/8 x 12**	10
5/8 x 17	10	40	-	-	-	-	-	-
3/4 x 10	10	40	**3/4 x 9-5/8**	10	**3/4 x 9-5/8**	10	**3/4 x 9-5/8**	10
3/4 x 11	10	30	-	-	-	-	**3/4 x 10**	10
3/4 x 12	10	30	-	-	**3/4 x 12**	10	-	-
3/4 x 14	10	30	**3/4 x 14**	10	**3/4 x 14**	10	**3/4 x 16**	10
3/4 x 17	10	20	-	-	**3/4 x 16**	10		
3/4 x 19	10	20	-	-	-	-	-	-
3/4 x 21	10	20	-	-	-	-	-	-
3/4 x 25	10	20	-	-	-	-		
7/8 x 10	10	20	**7/8 x 10 HDG**	5	**7/8 x 10**	10	**7/8 x 10**	10
-	-	-	**7/8 x 12 HDG**	5	-	-	-	-
7/8 x 13	10	20	**7/8 x 16 HDG**	5	-	-	**7/8 x 16**	10
1 x 12	4	16	**1 x 12**	4	**1 x 12**	4	**1 x 12**	4
1 x 14	2	16	**1 x 14**	2	-	-	-	-
1 x 16	2	12	**1 x 16**	2	-	-	**1 x 16**	2
1 x 20	2	12	**1 x 21**	2	-	-	**1 x 20**	2
1-1/4 x 16	4	8	**1-1/4 x 16**	4	-	-	-	-
1-1/4 x 22	4	8	**1-1/4 x 23**	4	-	-	-	-

Hilti Rods are now stamped on the end to show grade of steel and overall anchor length!

E = ISO 898 Class 5.8 Steel

B = ASTM A 193, Grade B7 Steel

R1 = AISI 304 Stainless Steel

R2 = AISI 316 Stainless Steel

HIS-N carbon steel and HIS-RN 316 stainless steel internally threaded inserts[1]

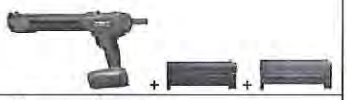
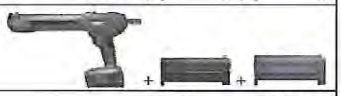
Description	Useable thread length (in)	Qty
3/8 x 4-1/4	1	10
1/2 x 5	1-3/16	5
5/8 x 6-5/8	1-1/2	5
3/4 x 8-1/4	2	5

1 All dimensions in inches.

3.2.3 HIT-HY 200 Adhesive Anchoring System

Accessories — Dispensers

Battery Powered

Description	
HDE 500-A18 Compact Battery Dispenser Kit[1] Includes dispenser, (2) compact B 18 1.6-Ah Li-Ion batteries, C 4/36 battery charger, black and red cartridge holders in a soft bag.	
HDE 500-A18 Industrial Battery Dispenser Kit[1] Includes dispenser, (2) industrial B 18 3.3-Ah Li-Ion batteries, C 4/36 battery charger, black and red cartridge holders in a soft bag.	
HDE 500-A18 Battery Dispenser Tool Body[1] Includes black and red cartridge holders	
Battery Charger C 4/36 Li-Ion 115V Use with all B 14.4, B 18 batteries or B 36 batteries	
Battery Compact 18 1.6-Ah Li-Ion	
Battery Industrial B 18 3.3-Ah Li-Ion	
HDE 500-A18 Hard Case	

Manual

Description	
MD 1000 Manual Dispenser[1] For HIT ICE	
HDM 500 Manual Dispenser with black foil pack holder For use with 11.1 fl oz/330 ml and 16.9 fl oz/500 ml foil packs of HIT-HY 150 MAX, HIT-HY 150 MAX-SD, HIT-RE 500, RE 500-SD, HIT-HY 10 PLUS, HIT-HY 70	
HDM 500 Manual Dispenser with red foil pack holder For use with 11.1 fl oz/330 ml and 16.9 fl oz/500 ml foil pack adhesives HY 200-A and HY 200-R	
HDM 500 Manual Dispenser with black and red foil pack holder For use with 11.1 fl oz/330 ml and 16.9 fl oz/500 ml foil pack adhesives HIT-HY 200-A, HIT-HY 200-R, HIT-HY 150 MAX, HIT-HY 150 MAX-SD, HIT-RE 500, HIT-RE 500-SD, HIT-HY 10 PLUS and HIT-HY 70	
HIT-CB 500 black cartridge (foil pack) holder replacement For use with 11.1 fl oz/330 ml and 16.9 fl oz/500 ml foil packs or HIT-HY 150 MAX, HIT-HY 150 MAX-SD, HIT-RE 500, HIT-RE 500-SD, HIT-HY 10 PLUS and HIT-HY 70	
HIT-CR 500 red cartridge (foil pack) holder replacement For use with 11.1 fl oz/330 ml and 16.9 fl oz/500 ml foil pack adhesives HIT-HY 200-A and HIT-HY 200-R	
HDM 500 Hard Case Only, no tool	

Pneumatic with 1/4 female compressed air coupling

Description	
P 3500 Pneumatic Dispenser[1] For use with HIT 11.1 fl oz/330 ml and 16.9 fl oz/500 ml foil pack	
HIT-P 8000D Pneumatic Dispenser[1] For use with HIT 47.3 fl oz/1400 ml jumbo foil pack	
P 3500 Cartridge (black foil pack) holder replacement For use with the P 3500 Pneumatic Dispenser and HIT-HY 150 MAX-SD, HIT-HY 150 MAX, HIT-RE 500-SD, HIT-RE 500, HIT-HY 70 and HIT-HY 10 PLUS	

1 Dispensers not compatible with HIT-HY 200 Adhesive Anchor System.

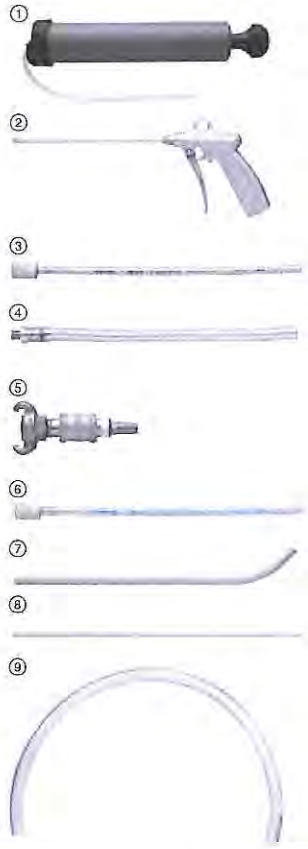
Color coded cartridge holders with the same quality dispenser

With the introduction of HIT-HY 200 and Safe Set™ Technology, Hilti has introduced a new chemistry with a 5:1 ratio. **All other Hilti adhesive anchor system have a 3:1 mix ratio.** The new technology allows for better performance and both the HDM 500 Manual Dispensers and HDE 500-A18 Battery Dispenser can accept both cartridge ratios. Simply change out the cartridge holder and you can use the dispenser on any jobsite with any Hilti foil pack adhesive.

HIT-HY 200 Adhesive Anchoring System 3.2.3

Hilti HIT Profi Accessories for blowing out drilled holes

Description		Diameter in.	Length ft	Qty
Blow-Out Pump For use in holes up to 10 in. deep	①			1
Blow-Out Tool G 1/4 NPT Inlet For use in holes up to 11 in. deep. For holes deeper than 11 in., use Blow-Out Tool plus the following extensions	②			1
Extension hose for blow-out tool HIT-DL 10/0.8	③	0.39	2.6	1
Extension hose for blow-out tool HIT-DL 16/0.8	④	0.71	2.6	1
3/8 Claw-type Quick Connect HIT-DL A	⑤			1
Extension hose for HIT-DL A HIT-DL V10/1	⑥	0.39	3.3	1
Extension tube HIT-DL B (Rigid/bent)	⑦	0.63		5
Extension tube HIT-VL 16/0.7 (Rigid/straight)	⑧	0.63	2.3	10
Coupler for blowing extensions HIT-DL K Metal coupler for splicing 16 mm extension hose		0.63		10
Extension hose HIT-VL 16 (Flexible)	⑨	0.63	33	1
HIT-DRS Dust Removal System with one hole for vacuum attachment and another hole for the Blow-Out Tool. For use with compressed air				1



3.2.3

Air nozzles

Attach to extension end for proper hole cleaning[1]

Description	Qty
HIT-DL 1/2 Use with 10 mm diameter hose	1
HIT-DL 9/16 Use with 10 mm diameter hose	1
HIT-DL 11/16 Use with 10 mm diameter hose	1
HIT-DL 3/4 Use with 16 mm diameter hose/tube	1
HIT-DL 7/8 Use with 16 mm diameter hose/tube	1
HIT-DL 1 Use with 16 mm diameter hose/tube	1
HIT-DL 1-3/8 Use with 16 mm diameter hose/tube	1

1 HIT-DL size determined by the diameter of drilled hole; see Accessory Selection Table below for proper sizing

Also avaliable in metric!

Round brush[2]

Piston plug (10 pack)[3]

Air nozzle

Hole diameter[1]	Description	Description	Use with hose dia.	Description
7/16	**HIT-RB 7/16**	-		-
1/2	**HIT-RB 1/2**	**HIT-IP 1/2**	9 mm	**HIT-DL 1/2**
9/16	**HIT-RB 9/16**	**HIT-IP 9/16**	9 mm	**HIT-DL 9/16**
5/8	**HIT-RB 5/8**	**HIT-IP 5/8**	9 mm	-
11/16	**HIT-RB 11/16**	**HIT-IP 11/16**	9 mm	**HIT-DL 11/16**
3/4	**HIT-RB 3/4**	**HIT-IP 3/4**	16 mm	**HIT-DL 3/4**
7/8	**HIT-RB 7/8**	**HIT-IP 7/8**	16 mm	**HIT-DL 7/8**
1	**HIT-RB 1**	**HIT-IP 1**	16 mm	**HIT-DL 1**
1-1/8	**HIT-RB 1 1/8**	**HIT-IP 1 1/8**	16 mm	-
1-1/4	**HIT-RB 1 1/4**	**HIT-IP 1 1/4**	16 mm	-
1- 3/8	**HIT-RB 1 3/8**	**HIT-IP 1 3/8**	16 mm	**HIT-DL 1 3/8**
1-1/2	**HIT-RB 1 1/2**	**HIT-IP 1 1/2**	16 mm	-
1-3/4	**HIT-RB 1 3/4**	**HIT-IP 1 3/4**	16 mm	-

1 Refer to adhesive anchor system installation instructions to determine the proper hole diameter for the fastening element to be used.
2 Attach brush to HIT-RBH T-handle, HIT-RBS or HIT-RBV extensions.
3 Use piston plugs to help prevent air voids during injection.

3.2.3 HIT-HY 200 Adhesive Anchoring System

Hilti HIT Profi Accessories for brushing drilled holes

Manual brush handle for round steel brush

Description		Qty
HIT-RBH (T-handle) Use to clean holes up to 11 in. deep	①	1

Manual brush extension for round steel brush

Description		Qty
HIT-RBV 11 in. extension for HIT-RBH (T-handle)	②	1

Holders for brush extension RBS

Connects RBS extension to your Hilti drill for use in cleaning holes

Description		Qty
TE-Y SDS Max connection	③	1
TE-C SDS + Connection	④	1

Extensions for round steel brushes

Description		Diameter in	Length ft	Qty
HIT-RBS 10/0.7	⑤	0.39	2.3	1
HIT-RBS-10/0.35	⑤	0.39	1.2	1

Hilti HIT Profi Accessories for adhesive injection

Extension hoses

For use in holes deeper than 10 in.

Description		Diameter in.	Length ft	Qty
HIT-VL 9/1.0 flexible hose	⑥	0.35	3.3	10
HIT-VL 16/0.7 rigid tube	⑦	0.63	2.3	10
HIT-VL 16 flexible hose		0.63	33	1

Coupler for injection extensions

Description		Diameter in.	Qty
HIT-VL K Plastic coupler for connecting 16 mm (0.63 in.) hoses and tubes	⑧	0.63	5

Overhead injection accessories

Description		Hole Diameter in.	Qty
HIT-OHW overhead wedge	⑨	7/16 to 1-1/4	100
HIT-OHC1 overhead drip guard	⑩	7/16 to 5/8	10
HIT-OHC2 overhead drip guard		11/16 to 1-1/4	10

6.4 Additional Vendor Information (if supplied)

This section intentionally left blank.

7 Electric Controls & Schematics

For AS BUILT electrical information, refer to Section 7 of your Vulcan Multi-Rake Screen O & M manual.

8 Project Data

Section 8
Project Data

8.1 Warranty
(See the following pages)

Warranty

VULCAN INDUSTRIES, warrants all equipment of its own manufacture to be free of defects caused by faulty material or workmanship and shall, of its option, exchange or repair without charge, F.O.B. its factory, such part or parts thereof that prove defective under normal use within twenty-four (24) months from date of actual start-up. **VULCAN INDUSTRIES** obligation under this warranty is limited to the above and does not apply to replacement or repairs which are required as the result of improper installation, misuse, maladjustment, abnormal operating conditions, or lack of routine maintenance. Nor does the warranty include the furnishing of service for maintenance or problems arising from the foregoing causes. No claims for labor or other expenses will be recognized. This warranty is in lieu of and to the exclusion of all other warranties expressed or implied, statutory or otherwise.

VULCAN INDUSTRIES shall not be liable for any claims, losses, labor, expenses or damages, direct or consequential, resulting directly or indirectly from the use of, or the inability to use, its products, or for other consequential loss or damage of any nature arising from any cause.

THIS WARRANTY IS THE SOLE WARRANTY OF VULCAN INDUSTRIES AND ANY OTHER WARRANTIES EXPRESS, IMPLIED IN LAW, IMPLIED IN FACT, INCLUDING WARRANTIES OR MERCHANTABILITY AND FITNESS FOR USE, ARE HEREBY SPECIFICALLY EXCLUDED.

PROJECT: Wichita, KS

PROJECT NO. 19177

8.2 Project Specifications
(See the following pages)

Job Name: Wichita, KS
Job No. 19177

SCREENINGS WASHING & COMPACTING SYSTEM
MODEL #EWP 300-600

1.0 DESIGN REQUIREMENTS

Number of Units:	Two (2)
Screenings Capacity:	Up to 53 cubic ft./hr. (batch service) Up to 159 cubic ft./hr. (continuous service)
Organic Removal:	up to 90%
Min. Volume Reduction:	up to 50%
Wash Water Requirements:	27 gpm max. (at 35-psi min., 55-psi max.) (intermittent usage)
Drive Motor, HP:	7.5
Water Line Connection:	1” NPT
Net Weight:	2,050 lb.

2.01 GENERAL

A. The washing press shall be provided to reduce the organic content, moisture content and volume of screenings material from a mechanical bar screen. Screenings material shall enter the inlet hopper and be transported by the rotating screw into the washing zone. In the washing zone, wash water is sprayed through the hollow shaft screw and into the screenings material to help dissolve and remove organic material.

B. During normal flow conditions, the washing press shall be operated in a forward and reverse sequence. The screenings will be transported to washing zone and the screw shall stop rotation. Wash water is then injected through the hollow shaft screw and into the screenings. The screw will then reverse, bring the screenings out of the washing zone and stop rotation to allow the washing zone to be flushed. The screw operates in the forward direction and repeats the washing sequence. This adjustable washing process shall be repeated a minimum of four times to ensure thorough cleaning of the screenings material. During peak loading conditions, the washing process shall automatically switch to operate in the forward direction to handle the larger amount of screenings with only short intervals of reversing to ensure that

material does not accumulate on the shaft of the screw. Four manual ball valves shall be provided, one for each solenoid valve, to allow personnel to isolate the solenoid valves or throttle the amount of wash water.

2.02 INLET HOPPER

A. The inlet hopper shall be designed to direct screenings material from the screw conveyor into the screw housing. The inlet hopper shall be constructed as shown on the submittal drawings. All materials of construction shall be of 316 stainless steel. All attachment hardware shall be of 316 stainless steel.

2.03 SCREW HOUSING

A. The screw housing and associated components shall be constructed of 316 stainless steel. The inlet flange shall have a minimum thickness of 3/4-inch and the outlet flange shall have a minimum thickness of 9/16-inch. The outlet flange shall incorporate a 12-inch pipe bolt pattern for connection to the discharge pipe.

B. The dewatering section shall incorporate anti-rotation bars around the complete circumference to contain the screenings material and prevent rotation of the screenings during the dewatering process. Counter sunk perforations shall be provided in the dewatering zone to allow the removal of the filtrate during compaction. Wash water inlets shall be provided on the top of the washing zone and on the top of the dewatering zone for automatic periodic flushing.

C. The removable cover for the dewatering section shall be held in place by a latching system to allow easy removal. A resilient seal shall be mounted to the cover to form a watertight seal with the screw housing. Designs that utilize covers that rely on tools for removal or designs where the cover is not removable are not acceptable.

D. The bottom of the housing shall contain a 1/2-inch thick, 316 stainless steel wedge wire section for drainage. The wedge wire section shall be constructed of individual profiled bars and shall have 2 mm linear openings. Round or slotted perforated holes in the drainage area are specifically excluded.

2.04 HOLLOW SHAFT SCREW

A. The hollow-shaft screw shall be constructed of alloy steel and it shall have a minimum outside diameter of 11.5 inches. The shaft shall be a minimum of 2-1/2 inches in diameter. The shaft shall be hollow with

perforations located in the washing zone to allow wash water to be injected into the screenings from the inside out.

B. The flights shall be cold formed from a continuous length of AISI 8620 steel bar with a minimum thickness of 3/4-inch. After fabrication the screw shall be precision machined to ensure that it is concentric along its length. The distance between the flights shall be arranged to allow transportation into the washing zone and compaction in the dewatering zone.

C. The screw shall have a minimum Brinell hardness of 200 and hard facing shall be applied to the end of the screw to extend the useful service life.

D. A stainless steel reinforced nylon brush shall be attached to the hollow shaft screw with setscrews in the drainage area to help prevent debris from blinding the drain. To reduce wear on the brush, the design shall be such that the screw shall not be allowed to rest in the press housing. The screw shall be fully supported and cantilevered off of the thrust bearing.

2.05 THRUST BEARING

A. An independent, stainless steel axial thrust bearing shall be flange mounted to the drive and flange mounted to the press body. The thrust bearing shall fully support the screw and handle the load created during compaction and reversal of the screw. The thrust bearing shall have a fabricated stainless steel housing and shall utilize self-aligning double tapered roller bearings located between two sets of double lip seals. The flanges on the housing shall have a 7/16-inch minimum thickness.

B. An O-ring seal shall be mounted in a machined groove on the face of the bearing to seal against the press body. The screw shall be cantilevered off the thrust bearing to prevent the screw from resting inside the screw housing.

2.06 DRIVE ASSEMBLY

A. The washing press shall be complete with an integrated drive assembly consisting of a Class 1, Division 1, Group C & D, explosion-proof electric reversing motor close-coupled to a gear reducer.

B. The motor shall be 7.5 horsepower, 230/460 volt, 3 phase, 60 Hertz with a service factor of 1.15. The motors shall be rated at 50°C

ambient with Class F insulation and shall have a Class B temperature rise at full load. The nominal motor speed shall be 1800 rpm.

C. The gear reducer shall be a right-angle helical bevel gear reducer. Gear reducer specifications shall be as shown in section 3.

D. Gear reducers shall have ball or roller bearings throughout with all moving parts immersed in oil. Gears shall be of alloy steel with threads precision ground and polished after casehardening. Shafts shall be of high strength alloy steel ground to required tolerances. All ball or roller bearings shall be rated and manufactured by a member of the Antifriction Bearing Manufacturer's Association. At least one bearing on each shaft shall be of the combined radial and thrust type.

2.07 DRAIN PAN

A. A drain pan shall be mounted to the bottom of the screw housing along the full length of the housing. The pan shall be sloped towards the drain and it shall be provided with a flushing nozzle on the dewatering end and a 4-inch diameter drainpipe on the drive end. The pan shall be held in place by a latching system to allow fast and easy removal.

B. The drain pan shall incorporate a resilient seal along its top edge to form a watertight seal with the screw housing. The drain pan shall be constructed of 316 stainless steel

2.08 DISCHARGE PIPE

A. The discharge pipe shall be mounted to the pipe flange on the press body and designed to transport the washed, dewatered and compacted screenings to the appropriate receiving device. The discharge pipe shall be constructed of minimum 11-gauge 316 stainless steel pipe and fabricated, UHMW lined U-trough and shall be configured as shown on the Submittal Drawings.

2.09 FREEZE PROTECTION

A. An insulated heat tracing system shall be provided on the exterior portion of the horizontal U-trough portion of the discharge piping. The U-trough shall be insulated and heat traced along the bottom circular portion of the trough. The heated portion shall extend from the inside face of the exterior wall to the point of discharge. The heat tracing and insulation shall be enclosed with a removable 316 stainless steel cover.

2.10 CONTROLS & ELECTRICAL SAFETY EQUIPMENT

A. Controls shall be supplied as shown in section 5.

2.11 WASH WATER MANIFOLD

A. Four (4) brass body explosion-proof solenoid valves, four (4) manual stainless steel ball valves and a pressure gauge shall be provided as part of a valve wash water manifold. The solenoid valves shall be activated by the PLC in the main control panel to provide wash water intermittently during cleaning and flushing cycles. The wash water manifold shall be mounted on a floor mounted 316 stainless steel support stand. Wash water manifold details are shown in section 5.

2.12 FASTENERS

A. All fasteners and anchor bolts shall be 316 stainless steel unless otherwise indicated in this specification. Anchor bolts shall be provided by the manufacturer for mounting the washing press and the solenoid valve manifold/local control station support stand. All threaded fasteners shall be coated with a nickel based anti-seize thread lubricant prior to assembly.

2.13 LUBRICATION

A. The manufacturer shall state in the operating manual the amount of and specification for any lubricant required.

2.14 PROTECTIVE COATINGS

A. Stainless steel and plastic components shall not be painted. The stainless steel structural components and enclosure panels shall be bead blasted and passivated as required after fabrication to remove embedded iron, surface rust and weld burn. All other surfaces shall be blast cleaned to an SSPC-SP6 finish, removing all dirt, rust, scale and foreign materials.

B. Cleaned surfaces shall be shop primed with one (1) coat of TNEMEC 69-1212 primer, or equal, to attain a minimum dry film thickness of 2.5 mils. The motor and gearbox shall have one coat, 2.5 mils DFT, Tnemec series N69 primer and two coats, 5 mils DFT, Tnemec series 1074 topcoat. The top coat shall be red in color and semi-gloss in finish.

2.15 SPARE PARTS

A. The Manufacturer shall furnish the following spare parts for each press.

1. One (1) replacement brush for screw
2. One (1) set of replacement fuses (1 of each type and size used)

All spare parts shall be properly packed in a white wooden box, labeled and stored where directed by the Owner or Engineer.

3.01 TESTING

A. The washing press shall be factory assembled and factory run tested for a minimum of 8-hours in the United States prior to shipment. The main control panel shall also be factory tested prior to shipment.

3.02 INITIAL START-UP AND TRAINING

A. The Contractor shall provide the services of a factory-employed service technician who shall adequately inspect the installation, test the equipment furnished under this Contract and instruct the Owner's operating personnel in its maintenance and operation. The services of the technician shall be provided as follows:

Two (2) trips, total of three (3) 8-hour days of service to inspect and certify the installation prior to startup and provide Owner's personnel in proper operation and maintenance of the equipment. Start-up service shall be combined with the start-up service for the bar screen and conveyor.

8.3 General Arrangement Drawing
(See the following pages)

For AS BUILT drawing(s) refer to Section 8, 8.3 of your Vulcan Multi-Rake Screen O & M manual.

8.4 Start-up Documents

To be inserted by Contractor after Installation
(See the following pages)

Operation and Maintenance Manual

Project Name: Plant 1 PS Screens

Project Location: Wichita, KS

Shaftless Screw Conveyors
TF-240

Contractor:
Wildcat Construction
3219 West May Street
Wichita, KS 67213
316-945-9408

Engineer:
Professional Engineering Consultants
303 South Topeka
Wichita, KS 67202
316-262-2691

Manufacturer:
Vulcan Industries, Inc.
212 S. Kirlin St.
Missouri Valley, IA 51555
712-642-2755, FAX 712-642-4256

Manufacturer's Representative:
Ray Lindsey Company
17221 Bel Ray Place
Belton, MO 64012
816-388-7440

Vulcan Job No. 19177

Prepared by: Joel Fredericksen
joel@vulcanindustries.com

General Safety Instructions

Technical & Functional Description

Receiving and Storage

Installation & Start-up Instructions

Maintenance Instructions & Lubrications Charts

Drive System Components & Replaceable Parts

Specifications & Installation Drawings

Electrical Control & Schematics

Vulcan Shaftless Screw Conveyor

Section 1

General Safety Instructions

1. General Safety Instructions

Before performing any maintenance or repairs to the equipment, personnel should review all governing Safety policies in effect. Note that the material handled by the equipment may come under the classification **" Bio-hazardous material "**. Additionally, the equipment may be controlled by remote controls, and can **start automatically** at any time. Follow the established "Lock out Tag out" procedures to isolate the equipment and prevent automatic starts, prior to performing any work on the equipment.

Caution, the conveyor can start automatically!

In general the following safety precautions must be observed:

- Screw conveyors are shipped with warning labels affixed at appropriate locations. DO NOT PAINT OVER WARNING LABELS! If labels are torn or difficult to read, contact the factory to obtain new warning labels.

- Ensure that persons cannot be put at risk when working on or in the machine.

- Before performing any maintenance, the power must be turned off to the main control panel. Follow your local "lock out – tag out" procedure to make sure there is no possibility of the equipment starting, or being connected back to power until all necessary work is performed.

- Only trained electricians should be allowed to make adjustments or repairs on any part of the electrical system.

- Protective covers and guards may be removed only after the power has been disconnected. All protective covers and guards must be in place before operating the equipment.

- Do not attempt any repairs or adjustments while the machine is in operation.

- Check all safety devices for proper operation.

A safety training and safe equipment operation program should be developed and presented to all personnel involved in the operation and maintenance of the equipment. The Conveyor Equipment Manufacturer's Association (CEMA), Rockville MD, has produced an audio-visual presentation titled "Safe Operation of Screw Conveyors – Three Basic Rules". Owners are encouraged to purchase and use this presentation to augment safety training.

At a minimum, the following warning signs must be attached to the machine:

Bio-hazardous material

Safety instruction

Automatic Starting
Danger of pinching

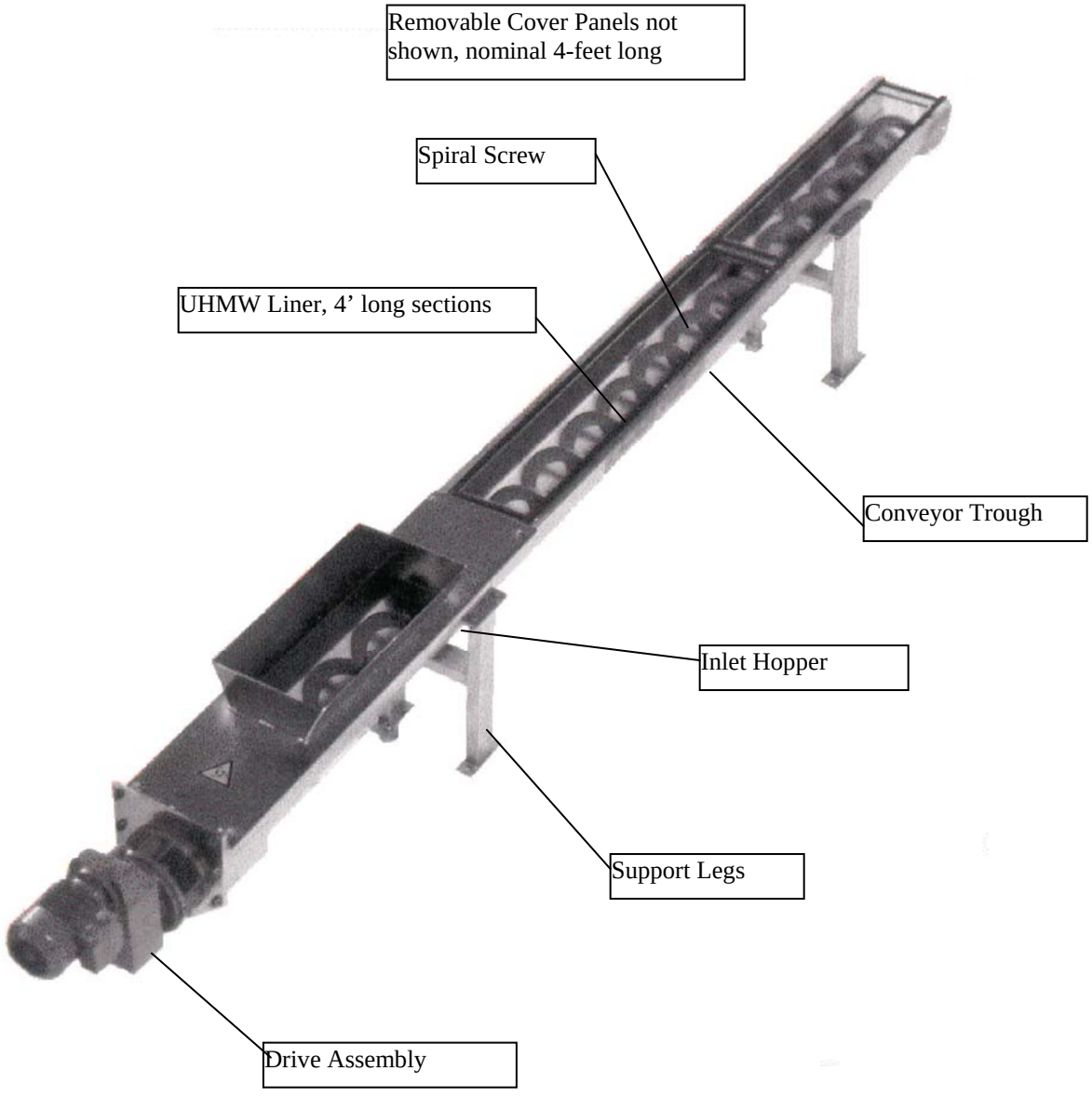
Vulcan Shaftless Screw Conveyor

Section 2

Technical & Functional Description

2a. Functional description

The spiral conveying system consists of a slowly rotating shaftless spiral which is placed in a lined “U” trough, or a lined pipe. The lining is a UHMW material. The spiral lies over the entire length of the liner. The large cross section of the spiral allows for very high axial loading. Thus the conveyor can handle high loading or long runs. The gear drive is located at the receiving end of the conveyor. The thrust is carried by the tapered bearings in the gear box at the drive end. This leaves the discharge free of hanger bearings or drive components, so that the conveyor can discharge directly out the end without obstruction.



Shaftless Screw Conveyor Major Components

The discharge end of the conveyor may be fitted with an optional compaction head. The compaction head dewaters and compacts by means of a weighted flap, which presses against the conveyed material. Excess moisture is pressed out of the screenings in a cylindrical, perforated section at the discharge end of the conveyor.

Under normal operation, the conveyor can be run continuously, or integrated with the feed source. Automatic and manual controls are available, as well as safety devices and alarms.

The conveyor should not be used to convey materials other than what it was designed for.

The feed rate to the conveyor should not exceed the rated capacity of the conveyor.

If the conveyor is used to charge another piece of equipment, the conveyor should not be run if the other equipment fails for any reason.

If the conveyor has set idle for long periods of time, the trough should be examined for dried residue. The residue should be removed, and the spiral should be observed for free rotation in the trough.

Vulcan Shaftless Screw Conveyor

Section 3

Receiving & Storage

3. Receiving and storage

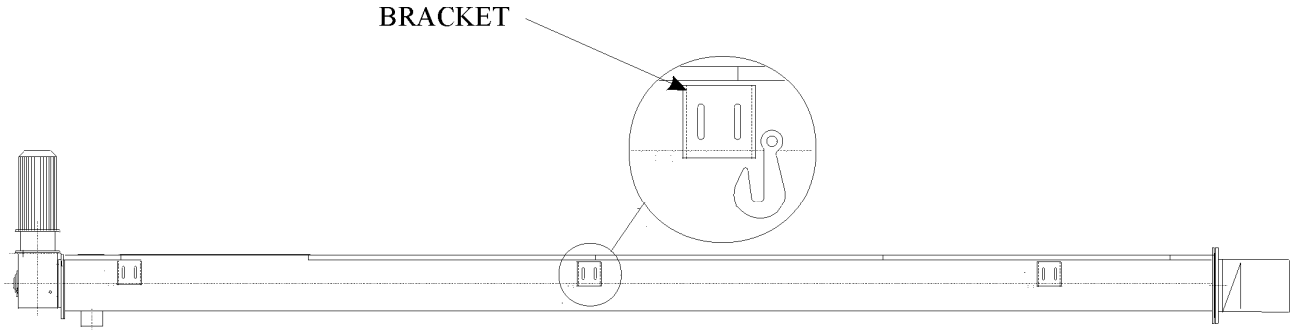
Weight of machine and space requirements can be found in Section 7 of this document. Review this section before receipt of equipment so that any rigging requirements may be met.

The machine is to be handled with care when unloading, transporting, storing and installing, and to be protected from damaging impact from other sources. The machine must be checked for transport damage immediately upon receipt. Contact **Vulcan Industries** if there are any concerns. Do not unload if damage is apparent, unless directed to do so by Vulcan Industries.

An example sheet of a standard Packing List and examples of the tagging system are included with this document. Please take the time to go through the packing list, and identify all items there noted. Contact **Vulcan Industries** if any discrepancies are found.

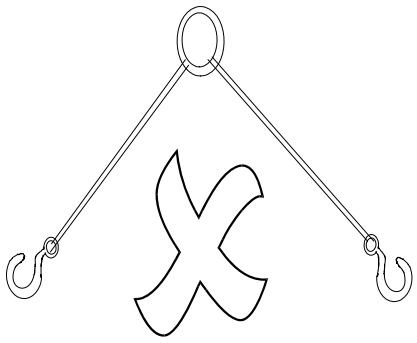
During transport or storage other containers must not be piled on the machine.

The use of lift trucks / fork lifts is acceptable for off loading or transport if the equipment is in its original shipping container. Cranes or other lifting devices are to be used at the following lifting points:

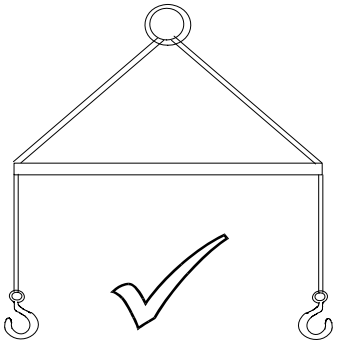


USE SUPPORT LEG BRACKETS FOR LIFTING POINTS

The use of chokers or slings is strictly prohibited for unloading, transport, or installation. Spreader bars must be employed.



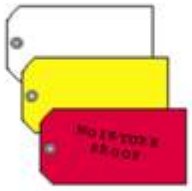
WRONG



RIGHT

TAGGING SYSTEM EXAMPLE SHEET

Model No: S-5544R 4.75 x 2 3/8 Red Plastic Tag 100/bd
Yellow Tags used on miscellaneous parts "not generally used"



- PLASTIC TAGS
- Durable, economical tags.
- Color code inventory and equipment.
- Tearproof 10 mil vinyl.
- Metal eyelet.
- Ideal for use with permanent markers.
- Please specify: Red, Yellow, White, Blue or Green.

Model No: H-543 Uline Plastic Truck Seals –
Yellow Tags used on pallets and screens.

- TAMPER RESISTANT
- Seals are consecutively numbered and embossed with either "ULINE" or your custom wording (up to 17 s
- Self-locking seal.
- ULINE PLASTIC SEALS: Minimum order of 300
- Colors available: Red, Yellow, Blue or White.

Model No: S-6000 1.5 x 1" Consecutive Number Labels,
0001 - 0500 500/rl

Used to inventory spare parts box and other miscellaneous boxes

VULCAN INDUSTRIES INC.
P O BOX 390/212 S. KIRLIN
MISSOURI VALLEY, IOWA
51555 U.S.A.
712.642.2755 or fax 712.642.4256

PACKING LIST

Purchase Order No.	DATE SHIPPED	SHIPPED VIA	OUR NO.	L/C NUMBER
contract #	(M/D/Y)	**Vulcan Industries**	####	

SHIP TO:
(Contractor Name.
(Project Name)
(Shipping Address).
Attn: (Contact Person)

NOTE:
The Spare Parts Box and Local Stations
MUST be stored **INDOORS!**

DO NOT ALLOW CRATES TO BE FLOODED and/or WEATHERED!

ITEM #	QTY	DESCRIPTION		
		Delivered on Vulcan Flat Bed		
	2	EWP 250-1200 Wash Press w/ Inlet Hoppers Attached		**1800**
	2	12' Long "U" Troughs		**550**
	2	6' Long "U" Troughs		**275**
	2			**100**
	6			**100**
	2	EWP Discharge Tubes		**150**
	1	**Assembly Parts Box as listed below:**		**100**
	17	Wash Press and Trough Leg Wedge Anchors	½" x 5½"	
	8	Support Stand, Valve Stand Wedge Anchors	3/8" x 3¾"	
	2	PVC Elbows for Drain Pan		
	32	Discharge Tube and Trough Flange Bolts w/ nylock nuts	½" x 1½"	
	16	Hose Clamps "Stainless Steel"	½"	
	50'	Clear Braided Valve Hose.	¾" x ½"	
	6	EWP Discharge Tube and Trough Flange Gaskets.		
	12	Trough Leg Attachment Bolts w/ Nylock Nuts	3/8" x 1¼"	
	1	**Spare Parts Box as listed below:**		**450**
	1	Complete Replacement Bearings Sets for the Drive Motor		
	2	Replacement Spiral Brushes		
	1	Replacement Screw		
	1	Replacement Thrust Bearing		
		1 year of lubricant		

Sample Packing List

CRATE TOTAL	CHECKED BY		ORDER COMPLETE	BALANCE TO FOLLOW	TOTAL WEIGHT	
	HSW		YES	NONE		**3525**

Receiving and Storage: Long Term Storage

Upon receipt of the shipment, carefully check the contents of the delivery against the packing list to insure that the delivery is complete, and all components are accounted for. No claims for missing components will be honored if not identified at the time of receipt of the shipment.

If at all possible, the equipment should be stored inside, in a climate controlled environment.

The major pieces of equipment are shipped on skids or pallets. Do not remove the equipment from the shipping skids or pallets, except as required to inspect the components, and check the scope of supply. Inventory all loose items identified on the packing list.

The skids must be placed on a smooth, level surface. If outside, suitable cribbing must be arranged to support the skids and their associated weight.

The equipment should be tarped to protect it from moisture, dust, or other harmful elements.

If the equipment is to be stored outside for more than one month, the following “lay up” procedures must be followed:

- Drain gear cases completely, and refill completely full with a compatible gear oil. Lubrication recommendations may be found in Section 5 of the Operation and Maintenance manual. The gear is normally shipped with a plug installed in the breather port. Make sure that the plug is installed, and not the breather. Tag the gear “Check oil level before operating”.

- The electric motor, and all exposed electrical components should be sealed in heavy duty plastic bags with a suitable number of desiccant packs placed in the bags. The storage period and the volume of the bag determine the number of bags.

After lay up, and before installing the equipment, the following procedures must be followed:

- Unbag all electrical components and inspect for corrosion.

- The equipment should be washed down completely, and thoroughly dried. Inspect for any signs of corrosion.

- Drain the gear cases down to the normal fill level. (note: some equipment may need to be installed prior to performing this step)

- Follow all lubrication instructions, as outlined in section 5 of the Operation and Maintenance manual.

Follow the normal installation procedures as outlined in Section 4 of the Operation and Maintenance manual.

Vulcan Shaftless Screw Conveyor

Section 4

Installation & Start-Up Instructions

4.1 Installation: Mechanical

Important! Vulcan Industries uses all stainless steel hardware and anchor bolts for the assembly and anchoring of the equipment. Vulcan strongly recommends the use of an anti-seize lubricant specifically formulated for use with stainless steel on assembly hardware. Unlubricated hardware has a tendency to seize, and cannot be properly tightened. Seized bolts must be replaced.

Bolt Torque:

3/8”	**15 Ft. Lb.**
1/2"	**35 Ft. Lb.**
5/8”	**50 Ft. Lb.**
3/4"	**80 Ft. Lb**

STANDARD ERECTING PRACTICES

All fabricated equipment manufactured by Vulcan Industries is shop assembled and tested prior to shipping, and should not present any abnormal erection problems. Due to varying field conditions, a reasonable amount of fit-up is considered standard erection practice. The use of such tools as “come-a-longs”, jacks, drifts, and reamers is to be expected. The equipment should be assembled and installed according to the AISC “Code of Standard Practice”. Section 7.12 of that code states:

> “Normal erection operations include the correction of minor misfits by moderate amounts of reaming, chipping, welding, or cutting, and the drawing of elements into line through the use of drift pins. Errors which cannot be corrected by the foregoing means or which require major changes in member configuration are reported immediately to the owner and fabricator by the erector, to enable whoever is responsible either to correct the error or to approve the most efficient and economic means of correction to be used by others.”

If an erection problem is traceable to Vulcan Industries fabrication or engineering departments, we will work to resolve the problem. If field modifications are done by others to correct the problem, they must be approved, in writing, by Vulcan Industries Inc. No back charges will be accepted by Vulcan Industries unless the deficiencies are documented, and the remedy is approved in writing by Vulcan Industries.

The conveyor is shipped with the support legs unattached. Begin by inspecting the area where the conveyor is to be located. The area must be cleared of any construction debris. The points of anchor should be checked for flatness and level. Slight deviations (+ or – 3/4”) can be shimmed out at the support feet. Gross deviations (over 3/4”) must be corrected before installation is begun.

Support legs are match marked for their respective locations. Identify marks, and lay out support legs at their respective locations. Using proper lifting techniques (refer to receiving instructions) raise the conveyor to its final position (see setting plan drawings, or work from approved shop drawings) and install support legs with hardware provided. Do not install anchors to the floor at this time.

Install all additional appurtenances such as inlet hoppers, discharge chutes, covers, etc. as shown on the General Arrangement drawings.

CRITICAL TO INSTALLATION!
Check the conveyor trough for straightness and for absence of twist. This can be accomplished using a laser level or other instruments as required to establish that the trough is straight within ½" over its entire length, and twisted less than 2° over the entire length. Adjust or shim support legs as required. The anchors may now be installed. Refer to the shop drawings for location, size, and type of anchor. Follow anchor manufacturer's instructions for anchoring.

4.2 Installation: Electrical

Electrical interconnection must be performed by qualified, licensed professional electricians. The interconnections required are documented in the Electrical section of the shop drawings. The electrical contractor should thoroughly familiarize himself with this section and identify all interconnection points before beginning work. Any questions regarding the work should first be directed to the General Contractor.

It is the electrician's responsibility to check the gearmotor for proper rotation. This may be done **ONLY** after all connections have been made, all safety devices are installed and have been verified as functional, and the conveyor has been cleared of any construction or installation debris. The rotation of the gearmotor is correct when the spiral, while turning, advances from the inlet toward the discharge. "Bump" the motor briefly to verify rotation. After verification, the electrician should attach a tag to the gearmotor confirming rotation verification. The tag should be signed and dated.

4.3 Start Up, Operation

1: Precautions:

Prior to initial startup of the equipment, verify the following:

- Check that equipment is anchored securely at all points
- Check all assembly bolts for tightness
- Check the gearmotor for proper lubrication level and venting (see section on gearmotor for lube type, quantity, and fill/drain locations)
- Check any piping connections for leakage

- Verify that all electrical connections have been made, gearmotor has been checked for proper rotation, and all electrical safety devices are installed, connected, and operating
- Check that no construction debris, tools, or other matter is in the conveying zone (spiral)
- Install all protective covers and fasteners

2: Trial Run:

Start the conveyor in hand mode, forward. Immediately verify that the motor rotation is correct by observing the direction of the spiral. The rotation is correct when the spiral appears to move toward the discharge end. Next, observe the spiral for smooth operation. There should be no signs of binding or vibration evident while the spiral is turning. If all is well, run the conveyor for about ten min. and check for hot spots or noisy operation. Conveyor may now be put into service.

3: Normal Operation:

Under normal operation the conveyor will generally be controlled by sequencing with upstream and downstream devices. Make sure all such devices are functional before selecting “auto” mode. Operators must be made aware of the fact that the equipment is remotely controlled and may start at any time. Equipment should never be operated with protective covers removed or safety devices in operative.

Vulcan Shaftless Screw Conveyor

Section 5

Maintenance Instructions
& Lubrication Charts

TF Screw Conveyor Troubleshooting Guide

PROBLEM	POSSIBLE CAUSE	SOLUTION
Machine won't start, motor not running	▪ Loss of Power ▪ Emergency Stop(s) engaged	▪ Check incoming power to control panel ▪ Check for control power (110 V.A.C.) out of control power transformer ▪ Check Fuses, disconnects ▪ Check overload devices, safety switches, reset as required
Power available, machine won't start in "Auto", motor not running	No signal to main control panel	▪ Try "Hand" operation. If machine operates in "Hand", check start signal input devices.
Power available, machine won't start in "Hand", motor not running	Emergency Stop(s) engaged Motor Bad	▪ Check E-stop device(s) ▪ Check and Replace Motor
Power available, machine won't start in "Hand", motor running	Breakdown in Power Transmission	▪ Check drive components; isolate faulty component and repair/replace as required.
Conveyor has excessive noise while running	Gear reducer failure	• Replace or repair gear reducer
	Trough liner wear	• Check trough liner for worn or thin areas, replace as required
	Bent spiral	• Check spiral for smooth, flat operation in trough. A bent spiral will require straightening or replacing.
	Solid obstruction	• Remove objects causing obstruction

5.1: Maintenance:

The maintenance requirements of the spiral screw conveyor are minimal, because of the small number of moving parts. The gear motor should be maintained according to recommendations in the section “Drive System Components”. The wearing parts (liner and spiral) should be checked for evidence of abrasion or wear monthly. To inspect, the covers must be removed. Before **ANY** maintenance is performed, be sure to follow all local lock out – tag out procedures to isolate the equipment from power sources.

Remember: Equipment is automatic and may start at any time if not locked out!

The following procedure should be followed for inspecting the spiral and the liner:

⇒ Stop material feed from upstream devices

⇒ Run the conveyor in manual until all the materials have been discharged

⇒ Flush the conveyor trough with clean water

⇒ Stop and lock out the conveyor

⇒ Now the covers may be removed. Additional flushing may be necessary.

⇒ Replace ALL covers before re-starting the machine.

5.2 Removing and installing the spiral, drive motor, and gear unit

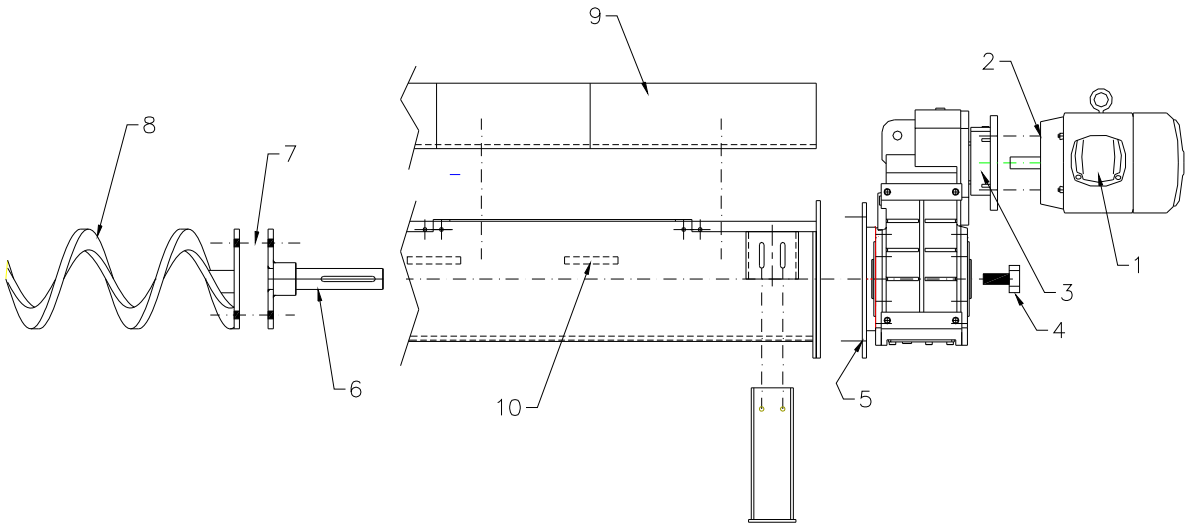


Figure 1

The following must be observed before removing any of the components:

Refer to Section 1: General safety instructions for necessary safety procedures. **Remember. The equipment is controlled automatically, and may start at any time. Follow your local "Lock Out Tag Out" procedures to ensure power is disconnected from equipment before proceeding.**

Remove all covers, wash components thoroughly with clean water. If necessary, disinfect all components.

To remove the motor:

1. Open electrical connection box at motor (1) and disconnect power leads. Refer to electrical schematic, and record connections, for future reconnection. Secure loose ends of wires with wire nuts or other type of insulators. Close the electrical connection box (1).

2. Loosen (two) setscrews inside the K5TC motor adaptor (3).

3. Remove four bolts (2) at the gear motor flange and remove the motor. Note that the motor shaft must slide out of the reducer quill. **Caution!** Motor is **heavy.** Use appropriate lifting straps and devices.

To remove the gear reducer:

1. Remove the bolt (4) and washer from the drive shaft (6)

2. Remove the flange bolts (5) from the gear reducer and conveyor trough end flange.

3. Use an appropriate puller to press the gear reducer off the drive shaft (6). **Caution!** Gear is **heavy.** Use appropriate lifting straps and devices.

To remove the spiral:

1. Remove the attaching bolts (7) from the spiral (8) and the drive shaft (6). The spiral may then be lifted vertically out of the trough, or slid horizontally out of the trough. Support the spiral at 6-foot intervals minimum, to prevent the spiral from bending.

2. Check the spiral for wear and abrasion. The outside diameter of the spiral should be within 12 mm. of the nominal spiral diameter (i.e., TF 280 = 280mm). Check the spiral for kinks or bends. This can be checked by rolling the spiral on a flat surface. If wear or bending is evident, replace spiral.

Replace parts in the reverse order of disassembly.

Before returning the equipment to service check the following:

1. Open the electrical connection box at the motor (1) and reconnect all leads. (Refer to wiring diagram and notations made at disassembly.)

2. Set the operating switch at the main control panel to “local – manual”. **Make sure that the machine cannot be switched on automatically.** “Bump” the motor “Forward” to check rotation of the spiral. The spiral should rotate clockwise looking from the back to the front, and appear to advance to the discharge end. If not, make appropriate connection changes.

3. Run the conveyor in forward a few turns to check for unobstructed rotation. The spiral should run smoothly in the trough with no unusual bumping or grinding.

4. Lock power back out, then replace all protective covers, guards, and safety devices. Check all safety devices for proper operation. The equipment may now be put back into service.

5.3 Replacing the Trough Liners

The trough liners are supplied in sections approximately four feet long. The sections are banded to help them retain their curved shape. The bands should be left on until the section is installed.

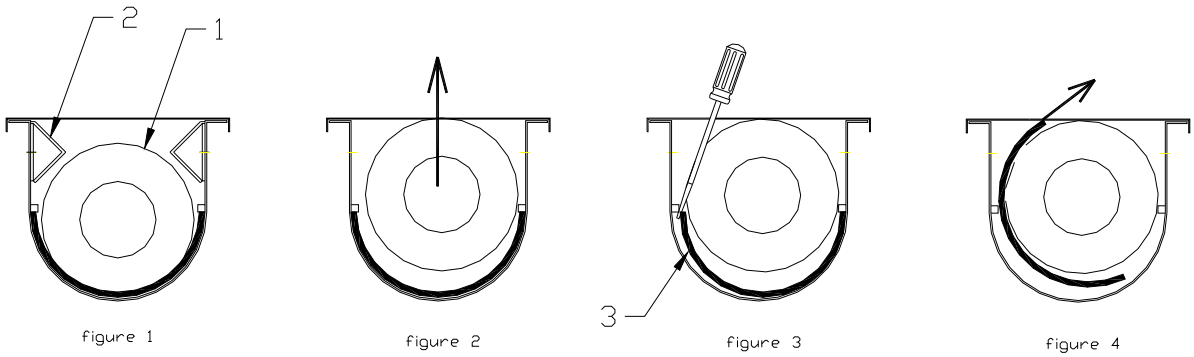


figure 1 figure 2 figure 3 figure 4

To replace the liner sections,

Fig. 1. Remove the spiral hold down angles (2)

Fig. 2. Lift and support the spiral off the liner. The spiral should be supported at a minimum of 6 foot intervals.

Fig. 3. Pry the liner out from the liner hold down tab.

Fig. 4. Rotate the liner around the spiral and out of the trough.

Roll new liner sections into position, making sure that liner is completely secured by the hold down tabs.

Reassemble trough components.

5.4 Lubrication Table

The ambient operating temperature should always be considered when selecting lubricants. The lubrication chart shows the recommended lubrication for various components operating at 70 Deg. F. ambient temperatures. This listing does not show an order of preference.

Never mix mineral oils with synthetic oils.

Never overfill gear reducers. Premature seal failure and leakage will result from overfilling.

Lubrication Schedule:

Maintenance Operation	Frequency	Lubricant (if Applicable)	Comments
Check gear reducer oil level, Check quality of gear oil	Half-Yearly (or every 600 Operating Hours)	Gear Oil	Reference: 6 of O & M

Reference Symbol	Mobil	Shell	Castrol	Allied	Or Equal
Gear Oil	Mobilgear XMP 220	Omala 220	Alpha SP 220	Gear Lube 75W90	BP Energol GR-XP 220
Reference: Section 6 of O & M "Maintenance Instructions & Lubrication Charts"					

Note: Equipment is shipped with Shell Omala 220 gear lube.

Notes

Vulcan Shaftless Screw Conveyor

Section 6

Drive System Components & Replaceable Parts

VULCAN INDUSTRIES, INC.

Quality Control Document

Form #: 4.4.11

Device 1

Job No.	**19177**
Job Name	**Wichita KS.**
Equipment Type	**TF - 240**
Equipment Serial No.	**19177-450-7**
	Tagged AWG-1

Date of test: **1/3/2020**

Description of test: **In Shop Factory Test**

Motor Nameplate Data

Mfg.	**Baldor-Reliance**			
Serial No.	**F1908272869**			
CAT No.				
Spec. #	**05F831W649G1**			
No.	**D61008958**			
Frame	Type	Code	Design	Class
145TC	**C1/D1**	**J**	**B**	**F**
Encl.	H.P.	PH.	HZ	RPM
	2	**3**	**60**	**1725**
S.F.	VOLTS		AMPS	
1.15	**208 - 230 / 460**		**5.7-5.4 / 2.7**	
DE brg	**6205**			
ODE brg	**6203**			

Reducer Nameplate Data

Mfg.	**Siemens**
Serial No.	**FDU1909/2500868 001**
Type	**KAZ89-K5-(140)**
Mount	**M4-A**
Oil Capacity	**6.8 liter**
T_2 =	**1054 Nm**
N_2 =	
I (ratio) =	**129.96**
SF	

Brake Nameplate Data

Mfg.	
Serial No.	
Model No.	
Ft lbs torque	
Voltage	

Test Remarks			
	Reducer vent plug installed	**Y**	N
	Oil level confirmed	**Y**	N
	All lubrication completed	**Y**	N
	Adjustment required	Y	**N**
	Operated with designed controls	**Y**	N
	Video taped operation	Y	**N**
	Control panel verified	**Y**	N
	8 hr run test completed	**Y**	N
	Screen hour meter start / finish	**0.5**	**8.7**

Testing Equipment:

Test Device 1:	Serial No.	Date of Calibration
Fluke 333 Clamp Meter	79610273	7/24/2020
Test Device 2:	Serial No.	Date of Calibration
Fluke 65 Thermometer	95600311	7/13/2020

Voltage Reading Phase to Phase:

L1-L2	L1-L3	L2-L3
482	**474**	**489**
Motor Amp Reading		
T1	T2	T3
1.2	**1.5**	**1.5**

Motor Temp. Rise		Reducer Temp. Rise
65	**at start up**	**64**
72	**15 min.**	**70**
75	**30 min**	**74**
81	**1 hr.**	**78**
82	**2 hr.**	**83**
82	**3 hr.**	**86**
83	**4 hr.**	**88**
82	**5 hr.**	**88**
82	**6 hr**	**89**
83	**7 hr.**	**89**
83	**8 hr.**	**89**

TEST REMARKS:

Went over control panel operation with technician, verifying complete operation.
Connected control panel to equipment and verified operation between the two pieces of equipment
Ran equipment for period of 8 hours monitoring amps, voltage, and temperature of both motor and gear box.

VULCAN INDUSTRIES, INC.

Quality Control Document

Form #: 4.4.11

Device 1

Job No.	**19177**
Job Name	**Wichita KS.**
Equipment Type	**TF - 240**
Equipment Serial No.	**19177-450-8**
	Tagged AWG-2

Date of test: **1/21/2020**

Description of test: **In Shop Factory Test**

Motor Nameplate Data

Mfg.	**Baldor-Reliance**			
Serial No.	**F1908272864**			
CAT No.				
Spec. #	**05F831W649G1**			
No.	**D61008957**			
Frame	Type	Code	Design	Class
145TC	**C1/D1**	**J**	**B**	**F**
Encl.	H.P.	PH.	HZ	RPM
	2	**3**	**60**	**1725**
S.F.	VOLTS		AMPS	
1.15	**208 - 230 / 460**		**5.7-5.4 / 2.7**	
DE brg	**6205**			
ODE brg	**6203**			

Reducer Nameplate Data

Mfg.	**Siemens**
Serial No.	**FDU1909/2500868 002**
Type	**KAZ89-K5-(140)**
Mount	**M4-A**
Oil Capacity	**6.8 liter**
T_2 =	**1054 Nm**
N_2 =	
I (ratio) =	**129.96**
SF	

Brake Nameplate Data

Mfg.	
Serial No.	
Model No.	
Ft lbs torque	
Voltage	

Test Remarks			
	Reducer vent plug installed	**Y**	N
	Oil level confirmed	**Y**	N
	All lubrication completed	**Y**	N
	Adjustment required	Y	**N**
	Operated with designed controls	**Y**	N
	Video taped operation	Y	**N**
	Control panel verified	**Y**	N
	8 hr run test completed	**Y**	N
	Screen hour meter start / finish	**0.8**	**9**

Testing Equipment:

Test Device 1:	Serial No.	Date of Calibration
Fluke 333 Clamp Meter	79610273	7/24/2020
Test Device 2:	Serial No.	Date of Calibration
Fluke 65 Thermometer	95600311	7/13/2020

Voltage Reading Phase to Phase:

L1-L2	L1-L3	L2-L3
474	**485**	**487**
Motor Amp Reading		
T1	T2	T3
1.4	**1.4**	**1.5**

Motor Temp. Rise		Reducer Temp. Rise
65	**at start up**	**64**
76	**15 min.**	**74**
79	**30 min**	**77**
82	**1 hr.**	**82**
85	**2 hr.**	**87**
84	**3 hr.**	**88**
85	**4 hr.**	**89**
83	**5 hr.**	**88**
83	**6 hr**	**88**
83	**7 hr.**	**88**
85	**8 hr.**	**89**

TEST REMARKS:

Went over control panel operation with technician, verifying complete operation.
Connected control panel to equipment and verified operation between the two pieces of equipment
Ran equipment for period of 8 hours monitoring amps, voltage, and temperature of both motor and gear box.

BALDOR
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BALDOR • RELIANCE

Product Information Packet

DXP INDUSTRIES

05F831W649G1

2HP,1725 65C RISERPM,3PH,60HZ,145TC,0532

Part Detail

Revision:	-	**Status:**	PRD/A	**Change #:**		**Proprietary:**	No
Type:	AC	**Prod. Type:**	0532M	**Elec. Spec:**	05WGW649	**CD Diagram:**	
Enclosure:	XPFC	**Mfg Plant:**		**Mech. Spec:**	05F831	**Layout:**	
Frame:	145TC	**Mounting:**	F1	**Poles:**	04	**Created Date:**	06-20-2012
Base:	RG	**Rotation:**	R	**Insulation:**	F	**Eff. Date:**	07-12-2012
Leads:	9#18	**Literature:**		**Elec. Diagram:**		**Replaced By:**	

Nameplate NP0977XP

NO.		**TEMP CODE**	T3C				
SPEC.	05F831W649G1	**DE BRG**	6205				
CAT.NO.		**ODE BRG**	6203				
HP	2	**GREASE**	POLYREX EM				
VOLTS	208-230/460	**MOTOR WEIGHT**	80 LBS				
AMPS	5.7-5.4/2.7	**NEMA-NOM-EFF**	86.5				
RPM	1725 65C RISE	**FL PF**	82				
CYCLE	60	**PH**	3	**CL**	F	**FRAME**	145TC
SER.F.	1.15	**DES**	B	**CODE**	J	**CC**	010A
SER.							
RATING	50C AMB-CONT						
USABLE AT 208V							

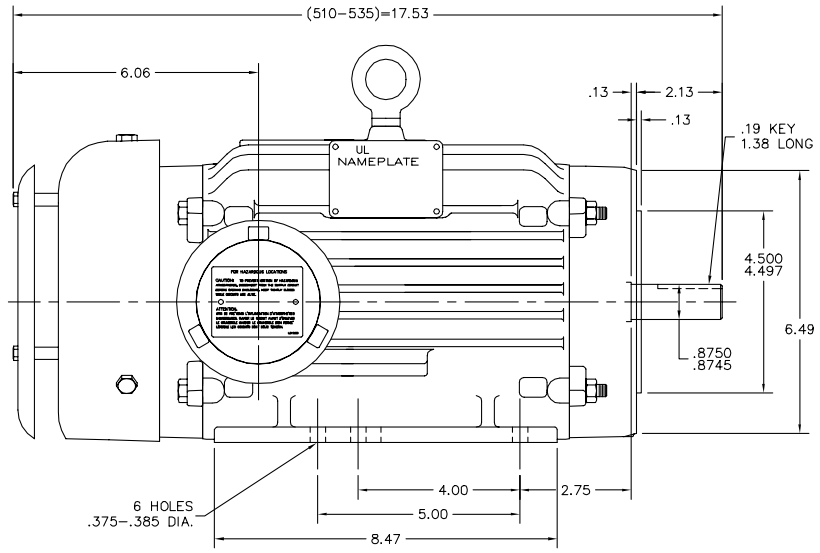
Parts List

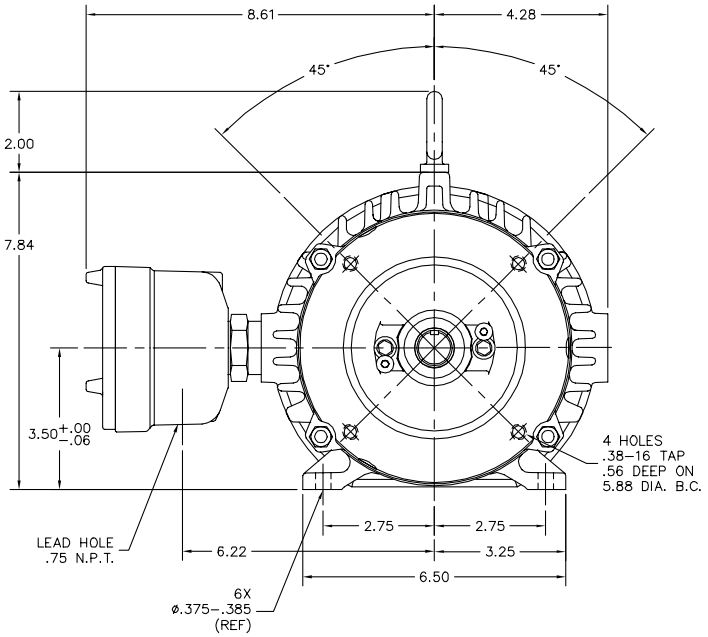
Part Number	Description	Quantity
SA247364	SA 05F831W649G1	1.000 EA
RA234238	RA 05F831W649G1	1.000 EA
HW3201A05	3/8-16 EYEBOLT	1.000 EA
HW4002A18	1"HEX STEEL PIPE NIPPLE FOR 305XP MTRS	1.000 EA
HW3021F12	SPRING PIN, .156 X 1.25	1.000 EA
35CB1005A01	CONDUIT BOX,MACH - GROUP "C" MTRS	1.000 EA
35EP1715A02	FR ENDPLATE,TEFC,35M,X-PROOF MTR,GROUP"C	1.000 EA
84XN3118J20	5/16-18 X 1 1/4" SOC HD CAP SCREW	4.000 EA
HW5100A03SP	WAVY WASHER (W1543-017)	1.000 EA
35EP1704A11	PU ENDPLATE, MACH GROUP "C"	1.000 EA
84XN3118J20	5/16-18 X 1 1/4" SOC HD CAP SCREW	4.000 EA
51XN1032A20	10-32 X 1 1/4 HX WS SL SR	2.000 EA
HW4001A01	1/4 HX SOC PIPE PLG (F/S) ALLOY STEEL W/	2.000 EA
60XN1032A07	10-32 X 1/2 TRUSS HEAD, TORX SERRATED ZN	2.000 EA
51XB1214A16	12-14X1.00 HXWSSLD SERTYB	1.000 EA
35FH1000A18	FAN COVER FOR DRIP COVER	1.000 EA
10XN2520A18	1/4-20 X 1-1/8 HEX CAP SCREW.	3.000 EA
35FH4500A11	DRIPCOVER(W/ AUTOPHERETIC PRIMER)	1.000 EA
HA2001A13	35-10103 SPACER WELKER	3.000 EA
51XN1032A20	10-32 X 1 1/4 HX WS SL SR	3.000 EA
35CB1501A01	CONDUIT BOX LID, MACH. - GROUP "C"MTRS	1.000 EA
RM1020A41	O-RING, -150 BUNA-N, .103 CS X 2.862 ID	1.000 EA
HW2501D13SP	KEY, 3/16 SQ X 1.375	1.000 EA
HA7000A01	KEY RETAINER 7/8" DIA SHAFT	1.000 EA

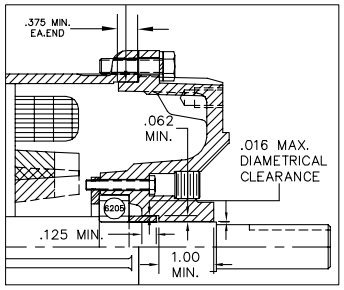
Parts List (continued)

Part Number	Description	Quantity
85XU0407S04	4X1/4 U DRIVE PIN STAINLESS	6.000 EA
LB1115	LABEL,LIFTING DEVICE	1.000 EA
LB1359	LABEL, UL/CSA "XP"	1.000 EA
MJ1000A75	GREASE, POLYREX EM EXXON	0.050 LB
35FN3002A05SP	EXFN, PLASTIC, 6.376 OD, .638 ID	1.000 EA
MG1025Z20	ACTIVATOR WILKOFAST 060.32	0.010 GA
MG1025G29	PAINT 789.205 DARK GRAY METALLIC (USE W/	0.017 GA
LB1119	WARNING LABEL	1.000 EA
LB1172A01	CUSTOM MTR CARTON LABEL LASER PRINTER	1.000 EA
LC0145B01	CONNECTION LABEL	1.000 EA
NP0977XP	BR XP UL CSA CC CL-I GP-C&D	1.000 EA
36PA1001	PACKAGING GROUP	1.000 EA

05LYF831





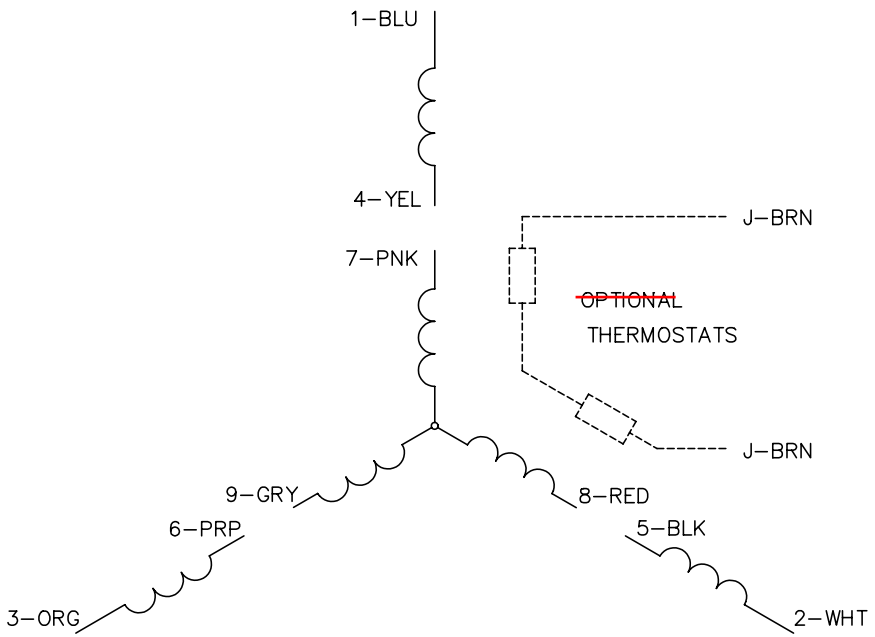


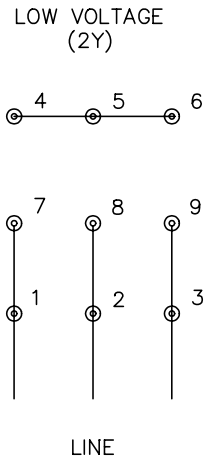
CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT BALDOR'S PRODUCT WILL PERFORM SUITABLY IN THE INTENDED APPLICATION.

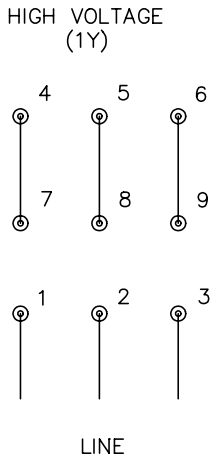
REV. DESC: NEW			BALDOR
REV. LTR: –	VERSION: 00	TDR: 000000752108	
FILE: \AAA\00192\650	REVISED: 01:43:59 06/20/2012	BY: ENALEM0	HOR 143-5TC XPFC X35M CLI GP C&D W/DRIP COVER
MTL: –			SH 1 of 1

05LYF831

CD0005





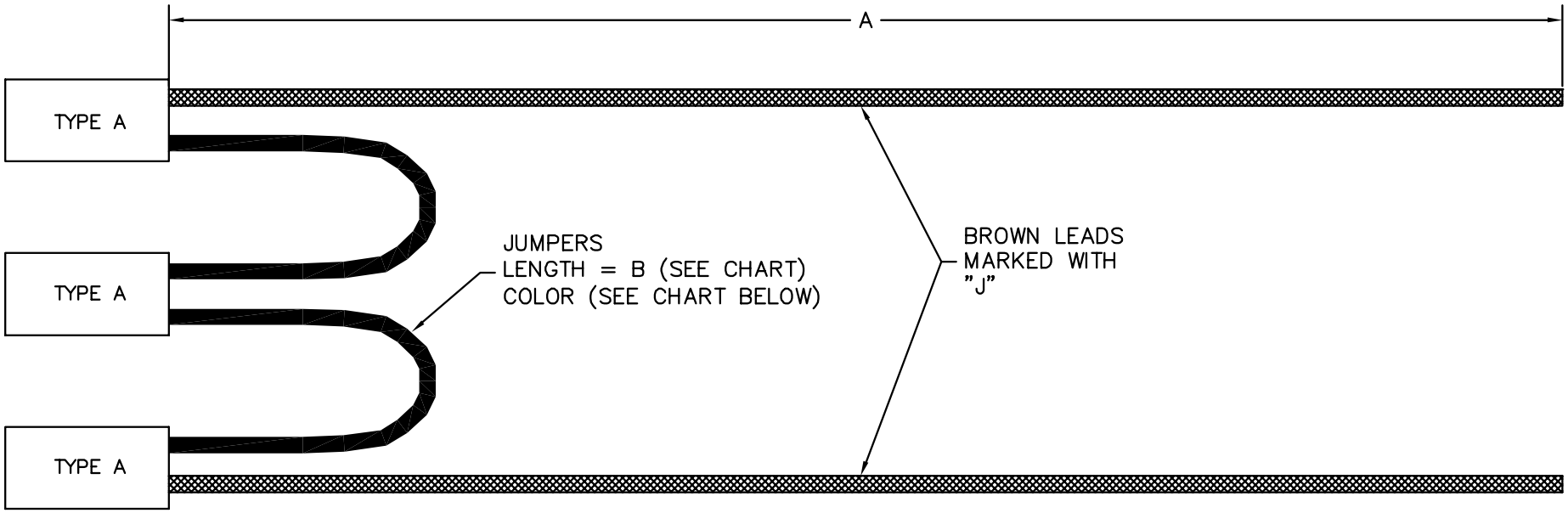


NOTES:

1. INTERCHANGE ANY TWO LINE LEADS TO REVERSE ROTATION.
2. ~~OPTIONAL~~ THERMOSTATS ARE PROVIDED WHEN SPECIFIED.
3. ACTUAL NUMBER OF INTERNAL PARALLEL CIRCUITS MAY BE A MULTIPLE OF THOSE SHOWN ABOVE.
4. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

CD0005

REV. DESC: REVISE TO SHOW OPTIONAL COLORS			BALDOR ELECTRIC Co.
REV. LTR: E	BY: JLP	REVISED: 01/19/99 10:15	TDR: 0171435
CD0005		FILE: AAA00005140	MDL: –
		MTL: –	3PH, DV, 9 LEADS



PART# SUFFIX	TEMPERATURE	JUMPER LEAD COLOR	SLEEVE MATERIAL	TI PART#	A	B	BALDOR MODEL
A01	135°C	YELLOW	.006" MYLAR	7AM034A5	28.00"	5.00"	35, 36, 37, 305, 306, 307
A02	150°C	BLACK	.006" MYLAR	7AM037A5	28.00"	5.00"	35, 36, 37, 305, 306, 307
A03	110°C	WHITE	.006" MYLAR	7AM029A5	28.00"	5.00"	35, 36, 37, 305, 306, 307

NOTES:

1. THERMOSATS: TI 7AMxxx DEVICES, NUMBER, AND TEMPERATURE SPECIFIED BY ASSEMBLY
2. ALL LEADS TO BE 18 GAGE, 150°C, 600V, XLPE
3. THERMOSTATS TO BE MARKED WITH TI PART NUMBER AND OPENING TEMPERATURE.
4. ALL LEADS TO BE UL RECOGNIZED
5. ALL LEADS TO BE CSA CERTIFIED, OR UL RECOGNIZED FOR CANADA

REV. DESC: REVISED NOTES TO MATCH UL REQUIREMENTS			BALDOR • DODGE • RELIANCE
REV. LTR: B	VERSION: 02	TDR: 000000465431	
FILE: \AAA\00106\872		REVISED: 10:58:16 05/19/2008	3 THERMOSTAT ASSEMBLY DRAWING
MTL: –		BY: ENBRAM0	SH 1 of 1

TP5050

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AC Induction Motor Performance Data

Record # 40516

Typical performance - not guaranteed values

Winding: 05WGW649	**Type:** 0532M	**Enclosure:** XPFC

Nameplate Data				General Characteristics at 460 V, 60 Hz: High Volt Connection	
Rated Output (HP)	2			Full Load Torque	6 LB-FT
Volts	208-230/460			Start Configuration	DOL
Full Load Amps	5.7-5.4/2.7			Break Down Torque	21 LB-FT
R.P.M.	1725			Pull-Up Torque	14.9 LB-FT
Hz	60	Phase	3	Locked-rotor Torque	17 LB-FT
NEMA Design Code	B	KVA Code	J	Starting Current	20.8 Amps
Service Factor	1.15			No-load Current	1.15 Amps
NEMA Nom. Eff.	86.5	P.F.	82	Line-line Res. @ 25°C.	8.18 Ohms
Rating - Duty	50C AMB-CONT			Temp. Rise @ Rated Load	37°C
S.F. Amps				Temp. Rise @ S.F. Load	46°C

Load Characteristics at 460 Volts, 60 Hz

% of Rated Load	25	50	75	100	125	150	S.F.
Power Factor	44	67	77	82	83	84	83
Efficiency	82.3	87.3	88.2	87.5	86	84	86.6
Speed	1783	1768	1751	1733	1712	1689	1720
Line Amperes	1.32	1.62	2.07	2.59	3.19	3.86	2.95

SIEMENS

Link to other documents

0.19.65

Datasheet for SIMOGEAR Geared Motors

MLFB-Ordering data: **2KJ3510-5BA05-0HD2-Z**
D14+K06+K41+L03+L50+Y00

{Y00:*AND@1755*|*ANL@1.49*}

Client order no.:
Order no.:
Offer no.:

Item no.:
Consignment no.:
Project:

Geared motor basic data

Type designation:	SIMOGEAR KAZ89-K5-(140)
Gearbox type:	Bevel gearbox
Installation size(s):	89
Application:	Standard
Light-duty sector acc. VDI 3643:	-
Transmission ratio:	129.96
Relation of number of teeth:	17155 // 132
Service factor:	-
Nominal torque:	1600 Nm
Output torque:	-
Output speed:	-
Environment temperature:	-15 ... +40°C
Specification:	CE (Europe / other countries)
Oil quantity:	6.80 l
Weight without oil:	57.0 kg
Adapter:	K5 Short adapter for NEMA motors
Permissible input torque:	13 Nm

General options

Surface treatments:	painted
Coating:	[L03] Coating for low environmental stress C2
RAL Color:	[L50] 5015 sky blue
Pretreatment:	-
Coating on Flange:	-
Conservation:	-
Rating Plate stainless steel:	-
Second rating plate:	[K41] second rating plate supplied loose
Packaging:	Standard packing
Fast lane:	-
Enclosed documentation:	-
Additional documentation (E-Mail):	-

Adapter options

Backstop:	-
Condensation drain hole:	-
Input Shaft w/o Feather Key:	-
Rotation output shaft:	-
Slip clutch with proximity switch:	-
Slip torque is set:	-
Rotating direction:	-

Gearbox options

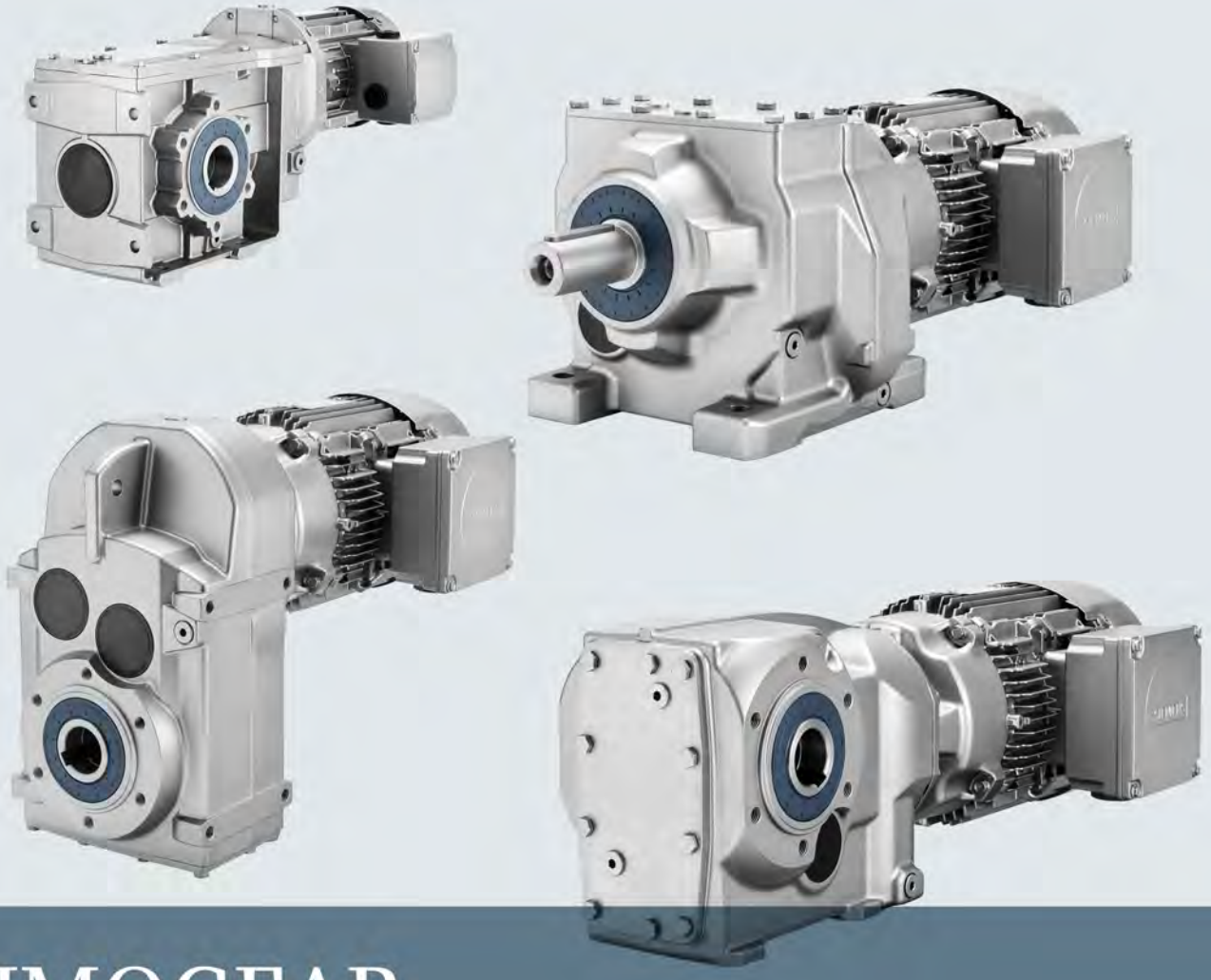
Mounting position:	[D14] M4 output side A
Special installation (Angle):	-
Permissible mount. position deviation:	-
Mount. pos. deviation (Angle):	-
Mounting type:	Housing flange
Position of torque arm:	-
Flange diameter:	-
Output flange tightened:	-
Output shaft:	H50
Output shaft bearing:	Standard bearing
Hollow shaft cover:	Sealing cap
Gear oil:	[K06] Mineral oil CLP VG220
Output shaft sealing:	Standard sealing
Gearbox breather:	Pressure breather valve
Oil level control:	Oil level screw
Electr. oil temperature monitoring:	-
Disconnector unit, 24 V param.:	-
Adapter cable USB/jacks:	-
Oil level gauge:	-
Separation switch gear:	-

Oil drain:	Oil drain plug
Housing material:	Cast iron
Backlash Design:	-
Relubrication:	-
Drywell:	-
24 V Drywell switch disconnector:	-
Flange-Figure:	-

Performance data motor

Input speed (Info):	1755 rpm
Motor power (Info):	1.49 kW

SIEMENS



SIMOGEAR

Gearbox

BA 2030

Operating instructions

Edition 04/2016

Answers for industry.

4.5 Gearbox with flange fastening

Note

Siemens AG recommends an anaerobic adhesive to enhance the friction lock between flange and mounting surface.

Table 4- 3 Thread size of the fastening bolt

Thread size	Flange	Helical gearbox D/Z	Parallel shaft gearbox F	Bevel gearbox B, K	Helical worm gearbox C
		Size			
M6	A120	19, 29, 39	29	B29	29
M8	A140, A160	19, 29, 39, 49, 59	29, 39	B29, B39, K39	39
M10	A200	39, 49, 59, 69	49	B39, B49, K49	49, 69
M12	A250, A300	59, 69, 79, 89	69, 79, 89	K69, K79, K89	89
M16	A350	89, 109, 129	109	K109	-
M16	A450	109, 129, 149, 169	129, 149	K129, K149	-
M16	A550	169, 189	169	K169	-
M20	A660	189	189	K189	-

Use screws / nuts of strength class 8.8 for gearboxes with a flange-mounted design.

Note the following exceptions:

Table 4- 4 Strength class of the fastening bolt for FF/FAF and KF/KAF

Gearbox size	Flange	Strength class for motor size										
		90	100	112	132	160	180	200	225	250	280	315
39	A160	10.9	10.9	-	-	-	-	-	-	-	-	-
49	A200	8.8	10.9	10.9	10.9	-	-	-	-	-	-	-
69	A250	8.8	8.8	8.8	10.9	-	-	-	-	-	-	-
79	A250	8.8	8.8	8.8	10.9	10.9	-	-	-	-	-	-
89	A300	8.8	10.9	10.9	10.9	10.9	10.9	-	-	-	-	-
109	A350	8.8	8.8	8.8	8.8	10.9	10.9	10.9	10.9	-	-	-
129	A450	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	-	-	-
149	A450	-	8.8	8.8	8.8	8.8	8.8	10.9	10.9	10.9	-	-
169	A550	-	-	8.8	8.8	8.8	10.9	10.9	10.9	10.9	10.9	-
189	A660	-	-	8.8	8.8	8.8	8.8	8.8	8.8	10.9	10.9	10.9

4.9 Installing and removing the shaft-mounted gearbox

4.9.1 General information on installing the shaft-mounted gearbox

NOTICE
Damage to shaft sealing rings caused by solvent
Avoid any contact of solvent or benzine with the shaft sealing rings.

NOTICE
Subjecting stress to the hollow shaft causes bearing failure
Skewing or stressing the hollow shaft increases the loading. This can cause bearing failure.
The hollow shaft must be flush with the machine shaft to avoid misalignment.
Do not subject the hollow shaft to axial and radial stress.

NOTICE
For shrink disks: **Lubricants in the area between the hollow shaft and machine shaft impair torque transmission**
Keep the bore in the hollow shaft and the machine shaft completely grease-free.
Do not use impure solvents and soiled cleaning cloths.

Note

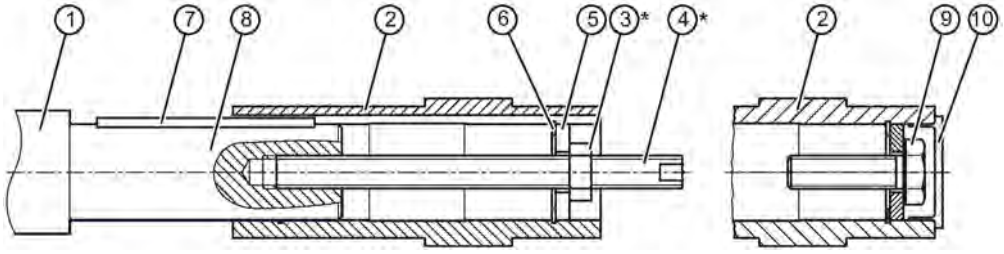
Coat the contact surfaces with the mounting paste supplied with the product or any suitable lubricant to prevent frictional corrosion.

Note

Observe the permissible concentricity tolerance of the cylindrical shaft extension of the machine shaft to the housing axle according to DIN 42955.

4.9.2 Hollow shaft with parallel key

4.9.2.1 Mounting the hollow shaft with parallel key



* Not included in scope of supply

①	Machine shaft	⑥	Circlip
②	Hollow shaft	⑦	Parallel key
③	Hexagon nut	⑧	Mounting paste
④	Threaded spindle	⑨	Bolt
⑤	Disk	⑩	Sealing caps

Image 4-4 Mounting the hollow shaft with parallel key

Instead of the nut and threaded spindle shown in the diagram, other types of equipment such as hydraulic lifting equipment may be used.

Procedure

1. Using benzine or a solvent, remove the anti-corrosion protection from the shaft ends and flanges.
2. Check the seats or edges of the hollow and machine shafts for damage. Contact Technical Support if you notice any damage.
3. Apply the mounting paste provided ① to the machine shaft ⑧. Apply the paste uniformly.
4. Fit the gearbox using the disk ⑤, threaded spindle ④ and nut ③. Support is provided by the hollow shaft ②.
5. Replace the nut ③ and the threaded spindle ④ with a screw ⑨. Tighten the bolts ⑨ to the specified torque.
6. Close the open hollow shaft end using a sealing cap ⑩.

You have mounted the hollow shaft with feather key.

Table 4- 6 Tightening torque for the screw

Thread size	M5	M6	M8	M10	M12	M16	M20	M24	M30
Tightening torque [Nm]	5	8	8	14	24	60	120	200	400

4.9.2.2 Removing the hollow shaft with parallel key

⚠ WARNING

Inadequately secured gearbox or geared motors can free themselves

Before driving out the machine shaft, fasten a suitably dimensioned means of absorbing load to the gearbox.

Slightly pretension the pulling equipment so that the gearbox does not drop onto it when the insert shaft is released.

NOTICE

Subjecting stress to the hollow shaft causes bearing failure

It is essential to prevent misalignment when removing the unit.

NOTICE

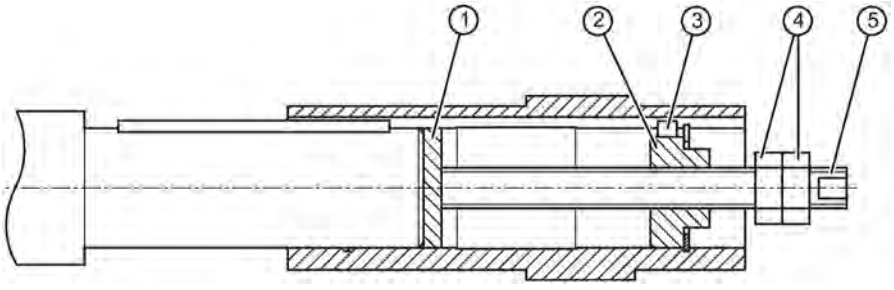
Excessive forces during removal

Excessive forces can occur during removal of the hollow shaft via the housing.

Stresses in the hollow shaft can lead to bearing failure and damage to the gearbox housing.

Note

If frictional corrosion has occurred on the seat surfaces, use rust solvent to facilitate the removal of the gearbox. Allow an adequately long time for the rust solvent to take effect.



Items ① to ⑤ are not included in the scope of supply.

① Disk
② Threaded block
③ Parallel key
④ Hexagon nut
⑤ Leadscrew

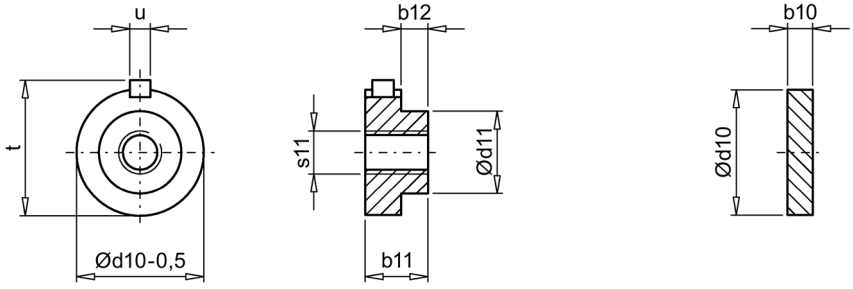
Image 4-5 Removing the hollow shaft with parallel key

Procedure

1. Remove the axial locking element from the hollow shaft.
2. Drive out the machine shaft using the disk ①, threaded block ②, feather key ③, threaded spindle ⑤ and hexagon nuts ④.

You have now removed the hollow shaft with parallel key.

Design suggestion for threaded block and disk



Gearbox	Size	Hollow shaft Ø	b10	b11	b12	d10	d11	s11	t_{max}	u
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
B	19	20	3	15	10	19.9	10	M6	22.5	6
B, C	29	20	3	15	10	19.9	10	M6	22.5	6
B, F	29	25	3	15	10	24.9	16	M10	28	8
C	39	25	3	15	10	24.9	16	M10	28	8
B, K, F, C		30	6	15	10	29.9	18	M10	33	8
B		35	6	15	10	34.9	24	M12	38	10
B		40	6	15	10	39.9	28	M16	43	12
C	49	30	6	15	10	29.9	18	M10	33	8
K, F, C		35	6	15	10	34.9	24	M12	38	10
B		40	6	15	10	39.9	28	M16	43	12
K, F, C	69	40	6	20	9	39.9	28	M16	43	12
C		45	6	20	9	44.9	36	M16	48	14
K, F	79	40	6	20	9	39.9	28	M16	43	12
K, F, C	89	50	7	20	10	49.9	36	M16	53.5	14
C		60	7	20	10	59.9	45	M20	64	18
K, F	109	60	10	24	14	59.9	45	M20	64	18
K, F	129	70	10	24	14	69.9	54	M20	74.5	20
K, F	149	90	10	24	14	89.9	72	M20	95	25
K, F	169	100	10	30	15	99.9	80	M24	106	28
K, F	189	120	10	30	15	109.9	80	M24	127	32

8.2 Checking and changing lubricants

8.2.1 General safety notes

⚠ WARNING

Danger of scalding from the hot oil emerging from the unit

Before starting any work wait until the oil has cooled down to below +30 °C.

⚠ WARNING

Risk of slipping on oil

Remove any oil spillage immediately with an oil-binding agent in compliance with environmental requirements.

NOTICE

Damage to the gearbox caused by incorrect oil quantities

The oil quantity and the position of the sealing elements are determined by the mounting position.

After removing the oil level screw, the oil level may not be below the specified fill level.

NOTICE

Damage to the gearbox due to open oil holes

Dirt and damaging atmosphere can penetrate through open oil holes.

Close the gearbox immediately after checking the oil level or changing the oil.

Note

Information about oil

Refer to the rating plate for the type of oil, oil viscosity and quantity of oil required.

For oil compatibility, see Recommended lubricants (Page 74).

Note

Gearbox sizes 19 and 29

Gearbox sizes 19 and 29 are lubricated for life. There is no opening to check the oil level. An oil change is not required.

In mounting positions M2 and M4 the gearboxes are equipped with a breather valve.

C29 has a breather valve in all mounting positions.

Note

Tandem gearbox - intermediate helical gearbox

- In a horizontal operating position the bulging part of the housing of the intermediate helical gearbox generally faces vertically downwards.
- The oil quantity is specified for every individual gearbox and is valid for the standard mounting position.
- Perform the following work for each individual gearbox:
  - Check the oil level.

    On the main gearboxes D/Z, F, K it is not possible to check the oil level in mounting position M4. The oil level is above the oil level bore so that the bearings above it are lubricated.
  - Check the oil quality.
  - Change the oil.
  - Fill in oil and top it up.

Note

Gearbox in special mounting position

The gearbox is intended for a specific rotation angle and is delivered with the correct quantity of oil for this purpose.

It is not possible to check the oil level. You will find information regarding oil quantity and type of oil on the rating plate.

When draining the oil a higher residual quantity of oil may remain in the gearbox. When you carry out an oil change remove any residual oil.

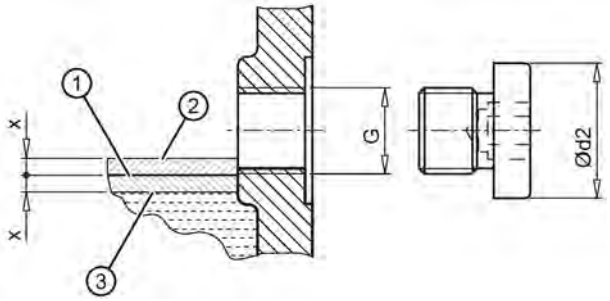
8.2.2 Checking the oil level

NOTICE

The volume of gearbox oil changes with temperature

If the temperature rises, the volume increases. Where temperature differences and filling quantities are significant, the volume difference can amount to several liters.

The oil level must therefore be checked while still slightly warm, approximately 30 minutes after switching off the drive unit.



① Specified oil level
② Maximum oil level
③ Minimum oil level

Image 8-1 Oil level in the gearbox housing

Table 8- 2 Minimum and maximum fill levels x

Oil level hole	Ød2	Fill level x	Tightening torque
	[mm]	[mm]	[Nm]
G 1/8"	14	2.5	10
G 1/4"	18	3	10
G 3/8"	22	4	25
G 3/4"	32	7	50

Procedure

1. Switch off the power supply to the drive unit.
2. Unscrew the oil level screw, see Mounting positions (Page 87). Oil escapes if the maximum fill level is above the plug hole.
3. Check the oil level. Observe the fill level x.
4. Top up the oil level if necessary and check it again.
5. Check the state of the sealing ring on the sealing element. If the sealing ring is damaged, replace the sealing element with a new one.
6. After checking, seal the gearbox immediately using the sealing element.

You have now checked the oil level in the gearbox housing.

8.2.3 Checking the oil level using the oil sight glass (optional)

If there is an oil sight glass to check the oil level ①, the oil must be visible in the center of the sight glass when the oil is cool. When the oil is hot, the oil level ① is above the center of the sight glass. The oil level ① of cold oil is below the center of the sight glass.

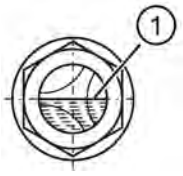


Image 8-2 Oil level in the oil sight glass

Top up the oil level ① if necessary, and check it again.

8.2.4 Checking the oil quality

Visible signs show effects on the oil. Fresh oil is clear to the eye, and has a typical smell and a specific product color. Clouding or a flocculent appearance indicates water and / or contamination. A dark or black color indicates residue, serious thermal decomposition or contamination.

Observe the symbols in the diagrams of the Mounting positions (Page 87):

Venting

Oil level

Procedure

1. Allow the geared motor to run for a short time. Wear and contaminant particles are visible in the oil shortly after shutting down.
2. Switch off the power supply to the drive unit.
3. Unscrew the sealing element at one of the points marked with the symbols listed above.
4. Remove some oil, using a suction pump and a flexible hose, for example.
5. Check the state of the sealing ring on the sealing element. When required, replace the sealing ring.
6. Seal the gearbox with the sealing element.
7. Check the oil for abnormalities. Change the oil immediately if you determine any abnormalities, see Changing the oil (Page 67).

You have now checked the oil quality.

8.2.5 Changing the oil

8.2.5.1 General safety notes for changing the oil

NOTICE

Impermissible mixing of oils leads to damage

Impermissible mixing of oils leads to:

- Darkening
- Sediment
- Foam formation
- Change of the viscosity or reduced corrosion protection
- Wear protection.

When changing oil of the same type, the residual volume of oil in the gearbox should be kept as low as possible. Generally speaking, a small residual volume will cause no particular problems.

Gear oils of different types and by different manufacturers must not be mixed. Have the manufacturer confirm that the new oil is compatible with the remaining volume of used oil.

If very different types of oil or oils with very different additives are changed, always flush out the gearbox with the new oil. When changing from mineral oil to polyglycol oil (PG) or vice versa, it is vital to flush the gearbox twice. All traces of old oil must be completely removed from the gearbox.

NOTICE

Contaminations of the oil impair the lubricity

Do not mix the gearbox oil with other substances.

Do not flush with paraffin or other solvents, as traces of these substances will always remain inside the gearbox.

Note

The oil must be warm because insufficient viscosity caused by oil that is too cold impairs correct emptying.

If necessary, run the gearbox for 15 to 30 minutes to become warm.

8.2.5.2 Draining the oil

Observe the symbols in the diagrams of the Mounting positions (Page 87):


Venting


Oil level


Oil drain

Procedure

1. Switch off the power supply to the drive unit.
2. Unscrew the vent plug.
3. Place a suitable and sufficiently large receptacle underneath the oil drain plug.
4. Remove the oil drain plug. Drain all the oil into the receptacle.
5. Check the state of the sealing ring on the sealing element. If the sealing ring is damaged, replace the sealing element with a new one.
6. After draining the oil, seal the gearbox immediately using the sealing element.

You have now drained the oil from the gearbox.

8.2.5.3 Flushing the gearbox when changing between incompatible oils

⚠ WARNING

Impermissible mixing of oils leads to damage

Residual quantities of original oil can impair the specific properties of the new oil.

A flushing process is required with biodegradable and physiologically safe oils.

The residual corrosion protection oil must amount to no more than 1% of the operating oil volume.

Note

Polyglycol oil has a higher density than mineral oil. Therefore, it sinks down towards the oil drain and the mineral oil floats on top.

This makes the required complete draining of mineral oil from the gearbox extremely difficult.

Note

After the second flush, we recommend that an appropriate analysis institute checks the quality of the flushed fluid.

Observe the symbols in the diagrams of the Mounting positions (Page 87):

Venting

Oil drain

Procedure

1. After the oil has been drained, wipe the gearbox clean of any remaining mineral oil using a cloth.
2. Unscrew the vent plug.
3. Fill the gearbox with a flushing oil, using a filter (filter mesh max. 25 µm). For the flushing oil, use either the new oil or one that is compatible with the new oil and is less expensive.
4. Operate the gearbox for 15 to 30 minutes under a low load.
5. Place a suitable and sufficiently large receptacle underneath the oil drain plug.
6. Remove the oil drain plug. Drain all the oil into the receptacle.
7. After flushing, immediately seal the gearbox using the sealing element.
8. Repeat this step for the second flushing.

You have now flushed the gearbox twice and can pour in the new oil.

8.2.5.4 Filling in oil

NOTICE
Mixing of different oils impairs the lubricity
When adding oil, use the same oil type and viscosity. If changing mutually incompatible oils, see Flushing the gearbox (Page 68).

Observe the symbols in the diagrams of the Mounting positions (Page 87):

Venting

Procedure

1. Unscrew the vent plug.
2. Fill the gearbox with fresh oil. Use a filler filter with mesh of max. 25 µm.
3. Check the oil level.
4. Top up the oil level if necessary and check it again.
5. Check the state of the sealing ring on the sealing element. If the sealing ring is damaged, replace the sealing element with a new one.
6. After filling with oil, seal the gearbox immediately using the sealing element.

You have now filled up the gearbox with oil.

8.2.6 Topping up with oil

If the mounting position of the gearbox is changed or oil lost because of leakage, check the oil level. If you notice oil escaping, locate the leak and seal the affected area. Top up and check the oil level.

At the time of going to print, the following types of oil are being used when the gearbox is filled for the first time:

CLP ISO VG220: Castrol Alpha SP 220

CLP ISO PG VG220: Castrol Tribol / Optigear Synthetic 1300/220

CLP ISO PG VG460: Castrol Tribol / Optigear Synthetic 1300/460

CLP ISO PAO VG68: Addinol Eco Gear 68S-T

CLP ISO PAO VG220: Addinol Eco Gear 220S

CLP ISO E VG220: Fuchs Plantogear Bio 220S

CLP ISO H1 VG100: Klüber Klübersynth UH1 6 100

CLP ISO H1 VG460: Castrol Tribol Foodproof / Optilep GT 1800/460

If, following agreement, the gearbox is filled at the factory with special lubricant for the special applications referred to above, the lubricant must be shown on the rating plate.

8.2.7 Change the roller bearing grease

The roller bearings are lubricated in the factory with the greases listed in the table.

Renew the grease quantify for grease-lubricated bearings with each oil change.

Clean the bearing before filling it with fresh lubricant.

In the case of bearings on the output shaft or intermediate shafts, the grease quantity must fill 2/3, and in the case of bearings on the input side, 1/3 of the space between the rolling elements.

Table 8- 3 Roller-bearing and shaft-sealing-ring grease

Fields of application	Ambient temperature	Manufacturer	Type
Standard	-40 °C to +80 °C	Klüber	Petamo GHY 133 N
Foodstuff-compatible for the food industry	-30 °C to +40 °C	Castrol	Obeen UF F2 NSF H1 / Optileb GR UF 2 NSF H1
Biologically degradable, for agriculture, forestry and water industries	-35 °C to +40 °C	BP	Biogrease EP 2

8.2.8 Service life of the lubricants

Note

In case of ambient conditions deviating from normal conditions, e.g. high ambient temperatures, high relative humidity, aggressive ambient media, the intervals between changes should be shorter. In such cases, contact Technical Support for assistance in determining the individual lubricant change interval.

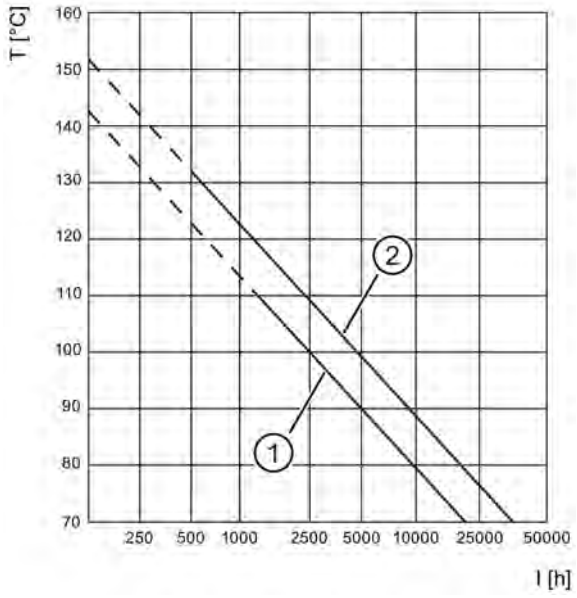
Note

Oil sump temperatures above +80 °C can reduce service life. A temperature increase by 10 K halves the service life by the amount as shown in the figure titled "Guide values for oil change intervals".

For a +80 °C oil sump temperature, the following service life can be expected when observing the properties specified by Siemens AG:

Table 8- 4 Service life of the oils

Type of oil	Service life
Mineral oil	10 000 operating hours or 2 years
Biodegradable oil	
Physiologically safe oil according to USDA-H1/-H2	
Synthetic oil	20 000 operating hours or 4 years



① Mineral oil
② Synthetic oil
T Oil-bath steady-state temperature [°C]
I Oil change interval in operating hours [h]

Image 8-3 Guide values for oil change intervals

Grease service life of roller bearing greases

Roller bearings and the clearance in front are filled with sufficient grease.

Under approved operating conditions and ambient temperatures, no regreasing is required.

We recommend that the grease in the bearings is also renewed when the oil or shaft sealing rings are replaced.

8.2.9 Recommended lubricants

⚠ DANGER

Used lubricants only have conditional approval

The used lubricants are not or only conditionally approved for use in the foodstuff or pharmaceutical industry.

Use only lubricants with USDA (United States Department of Agriculture) H1 / H2 approval for deployment in the foodstuff or pharmaceutical industry.

The released and recommended lubricants are listed in the T 7300 Operating Instructions.

NOTICE

Incorrect operating temperatures impair the lubricity of the gearbox oil

Operating temperatures outside the permitted range impair the lubricating property of the gearbox oil.

The temperature ranges are listed in the T 7300 Operating Instructions, Gearbox Lubrication. If you are working outside the specified temperature ranges, please contact Technical Support for advice on which oil to use.

If the housing temperature exceeds a value of +80 °C, please contact Technical Support.

Note

As standard, the lubricants and shaft seals are harmonized and coordinated with one another corresponding to the prevailing operating conditions.

Contact Technical Support for:

- Change of the operating conditions
- Change in oil grade
- Deployment of new shaft seals.

Note

The lubricants used are not at all or only conditionally biodegradable. If biologically degradable lubricants are required, use only gearbox lubricants with the appropriate classification listed in the T 7300 Operating Instructions.

Note

These recommendations are not a guarantee of the lubricant quality provided by your supplier. All lubricant manufacturers are responsible for the quality of their own products.

The oil viscosity is decisive for the oil selection (ISO VG class). The viscosity is specified on the rating plate of the gearbox. The viscosity class indicated applies for the contractually agreed operating conditions.

In the case of different operating conditions, please contact Technical Support.

If, following agreement, the gearbox is filled at the factory with special lubricant for the special applications referred to above, the lubricant is shown on the rating plate.

The quality of the oil used must comply with the requirements laid down in the BA 7300 Operating Instructions; otherwise, the Siemens warranty is null and void. We recommend the use of an approved gearbox lubricant specified in the T 7300 (http://support.automation.siemens.com/WW/view/en/44231658) Operating Instructions. These oils have been tested appropriately and satisfy the requirements.

The oils listed in the operating instructions are subject to continuous testing. It is possible that the oils recommended in the operating instructions are at a later point in time removed or replaced by oils that have been further developed.

We recommend that you regularly check as to whether the selected lubricating oil is still recommended by Siemens. Otherwise change the product.

8.3 Replace bearings

The bearing service life depends greatly on the operating conditions and so cannot be calculated reliably. In the operating conditions specified by the operator, bearing life can be calculated and indicated on the rating plate. If no information is given, changes in vibration and noise pattern can serve as an indicator that an immediate bearing replacement is necessary.

10.5 Mounting positions

10.5.1 General notes on mounting positions

Only operate the gearbox in the mounting position specified on the rating plate. This ensures that the correct quantity of lubricant is provided. The symbols are shown for the standard mounting position.

Note

Gearbox sizes 19 and 29

Gearbox sizes 19 and 29 are lubricated for life. There is no opening to check the oil level.

In mounting positions M2 and M4 the gearboxes are equipped with a breather valve.

C29 has a breather valve in all mounting positions.

Description of the symbols:

Venting

Oil level

Oil drain

A, B Position of insert shaft / solid shaft

* On opposite side

② Two-stage gearbox

③ Three-stage gearbox

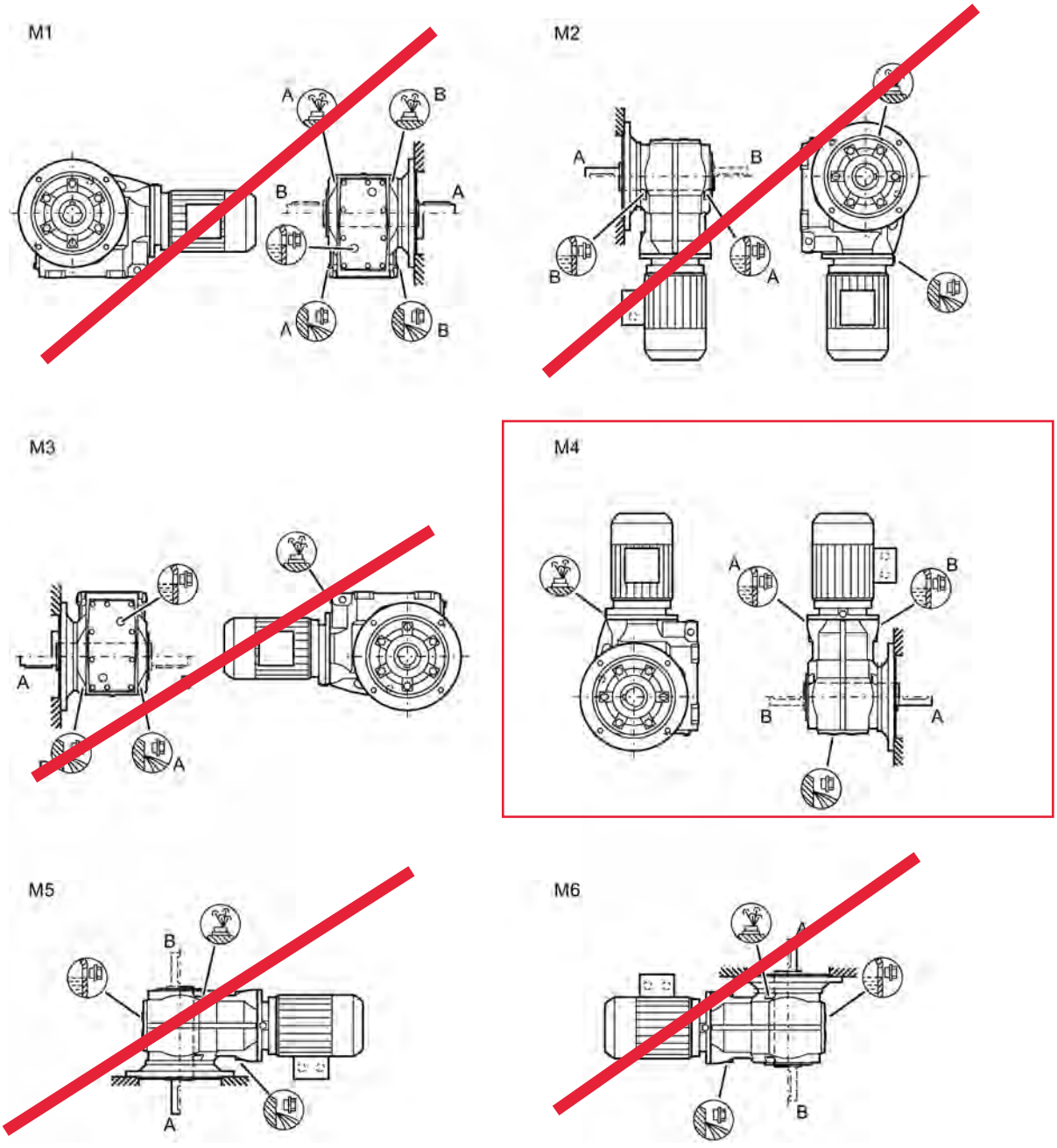


Image 10-23 Mounting positions for bevel gearbox K.F flange-mounted design and KAZ with housing flange, sizes 39 - 189

10.6.2 Parallel shaft gearbox

Table 10- 4 Oil quantities [l] for FD/Z, FD/ZZ, FD/ZA., FD/ZAF., FD/ZAZ., FD/ZAD., sizes 29 - 189

Type	Mounting position					
	M1	M2	M3	M4	M5	M6
FD.29	0.6	0.8	0.35	0.6	0.45	0.45
FD.39	0.95	1.1	0.7	1.2	0.8	0.8
FD.49	2.1	2.3	1.5	2.3	1.5	1.5
FD.69	2.2	2.7	1.6	2.7	1.8	1.8
FD.79	3	3.8	2.7	3.9	2.6	2.7
FD.89	5.6	7.6	5.9	7.8	5.1	5.2
FD.109	9.5	13	9.2	11.8	8.5	8.5
FD.129	16.1	20	16.3	23.5	14.9	15
FD.149	24.5	32.5	23	34	21.5	22
FD.169	39	50	37	54	34.5	35.5
FD.189	64	74	48	77	51.5	52
FZ.29	0.6	0.9	0.4	0.7	0.5	0.45
FZ.39	0.95	1.3	0.8	1.4	0.9	0.85
FZ.49	1.6	2.5	1.6	2.5	1.6	1.6
FZ.69	2.2	2.8	1.6	2.9	1.9	1.9
FZ.79	2.8	4.1	2.9	4.2	2.7	2.9
FZ.89	4.9	7.7	5.9	8.4	5.2	5.5
FZ.109	9.1	13.7	9.4	13.1	9	9.3
FZ.129	15.6	21.5	16.7	25	15.6	16.3
FZ.149	23.5	34	24	37	22.5	24
FZ.169	38	54	37.5	59	36.5	38.5
FZ.189	57	77	50	80	52.5	54

Table 10- 5 Oil quantities [l] for FD/ZF, sizes 29 - 189

Type	Mounting position					
	M1	M2	M3	M4	M5	M6
FDF29	0.6	0.8	0.35	0.6	0.45	0.45
FDF39	1	1.2	0.75	1.3	0.8	0.85
FDF49	2.2	2.3	1.5	2.4	1.6	1.5
FDF69	2.4	2.8	1.6	2.9	1.9	1.9
FDF79	3.1	3.9	2.7	4	2.7	2.6
FDF89	5.8	7.6	5.8	8	5.2	5.2
FDF109	9.7	13	9.2	12	8.6	8.6
FDF129	16.4	20	16.3	23.5	15.1	15.2
FDF149	25	32.5	23	35	22	22.5
FDF169	40.5	50	37	56	35.5	36.5

Type	Mounting position					
	M1	M2	M3	M4	M5	M6
FDF189	60	74	48	79	5[illegible]	53
FZF29	0.6	0.9	0.4	0.7	0.5	0.45
FZF39	1	1.4	0.85	1.[illegible]	0.95	0.9
FZF49	1.8	2.4	1.5	2.6	1.6	1.6
FZF69	2.4	2.9	1.[illegible]	3.1	2	2
FZF79	2.9	4.2	2.9	4.3	2.9	2.8
FZF89	5.1	7.7	5.8	8.6	5.3	5.4
FZF109	9.2	13.7	9.4	13.3	9.1	9.4
FZF129	16	21.5	16.7	25.5	15.[illegible]	16.5
FZF149	24	34	24	38	23	24.5
FZF1[illegible]9	39.5	54	37.5	61	37.5	39.[illegible]
FZF189	60	77	50	82	53.5	55

10.6.3 Bevel gearbox

Table 10- 6 Oil quantities [l] for B., sizes 19 - 49

Type	Mounting position					
	M1	M2	M3	M4	M5	M6
B.19	0.15	0.3	0.4	0.5	0.3	0.[illegible]3
B.29	0.[illegible]25	0.55	0.7	0.85	0.55	0.5
B.39	0.5	0.95	1.3	1.6	0.95	0.9
B.49	1	1.7	2.4	3.1	1.[illegible]	1.5

Table 10- 7 Oil quantities [l] for K, KA, KAS, KAT, sizes 39 - [illegible]89

Type	Mounting position					
	M1	M2	M3	M4	M5-A M6-B	M6-A M5-B
K.39	0.35	0.85	1.1	1.[illegible]2	0.85	0.9
K.49	0.55	1.4	1.8	1.9	1.5	1.6
K.69	0.75	2	2.5	2.7	2.2	2.2
K.79	1	2.2	2.9	3.4	2.7	2.5
K.89	1.9	4.5	6	6.8	5	5.3
K.109	3	7.2	9.2	10.5	7.1	7.5
K.129	5.2	13.4	16.6	19.5	13.2	13.6
K.149	9.3	21	28	33	21.5	22.[illegible]
K.16[illegible]	17	31	47	57.5	35.5	38.5
K.189	24.5	53	73	87	53.5	59

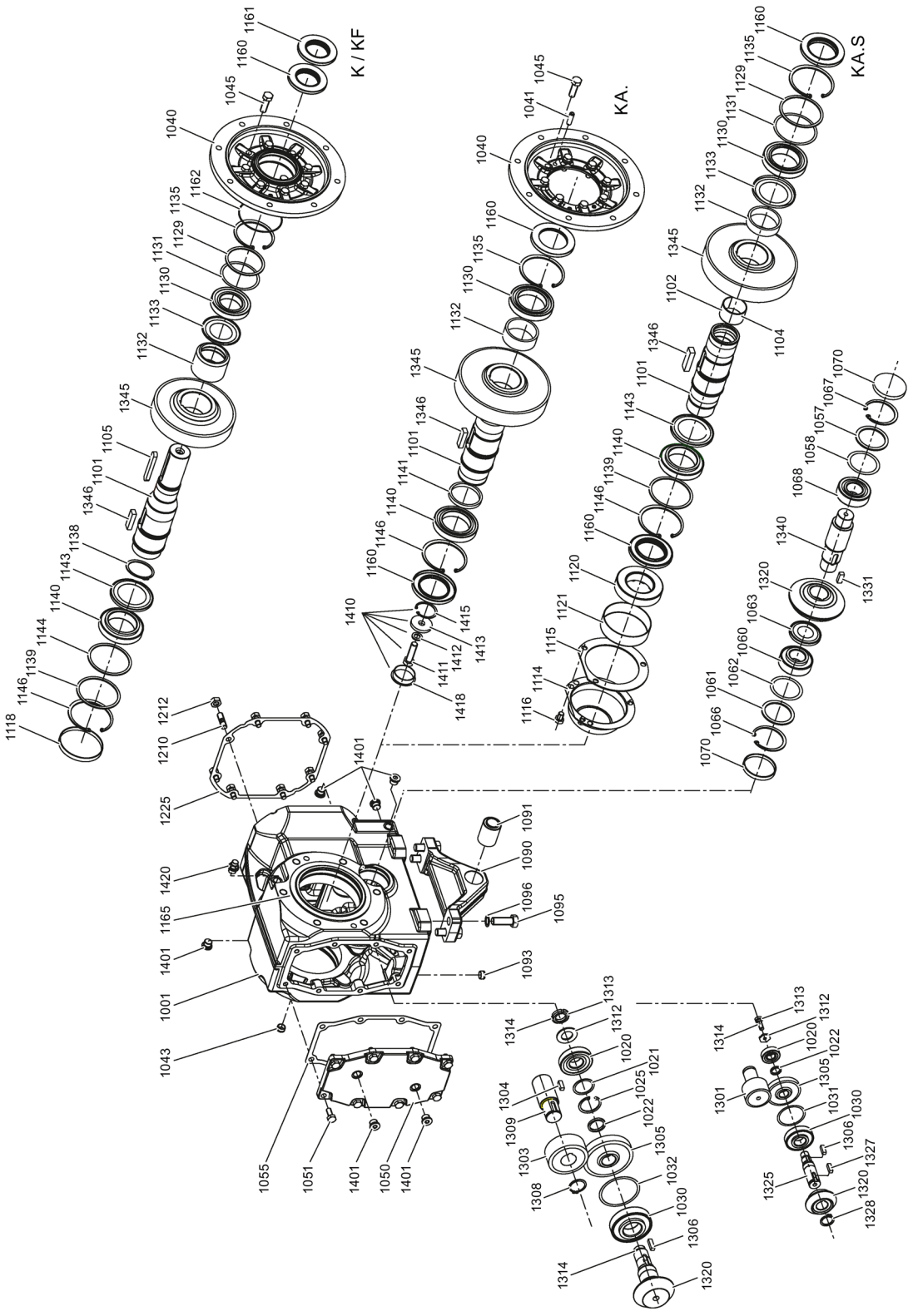
Table 10- 8 Oil quantities [l] for KZ, KAF., KAZ., KAD., sizes 39 - 189

Type	Mounting position					
	M1	M2	M3	M4	M5-A M6-B	M6-A M5-B
K.39	0.4	0.9	1.2	1.3	0.95	0.95
K.49	0.65	1.5	1.9	2.2	1.6	1.6
K.69	0.85	2.1	2.8	3.2	2.4	2.5
K.79	1.1	2.4	3.1	3.7	2.5	2.7
K.89	2.2	4.7	6.2	7.3	5.3	5.6
K.109	3.7	7.4	9.6	11.7	7.6	8.2
K.129	6.5	13.5	17.5	20.5	13.8	14.2
K.149	9.6	21.5	29	34.5	22.5	23.5
K.169	17	31	47	57.5	35.5	38.5
K.189	24.5	53	73	87	53.5	59

Table 10- 9 Oil quantities [l] for KF, sizes 39 -189

Type	Mounting position					
	M1	M2	M3	M4	M5-A M6-B	M6-A M5-B
KF39	0.35	0.9	1.2	1.3	0.95	1
KF49	0.6	1.4	2	2.2	1.6	1.7
KF69	0.85	2	2.8	3.1	2.4	2.4
KF79	1.2	2.3	3.1	3.8	3	2.5
KF89	2.1	4.6	6.5	7.6	5.6	5.5
KF109	3.6	7.4	9.8	11.7	8.1	7.8
KF129	6.7	13.9	18.1	21.5	14.4	14.8
KF149	9.7	22	30.5	36	23	24
KF169	16.9	30.5	48.5	59.5	36.5	39
KF189	24.5	54	76	90	56	60

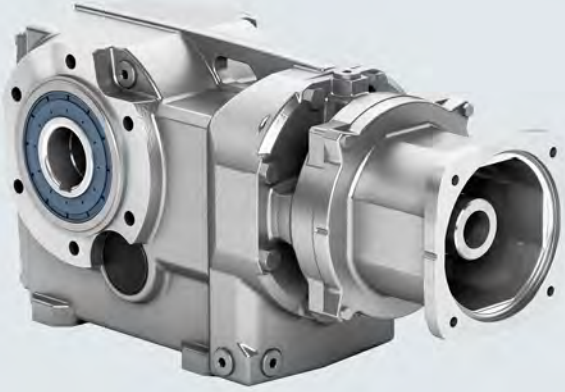
11.2.4 Bevel gearbox K, sizes 39 - 189



1001 Gearbox housing
1020 Bearing
1021 Supporting disk / shim
1022 Supporting disk / shim
1025 Locking ring
1030 Bearing
1031 Supporting disk
1032 Shim
1040 Output flange
1041 Pin
1043 Plug
1045 Bolt
1050 Housing cover
1051 Bolt
1055 Seal
1057 Supporting disk
1058 Shim
1060 Tapered roller bearing
1061 Supporting disk
1062 Shim
1063 NILOS ring
1066 Locking ring
1067 Locking ring
1068 Tapered roller bearing
1070 Sealing cap
1090 Torque arm
1091 Rubber bush
1093 Plug
1095 Bolt
1096 Screw lock
1101 Output shaft
1102 Bushing
1104 Seal
1105 Parallel key
1114 Cover NDE
1115 Seal
1116 Bolt
1118 Plug / sealing cap
1120 Shrink disk
1121 Protective cap
1129 Supporting disk
1130 Bearing
1131 Shim
1132 Supporting disk / shim
1133 NILOS ring
1135 Locking ring
1138 Locking ring
1139 Supporting disk
1140 Bearing
1141 Supporting disk / shim
1143 NILOS ring
1144 Supporting disk / shim
1146 Locking ring
1160 Shaft sealing ring
1161 Shaft sealing ring
1162 O ring
1165 Seal
1210 Bolt
1212 Nut
1225 Seal
1301 Plug-in pinion
1303 Slip-on pinion
1304 Parallel key
1305 Helical
1306 Parallel key
1308 Locking ring
1309 Seal
1312 Disk
1313 Screw / nut
1314 Screw lock
1320 Bevel gear pair
1325 Pinion shaft
1327 Parallel key
1328 Locking ring
1331 Parallel key
1340 Pinion shaft
1345 Helical
1346 Parallel key
1401 Screw plug
1410 Mounting accessories
1411 Bolt
1412 Locking ring
1413 Disk
1415 Locking ring
1418 Sealing cap
1420 Vent filter

Image 11-5 Bevel gearbox K, sizes 39 - 189

SIEMENS



SIMOGEAR

Adapter for gearbox

BA 2039

Operating instructions

Edition 04/2016

Answers for industry.

3.3 Thread sizes and tightening torques for fastening bolts

The general tolerance for the tightening torque is 10 %. The tightening torque is based on a friction coefficient of μ = 0.14.

Table 3- 1 Tightening torques for fastening bolts

Thread size	Tightening torque for strength class		
	8.8	10.9	12.9
	[Nm]	[Nm]	[Nm]
M4	3	4	5
M5	6	9	10
M6	10	15	18
M8	25	35	41
M10	50	70	85
M12	90	120	145
M16	210	295	355
M20	450	580	690
M24	750	1 000	1 200
M30	1 500	2 000	2 400
M36	2 500	3 600	4 200

3.4 Mounting an input or output element on the gearbox shaft

⚠ WARNING

Risk of burns caused by hot parts

Do not touch the gearbox without protection.

NOTICE

Damage to shaft sealing rings caused by solvent

Avoid any contact of solvent or benzine with the shaft sealing rings.

NOTICE

Damage to shaft sealing rings caused by heating

Use thermal shields to protect shaft sealing rings from heating above 100 °C due to radiant heat.

3.5.2 Mount the standard motor to the K4 or K5 short adapter

ATEX version gearboxes

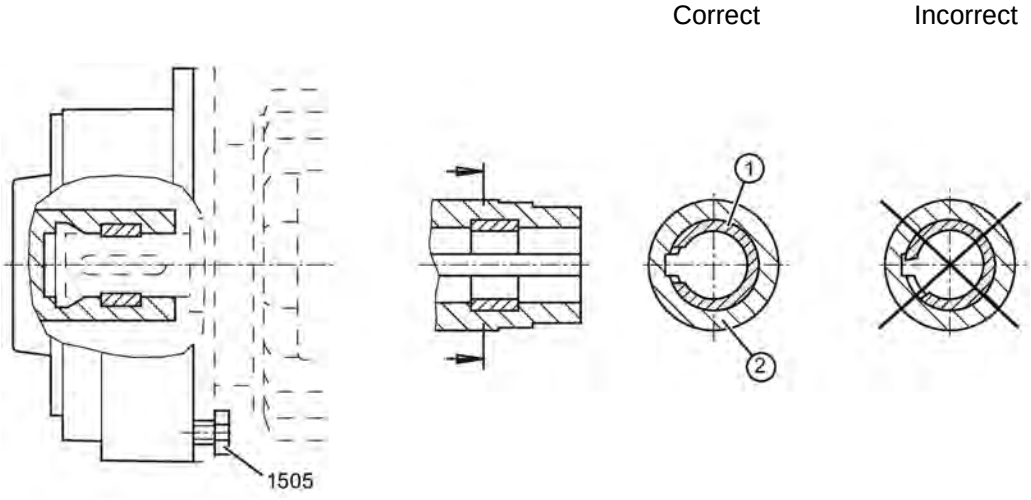
Impacts can cause sparks.

Apply adhesive (medium strength, e.g. Loctite 243) to the bolts 1505.

Note

Ensure that the plastic ring ① is located in the correct position.

The plastic ring ① prevents fretting rust. It does not need to be greased.



① Plastic ring
② Shaft
1505 Bolt

Image 3-4 Plastic ring for K4 and K5

Procedure

1. Check the correct position of the plastic ring ① in the shaft. Correct the position if required.
2. Align the position of the motor shaft so that you can insert it in the shaft ②. The shafts do not need to be greased.
3. Apply adhesive (medium strength, e.g. Loctite 243) to the bolts 1505.
4. Fasten the motor with the bolts 1505 with the prescribed torque. See Thread sizes and tightening torques for fastening bolts (Page 17).

You have mounted the standard motor on the K4 or K5 adapter.

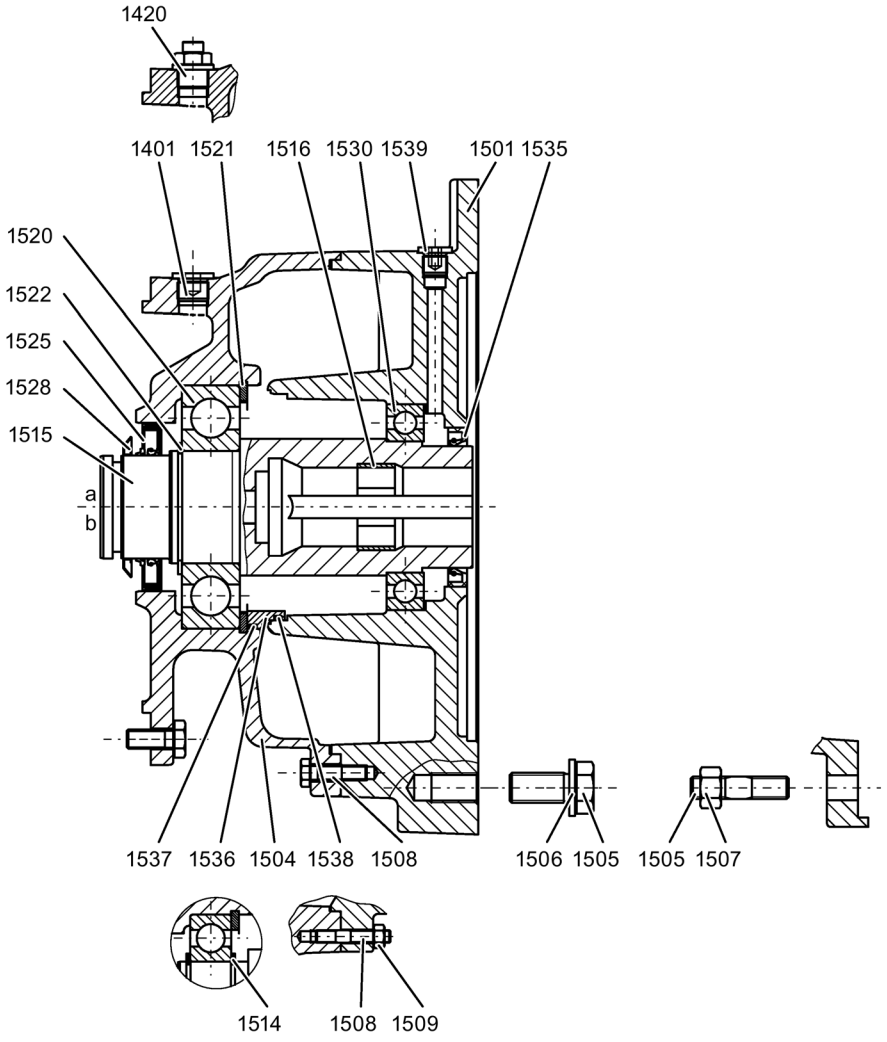
Table 3- 4 Adapter K4

Coupling size	**63**	**71**	**80**	**90**	**100**	**112**	**132**	**160**	**180**	**200**	**225**	**250**
Bolt 1505	M8	M8	M10	M10	M12	M12	M12	M16	M16	M16	M16	M16

Table 3- 5 Adapter K5

Coupling size	**56**	**140**	**180**	**210**	**250**	**280**	**320**	**360**
Bolt 1505	3/8"	3/8"	1/2"	1/2"	1/2"	1/2"	5/8"	5/8"
T_A for 1505 [Nm]	31	31	75	75	75	75	150	150

6.2.2 K4 and K5 short adapters with plug-in connection



1401	Screw plug	1520	Bearing
1420	Vent filter	1521	Locking ring
1501	Adapter	1522	Locking ring
1504	Bearing shield	1525	Shaft sealing ring
1505	Bolt	1528	Disk
1506	Plate / locking ring	1530	Bearing
1507	Nut	1535	Shaft sealing ring
1508	Bolt	1536	Intermediate ring
1509	Nut	1537	O-ring
1514	Locking ring	1538	O-ring
1515	Shaft	1539	Screw plug
1516	Bush		

Image 6-4 K4 and K5 short adapters with clamp connection

Vulcan Shaftless Screw Conveyor

Section 7

Specifications & Installation Drawings

For General Arrangement drawing please refer to Section 8: Project Data, 8.3 of your VMR O & M manual.

Job Location: Wichita, KS
Job No. 19177

SHAFTLESS SCREW CONVEYOR SYSTEM
MODEL # TF-240

1.00 DESIGN REQUIREMENTS

Number of Units:	Two (2)
Conveying Capacity:	70 cubic ft./hr. (Conveyor Capacity at 25% trough loading)
Net Weight:	2,300 lb.

2.01 GENERAL

A. The screw conveyor shall be provided to convey screenings material received from a mechanical bar screen. Screenings material shall enter the inlet hopper and be transported by the rotating screw to the point of discharge. The screw conveyor shall be designed to convey screenings from the drive end of the unit to the discharge end. Designs that pull the screenings towards the drive end shall not be acceptable.

2.02 INLET HOPPER

A. The inlet hopper shall be designed to direct wet screenings material into the screw housing from the mechanical bar screen. The inlet zone will be completely shrouded to contain the screenings. The inlet hopper shall be 12-gauge thick minimum and be constructed of 316 stainless steel. All attachment hardware shall be of 316 stainless steel.

2.03 SCREW HOUSING

A. The screw housing shall be a U-shaped trough constructed of 10-gauge thick 316 stainless steel. The interior of the housing shall incorporate a nominal 3/8-inch thick UHMW replaceable liner to prevent metal-to-metal contact between the screw housing and the

screw. The entire housing shall be supported by 316 stainless steel legs.

B. The transport area of the screw housing shall be furnished with removable cover panels. The cover panels shall have a minimum thickness of 20-gauge and be constructed of 316 stainless steel.

2.04 SHAFTLESS SCREW

A. The conveyor screw shall be of the shaftless spiral design and shall be connected to the drive unit and a sealing system shall be provided to prevent water from entering the drive unit.

B. The spiral shall be formed from continuous solid bar stock with a minimum nominal thickness of 3/4-inches and nominal outside diameter of 9 1/2-inches. A 2-inch minimum diameter drive shaft shall be attached to the screw and shall be direct coupled to the gear reducer.

C. The screw shall be constructed of high strength carbon steel and have a minimum Brinell hardness of 200.

2.05 DRIVE ASSEMBLY

A. The shaftless screw conveyor shall be complete with an integrated drive assembly consisting of a Class 1, Division 1, Group D, explosion-proof electric motor close-coupled to a parallel shaft helical bevel double reduction gear reducer.

B. The motor shall be 2.0 horsepower, 230/460 volt, 3 phase, 60 Hertz with a service factor of 1.15. The motor(s) shall be rated at 50°C ambient with Class F insulation and shall have a Class B temperature rise at full load. The nominal motor speed shall be 1800 rpm.

C. The gear reducer shall be a right-angle helical bevel gear reducer. Gear reducer specifications shall be as shown in section 3.

D. Gear reducers shall have ball or roller bearings throughout with all moving parts immersed in oil. Gears shall be of alloy steel with threads precision ground and polished after casehardening. Shafts shall be of high strength alloy steel ground to required tolerances. All ball or roller bearings shall be rated and manufactured by a member of the Antifriction Bearing Manufacturer's Association. At least one bearing on each shaft shall be of the combined radial and thrust type.

2.06 CONTROLS & ELECTRICAL SAFETY EQUIPMENT

A. Controls shall be supplied as shown in section 5.

2.07 FASTENERS

A. All fasteners and anchor bolts shall be 316 stainless steel unless otherwise indicated in this specification. Anchor bolts shall be provided for mounting the shaftless screw conveyor. All threaded fasteners shall be coated with a nickel based anti-seize thread lubricant prior to assembly.

2.08 LUBRICATION

A. The manufacturer shall state in the operating manual the amount of and specification for any lubricant required.

2.09 PROTECTIVE COATINGS

A. Stainless steel and plastic components shall not be painted. The stainless steel structural components and enclosure panels shall be bead blasted and passivated as required after fabrication to remove embedded iron, surface rust and weld burn. All other surfaces shall be blast cleaned to an SSPC-SP6 finish, removing all dirt, rust, scale and foreign materials.

B. Cleaned surfaces shall be shop primed with one (1) coat of TNEMEC 69-1212 primer, or equal, to attain a minimum dry film thickness of 2.5 mils. The motor and gearbox shall have one coat, 2.5 mils DFT, Tnemec series N69 primer and two coats, 5 mils DFT, Tnemec series 1074 topcoat. The top coat shall be red in color and semi-gloss in finish.

2.10 SPARE PARTS

A. The Manufacturer shall furnish the following spare parts for each conveyor.

1. One (1) set of replacement fuses (1 of each type and size used)
2. One (1) complete set of trough liners

All spare parts shall be properly packed in a white wooden box, labeled and stored where directed by the Owner or Engineer.

3.01 TESTING

A. The shaftless screw conveyor shall be factory assembled and factory run tested for a minimum of 8-hours in the United States prior to shipment. The main control panel shall also be factory tested.

B. The screw conveyor shall also be field tested after erection in the presence of the Owner and Engineer to confirm and verify the structural and mechanical compliance to the specification. The field acceptance test shall include demonstrating that the screw conveyor operates without vibration, jamming or overheating and perform its specified function satisfactorily.

3.02 INITIAL START-UP AND TRAINING

A. The Contractor shall provide the services of a factory-employed service technician who shall adequately inspect the installation, test the equipment furnished under this Contract and instruct the Owner's operating personnel in its maintenance and operation. Manufacturer's sales representatives are not considered acceptable service technicians. The services of the technician shall be provided as follows:

B. Two (2) trips and three (3) 8-hour days of service to inspect and certify the installation prior to startup and provide Owner's personnel in proper operation and maintenance of the equipment. Start-up service will be combined with the start-up service for the bar screen and washing press.

Vulcan Shaftless Screw Conveyor

Section 8

Electrical Control & Schematics

Refer to Section7: Electric Controls & Schematics of your VMR O & M manual.