

**WASTE WATER** Solutions

**Equipment and Control Panel O&M – Rev 0**

**City of Wichita Sewage Treatment Plant #2**

**Huber Sludge Screen #2**

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**Equipment:**

StrainPress SP290

**Manufacturer:**

Huber Technology, Inc.  
9735 NorthCross Center Ct., Suite A  
Huntersville, NC 28078

Contact: Lindsay Barnes , [lindsay.barnes@hhusa.net](mailto:lindsay.barnes@hhusa.net) , (704) 990-2050

**Customer:**

City of Wichita Sewage Treatment Plant #2  
2305 E. 57<sup>th</sup> St. South  
Wichita, KS 67216

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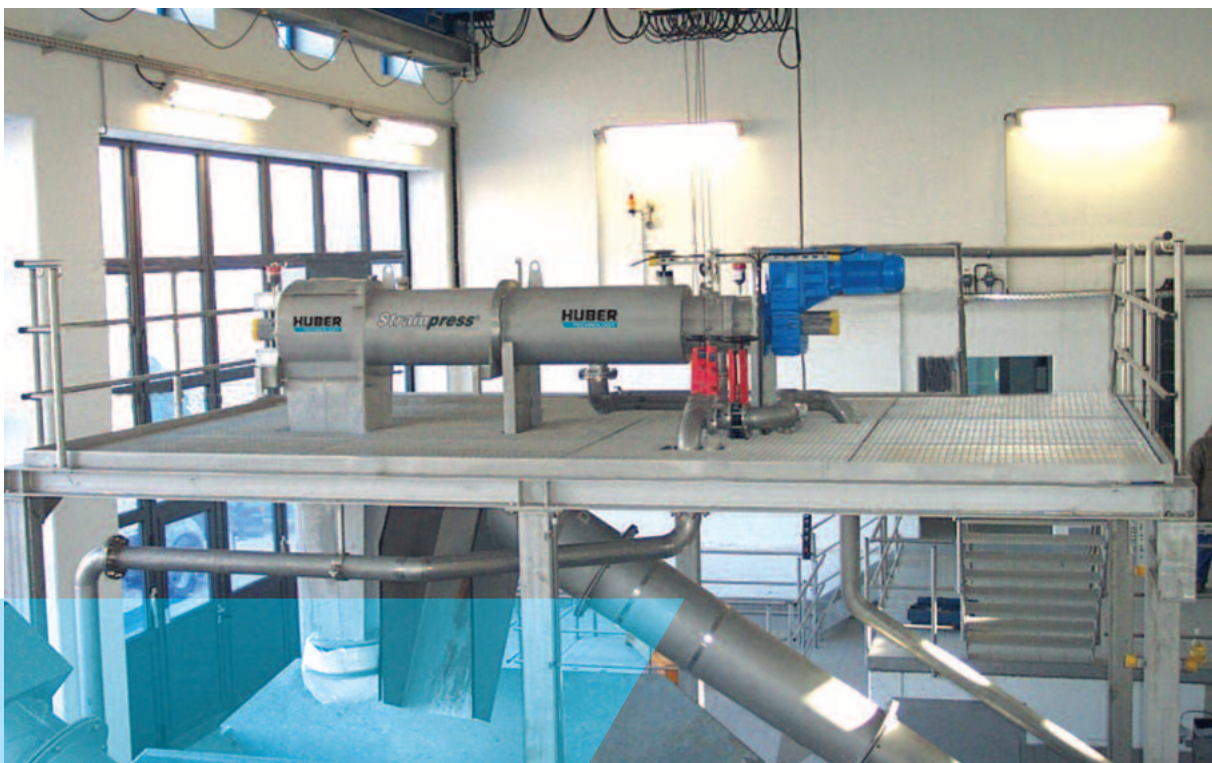
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# Section 1.0

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# Strainpress® Sludgecleaner SP



- continuous filtering or screening, dewatering and transport of coarse material in one operation
- coarse material separator for municipal and industrial sludges and process water

## ►► The STRAINPRESS® System

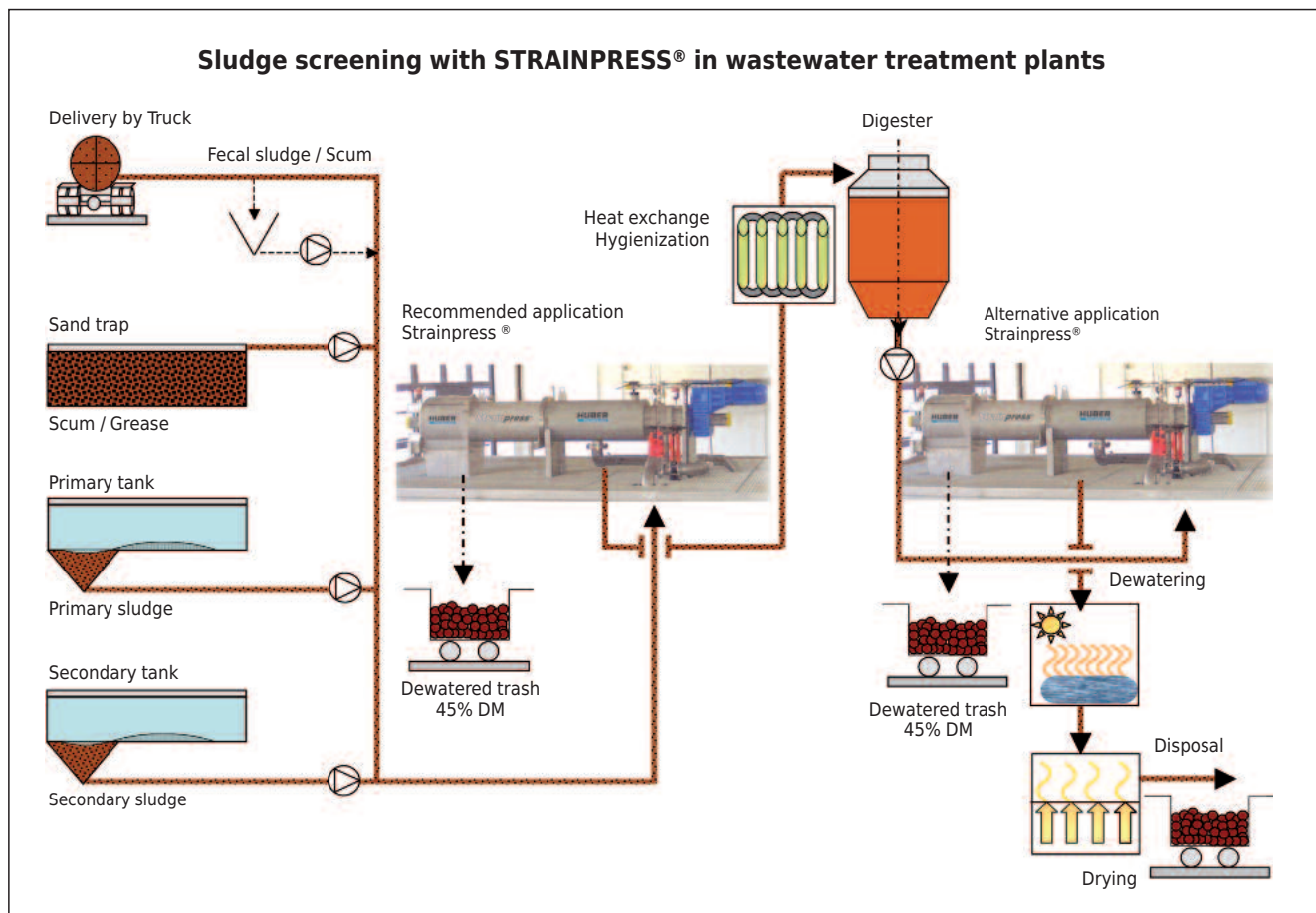
The STRAINPRESS® is a horizontal pipe-shaped coarse material separator which consists of inlet and driving zone, screening and press zone and finally a discharge section with a conical pressure-regulating device.

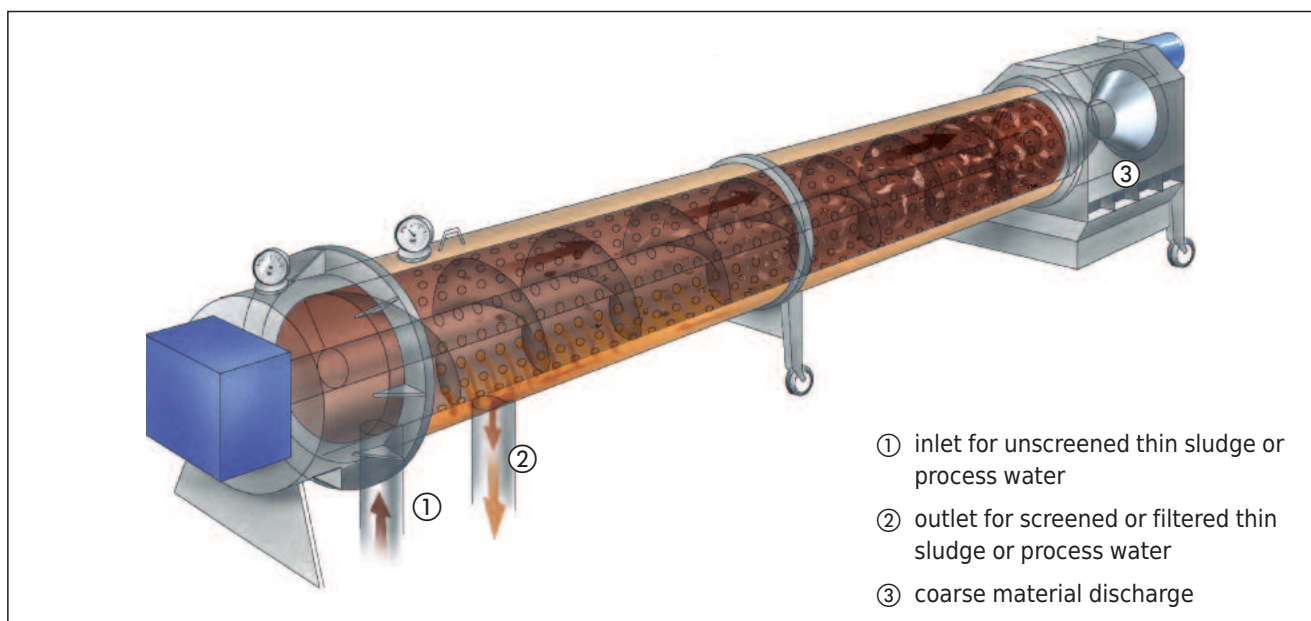
Feeding is by a pump which presses the medium through the screening zone and forwards it via the outlet pipe to further process steps. The coarse material which is retained on the screen surface is transported to the press zone by the screw which serves as a scraper unit. In the press zone, the material is dewatered to spadable condition and discharged afterwards. The motor speed, screen perforation and geometry of the discharge section can be adjusted to all different media. The coarse material is separated continuously under pressure and periodical cleaning of the screening zone by backwashing is thereby not required.

The below diagram shows the installation of the STRAINPRESS® within the wastewater treatment plant. It is easily possible to integrate the STRAINPRESS® into the existing pipeline and automatic system.

## ►► Main features

- Coarse material filtering or screening and dewatering to approx. 45 % DS content
- Pressure-fed system (inline) for process water and any type of sludge including viscous and grease containing sludge
- Reduces maintenance costs and increases the operating reliability of downstream sludge treatment systems, such as thickening, digestion, dewatering, hygienisation, drying, etc.
- Perforations of 0.15 to 10 mm for solids/liquid separation also in industrial applications
- Cost savings and reuse with filtration in a circulation water process
- Throughput capacity of up to 110 m<sup>3</sup>/h sludge and up to 150 m<sup>3</sup>/h process water
- Reliable perforated plate cleaning without the need for any external water
- Automatic pressure cone system for maximum dewatering efficiency
- Nearly 1000 installations worldwide





## ►► Easy to handle

The complete casing and perforated plate of the STRAINPRESS® are made of 1.4307 (AISI 304L) stainless steel. The opposite picture shows an open STRAINPRESS®, the press zone can be seen on the left, the screening zone on the right. The quick-opening and closure device makes control and inspection easy. The screen section is fixed, the press zone has castor swivel wheels and is therefore easy to shift.



## ►► Examples



Sludge screening on WWTP Barcelona, Spain



Screening of fermentation sludge (industry)

## ►► STRAINPRESS® applications

The STRAINPRESS® can be used for sludge screening or process water filtering as well as for all processes where solids are separated from liquids and / or compacted under pressure.

Examples for coarse material separation from:

- primary sludge / raw sludge
- mixed sludge
- floating sludge
- grease sludge
- digested sludge
- secondary sludge / excess sludge
- septic sludge
- industrial production waters
- circulation and process water



*Discharge of the separated pressed material*



*Separated material: paper, wood, plastic, tinfoil, rubber, textiles, etc.*

## HUBER SE

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Subject to technical modification  
1,0 / 4 - 8.2010 - 1.2004

STRAINPRESS® Sludgecleaner SP

## Installation List: STRAINPRESS® Sludg cleaner, SP

**432 Total Installations**

**701 Total Installed Units**

Date	Project	Country	Quant.	Size
Jan 2015	Offeringen, CH	Switzerland	1	
Jan 2015	Stein am Rhein, CH	Switzerland	1	
Jan 2015	Warrington North WwTW	Great Britain	1	
Jan 2015	Llanelli STW, GB	Great Britain	2	
Jan 2015	Brno COV - Modrice, CZ	Czech Republic	1	
Jan 2015	Gossau ZH, CH	Switzerland	1	
Nov 2014	Nyon - Techfina SA, CH	Switzerland	1	60 m <sup>3</sup> /h
Nov 2014	VEAS, NO	Norway	3	60 m <sup>3</sup> /h
Nov 2014	Tilburg RWZI, NL	Netherland	2	60 m <sup>3</sup> /h
Nov 2014	MS Nieuw Amsterdam, US	USA	1	60 m <sup>3</sup> /h
Oct 2014	Crawley STW, GB	Great Britain	2	
Sep 2014	Landquart / P14-3540	Switzerland	1	
Sep 2014	Lukoil Neftohim Burgas AD, BG	Bulgaria	1	
Aug 2014	Malabar	Australia	3	60 m <sup>3</sup> /h
Jul 2014	Bellozanne STW, GB	Great Britain	2	
Jun 2014	Krüger Kaldnes/IVAR Stavanger, NO	Norway	4	
Jun 2014	Sion Chandoline - Techfina SA	Switzerland	1	60 m <sup>3</sup> /h
Jun 2014	Würenlingen, CH	Switzerland	1	
May 2014	Bioggio Lugano, CH	Switzerland	2	60 m <sup>3</sup> /h
May 2014	Bern ARA, CH	Switzerland	3	60 m <sup>3</sup> /h
Apr 2014	Rolle - Techfina SA, CH	Switzerland	1	60 m <sup>3</sup> /h
Apr 2014	Einsiedeln, CH	Switzerland	1	60 m <sup>3</sup> /h
Mar 2014	Arroyo de la Reguera, ES	Spain	2	60 m <sup>3</sup> /h
Mar 2014	Los Tajos, CR	Costa Rica	3	
Mar 2014	Sanest Guia, PT	Portugal	3	60 m <sup>3</sup> /h
Mar 2014	Huyton STW, GB	Great Britain	1	60 m <sup>3</sup> /h
Mar 2014	Inventory and Pilot Machinery, US	USA	1	60 m <sup>3</sup> /h
Mar 2014	Inventory and Pilot Machinery, US	USA	8	60 m <sup>3</sup> /h
Mar 2014	Ganol WWTW, GB	Great Britain	2	60 m <sup>3</sup> /h
Mar 2014	Marrakesh, MA	Marocco	1	60 m <sup>3</sup> /h
Mar 2014	Long Reach STW, GB	Great Britain	2	60 m <sup>3</sup> /h
Feb 2014	Liverpool STW, GB	Great Britain	2	60 m <sup>3</sup> /h
Feb 2014	Loiola, ES	Spain	1	60 m <sup>3</sup> /h
Jan 2014	Rheinfelden ARA, CH	Switzerland	1	60 m <sup>3</sup> /h
Jan 2014	Grevesmühlen KA	Germany	1	Alle
Jan 2014	Mabagas Bardowick GmbH & Co. KG	Germany	1	
Jan 2014	VEAS, NO	Norway	3	60 m <sup>3</sup> /h
Jan 2014	Penrith WwTW, GB	Great Britain	2	60 m <sup>3</sup> /h
Jan 2014	PERPIGNAN (66), FR	France	1	60 m <sup>3</sup> /h
Jan 2014	Taunton (Ham) STW, GB	Great Britain	1	60 m <sup>3</sup> /h
Nov 2013	Bergen Biogas, NO	Norway	1	
Nov 2013	Andong STP, KR	Korea	1	
Nov 2013	Daejeon STP, KR	Korea	1	

Date	Project	Country	Quant.	Size
Nov 2013	Zuchwil, ARA Emmenspitz, CH	Switzerland	1	
Oct 2013	Uppsala Vatten/Uppsala Biogas,	Sweden	1	
Oct 2013	Barrow STW, GB	Great Britain	3	60 m <sup>3</sup> /h
Sep 2013	Diyarbakir, TR	Turkey	3	
Sep 2013	Chillian WWTP, CL	Chile	3	
Sep 2013	Kristiansand Odderoya RA, NO	Norway	1	
Sep 2013	Douvaines, FR	France	1	
Sep 2013	Crawley, Rotamat 184-185, GB	Great Britain	2	
Aug 2013	Jabel Ali STP, AE	United Arab Emirates	4	60 m <sup>3</sup> /h
Aug 2013	Jiangjin, CN	China	1	
Aug 2013	Xiaohongmen, CN	China	2	
Aug 2013	MS Eurodam, CH	Netherland	1	
Jul 2013	Etampes - Bionerval, FR	France	1	
Jul 2013	Glina Bukarest - Veolia, RO	Romania	2	60 m <sup>3</sup> /h
Jul 2013	Gifhorn KA	Germany	1	4
Jun 2013	Ilanz, CHF	Switzerland	1	60 m <sup>3</sup> /h
Jun 2013	Taurage, LT	Lithuania	1	60 m <sup>3</sup> /h
Jun 2013	Peel Common 3, Rotamat 183, GB	Great Britain	1	60 m <sup>3</sup> /h
Jun 2013	Oxford 3+4/Rotamat 181-182, GB	Great Britain	2	60 m <sup>3</sup> /h
Jun 2013	Tilburg, NL	Netherland	2	60 m <sup>3</sup> /h
Jun 2013	Seengen, ARA Hallwilersee, CH	Switzerland	1	60 m <sup>3</sup> /h
Jun 2013	Stetten - Techfina, CH	Switzerland	1	60 m <sup>3</sup> /h
May 2013	Lindum (NO), Hydropress, NO	Norway	1	
May 2013	Toledo Estiviel, HHES	Spain	2	
Apr 2013	Shanks, Westcott Park, Rotamat	Great Britain	1	
Apr 2013	Kirchhain KA	Germany	1	
Mar 2013	BGA Lustenau, AT	Austria	1	
Mar 2013	Scherzingen, CH	Switzerland	1	
Feb 2013	San Roman, ES	Spain	1	60 m <sup>3</sup> /h
Jan 2013	Rheine - Nord KA	Germany	1	60 m <sup>3</sup> /h
Jan 2013	Thalwil, CH	Switzerland	1	60 m <sup>3</sup> /h
Jan 2013	Grenoble, FR	France	1	60 m <sup>3</sup> /h
Jan 2013	Cherbourg Ouest, FR	France	1	60 m <sup>3</sup> /h
Jan 2013	Baraki Algérie, FR	France	1	60 m <sup>3</sup> /h
Jan 2013	Wonju STP, KR	Korea	2	60 m <sup>3</sup> /h
Dec 2012	Murcia-Este, ES	Spain	1	60 m <sup>3</sup> /h
Dec 2012	Terre Sainte, CH	Switzerland	1	60 m <sup>3</sup> /h
Dec 2012	Stäfa, CH	Switzerland	1	60 m <sup>3</sup> /h
Dec 2012	Shafdan, IL	Israel	8	60 m <sup>3</sup> /h
Dec 2012	Biogen Twinwoods 2, Rotamat	Great Britain	1	60 m <sup>3</sup> /h
Dec 2012	Haugesund Arabrot RA, NO	Norway	1	60 m <sup>3</sup> /h
Nov 2012	Guinness (SP4 / CH), IE	Great Britain	4	60 m <sup>3</sup> /h
Nov 2012	Crossness STW, GB	Great Britain	4	60 m <sup>3</sup> /h
Nov 2012	Beckton STW, GB	Great Britain	4	60 m <sup>3</sup> /h
Oct 2012	Haljala (SP4), EE	Estonia	1	60 m <sup>3</sup> /h
Sep 2012	Andigestion, Holsworthy,	Great Britain	1	60 m <sup>3</sup> /h
Aug 2012	Monmouth STW, Rotamat 164; GB	Great Britain	1	60 m <sup>3</sup> /h
Aug 2012	Gowerton STW, Rotamat 162; GB	Great Britain	1	60 m <sup>3</sup> /h
Aug 2012	Lampeter STW, Rotamat 163; GB	Great Britain	1	60 m <sup>3</sup> /h

Date	Project	Country	Quant.	Size
Aug 2012	Aberystwyth STW, Rotamat 161;	Great Britain	1	60 m <sup>3</sup> /h
Aug 2012	Llanina WwTW, Rotamat 165; GB	Great Britain	1	60 m <sup>3</sup> /h
Jul 2012	Biorender 2, CH	Switzerland	1	60 m <sup>3</sup> /h
Jul 2012	Barkip AD Plant, Rotamat 160	Great Britain	1	60 m <sup>3</sup> /h
Jun 2012	Echten (NL), CH	Switzerland	2	60 m <sup>3</sup> /h
Jun 2012	Schwetzingen KA	Germany	2	60 m <sup>3</sup> /h
May 2012	Gordola Foce Ticino Locarno, CH	Switzerland	2	60 m <sup>3</sup> /h
May 2012	Tres Cantos, HHES	Spain	1	60 m <sup>3</sup> /h
Apr 2012	Ecublens - VOG La Verna, CH	Switzerland	1	60 m <sup>3</sup> /h
Mar 2012	Biogas Oslo, Cambi	Norway	2	60 m <sup>3</sup> /h
Mar 2012	Biogas Oslo, Cambi	Norway	2	60 m <sup>3</sup> /h
Mar 2012	Alvim RA, NO	Norway	1	60 m <sup>3</sup> /h
Mar 2012	Biogasanlage Geislingen	Germany	1	60 m <sup>3</sup> /h
Feb 2012	BGA Etampes (AT), FR	France	1	60 m <sup>3</sup> /h
Feb 2012	Lenzerheide, CH	Switzerland	1	60 m <sup>3</sup> /h
Jan 2012	Avonmouth Rotamat 158, GB	Great Britain	1	60 m <sup>3</sup> /h
Jan 2012	Biogen Greenfinch Twinfoods, GB	Great Britain	1	60 m <sup>3</sup> /h
Dec 2011	Fulda - Biogasanlage	Germany	1	60 m <sup>3</sup> /h
Dec 2011	Whacheon STP, KR	Korea	1	60 m <sup>3</sup> /h
Nov 2011	Swansea 3 Rotamat 157, GB	Great Britain	1	60 m <sup>3</sup> /h
Nov 2011	Cardiff 2, Rotamat 156, GB	Great Britain	1	60 m <sup>3</sup> /h
Nov 2011	Trade Effluent Services, GB	Great Britain	1	60 m <sup>3</sup> /h
Oct 2011	Swansea Bay Rotamat, GB	Great Britain	1	60 m <sup>3</sup> /h
Oct 2011	Kincumber, AU	Australia	1	60 m <sup>3</sup> /h
Sep 2011	Zurzach, CH	Switzerland	1	60 m <sup>3</sup> /h
Sep 2011	Kohlfurth KA	Germany	2	60 m <sup>3</sup> /h
Sep 2011	Borregaard Pilot Plant, NO	Norway	4	60 m <sup>3</sup> /h
Aug 2011	Howdon, Rotamat 148-153, GB	Great Britain	6	60 m <sup>3</sup> /h
Jul 2011	Zweisimmen, CH	Switzerland	1	60 m <sup>3</sup> /h
Jul 2011	Stavanger, NO	Norway	2	60 m <sup>3</sup> /h
Jul 2011	PTAS Temuco, CL	Chile	2	60 m <sup>3</sup> /h
Jun 2011	Sour Tyr, FR	Lebanon	1	60 m <sup>3</sup> /h
Jun 2011	Linköping, Hydropress, SE	Sweden	1	60 m <sup>3</sup> /h
May 2011	Motney Hill 2, GB	Great Britain	2	60 m <sup>3</sup> /h
May 2011	Shoreham, GB	Great Britain	2	60 m <sup>3</sup> /h
May 2011	Eastnourne, GB	Great Britain	2	60 m <sup>3</sup> /h
Apr 2011	Hans Gerd Buschhaus GmbH	Germany	1	
Apr 2011	Gifhorn KA	Germany	1	60 m <sup>3</sup> /h
Apr 2011	Alzira, ES	Spain	1	60 m <sup>3</sup> /h
Apr 2011	Mouscron, BE	Belgium	1	60 m <sup>3</sup> /h
Mar 2011	Tullamore Rotamat 141, GB	Great Britain	1	60 m <sup>3</sup> /h
Mar 2011	Eu-Rec plast GmbH	Germany	1	
Feb 2011	Rennes, FR	France	1	60 m <sup>3</sup> /h
Feb 2011	Loiola, ES	Spain	1	60 m <sup>3</sup> /h
Feb 2011	Five Fords, Rotamat 137-140, GB	Great Britain	4	60 m <sup>3</sup> /h
Feb 2011	Holsworthy, Rotamat 136, GB	Great Britain	1	60 m <sup>3</sup> /h
Feb 2011	Fehraltdorf, CH	Switzerland	1	60 m <sup>3</sup> /h
Feb 2011	Schradenbiogas GmbH & Co. KG	Germany	1	
Jan 2011	Harborough Rotamat 134-135, GB	Great Britain	2	60 m <sup>3</sup> /h

Date	Project	Country	Quant.	Size
Dec 2010	Cazis, ARA Waldau	Switzerland	1	
Dec 2010	Gardermoen, NO	Norway	1	
Dec 2010	Runcorn (Rotamat 133), CH	Great Britain	1	
Dec 2010	Högl Kompostierbetriebe	Germany	1	
Nov 2010	Arroyo Quinones (ES), HHES	Spain	2	
Nov 2010	Cape Flats, ZA	South Afrika	2	
Nov 2010	Steinach - ARA Morgental, CH	Switzerland	1	
Oct 2010	Ebersbach an der Fils KA	Germany	1	
Sep 2010	Jönköping - Torsvik, SE	Sweden	2	60 m <sup>3</sup> /h
Aug 2010	Riverside, Rotamat 130-132, UK	Great Britain	3	60 m <sup>3</sup> /h
Aug 2010	Beckton, Rotamat 126-129, UK	Great Britain	4	60 m <sup>3</sup> /h
Aug 2010	Brighton&Hove, ROTAMAT 122-125,	Great Britain	4	60 m <sup>3</sup> /h
Aug 2010	Christies Beach, AU	Australia	2	60 m <sup>3</sup> /h
Aug 2010	Carre de Reunion, FR	France	1	60 m <sup>3</sup> /h
Jul 2010	Merlins Bridge, Rotamat; UK	Great Britain	1	
Jul 2010	Pembroke Dock, Rotamat 119; UK	Great Britain	1	
Jul 2010	Gowerton, Rotamat 120; UK	Great Britain	1	
Jul 2010	Coslech, Rotamat 121; UK	Great Britain	1	
Jul 2010	Park y Splott, Rotamat; UK	Great Britain	2	
Jul 2010	Pen-y-bont, Rotamat; UK	Great Britain	2	
Jul 2010	Shanganagh, IE	Ireland	1	
Jul 2010	Nash WWF, UK	Great Britain	2	
Jul 2010	Seonam 2, KR	Korea	3	
Jun 2010	Bruxelles 3, Belgique	Belgium	1	60 m <sup>3</sup> /h
Jun 2010	Davyhulme 2, Rotamat UK	Great Britain	5	60 m <sup>3</sup> /h
Jun 2010	La Feyssine, FR	France	1	60 m <sup>3</sup> /h
May 2010	Hejsta Växthus, SE	Sweden	1	60 m <sup>3</sup> /h
May 2010	Tours, FR	France	1	60 m <sup>3</sup> /h
May 2010	Mapocho, CL	Chile	4	60 m <sup>3</sup> /h
May 2010	La Farfana, CL	Chile	1	60 m <sup>3</sup> /h
May 2010	Tourlaville-Cherbourg, FR	France	1	60 m <sup>3</sup> /h
Apr 2010	Amsterdam, NL	Netherland	4	60 m <sup>3</sup> /h
Apr 2010	Kastelbell, IT	Italy	1	60 m <sup>3</sup> /h
Apr 2010	Roma Est, IT	Italy	2	60 m <sup>3</sup> /h
Apr 2010	Rovereto - Wet Oxydation, IT	Italy	2	
Apr 2010	St. Helens, Rotamat 106, UK	Great Britain	1	60 m <sup>3</sup> /h
Apr 2010	Varna (BG), CH	Switzerland	1	60 m <sup>3</sup> /h
Mar 2010	Dübendorf - Wallisellen, CH	Switzerland	1	
Jan 2010	Knarrdalsstrand	Norway	1	60 m <sup>3</sup> /h
Dec 2009	Epele, ES	Spain	1	60 m <sup>3</sup> /h
Dec 2009	Braunschweig-Steinhof KA	Germany	2	60 m <sup>3</sup> /h
Oct 2009	Biorender, Münchwillen, CH	Switzerland	1	
Oct 2009	Klintehamn AR-Gotland, SE	Sweden	1	60 m <sup>3</sup> /h
Oct 2009	SIGE Roche, CH	Switzerland	2	60 m <sup>3</sup> /h
Oct 2009	Göttingen KA	Germany	1	60 m <sup>3</sup> /h
Sep 2009	Bahia Gaditana HHES	Spain	1	
Sep 2009	Afan, Rotamat 104-105, UK	Great Britain	2	60 m <sup>3</sup> /h
Sep 2009	Cardiff, Rotamat 100-103, UK	Great Britain	4	60 m <sup>3</sup> /h
Sep 2009	Debrecen WWTP (HU), CH	Hungary	1	60 m <sup>3</sup> /h

Date	Project	Country	Quant.	Size
Sep 2009	Lyss, CH	Switzerland	1	60 m <sup>3</sup> /h
Aug 2009	Ibach, ARA Schwyz; CH	Switzerland	1	60 m <sup>3</sup> /h
Aug 2009	Den Haag, NL	Netherland	3	60 m <sup>3</sup> /h
Aug 2009	Fleetwood, Rotamat 95-97, UK	Great Britain	3	60 m <sup>3</sup> /h
Jul 2009	Le Havre, F	France	1	
Jul 2009	Hillhouse, Rotamat 98-99, UK	Great Britain	2	
Jul 2009	Slite AR-Gotland, S	Sweden	1	60 m <sup>3</sup> /h
Jun 2009	Beenyup STP, AU	Australia	4	60 m <sup>3</sup> /h
Jun 2009	Dasan STP, KR	Korea	1	60 m <sup>3</sup> /h
May 2009	Tang Jia Tuo II WWTP, CN	China	2	60 m <sup>3</sup> /h
May 2009	Avonmouth 4, Rotamat UK 94, UK	Great Britain	1	60 m <sup>3</sup> /h
May 2009	BIGA Energie GmbH & Co. KG	Germany	1	
Apr 2009	USA SP4 Folgt	USA	13	60 m <sup>3</sup> /h
Apr 2009	ORBE, CH	Switzerland	1	60 m <sup>3</sup> /h
Apr 2009	Bruxelles 2, BE	Belgium	1	60 m <sup>3</sup> /h
Mar 2009	Vilnius WWTP, LT	Lithuania	1	60 m <sup>3</sup> /h
Mar 2009	Christies Beach WWTP, AU	Australia	2	60 m <sup>3</sup> /h
Feb 2009	Möhlin, CH	Switzerland	1	60 m <sup>3</sup> /h
Feb 2009	Morpeth, Rotamat UK 93; GB	Great Britain	1	60 m <sup>3</sup> /h
Feb 2009	Hereford Eign, Rotamt UK; GB	Great Britain	3	60 m <sup>3</sup> /h
Jan 2009	Hendon, Rotamat UK 88-89; GB	Great Britain	2	60 m <sup>3</sup> /h
Jan 2009	Baden-Baden - Sinzheim GKA	Germany	1	
Dec 2008	Benidorm, ES	Spain	1	
Dec 2008	Troqueerl, Rotamat UK 86-87; GB	Great Britain	2	
Dec 2008	Dresden-Kaditz KA	Germany	2	60 m <sup>3</sup> /h
Nov 2008	Carlisle, Rotamat UK 84-85; GB	Great Britain	2	60 m <sup>3</sup> /h
Oct 2008	Willington, Rotamat UK 82; GB	Great Britain	1	60 m <sup>3</sup> /h
Oct 2008	Birtley, Rotamat UK 81; GB	Great Britain	1	60 m <sup>3</sup> /h
Oct 2008	Tudhoe Mill, Rotamat UK 83; GB	Great Britain	1	60 m <sup>3</sup> /h
Sep 2008	Psyttalia, GR	Greece	6	60 m <sup>3</sup> /h
Sep 2008	BASF Espanola, ES	Spain	1	60 m <sup>3</sup> /h
Sep 2008	Carlisle, Rotamat UK 78-79; GB	Great Britain	2	60 m <sup>3</sup> /h
Sep 2008	Tang Jia Tuo WWTP, CN	China	1	60 m <sup>3</sup> /h
Aug 2008	Tuzla WWTP, TR	Turkey	4	60 m <sup>3</sup> /h
Jul 2008	MBA Lübeck	Germany	2	60 m <sup>3</sup> /h
Jun 2008	Schwarting Biosystem GmbH	Germany	1	
Jun 2008	Zalaegerszeg, Hunicoop; HU	Hungary	1	60 m <sup>3</sup> /h
May 2008	USA 68-79, US	USA	12	60 m <sup>3</sup> /h
Apr 2008	Beddington, Rotamat 76-77; UK	Great Britain	2	60 m <sup>3</sup> /h
Apr 2008	Haßloch KA	Germany	1	60 m <sup>3</sup> /h
Mar 2008	Paju Unjeong STP, KR	Korea	3	60 m <sup>3</sup> /h
Mar 2008	Brüssel, BE	Belgium	1	60 m <sup>3</sup> /h
Feb 2008	Budapest, Hunicoop; HU	Hungary	1	60 m <sup>3</sup> /h
Feb 2008	Bolton, Rotamat UK 76; GB	Great Britain	1	60 m <sup>3</sup> /h
Feb 2008	Hyunpoong STP, KR	Korea	2	60 m <sup>3</sup> /h
Jan 2008	Horden, Rotamat UK 75; GB	Great Britain	1	60 m <sup>3</sup> /h
Jan 2008	Seaton Carew, Rotamat UK 74; GB	Great Britain	1	60 m <sup>3</sup> /h
Jan 2008	Trowbridge, Rotamat UK 71; GB	Great Britain	1	60 m <sup>3</sup> /h
Jan 2008	Ratfin, Rotamat UK 72-73; GB	Great Britain	2	60 m <sup>3</sup> /h

Date	Project	Country	Quant.	Size
Nov 2007	Gland, CH	Switzerland	1	60 m <sup>3</sup> /h
Nov 2007	Arrow Ecology - Sydney, AUS	Australia	2	
Nov 2007	Swansea, Rotamat UK 70; GB	Great Britain	1	60 m <sup>3</sup> /h
Oct 2007	Oxford-Rotamat UK 68-69; UK	Great Britain	2	60 m <sup>3</sup> /h
Oct 2007	Rotamat, Great Billing; UK	Great Britain	3	60 m <sup>3</sup> /h
Sep 2007	Bellozanne-Rotamat 64 (UK),GB	Great Britain	1	60 m <sup>3</sup> /h
Sep 2007	Torrejon de Ardoz (ES), ES	Spain	2	60 m <sup>3</sup> /h
Aug 2007	Marrakesch HHF, MA	Marocco	1	60 m <sup>3</sup> /h
Jul 2007	Küblis Dalvazza, CH	Switzerland	1	Alle
Jul 2007	Skelleftea 3, SE	Sweden	1	Alle
Jul 2007	Ollon, CH	Switzerland	1	Alle
Jul 2007	St. Etienne, FR	France	1	Alle
Jul 2007	Dresden-Kaditz KA	Germany	3	60 m <sup>3</sup> /h
Jul 2007	Skelleftea 2, SE	Sweden	1	Alle
Jul 2007	Camposampiero Veneto, IT	Italy	1	Alle
Jun 2007	Ischgl KA	Austria	1	60 m <sup>3</sup> /h
Jun 2007	Demo Unit SP4, CN	China	1	60 m <sup>3</sup> /h
May 2007	Durban ZA	South Afrika	1	60 m <sup>3</sup> /h
May 2007	Fuglevik NO	Norway	1	60 m <sup>3</sup> /h
Apr 2007	Mitterteich KA	Germany	1	60 m <sup>3</sup> /h
Mar 2007	Witney-Rotamat UK, GB	Great Britain	1	60 m <sup>3</sup> /h
Feb 2007	USA 57-58, US	USA	2	60 m <sup>3</sup> /h
Feb 2007	USA 59-62, US	USA	4	60 m <sup>3</sup> /h
Feb 2007	USA 63-67, US	USA	5	60 m <sup>3</sup> /h
Jan 2007	Verdal Biogas / Cambi AS, NO	Norway	2	
Dec 2006	Kings Lynn (GB), UK	Great Britain	4	
Dec 2006	Thiene Veneto (HHI), IT	Italy	1	
Dec 2006	Biffa Waste Services Ltd., GB	Great Britain	1	
Oct 2006	Llanelli (GB)	Great Britain	1	
Sep 2006	Biffa Waste Services Ltd., GB	Great Britain	2	
Sep 2006	Zwiesel KA	Germany	1	
Sep 2006	USA 56, US	USA	1	
Aug 2006	Birsfelden - Birs 2, CH	Switzerland	1	
Jul 2006	Interlaken, CH	Switzerland	1	
Jul 2006	Tallinn - Estland	Estonia	1	
Jul 2006	Winterthur, CH	Switzerland	2	
Jul 2006	Kayseri Türkei (TR)	Turkey	3	
Jul 2006	Dietikon, Limmattal; CH	Switzerland	1	
Jul 2006	Wincanton (GB)	Great Britain	1	
Jun 2006	Klosters, CH	Switzerland	1	
Jun 2006	Degremont, Huber Technology,	France	2	
Jun 2006	Stams ARA	Austria	1	60 m <sup>3</sup> /h
Jun 2006	USA 46-55	USA	10	
May 2006	Jeongseon STP, KR	Korea	1	
Apr 2006	Andritz Tilbury (GB)	Great Britain	6	
Apr 2006	Wootton Bassett (GB)	Great Britain	1	
Mar 2006	Visby (SE)	Sweden	1	
Feb 2006	Sandefjord 2 (N) Hydropr.	Norway	1	60 m <sup>3</sup> /h
Feb 2006	ARA Hofsteig	Austria	1	

Date	Project	Country	Quant.	Size
Jan 2006	Seonam/Tancheon STP, KR	Korea	10	Alle
Jan 2006	Boden (SE)	Sweden	1	Alle
Jan 2006	La Farfana (Santiago/Chile)	Chile	3	Alle
Oct 2005	Mysen (N) Hydropress	Norway	1	
Oct 2005	Erkelenz KA	Germany	1	
Jun 2005	Hese Umwelt GmbH	Great Britain	2	
Jun 2005	Skelleftea (HHS) Hydropress	Sweden	1	
May 2005	Piemonte (HHL) "Po Sangone"	Italy	6	
May 2005	Culmore WTW, Rotamat	Great Britain	2	
May 2005	Ergolz 2, Füllinsdorf; CH	Switzerland	1	
Jan 2005	USA 36-45	USA	10	
Jan 2005	Hese Umwelt GmbH	Great Britain	1	
Jan 2005	Montornes (HHE)	Spain	1	
Dec 2004	Emschermündung KW	Germany	1	
Dec 2004	Estavayer, CH	Switzerland	1	
Nov 2004	Hese Umwelt GmbH	Great Britain	1	
Nov 2004	Vigo 2 (E)	Spain	1	
Nov 2004	Brno 2 (CZ)	Czech Republic	1	
Jul 2004	Rochefort, CH	France	1	
Apr 2004	USA 26-35	USA	10	
Jan 2004	Küsnacht	Switzerland	1	
Dec 2003	Waßmannsdorf	Germany	1	
Sep 2003	Wodzislaw Slaski	Poland	1	
Sep 2003	Vorrat 53	Great Britain	1	
Sep 2003	Sölden	Austria	1	
Sep 2003	Vorrat 49	Great Britain	1	
Sep 2003	Vorrat 50	Great Britain	1	
Sep 2003	Vorrat 51	Great Britain	1	
Sep 2003	Vorrat 52	Great Britain	1	
Aug 2003	Arosa	Switzerland	1	
Aug 2003	Chur	Switzerland	1	
Aug 2003	Kongsberg 2	Norway	1	
Jun 2003	Waßmannsdorf	Germany	1	
Apr 2003	USA 16	USA	1	
Apr 2003	USA 17	USA	1	
Apr 2003	USA 18	USA	1	
Apr 2003	USA 19	USA	1	
Apr 2003	USA 20	USA	1	
Apr 2003	USA 21	USA	1	
Apr 2003	USA 22	USA	1	
Apr 2003	USA 23	USA	1	
Apr 2003	USA 24	USA	1	
Apr 2003	USA 25	USA	1	
Feb 2003	Kongsberg	Norway	1	
Jan 2003	Sölden	Austria	1	
Dec 2002	Trondheim 2	Norway	1	
Oct 2002	Brünn	Czech Republic	1	
Oct 2002	Alpnach/ Sarneraatal	Switzerland	1	
Sep 2002	Vorrat 48	Great Britain	1	

Date	Project	Country	Quant.	Size
Aug 2002	Sarno Abate	Italy	2	
Jun 2002	Vasteras	Sweden	2	
May 2002	Vorrat 44	Great Britain	1	
May 2002	Vorrat 45	Great Britain	1	
May 2002	Vorrat 46	Great Britain	1	
May 2002	Vorrat 47	Great Britain	1	
May 2002	Hunicoop AG Vesprem	Hungary	1	
Apr 2002	Vorrat 42	Great Britain	1	
Apr 2002	Vorrat 43	Great Britain	1	
Mar 2002	Freienbach	Switzerland	1	
Mar 2002	Helsingor	Denmark	1	
Feb 2002	Vorrat 36	Great Britain	1	
Feb 2002	Vorrat 37	Great Britain	1	
Feb 2002	Vorrat 38	Great Britain	1	
Feb 2002	Vorrat 39	Great Britain	1	
Feb 2002	Vorrat 40	Great Britain	1	
Feb 2002	Vorrat 41	Great Britain	1	
Feb 2002	Vorrat 35	Great Britain	1	
Jan 2002	USA 11	USA	1	
Jan 2002	USA 12	USA	1	
Jan 2002	USA 13	USA	1	
Jan 2002	USA 14	USA	1	
Jan 2002	USA 15	USA	1	
Oct 2001	Vorrat 25	Great Britain	1	
Oct 2001	Vorrat 26	Great Britain	1	
Oct 2001	Vorrat 27	Great Britain	1	
Oct 2001	Vorrat 28	Great Britain	1	
Oct 2001	Vorrat 29	Great Britain	1	
Oct 2001	Vorrat 30	Great Britain	1	
Oct 2001	Vorrat 31	Great Britain	1	
Oct 2001	Vorrat 32	Great Britain	1	
Oct 2001	Vorrat 33	Great Britain	1	
Oct 2001	Vorrat 34	Great Britain	1	
Sep 2001	Krefeld	Germany	1	
Aug 2001	USA 10	USA	1	60 m <sup>3</sup> /h
Aug 2001	USA 6	USA	1	60 m <sup>3</sup> /h
Aug 2001	USA 7	USA	1	60 m <sup>3</sup> /h
Aug 2001	USA 8	USA	1	60 m <sup>3</sup> /h
Aug 2001	USA 9	USA	1	60 m <sup>3</sup> /h
Aug 2001	Besos Barcelona	Spain	5	25 l/s
Jul 2001	Vorrat 15	Great Britain	1	60 m <sup>3</sup> /h
Jul 2001	Vorrat 16	Great Britain	1	60 m <sup>3</sup> /h
Jul 2001	Vorrat 17	Great Britain	1	60 m <sup>3</sup> /h
Jul 2001	Vorrat 18	Great Britain	1	60 m <sup>3</sup> /h
Jul 2001	Vorrat 19	Great Britain	1	60 m <sup>3</sup> /h
Jul 2001	Vorrat 20	Great Britain	1	60 m <sup>3</sup> /h
Jul 2001	Vorrat 21	Great Britain	1	60 m <sup>3</sup> /h
Jul 2001	Vorrat 22	Great Britain	1	60 m <sup>3</sup> /h
Jul 2001	Vorrat 23	Great Britain	1	60 m <sup>3</sup> /h

Date	Project	Country	Quant.	Size
Jul 2001	Vorrat 24	Great Britain	1	60 m <sup>3</sup> /h
May 2001	Essen-Bergerhausen	Germany	1	4
May 2001	Duisburg/Alte Emscher	Germany	1	4
May 2001	Duisburg/Alte Emscher	Germany	1	4
May 2001	Vorrat 10	Great Britain	1	
May 2001	Vorrat 11	Great Britain	1	
May 2001	Vorrat 12	Great Britain	1	
May 2001	Vorrat 13	Great Britain	1	
May 2001	Vorrat 14	Great Britain	1	
May 2001	Saulekilen	Norway	1	
May 2001	Sindico	New Zealand	1	
Feb 2001	TEMA	Australia	1	4
Jan 2001	Spremberg	Germany	1	
Jan 2001	Vorrat 5	Great Britain	1	
Jan 2001	Vorrat 6	Great Britain	1	
Jan 2001	Vorrat 7	Great Britain	1	
Jan 2001	Vorrat 8	Great Britain	1	
Jan 2001	Vorrat 9	Great Britain	1	
Oct 2000	Birs	Switzerland	1	
Sep 2000	Vigo	Spain	1	60 m <sup>3</sup> /h
Sep 2000	USA 2	USA	1	60 m <sup>3</sup> /h
Sep 2000	USA 3	USA	1	60 m <sup>3</sup> /h
Sep 2000	USA 4	USA	1	60 m <sup>3</sup> /h
Sep 2000	USA 5	USA	1	60 m <sup>3</sup> /h
Sep 2000	Waidhofen	Austria	1	4
Aug 2000	USA 1	USA	1	
Aug 2000	Waßmannsdorf	Germany	1	4
Aug 2000	Waßmannsdorf	Germany	1	4
Jul 2000	Vorrat 4, UK	Great Britain	1	60 m <sup>3</sup> /h
Jul 2000	Daldowie	Great Britain	6	4
Jul 2000	Daldowie	Great Britain	1	4
Jul 2000	Daldowie	Great Britain	1	60 m <sup>3</sup> /h
Jul 2000	Vorrat 1	Great Britain	1	4
Jul 2000	Vorrat 2	Great Britain	1	4
Jul 2000	Vorrat 3	Great Britain	1	4
Jun 2000	Staz, CH	Switzerland	1	
Jun 2000	Kopenhagen, DK	Denmark	1	
Jun 2000	Modena, I	Italy	1	
Jun 2000	Chichester, UK	Great Britain	2	
Mar 2000	Aarburg CH	Switzerland	1	
Feb 2000	Würzburg	Germany	1	
Feb 2000	New Haven	Great Britain	1	
Aug 1999	Lachen	Switzerland	1	
Jun 1999	Kläranlagen England	Great Britain	5	
Jun 1999	Kläranlagen England	Great Britain	3	
Jun 1999	Kläranlagen England	Great Britain	2	

# Strainpress® In-Line Sludge Screen

Reference List



Installation Photo	Contact Information
	<p><b>City of San Diego CA</b> <b>FIRP / NSPF</b> Ted Taylor Senior Plant Technician Supervisor (619) 221-8761</p> <p>Six (6) STRAINPRESS®</p>
	<p><b>Upper Occoquan Service Authority, VA</b> Bob Chenevey Mechanical Systems Manager (703) 830-2200 or 703-227-0276</p> <p>Four (4) STRAINPRESS®</p>
	<p><b>SynAgro, Elk Grove, CA</b> Paul Santos Synagro Tech Plant Manager (916) 220-4416</p> <p>One (1) STRAINPRESS®</p>

Additional references:

**Gilder Creek WWTP, SC**

David Collyer  
Plant Foreman  
(864) 419-2396

Two (2) STRAINPRESS®

**Three Rivers Regional, Longview WA**

Gordon Templeton  
(360) 577 2020

One (1) STRAINPRESS®

**Fort Collins, CO**

Jerry Yakel  
Maint. Specialist  
(970) 222-4019 cell  
(970) 221-6900 office

One (1) STRAINPRESS®

**Blue Lake WWTP, MN**

Dave Simmons  
Plant Manager  
(651) 602-4604 office  
(651) 602-4602 cell

Three (3) STRAINPRESS®

**Synagro-Stamford, CT**

Pete Scorziello  
Plant Manager  
(646) 296-3362

One (1) STRAINPRESS®

# Section 2.0

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# Scope of Supply

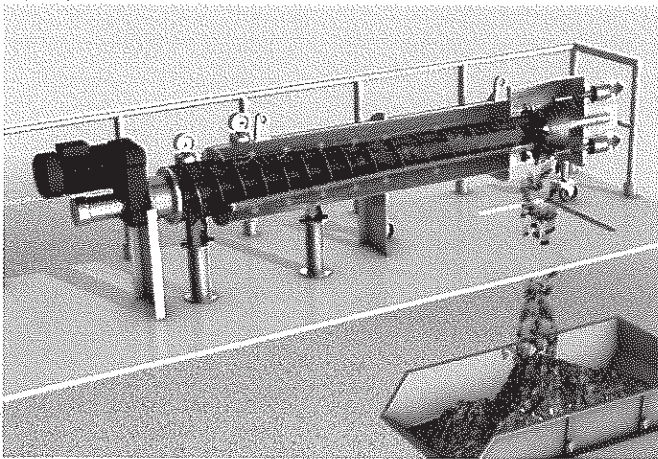
Project Name: Witchita, KS

Equipment Type:  
Strainpress® 290 (5 mm)

Huber Proposal Number:  
442241

Proposal Date:  
5/10/2019

Bid Date:  
5/1/2019



#### Huber Contacts:

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Regional Sales Director - Central  
816-623-9955  
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704-990-2433  
Christian.Primm@hhusa.net

Represented by:  
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**HUBER**  
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WASTE WATER Solutions

Huber Technology, Inc.

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Suite A  
Huntersville, NC 28078

Phone: (704) 949-1010

Fax: (704) 949-1020

# Strainpress® 290 Design Parameters

Witchita, KS

May 1, 2019

## Sludge Characteristics

Sludge Type: WAS  
 Sludge Concentration: 1 % (assumed)

## Equipment Design Parameters

Recommended Unit Quantity: 1  
 Recommended Opening Size: 5 mm  
 Operational Schedule: 40 hr/wk (assumed)  
 Maximum Hydraulic Loading Rate (per unit): 440 gpm (99.9 m3/hr) at 1% solids  
 Alternate Hydraulic Loading Rate (per unit): 375 gpm (85.1 m3/hr) at 2% solids

Estimated Screenings Dryness: 35-45% dry solids  
 Maximum Screenings Removal Rate: 25 ft3/hr (0.71 m3/hr)  
 Typical Air Requirement (per unit): 0.53 SCFM at 102 psi (15 L/min at 7 bar)  
 Maximum Air Requirement: 1.06 SCFM at 131 psi (30 L/min at 9 bar)

NOTE: All performance is estimated based on typical Strainpress® 290 performance. In order to guarantee performance Huber must test the sludge or run a pilot test.

## Equipment Description

Wichita, KS

May 1, 2019

### Strainpress® 290:

One (1) Strainpress® 290 in 304L stainless steel construction; pickled and passivated in acid bath.

Each Including:

- Perforated screening baskets (one conical and one cylindrical)
- 5.0 hp, 3 ph, 460 VAC, 60 Hz main drive motor
- Support legs
- Pressure monitor

### Ancillary Equipment:

- Compressor for pneumatic retention cone

### One (1) Strainpress® 290 Main Control Panel, including:

- Enclosure, NEMA 4X, 304 Stainless Steel
- Motor Starter, IEC Non-Reversing, w/ Branch Circuit Protection [5 hp max, 3/60/480VAC]
- PLC, AB MicroLogix 1400
- HMI, AB PanelView Plus C400
- UL Label

One (1) Huber Standard Pneumatic Control Panel design. Each Including:

- Enclosure, NEMA 4X, 304 Stainless Steel
- Filter/regulator
- Pressure switch
- Solenoid and manual valves
- brass fittings

### Freight and Supervision Services:

- Four (4) total days onsite for certification of proper installation, start-up of equipment, and training of personnel
- Two (2) total trips for installation supervision services
- Freight to jobsite.

## Pricing

Wichita, KS

May 1, 2019

Qty	Equipment Description	Price
1	Strainpress® 290 Sludge Screen	Included
1	Strainpress® 290 Main Control Panel	Included
1	Manufacturer's Service and Freight	Included

## Notes

- 1 Huber has received no Bid Plans and Specs, and has included their Standard Strainpress Offering
- 2 All electrical interconnections, wiring, junction boxes, and terminations between the equipment and electrical components are to be provided by installing contractor.
- 3 All piping to and from the equipment is to be supplied by the installing contractor.
- 4 Any item not specifically listed above is not considered part of this scope of supply. Please contact the Huber Technology representative listed above for further clarification.
- 5 Programming software and spare parts for the controls systems are not included in this scope of supply unless stated otherwise. These items are available for an additional price adder upon request.
- 6 Huber will supply our standard compressor system. This is to be a self-regulated unit and will not be controlled by the Strainpress® 290 Main Control Panel.
- 7 Sludge TS has been assumed as 1%, with alternate Sludge TS assumed at 2%.

## StrainPress Start up checklist

Site: \_\_\_\_\_ Contractor/Owner: \_\_\_\_\_

Date: \_\_\_\_\_ Machine number: \_\_\_\_\_

Machine size: \_\_\_\_\_ Project no: \_\_\_\_\_

### 1. Check control panel:

- a) Open the panel and check all field devices are landed in their appropriate locations and terminals are tight. \_\_\_\_\_
- b) Check that all necessary jumpers for non-existent devices are present. \_\_\_\_\_
- c) Turn off all selector switches and internal circuit breakers then turn on cabinet feed voltage and check for value and balance. \_\_\_\_\_
- d) Turn on internal circuit breakers one at a time and ensure correct systems are powering up. \_\_\_\_\_
- e) Check that inlet and discharge pressure sensors are powered up and are returning the proper signal back to the cabinet. \_\_\_\_\_
- f) Change the units and scaling in the inlet and discharge pressure sensors to match units and scaling in the OIU. \_\_\_\_\_
- g) Check sludge moisture probe is installed correctly (Wires 1 &2 from probe are signal and wires 3 &4 are 24V power) \_\_\_\_\_
- h) Check that settings in power monitor match motor nameplate data, ie: HP, FLA, etc.. \_\_\_\_\_
- i) Check motor leads and ensure continuity between T1, T3, and T3 and that there is no continuity between T1-3 and ground. \_\_\_\_\_
- j) Manually start motor and check the rotation is correct, if not change position of T1 and T3 and check again. \_\_\_\_\_
- k) Check setpoints in OUI and enter appropriate values as needed. See list of typical values below. \_\_\_\_\_

### 2. Check pneumatic control panel:

- a) Turn on air supply to pneumatic cabinet from plant air supply and check for leaks. \_\_\_\_\_
- b) Set supply pressure in cabinet to 120psi, this setting is made on the first regulator in the cabinet usually labeled (REG1/PW1) \_\_\_\_\_
- c) Set closing pressure on the cone to 75psi, this setting made on the regulator usually labeled (REG2) \_\_\_\_\_
- d) Check that pneumatic cylinders are connected properly to pneumatic panel (connection labeled CYLINDER CONNECTION goes to the back of the cylinder, connection labeled CONTROL CONNECTION goes to the front of the cylinders) Cylinder is closing pressure, Control is opening pressure. \_\_\_\_\_

### StrainPress Start up checklist

- 3. Check that the two machine housings are aligned. \_\_\_\_\_
- 4. Check that the connecting rod connecting the two screws together are tight. \_\_\_\_\_
- 5. Turn on the motor and let run for 15-20 seconds and take a note of the average power percentage on the OIU. \_\_\_\_\_
- 6. Adjust the screw using the the brass locknuts on the discharge end until the average power percentage is roughly 6-8% higher than the base reading. \_\_\_\_\_
- 7. Put Strainpress HOA switch in Auto, and cone direction selector switch in Forward. \_\_\_\_\_
- 8. Introduce sludge to Strainpress. \_\_\_\_\_
- 9. Optimize settings. \_\_\_\_\_

If sludge is not available at startup then the contractor/owner needs to acknowledge by signing that all settings are not final and will need to be adjusted/optimized when sludge is available. Startup is incomplete.

Motor and gearbox data: \_\_\_\_\_  
\_\_\_\_\_

Gearbox model and serial no: \_\_\_\_\_  
\_\_\_\_\_

Motor nameplate data: \_\_\_\_\_  
\_\_\_\_\_

Serial number: \_\_\_\_\_ Catalog number: \_\_\_\_\_

Voltage: \_\_\_\_\_ HP: \_\_\_\_\_ FLA: \_\_\_\_\_ Hz: \_\_\_\_\_

Service Factor: \_\_\_\_\_ RPM: \_\_\_\_\_ Frame: \_\_\_\_\_

Efficiency: \_\_\_\_\_

## StrainPress Start up checklist

### Typical Settings:

- START DIFFERENTIAL PRESSURE: 4-17psi
- START INLET PRESSURE: +2psi from whatever inlet pressure is whenever differential is met.
- HIGH INLET PRESSURE: +2psi for start inlet pressure(42max)
- MAINTAINED HIGH INLET PRESSURE FAULT TIME: 5 sec
- HIGH INLET PRESSURE RECOVERY TIME: 30 sec
- HIGH INLET PRESSURE FAULT COUNT RESET TIME: 120sec
- HIGH INLET PRESSURE ATTEMPTS TO CLEAR FAULT: 3
- STRAINPRESS OFF DELAY TIME: 20 sec
- STRAINPRESS OVERTORQUE FAULT: 80%
- STRAINPRESS OVERTORQUE DELAY TIME: 2 sec
- HIGH MOISTURE FAULT DELAY TIME: 5 sec
- LOW AIR SUPPLY PRESSURE DELAY TIME: 90 sec
- CYLINDER MAX CONTROL PRESSURE: 100%
- CYLINDER MIN CONTROL PRESSURE: 0%
- STRAINPRESS MIN POWER: 20%
- STRAINPRESS MAX POWER: 80%

### Actual Settings:

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### Other settings:

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### Notes:

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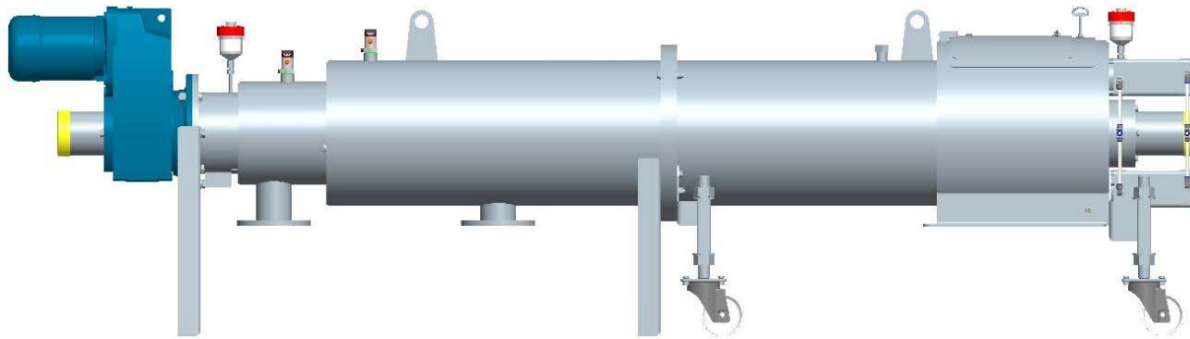
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Huber Startup Technician: \_\_\_\_\_

Contractor/Owner name & title: \_\_\_\_\_

# Huber STRAINPRESS® SP4 Pressurized Sludge Screen



## Customer Training Manual

# Strainpress Training Manual

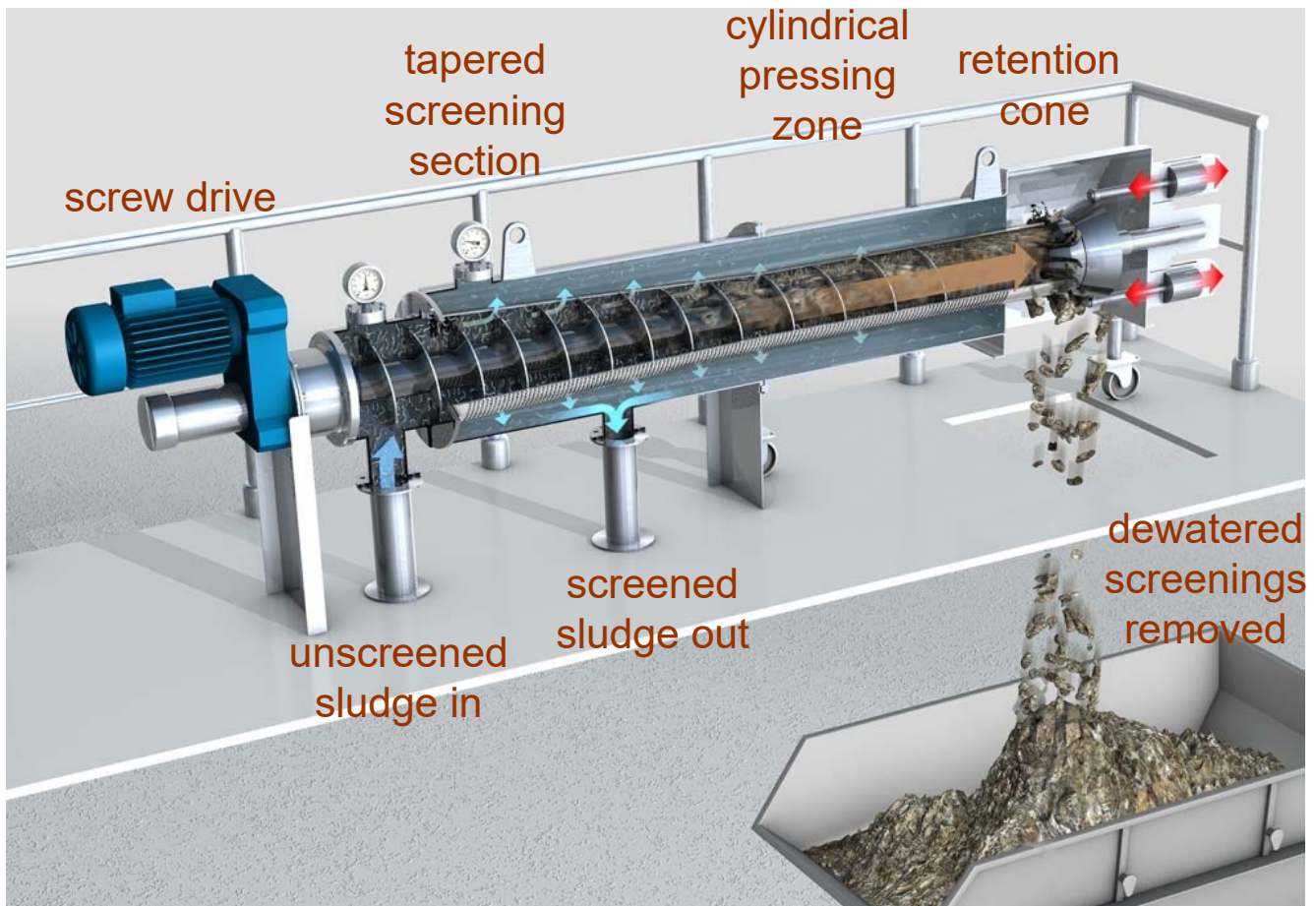
## Table of contents :

- ❑ Overview of Principle components
- ❑ Principle of operation
- ❑ Safety features
- ❑ Screen controls overview
- ❑ Control Philosophy
- ❑ Internal overview
- ❑ Maintenance
- ❑ External overviews
- ❑ Troubleshooting
- ❑ Summary

### Note :

This manual is for training purposes only – reference should to made to the SP4 O&M manual prior to undertaking any work on the unit.  
Huber SP4 Customer  
Training Manual

# Principle Components



## Principle of Operation

- ❑ Unscreened sludge enters the screen via the sludge inlet pipeline.
- ❑ The screenings zone comprises a conical section perforated mesh basket (typically  $\varnothing 5\text{mm}$  perforations, but other sizes are available) and the matching conical screen zone screw. The sludge passes in through the large diameter end of the conical screen and out through the perforated mesh to be discharged into the sludge outlet pipeline.
- ❑ Solids larger than the mesh perforations are retained in the basket and causes the inlet pressure to rise. Once the difference between the inlet pressure and discharge pressure reaches the start differential set point, the machine will begin a cleaning cycle.
- ❑ Screenings are cleaned off of the screen zone screen by the screen zone screw, and transported by the press zone screw into the dewatering zone.
- ❑ The screw flights end within the dewatering zone and a formation of screenings start to form in the press zone. This is known as the screenings or solids “plug.”
- ❑ The dewatering zone which is at the non-drive end of the conveyor screw is encased by a cylinder with a perforated wall ( $\varnothing 2\text{mm}$  perforations). As the plug of screenings is pushed towards the discharge chamber, effluent is pressed from the screenings.
- ❑ The effluent drains from the dewatering zone and is returned to the screened sludge flow.
- ❑ The discharge of screenings from the discharge chamber is controlled by the combined action of the discharge nozzle and the screenings retention cone.

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## Principle of Operation (continued)

- ❑ Force is applied to the screenings retention cone via two pneumatic actuators. This force provides a retention pressure against the screenings and enhances the screenings dewatering process. The retention pressure is regulated by an electro-pneumatic regulator linked to a motor power monitor (MPM).
- ❑ This system allows the force of the screenings retention cone to be optimized while ensuring that neither the motor is overloaded nor the screen is overstressed.
- ❑ The system must maintain a healthy air pressure at all times, and cannot be operated without it.
- ❑ The maximum allowable differential across the screens is 17psi, while the maximum allowable overall internal pressure of the machine is 43psi.

## Safety features

### **SAFETY FEATURES**

The electrical control panel incorporates the following safety features:

**Emergency Stop** - The emergency stop pushbutton is of the stay-put/twist release type. When the emergency stop is pressed the screen stops or is prevented from starting. Before the screen will restart, the emergency stop pushbutton must be released and the reset pushbutton pressed.

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## Screen Controls Overview.

- ❑ Two control panels are required for the operation of the screen. One of the control panels house the main disconnect, electrical controls and indicators, the other houses the electro-pneumatic controls, indicators and a compressed air system which provides the pneumatic function.
- ❑ The electrical control panel is either mounted adjacent to the screen or may be mounted remotely with the addition of an emergency stop adjacent to the screen. It is recommended that the pneumatic control panel should be mounted within 30 feet of the screen's pneumatic actuators.
- ❑ The standard control panel enclosures are of stainless steel and offer IP65 protection.(NEMA4x).
- ❑ The compressed air system comprises a piston compressor an air receiver or regulator complete with pressure switch, an automatic anti-condensate drain valve , an electro-pneumatic regulator, manual pressure regulator, and a 3 way pneumatic solenoid valve.

---

## Control Philosophy

*HAND MODE* - In *hand* mode, the screen will only start and stop in response to the Hand-Off-Auto selector switch on the front of the control panel. *Hand* mode is provided for maintenance purposes only, and the sludge feed pump remains inhibited when the screen is operating in this mode.

*AUTO MODE* - In *Auto* mode the machine will start immediately when the start differential pressure or start pressure set point is reached. The screen continues to operate until the differential and/or start pressure drops below the start level, after which the screen continues to operate until the time in the off-delay timer has expired. The screen will re-start as soon as the start differential pressure or start pressure again exceeds their respective set point.

In *Auto* mode the operation of the sludge feed pump or feed valve is interlocked with the *auto available* relay in the screen control panel. This serves to inhibit operation of the pump if the screen is not *available*.

*Auto Available* is defined as follows:

- no trip conditions
- selector switch in *Auto*
- power supply available
- no moisture detected
- emergency stop/interlock switches not operated
- the pneumatic air supply is healthy(minimum 75psi). This is monitored by a pneumatic pressure switch.

**Note:** The screen will automatically try to re-start after failure of the air supply.

---

## Control Philosophy (continued)

### Motor Power Monitor

□ The motor power monitor is used to measure the load on the screen drive motor and control the air pressure that is applied to the screenings retention cone actuators. The device measures voltage, current, frequency and power factor and calculates real power consumption. The power consumption is shown on the power monitor's digital display and on the analogue power meters fitted to the electrical control panels Operator Interface Unit.

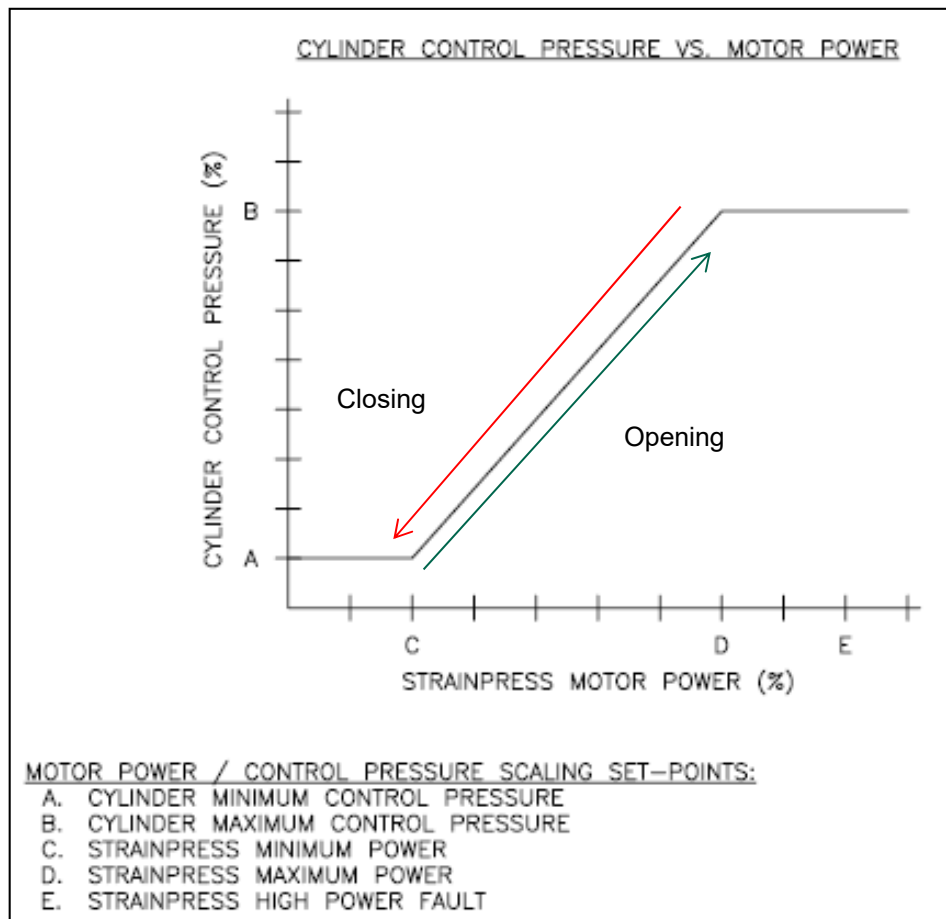
□ The power monitor's 4-20mA output is connected to the electro-pneumatic regulator in the pneumatic control panel, which automatically adjusts the air pressure. Motor power consumption is typically in the 20% range of full load power (flp) when the screen is running idle, rising up to 80% flp when screenings are discharged at 35-45% dry solid.

□ The Strainpress should be set to trip if the power consumption exceeds 80% (set point available in OUI).

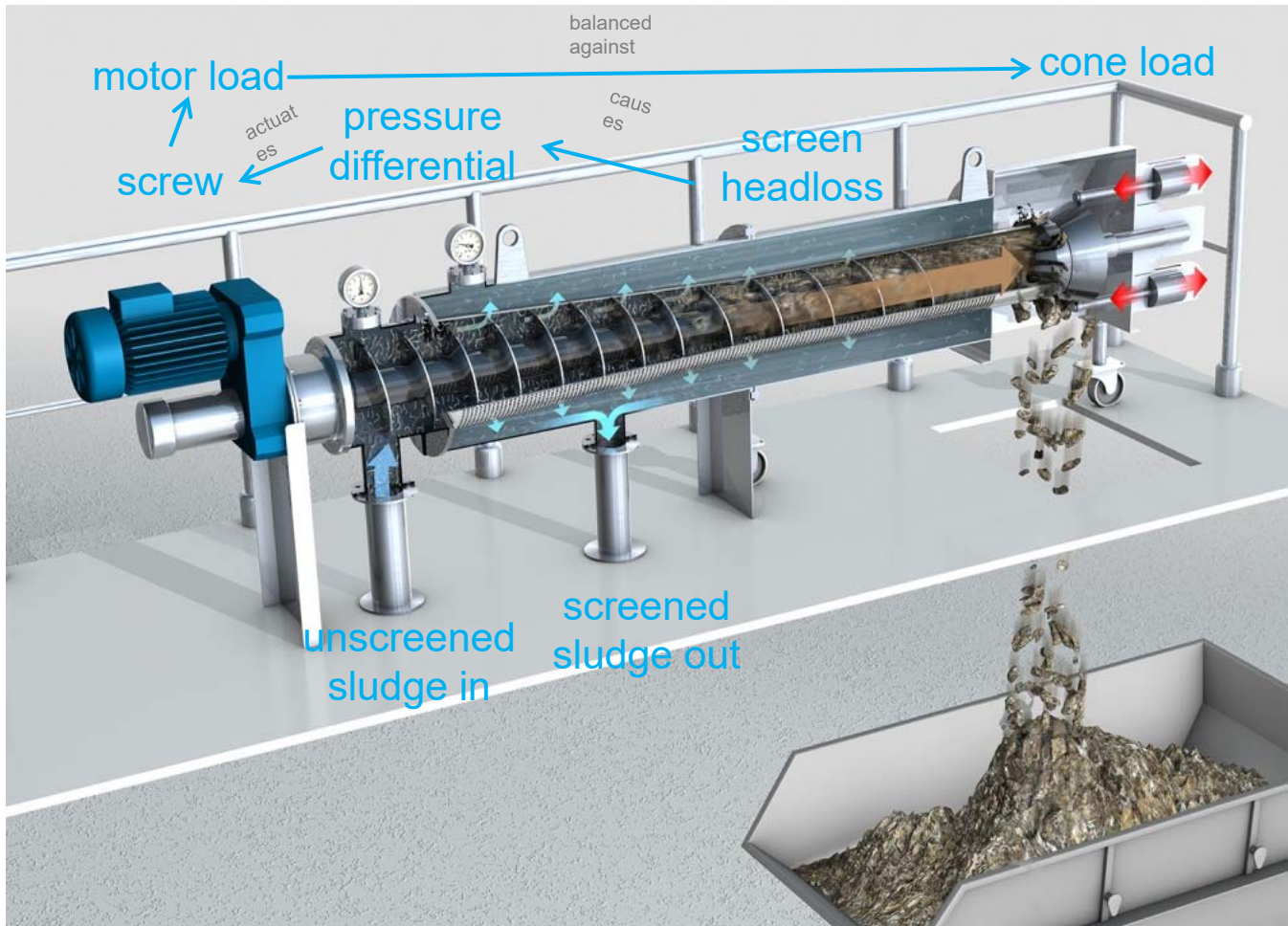
□ The pneumatic actuators apply force to the screenings retention cone to ensure that the screen's dewatering performance is optimised. Maximum closing pressure is applied to the screenings retention cone when motor power is at and below the Strainpress minimum power set point. A balanced pressure (i.e. equalised pressure on both sides of the actuator) is applied when the motor power is at and above the Strainpress maximum power set point.

## Control Philosophy (continued)

When the Strainpress begins to run, the power monitor will provide a 4-20mA signal proportional to motor load from 0-100% of motor nameplate power . This signal will be used by the electro-pneumatic regulator to adjust the amount of air pressure to the control side of the pneumatic cylinders. As motor power fluctuates between the minimum and maximum power set points, the air pressure will fluctuate between the minimum and maximum control power set points.



# Strainpress Internal Overview



This view depicts how the sludge is screened and how the screenings are transported and discharged from the Strainpress

# Maintenance

## ***On attending site - Visual checks***

- The screenings should be relatively clean and dry.
- Check that the pressure on the inlet pressure sensor does not exceed 43 psi. If it does refer to O&M or troubleshooting.
- Check that the differential pressure between the inlet and outlet pressure sensors does not exceed 17 psi. If it does refer to section 8 of the O&M.
- No trip lamps should be illuminated on the control panel fascia.

## ***Monthly***

- Measure the conveyor screw reference dimensions  $L_V$  and  $L_H$  as shown in figure 6.1 of the O&M. Record these and the other specified parameters on the *Strainpress Operation Data Sheet* in section 10 of the O&M. The sum of  $L_V$  and  $L_H$  should remain constant. If  $L_H > 55\text{mm}$  (2.125"), a replacement conveyor screw should be ordered. (The main wear item in the Strainpress is the screen zone screw.)
- Lubricate the Strainpress at the points identified in 7.2 of the O&M.
- Check operation of the screenings retention cone is in a good working order. Clean and grease the section of the screw conveyor shaft over which the cone slides.
- Check the operation of the moisture sensor. Test by pressing a wet cloth against the sensor. The Strainpress and sludge feed pump and/or valve should shut off immediately.

## Maintenance (continued)

### ***Bi-annually (every 6 months)***

Check the operation of the compressor safety valve & replace both auto greasers.

### ***Yearly***

- Repeat the *Commissioning Procedure* in section 6 of the O&M.
- Check for oil leaks from the geared motor.
- Change the compressor suction filter.
- Split the two halves of the Strainpress at the central flange. Clean and inspect the tapered and parallel screen sections.

### ***2 years/10,000 hours screen operation***

Change the lubricant in the geared motor. Remove the motor rotor bearings. Clean, inspect, re-lubricate and re-assemble.

## Maintenance (continued)

### ***As needed.***

Adjust screen zone screw.

### ***Screen Zone Screw Adjustment.***

Periodically the screen zone screw needs adjusting to maintain the tight clearance against the screen zone screen as it wears. When symptoms arrive, operations should contact maintenance and have the screw adjusted to avoid operation problems.

### ***Symptoms screw may need adjustment***

- The screen dwells for shorter periods of time when flow rates or DS% has no increased.
- The machine runs continuously even though flow rates or DS% has not increased.
- When the machine is running the inlet pressure does not decrease.
- The motor power % falls below the point of last adjustment.

If any of the above symptoms are displayed either individually or simultaneously, it is likely the screen zone screw needs adjustment.

## Maintenance (continued)

### ***Adjusting the screw.***

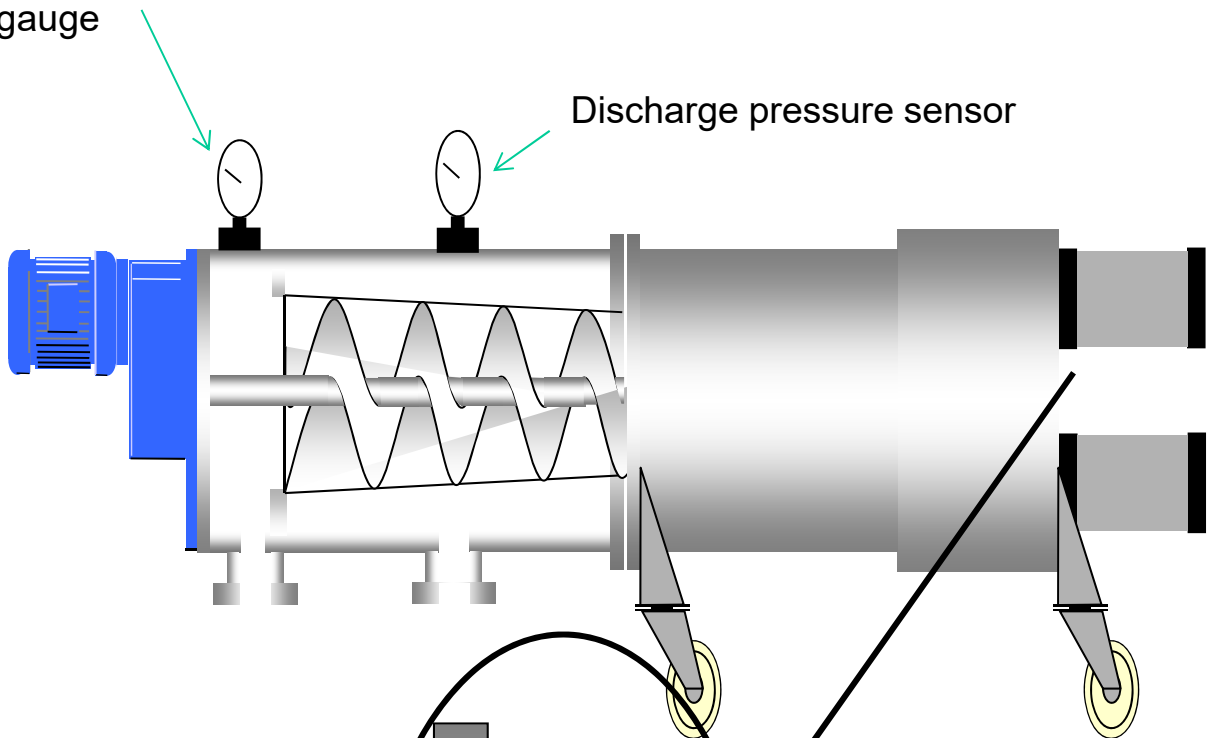
Take the following steps to adjust the screen zone screw:

1. Isolate the machine by closing inlet and discharge valves and turning the Hand-Off-Auto switch to the OFF position.
2. Allow pressure to dissipate from machine. (both sensors read <1psi.
3. Open the cone by setting the cone direction selector switch on the control panel from Forward to Reverse. (All screw adjustments must be made with the cone in the OPEN position.)
4. Place the machine in the HAND mode and allow it run for 1 minute while monitoring the motor power % on the Operator Interface.
5. Record this base power % (BS)
6. Remove the cover over the adjusting nuts.
7. Using the provided specialty tools break the lock nut from the adjusting nut being careful not to move the adjusting nut.
8. Turning the adjusting nut clockwise in small increments, then re-tighten the lock nut.
9. Place the machine back in HAND mode and allow it run for 1 minute while monitoring the motor power % on the Operator Interface.
10. Record this power % (A)
11. Continue this process in small increments until you increase the motor power % by 10 percentage points after 1 minute of runtime. ( $BS + 10 = A$ )
12. Replace the cover on the adjusting nuts.
13. Place the cone directional selector switch from the Reverse to the Forward position.
14. Place the Hand-Off-Auto switch to the AUTO position.
15. Open isolation valves and introduce flow to the machine.
16. Measure new  $L_H$ . (Screw must be replaced at 55mm to prevent damage.)

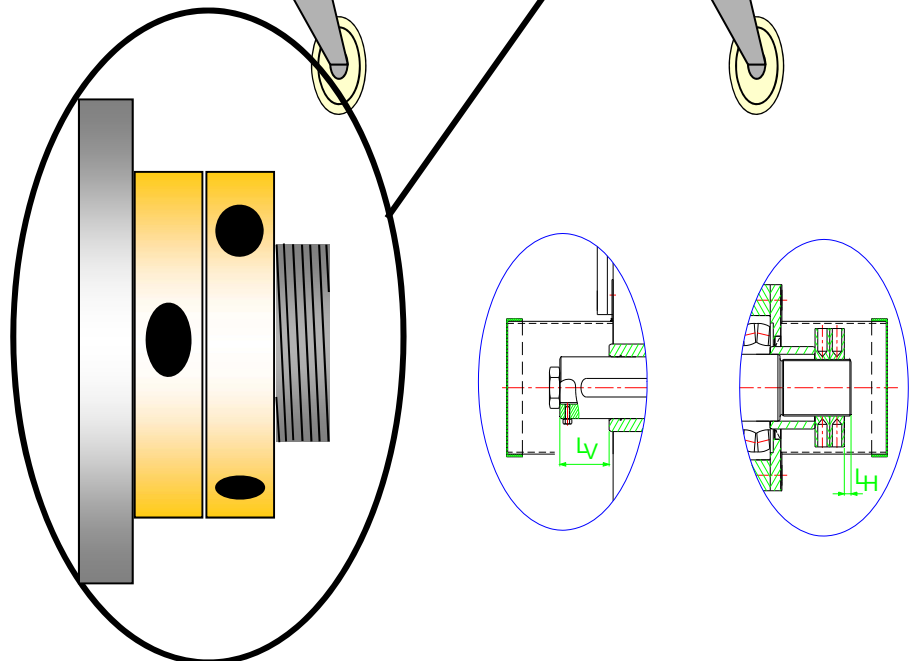
# Strainpress External view

Inlet pressure sensor.  
Start & High pressure detected by  
this gauge

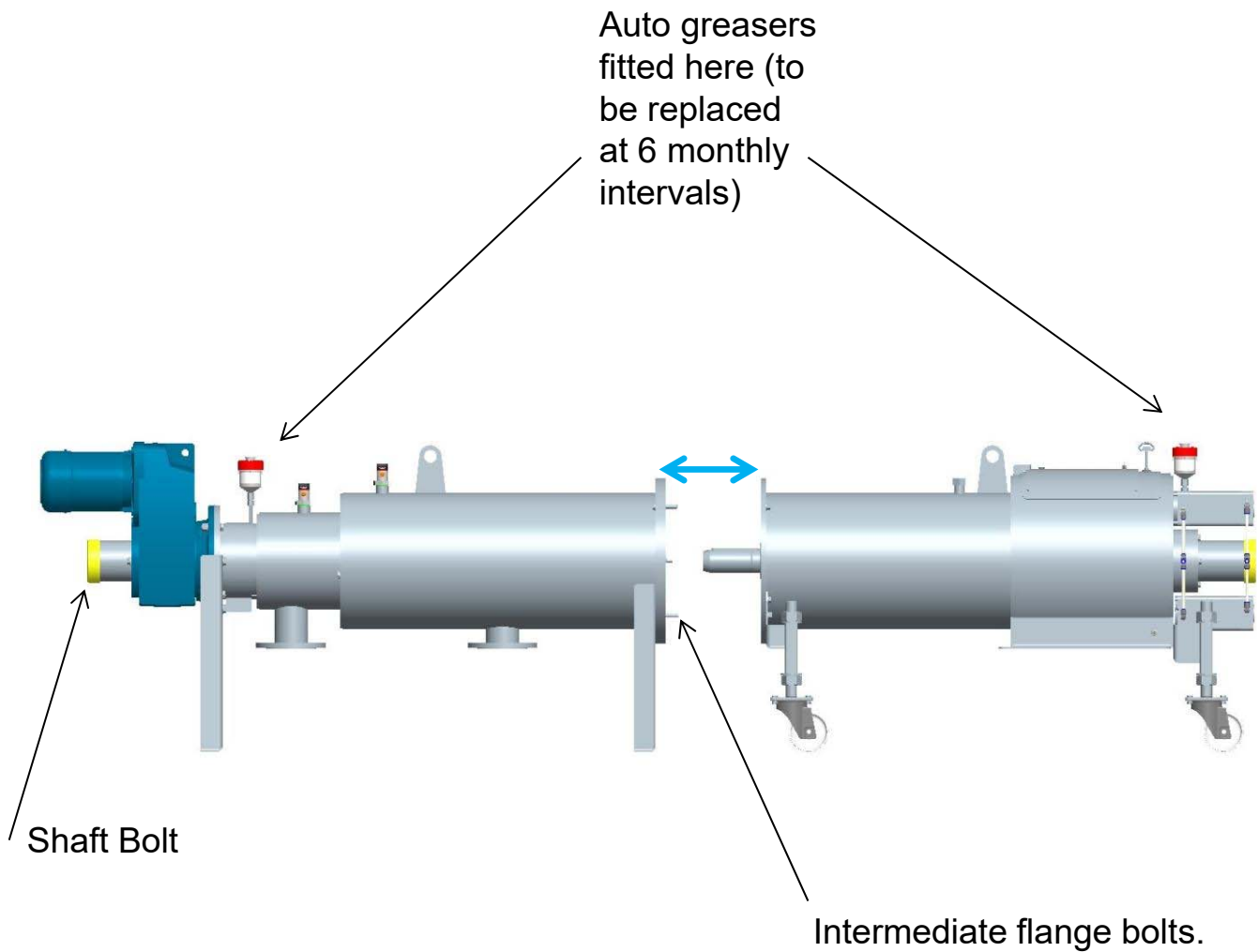
Discharge pressure sensor



This view shows  
the pressure  
gauges and  
means of  
adjustment of  
the conveyor  
screw



# Strainpress External Overview



This view shows the location of the grease points, the shaft bolt and intermediate flange bolts

# Troubleshooting

Symptoms	Probable Causes	Possible Solutions
<p>Fault Light is energized.</p>	<ol style="list-style-type: none"> <li>1. Strainpress motor has overloaded.</li> <li>2. Strainpress has shut down on maintained high inlet pressure.</li> <li>3. Discharge pressure has become higher than inlet pressure.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check that the settings in the power monitor are correct. <ol style="list-style-type: none"> <li>a. Check the power settings in the OIU are correct.</li> <li>b. Check the thermal over-loads.</li> <li>c. Make sure screenings are not too dry.</li> <li>d. Make sure throughput is not too high for sludge DS%.</li> </ol> </li> <li>2. Check that the screw is adjusted. <ol style="list-style-type: none"> <li>a. Make sure throughput is not too high for sludge DS%.</li> <li>b. Make sure discharge valve is open and there is no blockage in pipe.</li> </ol> </li> <li>3. Check that sludge is not flowing in reverse through the Strainpress. <ol style="list-style-type: none"> <li>a. Make sure check valve on discharge is functioning.</li> <li>b. Make sure sensors are set up properly.</li> </ol> </li> </ol>
<p>Machine runs continuously</p>	<ol style="list-style-type: none"> <li>1. Screw is out of adjustment.</li> <li>2. Flow rate is too high for sludge DS%.</li> <li>3. Start differential pressure is too low.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust screw.</li> <li>2. Reduce flow rate to acceptable level for sludge concentration.</li> <li>3. Increase start differential pressure to increase the dwell time.</li> </ol>

## Troubleshooting(continued)

Symptoms	Probable Causes	Possible Solutions
Pressure does not reduce when machine cycles.	<ol style="list-style-type: none"> <li>1. Screw is out of adjustment.</li> <li>2. Throughput is too high for sludge DS%.</li> <li>3. Blockage in discharge pipe.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust the screw.</li> <li>2. Reduce throughput to acceptable level for sludge concentration.</li> <li>3. Check all valves are open and there is no blockage in pipe.</li> </ol>
Moisture breakthrough lamp is lit.	<ol style="list-style-type: none"> <li>1. Cone opens too soon and allows liquid sludge to discharge.</li> <li>2. More than 17psi across the screens.</li> <li>3. Overall pressure exceeded.</li> <li>4. Air pressure has dropped too low.</li> </ol>	<ol style="list-style-type: none"> <li>1. Increase Strainpress minimum power set point.</li> <li>2. Check that the screw is adjusted. <ol style="list-style-type: none"> <li>a. Check that throughput is not too high for sludge concentration.</li> </ol> </li> <li>3. Check that the screw is adjusted. <ol style="list-style-type: none"> <li>a. Check that throughput is not too high for sludge concentration.</li> <li>b. Check that all valves are open and there is no blockage in discharge pipe.</li> </ol> </li> <li>4. Check air supply is healthy and all air valves are open. <ol style="list-style-type: none"> <li>a. Check that air lines to cylinders have not become disconnected.</li> <li>b. Make sure manual regulator is set to minimum 75psi.</li> <li>c. Make sure cone directional selector switch is in Forward position.</li> </ol> </li> </ol>

## Troubleshooting(continued)

Symptoms	Probable Causes	Possible Solutions
Screenings are too dry (>50%) causing motor overload.	<ol style="list-style-type: none"> <li>1. Strainpress minimum power set too low.</li> <li>2. Machine has been offline for too long while screenings left inside.</li> <li>3. Cone hold pressure set too high.</li> <li>4. Dwell time is too long due to extremely low throughput and sludge DS%.</li> </ol>	<ol style="list-style-type: none"> <li>1. Decrease Strainpress minimum power set point.</li> <li>2. Split machine and clean.</li> <li>3. Decrease setting on manual regulator to 75psi.</li> <li>4. Decrease start differential set point so machine will cycle more frequently.</li> </ol>
Screen does not appear to be cleaning after a proper screw adjustment.	<ol style="list-style-type: none"> <li>1. Screw can no longer be adjusted (<math>L_H \geq 55\text{mm}</math>)</li> <li>2. Non OEM screw and/or screen has been installed.</li> <li>3. Throughput is too high for sludge DS%.</li> </ol>	<ol style="list-style-type: none"> <li>1. Purchase and install new Huber OEM screen zone screw.</li> <li>2. Purchase and install new Huber OEM screen zone screw and/or screen.</li> <li>3. Reduce throughput to an acceptable level for current sludge concentration.</li> </ol>
Sludge throughput is steadily decreasing.	<ol style="list-style-type: none"> <li>1. The sludge DS%/screenings loading has been increased.</li> <li>2. Due to wear of the screw the screen is not being cleaned efficiently.</li> </ol>	<ol style="list-style-type: none"> <li>1. Reduce screenings loading or DS% if higher flows are required.</li> <li>2. Adjust the screw.</li> </ol>
Discharged screenings are too wet. (>35%)	<ol style="list-style-type: none"> <li>1. Strainpress minimum power set point is too low.</li> <li>2. Retention cone movement is restricted.</li> <li>3. Screen is not being cleaned efficiently.</li> </ol>	<ol style="list-style-type: none"> <li>1. Increase Strainpress minimum power set point.</li> <li>2. With machine isolated and offline, cycle cone forward and reverse and ensure free movement.</li> <li>3. Adjust the screw.</li> </ol>
Sum of screw adjustment measurements ( $L_V + L_H$ ) has varied.	<ol style="list-style-type: none"> <li>1. Screw coupling rod is loose.</li> </ol>	<ol style="list-style-type: none"> <li>1. Tighten screw coupling rod and readjust screw.</li> </ol>

## Summary of SP4 Sludge Screen Features

- Operates without wash water.
- Flows up to 450 gpm, aperture 3 - 6mm.
- Suitable for pressurised pipelines.
- Screenings discharge pressure regulator for optimum dry product.
- Manufactured entirely from Stainless Steel.
- Throughput (based on 5mm perforations) :
  - 150 gpm @ 8% ds
  - 220 gpm @ 7% ds
  - 260 gpm @ 6% ds
  - 270 gpm @ 5% ds
  - 285 gpm @ 4% ds
  - 330 gpm @ 3% ds
  
- \*\* Throughput varies depending upon sludge DS% and amount of screenings > screen basket perforations.

## Contact information

## Huber Technology Aftermarket Services

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Suite A  
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General Service:	Phone:	(704) 949 – 1015
Scheduling:	Phone:	(704) 949 – 1015
Spare or wear Parts:	Phone:	(704) 949 – 2480
Service Technical Support:	Phone:	(704) 949 - 2401
Aftermarket Services:	E-mail:	
<a href="mailto:service@hhusa.net">service@hhusa.net</a>		
Spare and/or wear Parts:	E-mail:	<a href="mailto:parts@hhusa.net">parts@hhusa.net</a>

Or visit our website [huber-technology.com](http://huber-technology.com) for up-to-date information concerning our Business Unit Aftermarket Services.



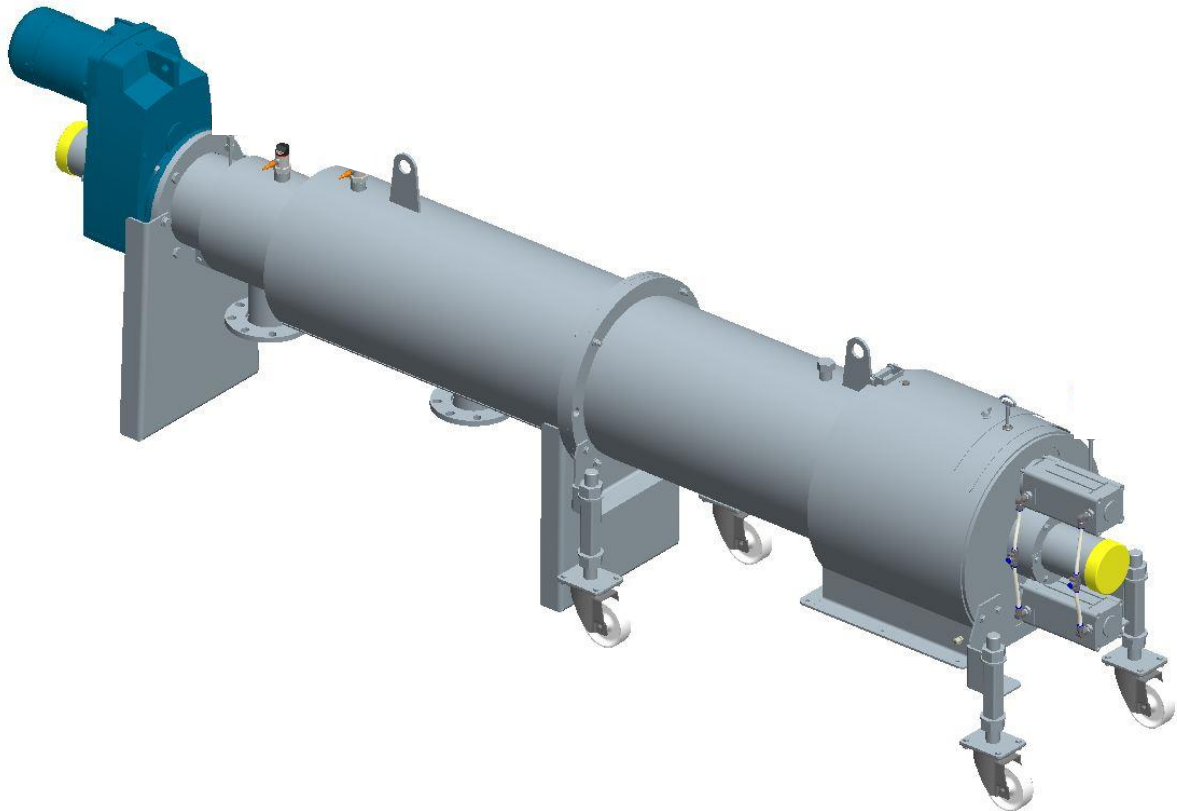
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Huntersville, NC 28078  
[www.huber-technology.com](http://www.huber-technology.com)

# Section 3.0

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# Operation Manual


## HUBER Sludg cleaner STRAINPRESS®



**Huber Technology, Inc.**

**9735 NorthCross Center Court STE A  
Huntersville, NC 28078**

Original Operating Manual  
Version 02/19

	<b>NOTICE</b>
<p>This manual is part of the plant and must be available for the operators any time. The safety instructions must be observed. In case of selling the plant, the manual must be included. For a better overview this manual may contain photos/graphics of the machine without safety devices. Operation of the machine is only permitted when all prescribed safety devices as e.g. covers or railings are mounted.</p>	

**Translation**

For delivery in the EEA, the operating manual is to be translated into the language of the target country.

If inconsistencies occur in the text, refer to the original operating manual (German), or contact the manufacturer.

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# 1 Product specification

## 1.1 Intended use

The equipment is intended to separate solids from water and higher viscous liquids, such as sewage sludge for example.

The machine is applied for solids separation ...

- in wastewater treatment plants (municipal and industrial)
- for industrial process and partial flows

The intended use also includes:

- Observance of the start-up, operation and maintenance conditions as set out in this operating manual.
- Due consideration of foreseeable misuse
- Operation by skilled workers only (who are familiar with the correct procedures and know the dangers)

### **WARNING**

The machine is intended exclusively for the above specified use.

Any additional use or rebuilding of the equipment without prior written approval by the manufacturer does not comply with the intended use.

The manufacturer will not assume liability for consequential damage. The operator alone will bear the risk.

Do not start up the machine before there has been ensured that all safety devices are completely mounted and operable, and that the plant into which the machine may be incorporated complies with the rules.

## 1.2 Intended use (ATEX)

The machine is suitable to be applied in EX protection areas if a separate ATEX Declaration of Conformity has been issued and one of the below additional specifications is made on the identification plate.

It is mandatory to perform the ATEX-related maintenances (see chapter Maintenance).

Ambient temperature limit for zone 1 ex-protection areas: 50°C

The machine is suitable to be used in Class 1 Division 2 areas.

## 1.3 EMC advice

### **NOTICE**

**Advice** for applying the EC rule EMV 2014/30/EU:

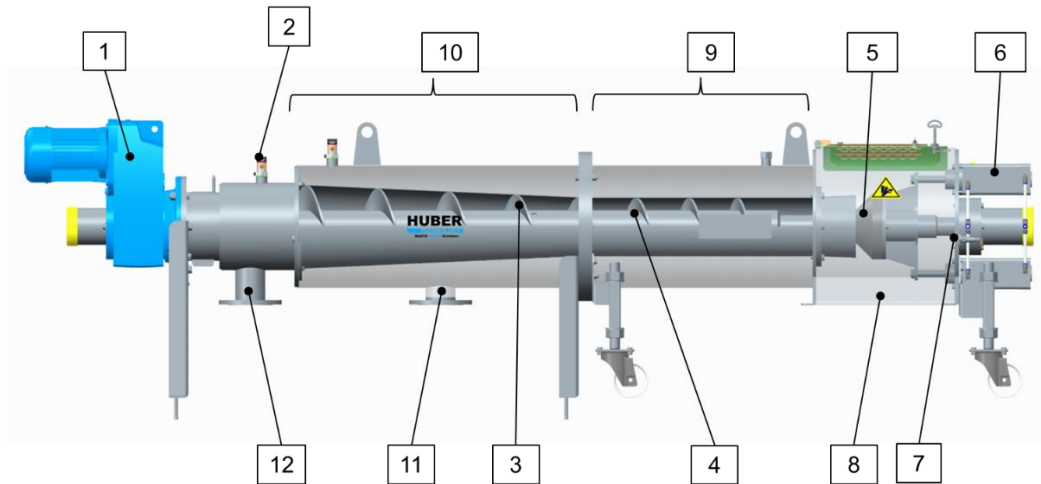
The plant is prepared for operation in industrial areas acc. to DIN EN 61000-6-4 (generic standards for transient emissions in industrial areas). Wiring and control technology have to meet additionally the requirements of DIN EN 61000-6-3 (transient emission in living areas) for operation in living areas, in business and commercial areas and in small companies.

## 1.4 Definition of terms for equipment components

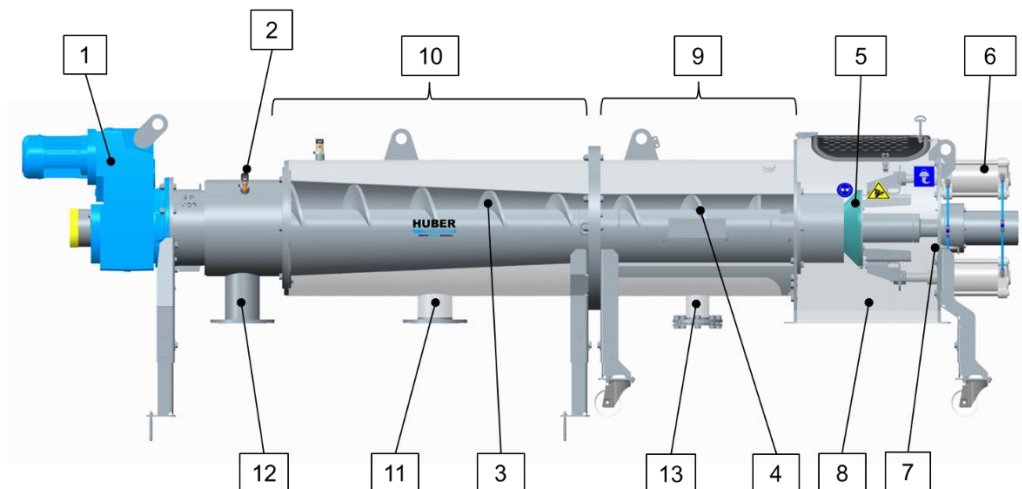
### Definition of terms:

Terms for equipment components according to the following cross section drawing.

SP 290:



SP 430:



- |   |                                 |       |                       |
|---|---------------------------------|-------|-----------------------|
| 1 | drive                           | 7     | sludge probe          |
| 2 | pressure probe                  | 8     | solids discharge      |
| 3 | screw section in screening zone | 9     | press zone casing     |
| 4 | screw section in press zone     | 10    | screening zone casing |
| 5 | pressure cone                   | 11/13 | outlet                |
| 6 | pressure cone system            | 12    | inlet                 |

Optional equipment, such as a discharge chute or bagging unit, can be mounted to the outlet.

Typical variants of the STRAINPRESS® relate to:

- Perforation of the screening zone
- Length of the screw shaft press zone
- Length and design of the press zone extension: length of the pneumatic push rods
- Wear protection of the screw shaft
- Design of the feet / rollers
- Electrical consumers

#### Supply limits:

##### Mechanical:

- Inlet and outlet flange
- Compacted material discharge
- Machine feet
- Lifting eyes on the machine

##### Pneumatic:

- Compressed air connections of pneumatic cylinders

##### Electrical:

- Motor terminal box
- pressure probe, 2. pressure probe optional
- Sludge probe in screenings discharge

## 1.5 Functional description of the plant

The operation principle of the plant is based upon the principle of an internal flow drum screen. The special feature of the plant is its integrated press zone, which continuously dewateres the separated solids and discharges them in spadable condition.

The machine is installed in a closed line system. Feeding by means of a pump that is designed to suit the medium and pressure conditions.

The screening and press zone lie one after the other in the horizontal longitudinal axis, encased by the screen baskets.

The press zone and particularly the pressure cone at the end of the press zone that regulates the discharge opening by means of an adjustable contact pressure are provided to ensure the controlled discharge of solids.

The gear motor installed at the inlet end drives both screws. The liquid to be treated is pumped into the screening zone at the screen front end. While the liquid streams through the perforated screen basket from inside to outside, any solids bigger than the selected perforation size are retained at the inner basket surface and continuously conveyed by the screw towards the press zone.

While the screened liquid exits from the STRAINPRESS® and flows through additional treatment stages, the separated solids accumulate in the press zone until being taken up by the press screw and compacted to a plug.

The press liquor flows through the press zone screen with its fine perforations and mixes with the effluent from the screening zone.

The slowly exiting solids plug, braked by the press zone and pressure cone, serves also as a sealing between the overpressurized interior and the exterior. When arriving at the pressure cone the plug expands and is torn into pieces. The individual pieces fall down. Depending on their intended use, they are collected or disposed of.

The operating status is monitored by pressure measurement in the inlet and outlet (option). In this way, the pressure loss in the screening zone and the internal pressure onto the solids plug are identified.

The main load onto the drive is caused by the compaction process. The motor must be protected against overload.

When the pressure exceeds the limit pressure (approx. 1.2 bar in the screening zone), there is a risk of water breakthrough in the plug area.

Therefore, a liquid sensor (sludge probe) is installed in the solids discharge chamber. The probe senses any breakthrough and in such a case interrupts the feeding process and initiates closing of the shut-off devices on the inlet and outlet end.

## 1.6 Performance data

The achievable throughput depends on

- Medium viscosity
- Volume and type of solids to be separated
- Size of apertures in the screening zone

Please note that the performance data refer exclusively to municipal sewage sludge.

The performance data are based on an assumed average fresh sludge of approx. 4% DS from aeration plants with a preceding screen (with approx. 15 mm bar spacing).

Separation of foreign matter from:	sewage sludge
Capacity:	SP 290: approx. 30 – 60 m <sup>3</sup> /h SP 430: approx. 60 – 120 m <sup>3</sup> /h
Dry substance content:	approx. 3-6% DS
DR content of discharged solids:	approx. 35-45%
Maximum transportable solids volume:	SP 290: 1000 l/h SP 430: 2000 l/h
Maximum permissible casing internal pressure:	3 bar (42 psi)
Permissible operating pressure:	1.2 bar (17 psi)
Perforation (press zone):	Ø 2 mm
Perforation (screening zone):	Ø 5 mm

## 1.7 Experiences with sewage sludge

The sludge quality is frequently subject to fluctuations with the result that the pressure losses in the STRAINPRESS® increase if the delivery volume remains constant (positive displacement pump), or the throughput capacity decreases if a centrifugal pump is used.

Large amounts of incompressible solids, e.g. pure gravel or fruit stones from distilleries may block the press zone and put the machine out of operation as the overload protection responds. This failure can occur where external sludges are involved. It is in most cases possible to adjust the press zone to specific requirements.

The press zone is designed for the average amount of coarse material that corresponds to the multiple of the normal sewage sludge. The capacity reserve may be exceeded if floating sludge from aerated grit traps for example is added without prior mixing with fresh sludge. This would result in higher residual moisture in the plug, or sludge breakthrough in case of extreme overload. The feed pump and STRAINPRESS® as well as the shut-off devices in the feed and discharge pipeline are immediately stopped via the sludge probe that is fitted in the plug area. It must however be ensured nevertheless that the exiting sludge can be discharged without causing damage.

Along with the coarse material, also much finer materials are separated, such as hairs, textile fibres, etc. Especially the fibres tend to felting with the perforated plate and form a furry layer on the outside of the sieve. This layer does not impair the STRAINPRESS® function as the screw continuously comminutes and pushes away the fibres. Part of them, however, fall outside and are flushed out of the screening zone along with the treated sludge. Plaits of fibres longer than 20 cm may entangle themselves around the screw shaft of the STRAINPRESS®. They must be removed manually.

## 1.8 Optimal operating conditions

- Feeding with a centrifugal pump, eccentric screw pump, etc.
- Maximum sludge concentration of up to 6% DS.
- Pressure loss in the screening zone around 4 m WG.
- Maximum counterpressure after the STRAINPRESS® of up to 0.8 bar.
- High pressures should be coped with a subsequent inline centrifugal pump.
- The input pressure (corresponding with the liquid pressure on the plug) should be kept as low as possible and must not exceed 1.2 bar.
- The solids should be collected in an odour-tight tank (or plastic bag).
- The machine must be protected against temperatures below zero.

## 2 **EC Conformity Certificate, Certificate of Incorporation**

The plant conforms to the EU directives required for CE marking. With the EC Conformity Certificate we confirm that the machine delivered as ready for use conforms to all relevant health and safety standards. The EC Conformity Certificate is provided only if the HUBER plant is supplied as a ready-to-operate unit complete with the electrical switchboard and control panel, and if plant installation and commissioning are performed by HUBER SE.

The Certificate of Incorporation is required if the machine we supply is not ready for use, for example if it is to be connected to other machines in a system or if the switchgear and control system is provided by a third party. We herewith declare that the design of the plant as supplied complies with standards, EC directives and DIN EN standards, as far as applicable as delivery does not include the electrical switchboard and control panel. Any modification of the machine without our prior approval will invalidate this declaration. Start-up of the machine is prohibited until the complete plant is in conformity with the quoted directives.

The Certificate of Incorporation is attached in the appendix and is separately listed in the table of contents.

## 3 Safety

### 3.1 General safety instructions

#### **DANGER**

„DANGER“ indicates a hazardous situation which, if not avoided, will result in death or serious injury.

#### **WARNING**

„WARNING“ indicates a hazardous situation which, if not avoided, could result in death or serious injury.

#### **CAUTION**

„CAUTION“ indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.

#### **NOTICE**

„NOTICE“ indicates a property damage message. Follow notices to avoid material damage!

These operating instructions have to remain attached to the machine. It must be made sure that the operating instructions are ready to hand any time for any person that has to perform work on the machine. In addition to these operating instructions, instructions in the sense of the labour protection law and ordinance regulating the use of tools have to be available. As these operating instructions contain fundamental instructions to be observed when installing, operating and servicing the machine, the responsible staff must read the instructions prior to machine installation and start-up. The operating instructions must at any time be available ready to hand at the installation place of the machine/plant. Not only the general safety instructions contained in this chapter have to be observed but also the special safety instructions added under the main items.

#### 3.1.1 Operator's duty of care

The plant has been constructed and manufactured taking into consideration a risk analysis and after careful selection of the applicable harmonized standards and other technical specifications. The machine complies with the state-of-the-art technology and offers a maximum amount of safety.

To achieve such safety in practical operation, it is however necessary to take any measures required therefore. It is the operator's duty of care to plan these measures and control their implementation.



The machine is equipped with electro-mechanical pressure limiter to prevent overpressure in the casing (CE design). The operator is responsible to make sure that the feed pump is stopped via these pressure sensors manometers in case of increased pressure ( $p > 3$  bar). Danger of bursting!

The operator must especially ensure that

- The machine is applied according to its intended use (see chapter Product Specification)
- The machine is operated only in a perfect ready-to-operate condition and especially the safety devices are regularly controlled.
- Protective gear for the operating, maintenance and repair personnel is available and used.
- These operating instructions are permanently available on site complete and in a legible condition.
- Only sufficiently qualified and authorized personnel is in charge of machine operation, maintenance and repair.
- Such personnel receives regular briefing concerning all questions of safety and environmental protection and knows these operating instructions, especially the safety instructions contained.
- Any safety and warning symbols attached to the machine remain there in a legible condition.

3.1.2 Description of safety symbols

	 <b>WARNING</b>
	<p><b>Occupational safety symbol</b>                  This symbol will accompany all safety instructions that are associated with risks to life and/or limb. Follow these instructions and proceed carefully! At the same time, follow all applicable laws, general safety and accident prevention regulations.</p>

	 <b>WARNING</b>
	<p><b>Electric current warning</b>                  This symbol warns of electric current. Prior to performing any work, switch off the mains isolator and make sure that the system is off-circuit.                  At the same time, follow all applicable laws, general safety and accident prevention regulations.</p>

	 <b>WARNING</b>
	<p>Automatic machine start:                  Be careful not to get caught when starting up, servicing or repairing the machine!</p>

<h2 style="margin: 0;">NOTICE</h2>
<p>This symbol is found where special attention is required to ensure compliance with instructions concerning correct operating sequences to prevent damage to the machine or its function.</p>

Instructions directly attached to the machine, e.g.

- Instructions and warning signs
  - Labels for liquid connections
  - Arrow showing the direction of rotation
- must be strictly followed and kept in absolutely legible condition.  
 Signs or labels that have become illegible must be replaced immediately.

### 3.1.3 Qualification and training of personnel

Only well-trained and briefed persons who know these operating instructions and act according to these instructions are authorized to operate the machine. The individual areas of responsibility of operating staff must be defined clearly. The area of authority, responsibility and control of the personnel must be precisely regulated by the operator. The operator must further ensure that the personnel has fully understood these operating instructions.

Personnel being trained must in the beginning work under the supervision of an experienced person. The completed successful training and briefing must be confirmed in writing.

Any electrical control and safety devices must generally be operated by instructed and authorized persons only.

Any person performing work on the machine must read these operating instructions and confirm by signature that the operating instructions have been understood.

### 3.1.4 Safety instructions for maintenance, inspection, installation

Any maintenance work must be carried out by qualified staff only.

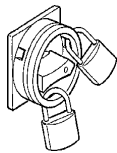
Any inspection and installation work must be carried out by authorized and qualified staff only. Work on electrical equipment may only be carried out by a skilled electrician in accordance with DIN VDE 1000-10.

Work on the plant may only be carried out when the plant is disconnected from the mains.

Enclosed rooms of wastewater treatment plants that must be entered for service and maintenance have to be aerated in a way that prevents a dangerous explosive atmosphere, lack of oxygen and presence of harmful concentrations of gas or vapour.

## WARNING

Secure the machine against unexpected start in case of open access to the screenings discharge resp. secure the access to this danger area before changing the screenings container or doing maintenance work or disassembling on a downstream machine. Disconnect the compressed air supply before operation in the screenings discharge!



## WARNING

**Shutdown procedure:** Switch off mains isolator and lock it.

Each person who is commissioned to perform maintenance work on the machine must have his own padlock. Starting the machine is only possible when all padlocks on the mains isolator have been removed.

Check if upstream and downstream equipment may cause a danger, switch off power supply for upstream and downstream equipment before performing maintenance or repair.

If the whole plant cannot be disconnected from the mains for operational reasons, individual machines must be disconnected by a skilled electrician in accordance with DIN VDE 1000-10 and secured against unintentional restart acc. to DIN EN 50110-1 VDE 0105-1.

As an option all machine drives can be supplied with a repair switch. For maintenance work the machine or area concerned can be switched off acc. to DIN VDE 0100-200. The repair switches must be switched off and locked as described above.

## NOTICE

The STRAINPRESS® is controlled automatically. Prior to any interference, therefore, the power supply is interrupted via the mains isolator and in addition the air supply must be interrupted manually.

**⚠ CAUTION**

Always protect yourself by means of waterproof protective gear, boots, gloves, and, if possible, also by face protection during cleaning of the machine - especially if a high pressure cleaner is being used – to avoid being hit by waste water, organic material, etc.

Re-attach all safety equipment, covers, grates completely to their original place and assure that they are properly and completely reattached.

Use only tools and means that are expressly intended for such work.

Before starting the machine check the closed position of the turning lock on safety equipment like covers, these locks keep the covers in safe position.

Before starting the machine again, check the items mentioned in chapter Start-up.

**3.1.5 Residual risk**

The residual risk describes the risk of a system that remains after the implementation of planned risk containment measures and in spite of existing safety devices.

The following residual risks may appear:

- Automatic machine start
- Aerosols contaminated by viruses and bacteria caused by manual cleaning
- Reaching into the running machine
- Danger of crushing at pressure cone: Pressurisation continues until the machine is shut down.

**3.1.6 Unauthorised rebuilding and production of spare parts**

Alterations or changes to the machine:

For safety reasons, it is not permitted to make unauthorized alterations or changes to the machine. This applies also to welding work on bearing components.

Any intended modifications, alterations or changes require the prior written consent of HUBER SE.

Use only original spare parts, original wearing parts and original accessories as these are especially designed for the machine. Components purchased from other sources give no guarantee that they have been designed and manufactured to suit the specific operating and safety requirements.

**3.2 Machine identification**

Any specifications made in these operating instructions apply to only the type of machine that is named on the title page.

The identification plate is attached to the screenings discharge and specifies the following.

- Name and address of supplier
- CE sign
- Serial name and type, optionally serial number
- Year of manufacture

Always forward the machine type, year of manufacture and order number when inquiring or ordering spare parts to ensure perfect and prompt processing of your queries and orders.

### 3.3 Incorporated safety systems

The incorporated safety systems are subject to regular checkups (**t** = daily, **w** = weekly, **m** = monthly, **j** = yearly). The following methods are applied:  
**S** = sight inspection, **F** = functional test, **M** = measuring.

**Mains isolator**

The mains isolator is located on the control panel and disconnects/connects the machine from/with the mains supply.

Padlock the mains isolator after switch-off prior to performing service or repair work.

Checkup	
Interval	Method
y	F

**Emergency cutoff circuit**

The machine is equipped with an emergency cutoff circuit. Whenever the emergency cutoff switch (option) is operated, the machine or complete plant including incorporated units will be set into a safe operating state.

The emergency cutoff switch can be released by pulling or turning to the right.

Checkup	
Interval	Method
m	F

**Motor temperature control**

The machine is equipped with an indirect motor temperature control with overload protection. The motor of the machine is switched off in the event of too much heat built-up. The overcurrent safety device using a thermic delay must be set to disrupt the drive motor from the power system within the delay  $t_E$ .

Checkup	
Interval	Method
y	F, M

**Plant control**

Internal plant control includes a 5-conductor feed system, 3 phase, with separate earth line with GREEN/YELLOW line coating. Additionally earth the machine casing for potential equalisation..

Checkup	
Interval	Method
m	V, F, M

**Pressure control**

The machine is equipped with a sensor that controls the pressure in the screening zone. If limit pressures are exceeded, the feed to the machine is stopped and the feed and discharge pipelines are shut off.

Checkup	
Interval	Method
y	F, M

### Sludge breakthrough control

The machine is equipped with a moisture probe to detect sludge breakthrough. In case of a sludge breakthrough the feed to the machine is stopped and the feed and discharge pipelines are shut off.

Checkup	
Interval	Method
m	F

### Pneumatic isolation / maintenance system

As an option the machine is equipped with a pneumatic maintenance mechanism.

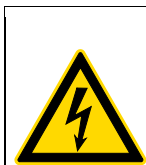
The pneumatic pressure cone can be depressurized for the purpose of executing maintenance and inspection work.

Checkup	
Interval	Method
m	F

### Categories according to DIN EN ISO 13849-1

The following categories are installed in the plant:

Category	System performance	Component	Inspection interval
1	<ul style="list-style-type: none"> <li>A fault may cause the loss of safety function,</li> <li>Some faults may stay unrecognized</li> </ul>	Main switch, water shut-off device with protection against restart	1x per year or acc. to instructions of supplier of components
2	<ul style="list-style-type: none"> <li>A fault may cause the loss of safety function between the tests.</li> <li>The loss of safety function is recognized by the test.</li> </ul>	Emergency stop (emergency cut-off relais with push-button and cut-off protection)	1x per year or acc. to instructions of supplier of components



## WARNING

Control panels can only be opened by using a special key. The special key may only be handed to an authorized person. Take care that doors of control panels are only opened by skilled staff for maintenance work and fault detection, otherwise the doors must stay locked!

## NOTICE

These operating instructions are part of the machine and have to be available for the operating staff at any time.  
The safety instructions contained must be observed.  
It is strictly prohibited to override any safety instructions or change the mode of action of safety instructions.

### 3.4 Safety measures

It is the operator's responsibility to instruct his operating and servicing staff concerning:

- Protective devices on the machine,
- Control of observance of safety measures.

This copy of operating instructions has to be stored to be at hand when needed in the future. Observe the intervals for inspection and control measures! In these operating instructions, the work is described so that it can be understood

- by an instructed person (referring to chapter Operation and operation modes)
- by skilled staff (referring to chapters Transport, Installation, Maintenance, Trouble Shooting and Repair).

The chapters Transport, Installation, Maintenance, Trouble Shooting and Repair are intended for skilled staff only. Any work described under these chapters must be performed by skilled staff only.

#### Instructed person

An instructed person is a person that has been instructed by a skilled person, and trained if necessary, about the assigned jobs and possible risks arising from improper performance and informed about necessary protective devices and protective measures.

#### Skilled persons

Skilled persons are persons that are able to evaluate assigned jobs and recognize possible risks, due to their professional skills, expertise and experience and knowledge of corresponding standards.

**This definition follows EN 60204-1**

### 3.5 Operator's duty of care

#### NOTICE

The valid national version of the framework directive 89/391/EEG and corresponding individual directives, especially 89/655/EEG concerning minimum requirements for safety and health protection of staff when using work equipment, are applicable in EEA countries and must be observed.

For Germany, the occupational safety directive of 2015 is applicable and must be observed.

The operator has to obtain the local operating license and observe the respective requirements. In addition, the operator has to observe the local laws concerning

- Safety of personnel (accident prevention regulations)
- Safety of work equipment (protective gear and maintenance)
- Product disposal (Waste Management Law)
- Material disposal (Waste Management Law)
- Cleaning (cleaning agent and disposal)
- Environmental compliance

#### Connections:

The operator has to ensure before start-up of the machine, if installation and start-up are performed by the operator himself, to comply with local standards (such as for electrical connection for instance).

**NOTICE****Lighting**

The operator has to provide sufficient and equal lighting in all areas of the plant. The recommended illumination level is 300 lux (value for maintenance; in Germany acc. to ASR).

**3.6 Safety tests**

Performed by the manufacturer before delivery

1. Airborne sound measurement

- as per rules for machines, appendix 1 (1.7.4/f)

The noise level of the plant lies below 70 dB(A).

2. Test and checkup as per DIN EN 60204-1

- Check of electrical equipment for correspondence with the technical documentation
- Functional tests  
Test of functions of electrical devices, especially those relating to safety and protective measures.

## 4 Handling and transporting

Observe the following points to avoid damage to the machine or persons when handling the equipment:

- Only qualified persons are permitted to perform transport work, observing the safety instructions.
- Lifting and righting of the equipment must be done only by the lifting eyes provided.
- Use only the lifting devices specified hereunder to transport the machine.
- Read also the chapter General Safety Instructions.

### 4.1 Dimensions and weight

The plant is available in 2 sizes. The plant dimensions are specified in the project-specific installation drawing or general dimension sheet, which is attached to these operating instructions. The weight empty of the plant is

SP 290: 690 kg  
 SP 430: 1300 kg

The weight is also specified on the nameplate.



All weights (kg) apply to machines without optional equipment. The screen length and width are specified in the data sheet. The machines can be delivered with an optional wooden underframe for transport.

### 4.2 Permitted transport devices and auxiliaries

#### CAUTION

**Have transport and unloading done by experienced experts only.**

Lifting vehicles of sufficient lifting capacity to handle the weight and size of the equipment, to be operated by qualified personnel only. Rope slings or straps of required load bearing capacity. Prior to unloading, remove the small parts supplied with the machine, such as supports, from the transport rack.

	<b> WARNING</b>
	<p>Attachment: Hook shackle, load hook etc. into the lifting eyes on the upper side of the plant. Fixing points are marked with the symbol LIFT HERE (as illustrated here). The ropes of the lifting device must hang freely. The machine must hang horizontally during unloading.</p> <p>Never wrap a chain around the machine as this may slip and cause the machine to tilt over. In addition, the machine will rust on those points where it gets into touch with black steel if it is not re-pickled.</p>

Inspect all materials for damage before and during unloading. Any transport damage found should be noted on the bill of lading and the forwarder and manufacturer/supplier notified immediately.

#### NOTICE

Make sure the delivery is complete by carefully checking all received materials against the bill of delivery.

## 4.3 Storage

When selecting the storage place take care that the components cannot be damaged by vehicles or careless working. Make sure the components cannot get dirty due to splashes of concrete or mortar and protect the machine against spark fountains from angle grinders etc. The place of installation must be vibration-free.

Never store organic solvents in the machine storage place.

Avoid UV radiation as well as ozone, hydrogen sulphide and chloride containing ambient air.

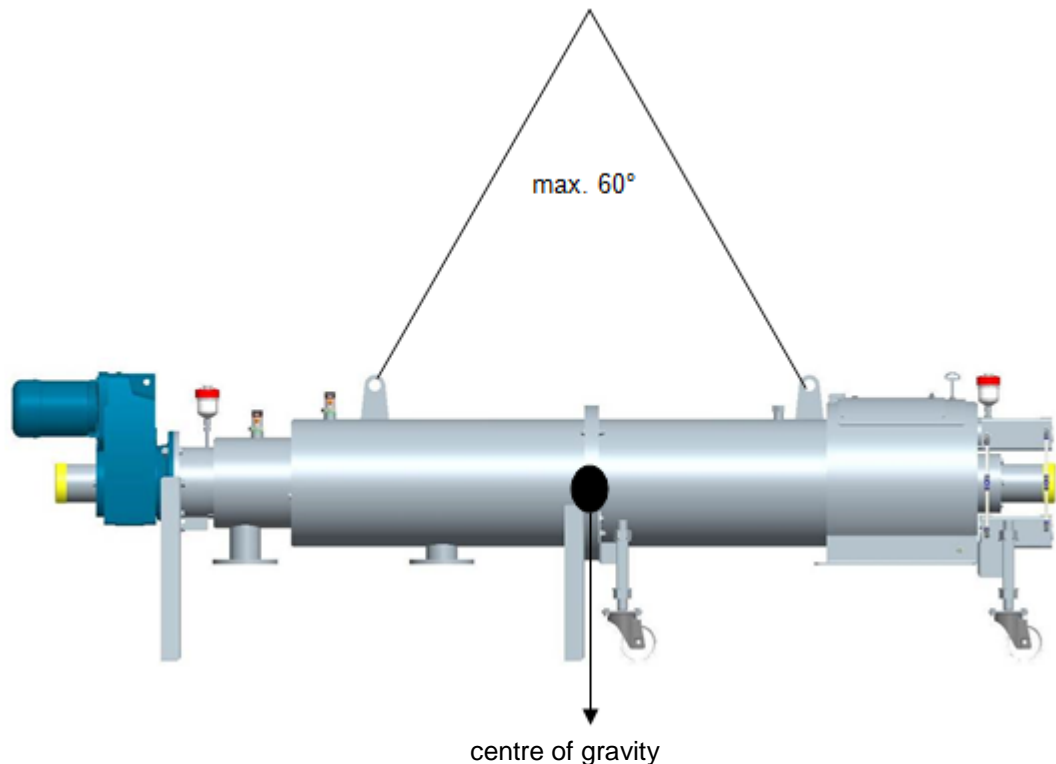
Cover the motor (in order to avoid ingress of water) on machines stored outdoors, but do not wrap it. Never expose the control panel to rain (temperature down to - 5°C is permissible).

## 4.4 Transport to the installation place

As there are different situations and possibilities at the individual sites, we cannot give exact installation instructions. This work must be carried out by qualified fitters.

You always need lifting equipment for transporting the machine from the intermediate storage place to the installation place because of the machine weight.

Mount appropriate load-carrying equipment to the 2 lifting eyes at the top of the machine. (See below photo.) Make sure the load-carrying equipment is suitable to bear the machine weight.



### ⚠ WARNING

The maximum working load of the lifting device must be above the weight of the single machine components.  
Observe the stability of the lifting device.

### ⚠ CAUTION

Wear safety shoes with steel caps to prevent injuries.

	<b>! WARNING</b>
	Always stand clear off a suspended load!

<b>! WARNUNG</b>
In case of split transport of screening zone and press zone, remove screw and screen body from screening zone.

**Unpacking:**

Do not loosen the clamping bands or steel ropes before the machine is right in its installation place.

## 5 Installation

Observe the following safety instructions when installing the machine to avoid critical injuries, damage to the machine and other damage.

- Only qualified persons are permitted to perform installation work, observing the safety instructions.
- Check the machine for transport damage prior to starting with any installation work.
- Make sure that only authorized persons have access to the working area and that installation work does not endanger any other persons.
- When laying machine connections, make sure that no one can trip over laid cables, hoses, pipelines, etc.
- Observe the prescribed bending radii when laying cables/hoses/pipelines.
- Observe the instructions for operating media, lubricants, auxiliary material used.
- Read also the chapter General Safety Instructions.

### 5.1 Acceptable environmental conditions

#### **Protection against dust and water:**

As the atmosphere at the installation place is permanently humid, the equipment is designed to resist such conditions. All components in contact with water and solids are made of stainless steel.

The gear motor, the pressure probe and the sludge probe are made for IP 65 and are therefore protected against permeation of dust and spray water from any direction.

#### **Protection against explosion (optional):**

The plant and its components are also available as ex-protected versions.

Gear motor

Pressure probe

Sludge probe

Pneumatic cylinder

Adjacent control box

Conformity certificates are attached in the appendix.

#### **Lightning protection concept:**

The plant must be integrated into the complete concept of the treatment plant for observing the Lightning Protection Standard DIN EN 62305-3.

The state of the art of a functioning overall concept for wastewater treatment plants is particularly described in the supplement 2.

#### **Lighting**

The lighting system must be designed to ensure at any time riskless and safe working on any machine parts.

### NOTICE

#### **Lighting**

The operator has to provide sufficient and equal lighting in all areas of the plant. The recommended illumination level is 300 lux (value for maintenance; in Germany acc. to ASR).

## 5.2 Site requirements

The regulations of DIN EN ISO 13857 "Safe distances preventing upper limbs reaching dangerous areas" and corresponding standards must be observed. Ensure that sufficient space is available around the machine for maintenance and repairs.

Required minimum distance to the machine:

- 1 m at the side
- 1.5 m in front of (SP 290), 1,7 m in front of (SP 430)
- 0.5 m behind the machine

Static dimensioning of the support points must be in compliance with the weights specified by the manufacturer.

Lifting devices, mounting supports, or anchor points of sufficient load-bearing capacity must be available for mounting and maintenance work (see chapter 9).

Shut-off valves must be provided to shut off pressure-fed, sludge-carrying pipelines when operating troubles occur and while maintenance work is carried out.

It is recommended to install a drain valve  $\geq$  DN 50 ( $\geq$  PN 6) in the outlet line of the STRAINPRESS®.

## 5.3 General instructions for installation

Installation must be carried out in accordance with these instructions if installation is not part of the supply contract with HUBER SE. If installation is not performed by HUBER SE, HUBER SE cannot accept responsibility for incorrect offloading or installation. Installation must be performed by qualified and experienced personnel.

### Prior to installation:

- Completely read these instructions. They contain important information how to prevent damage caused by lack of knowledge.
- Ensure that access routes to the place of installations are level so that the machine can be installed outside the building with a crane or installed inside the building with a lifting truck rollers and chain hoists.
- Electrical power must be provided to be available on site at the installation date.

### Preparatory work before installation:

- Check that all assembly and fixing materials are present.
- Prepare all cables in accordance with the cable list (see wiring diagram) and all required incidental parts.
- Ensure that lifting equipment is available which has a sufficient load-bearing capacity.
- Clean the place of installation with a broom before installation to avoid injuries caused by slipping.

## 5.4 Assembly and installation

### 5.4.1 Mechanical installation

#### General instructions:

- Fix lifting devices (2 chain hoists or similar) to the prepared installation supports over the place of installation. If necessary, prepare points of suspension with required load bearing capacity and arrange in such a way that the plant can hang above the installation area without manual moving.
- Secure safety load hooks on transport eyes or rope straps to the machine and the lifting device.

**NOTICE**

Blow the holes for the stainless steel plugs under pressure after drilling (using bellows, air pump, etc.) to ensure a professional durable adhesive joint.

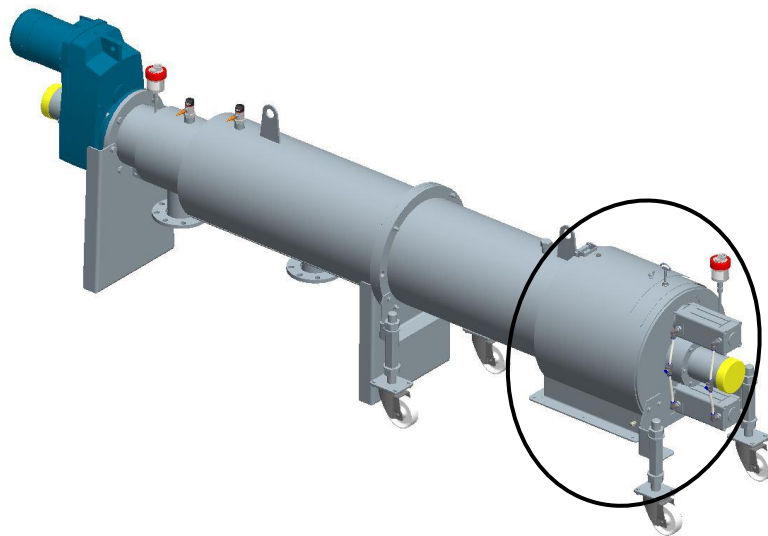
Use grease for all unlockable screws, thus providing a durable mobility of thread.

**How to proceed:**

- Use suitable lifting and transport devices to transport the machine to its installation place.
- Mount loosely enclosed machine feet according to the installation drawing or dimension sheet to the machine body.
- Bring the machine into an exactly horizontal position. The longitudinal axes of the screening and press zone must be in line. Align the 4 height adjustable castors and fix them with the nuts.
- Connect the inlet and outlet lines to the corresponding connections provided on the machine.
- Install the screenings collection unit.

**⚠ CAUTION**

If the STRAINPRESS® is to be placed onto a platform, pay attention that while manoeuvring the moveable part of the plant cannot move over the edge of the platform or get into a floor drain. Otherwise, the machine part may overbalance!

**⚠ WARNING**

In case of open access to the discharge area, protect the machine against unintended start-up and secure the danger zone prior to starting the machine or executing maintenance on the machine, or dismantling the machine. The requirements of DIN EN 13857 ("Safe distances to prevent danger zones being reached by the upper limbs") must be observed.

## 5.4.2 Electrical installation

Electrical installation to be carried out by qualified electricians only.

### CAUTION

The electrical and pneumatic control system as well as the wiring and hose system must be executed according to the respective HUBER Control Descriptions and Operation Manuals.

#### General information for electrical installation:

Installation must be carried out in accordance with these instructions if electrical installation is not part of the supply contract with HUBER SE.

If the customer assembles the machine, the manufacturer assumes no liability for damage which may occur as a result of improper assembly.

### NOTICE

The drive motor can be designed as a permanently-energised synchronous motor. In this case, the drive must only be operated on a suitable frequency converter.

#### Wiring:

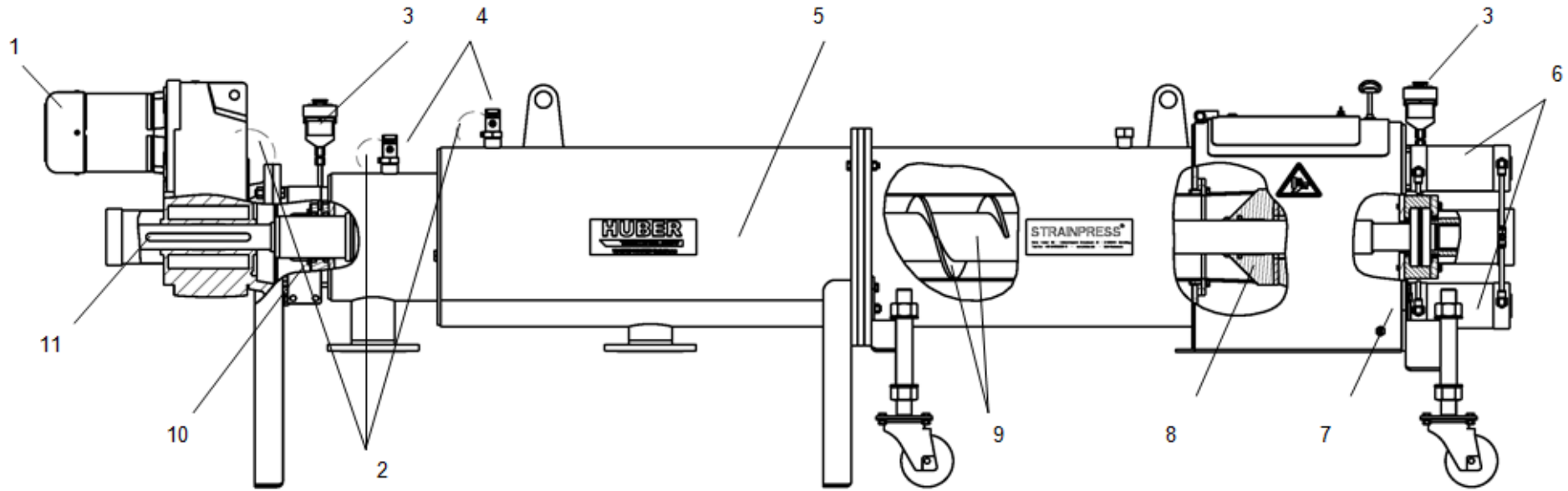


### WARNING

**Make sure that power supply is disconnected!  
Secure this condition by appropriate measures!**

- Establish the earth connection to the plant prior to beginning any other work, and earth the gear motor to the plant. The degree of protection of the terminal boxes and cable glands must match that of the safety area in which the machine is installed. Refer to the drawing on the following page which shows the required earth connections.
- Fix the control panel with bolts in its intended position.
- Fix the adjacent control box with dowels next to / onto the machine.
- Prepare all cables between the plant, control panel and adjacent control box and connect the plant to the power supply according to the specifications in the wiring diagram. The wiring diagram and cable list are attached in the appendix, if the electrical switchboard and control panel is part of the HUBER supply contract.

Check the running direction of the motors prior to initial start-up and prior to any re-start (e.g. after a change of voltage supply)!



- |  |                                      |
|--|--------------------------------------|
| 1 Gear motor   | 7 Sludge probe                       |
| 2 Potential equalisation conductor 6 mm <sup>2</sup> | 8 Pressure cone                      |
| 3 Electronic grease cartridge                        | 9 Flights, screen body               |
| 4 Pressure probe                                     | 10 Grooved ring packing              |
| 5 Protective conductor connection point              | 11 Drive shaft, corrosion protection |
| 6 Pneumatic cylinder                                 |                                      |

Protective conductor terminal: (M8 x min. 20 mm)

The conductor terminal as connection to the main potential equalisation acc. to DIN EN 60204-1 (VDE 0113-1) is shown by the conductor marking grounding EN 61310 D 20, see pictogram aside. Observe local protective measures as per local standards (DIN, VDE, EN, EeEx-Atex 100a).



## 6 Start-up

Observe the following safety instructions for machine start-up to avoid damage to the machine or injuries.

- Only qualified persons are permitted to perform start-up work, observing the safety instructions.
- Check before the first start-up that all tools and foreign objects have been removed.
- Activate all safety devices and emergency cutoff switches before start-up.
- Read also the chapter General Safety Instructions.

### 6.1 Customer-supplied connections

All customer-supplied connections must be installed on the marked positions, or at least as close as possible, according to the manufacturer's instructions respectively installation drawing.

#### NOTICE

The connections on the movable press zone casing must be easily detachable.

- screenings discharge
- sludge breakthrough detector
- pneumatic connections



#### 6.1.1 Electrical connection

The electrical connections must be laid to the installation place of the control panel; supply of 3 x 400 V (or special voltage) with 50 Hz (special: 60 Hz) PEN. The connecting line has to be defined according to local regulations taking into account the project-specific connecting line. Provision of multi-polar cables for transmission of operation and trouble signals or any other signals to a central control plant.

Control lines and load lines must be laid separately, i.e. separate laying of cable ducts. They must be laid from the control panel to the installation site.

## 6.2 Checks prior to initial start-up

Prior to start-up:

Make yourself familiar with the

- operation and control elements of the machine
- machine equipment
- operation principle of the machine
- immediate environment of the machine
- safety devices of the machine
- measures to be taken in case of emergency

Perform the following work prior to any start-up:

- Check and make sure that all safety device are attached and in a ready-to-operate condition.
- Parametrisation of the frequency converter and the electropneumatic controller
- Check the machine for visible damage and eliminate any damage found immediately or report them to the supervisory staff, as machine operation is only permitted if the machine is in a perfect condition.
- Check and make sure that authorized persons only have access to the operation area of the machine and no other persons are endangered by starting the machine.
- Check and make sure that the protection circuit system is persistently connected.
- Remove any objects or other material from the operation area of the machine, which is not needed for machine operation.

Check that the screw-type cable fitting fits tight and re-tighten the screw, if necessary, to prevent ingress of water into the motor. (See below picture of the screw-type cable fitting.)



Screw-type cable fitting

### 6.3 Dry run testing

#### NOTICE

The STRAINPRESS® is controlled automatically. Prior to any interference, therefore, the power supply is interrupted via the mains isolator and in addition the air supply must be interrupted manually.

- Check the rotation direction of the screw. Pay attention to the shown arrow direction!
- Adjust the pneumatic pressure regulating cone.
- Measure the screw position (measures LV and LH) and keep records. Open the protection hoods (item 036, drawing in chapter 9.3).
- Note down the torque output of the drive motor in no load mode.

#### NOTICE

The torque output of the motor should be  
SP 290: approx. 1 Nm maximum 1,7 Nm  
SP 430: approx. 2,2 Nm maximum 3,5 Nm

- Correct the screw position acc. to chapter 7.2.5 if the torques are not achieved
- Close and lock the cover hood in the discharge area of the machine.

#### NOTICE

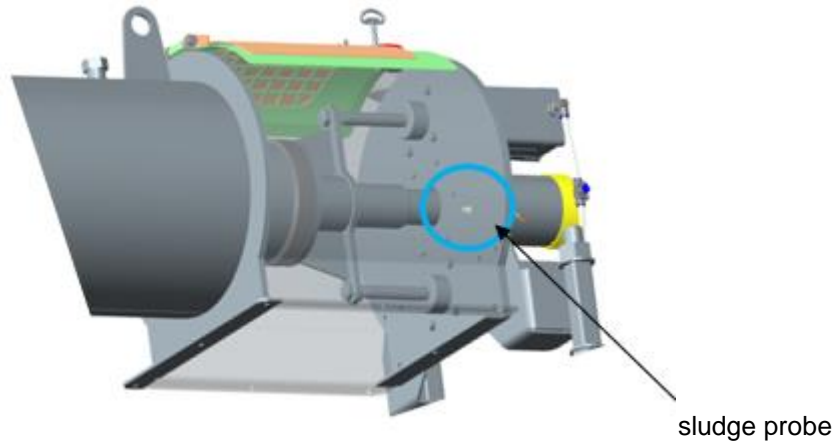
Please note that, during dry run testing, the machine should not run longer than 1 minute.

### 6.4 Wet start-up

#### NOTICE

The STRAINPRESS® is controlled automatically. Prior to any interference, therefore, the power supply is interrupted via the mains isolator and in addition the air supply must be interrupted manually.

- Switch on the STRAINPRESS® and feed pump.
- The formation of a dense coarse material plug at the end of the press zone may take some minutes or even hours, depending on the volume of coarse material. During this time, sludge exits from the gap between the press zone extension piece and pressure cone. This fact is utilised to check the function of the installed sludge probe (item 806). The probe must react after some splashes of sludge and switch off the feed pump.



- A paper plug can be used as an auxiliary means to enhance the formation of a coarse material plug: Switch off the machine, relieve the pneumatic pressure, and manually compact paper in the press zone of the STRAINPRESS®. Reactivate the pneumatic system and feed to the machine.
- Note down the pressure values of both pressure sensors. In pressure differential should lie between 0 and 0.4 bar. The pressure difference varies with the sludge viscosity, pump performance and screen perforation.
- When the plug is dense enough, the separated solids are slowly discharged. They are relatively moist in the beginning.
- Note down an average of the torque output.
- Measure and note down the throughput.

Measured values:

- Screw position
- Torque output in no-load operation
- Pressure values
- Torque output under operating load
- Throughput
- Pause times between screw shaft operations

These are the most important operating data of the STRAINPRESS®.

During the following operating time these values may change. It is therefore important to keep records of any changes as conclusions can be drawn from such records concerning the condition of the machine.

## 7 Operation

In order to prevent injuries and damage to the machine, it is important to observe the following points while operating the machine:

- The machine must only be used in accordance with its intended use.
- Before starting the machine, make sure that you are aware of the correct procedures in the event of a fault.
- Before starting the machine, check that the following components are functioning:
  - Safety mechanisms
  - Emergency stop switch
  - Release of pneumatics

Also refer to the chapter General Safety Instructions.

### 7.1 Description of the electrical switchboard and control panel

The electrical control regulates all automated functions of the plant both in automatic and hand mode. After switching the mains isolator on, the plant works in automatic mode. The control panel must be installed outside the screening room.

If the control panel is supplied by a third party company, the HUBER SE control specifications must be considered and observed.. The control cabinet must be prepared (completely wired) for the machine to be connected, and the wiring diagram must be placed in the control cabinet.

### 7.2 Operation monitoring

#### 7.2.1 Manual and visual inspection

##### **Pressure sensors:**

By means of the two pressure sensors in the inlet and outlet of the STRAINPRESS® the pressure differential can be measured during plant operation. In continuous operation the differential should lie between 0 and 0.4 bar. Temporary peaks of up to maximum 1 bar as a result of varying sludge quality are permissible.

If the pressure differential is too high this is a sign for poor cleaning of the screening zone area, or for a high DR content, or for a too high content of screenings in the sludge.

## NOTICE

If the pressure differential exceeds 0.4 bar over a longer period of time, the screw must be stopped in order to re-establish the cleaning efficiency.

##### **Indication of the torque output:**

The frequency converter indicates the torque output of the motor. The gear motor possesses a very high power reserve so that even motor currents which are permanently above nominal current are no problem.

Most of the power is required in the press zone.

An increase in torque is a sign for danger of blocking in the press zone. Blocking can be caused by too much incompressible coarse material or too high a contact pressure on the pressure cone (infrequently also by too much coarse material).

Gradual blocking may therefore occur even with a relatively low contact pressure caused by abnormal coarse material composition. Frequently, incipient blocking can be eliminated by lowering the contact pressure of the pressure cone. This happens automatically with the pneumatic pressure regulating cone.

In case of emergency the pressure cone must be totally relieved by closing the hand valve. By starting the STRAINPRESS® (without sludge feed) all the coarse material stuck inside the press screw is pushed out.

The machine should remain in operation until the torque values show normal values again.

## NOTICE

Do not operate the plant in reverse direction!  
Re-start the pressure cone with a small contact force.

### 7.2.2 Automatic monitoring

#### 7.2.2.1 Electronic monitoring of the torque output:

The torque output of the motor is continuously measured. If the set torque limit is exceeded, the machine will switch off.

By means of a start delay the motor torque peak can be filtered out. Also the alarm release due to interference peaks in torque values can be avoided with the reaction time.

**Torque evaluation serves three purposes:**

##### 1. Machine protection

Incipient blocking of the press zone can be recognized early by setting the release point below nominal load. The increasing torque output of the STRAINPRESS® switches off the press and an alarm is released.

##### 2. Indication of the torque output:

The torque output is continuously displayed on the control panel.

##### 3. Signal transmitter for automatic pressure cone adjusting system

The electropneumatic transformer of the pressure cone system uses the 0 output signal of the frequency converter for automatic regulation of the contact pressure.

#### 7.2.2.2 Pressure transmitter with analog output:

**Pressure measurement has two functions:**

##### 1. Start signal for screw shaft drive

When the pressure increases, the drive motor of the screw shaft is started. The inner side of the screen surface is cleaned by the screw shaft and the pressure falls again.

##### 2. Protection against overpressure

An overpressure > 1.2 bar impairs the stability of the screenings plug in front of the pressure cone. As a result, screenings moisture would increase and even sludge breakthrough could occur.

An overpressure  $\geq$  3 bar is generally not permissible.

#### 7.2.2.3 Sludge probe

A sludge probe is installed in the coarse material discharge zone of the STRAINPRESS®. The probe ensures that the feed pumps stop immediately and the shut-off devices in the sludge lines close if sludge breaks through in the plug area.

**Test the probe always with sludge.**

#### 7.2.2.4 Pneumatic pressure cone system

**General information:**

The main load on the motor is caused by the pressing process.

This fact is used to automatically regulate the contact pressure of the pressure cone in dependence of the torque output of the motor.

The function of the electronic torque control is described in chapter 7.2.2.

By means of an electropneumatic transformer a corresponding air pressure is generated and thus the contact pressure of the pressure cone automatically regulated.

Torque output STRAINPRESS® 290:

- dry run mode without a sludge plug ca. 1 Nm
- dry run mode with a sludge plug 2-3 Nm

Torque output STRAINPRESS® 430:

- dry run mode without a sludge plug ca. 2 Nm
- dry run mode with a sludge plug 4-6 Nm

In pressing mode, the torque should not exceed

SP 290: 13 – 15 Nm

SP 430: 15 – 20 Nm

in order to achieve a DS content in the screenings of approx. 35 - 45% and prevent blockages in the press zone and excessive wear.

**Adjustment:**

Adjust the pneumatic pressure regulating cone as described here:  
(The numbers in brackets refer to the below pneumatic diagram.)

1. Regulate the input pressure to at least 7 bar (3).
2. Set the static primary pressure onto the cylinder at the pressure cone to 5 bar (4).  
The screenings DS content can be influenced by which static primary pressure is selected. The higher the pressure, the higher the DS content in the screenings.
3. Parameterise the electropneumatic transformer so that
  - a linear characteristic results for the counterpressure onto the cylinder at the pressure cone
  - counterpressure regulation begins at
    - SP 290: 3,7 Nm
    - SP 430: 6 Nm
  - regulation to 5 bar counterpressure takes place at:
    - SP 290: 13,1 Nm
    - SP 430: 15,1 Nm
  - regulation to the maximum possible counterpressure takes place at:
    - SP 290 16,8 Nm
    - SP 430: 20 Nm
4. The pneumatic pressure cone adjusting system is now ready to operate.
5. Vary only the static primary pressure (4), via the manual pressure controller, to adjust the optimal operating range. It must be ensured that the manual primary pressure lies at least 20% below the maximum counterpressure provided by the electropneumatic controller.

## 7.2.3 Screw position

### **⚠ CAUTION**

**Always switch off the machine via the mains isolator for adjusting the screw position!**

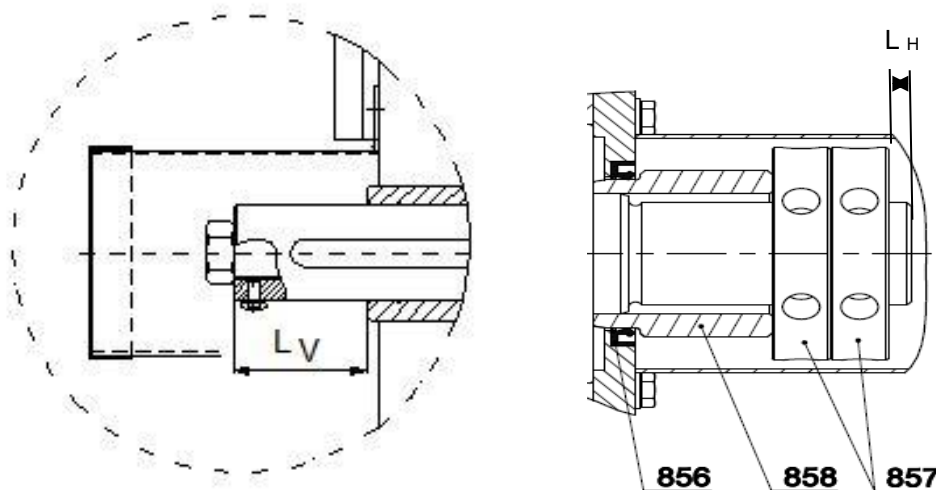
For optimal adjustment of the play between the screw edges and the screen the screw is adjustable in axial direction.

The possibility to exactly define the screw position is important for control and monitoring.

The measures LH and LV are helpful in this respect. (See drawing below.) The sum of LH and LV must always be constant; it is a specific value of each machine.

The sum is also helpful for control after dismantling of a machine, as it shows if the screw joint between the two screws (screening zone screw and press zone screw) is complete and tight.

When measuring LH pay attention that the bronze nuts (857) fit and are locked!



## 7.2.4 Screw adjustment

### **⚠ CAUTION**

**Always switch off the machine via the mains isolator for adjusting the screw position!**

In order to avoid blinding of the screening zone screen, the play between the screen and screw must be kept as small as possible.

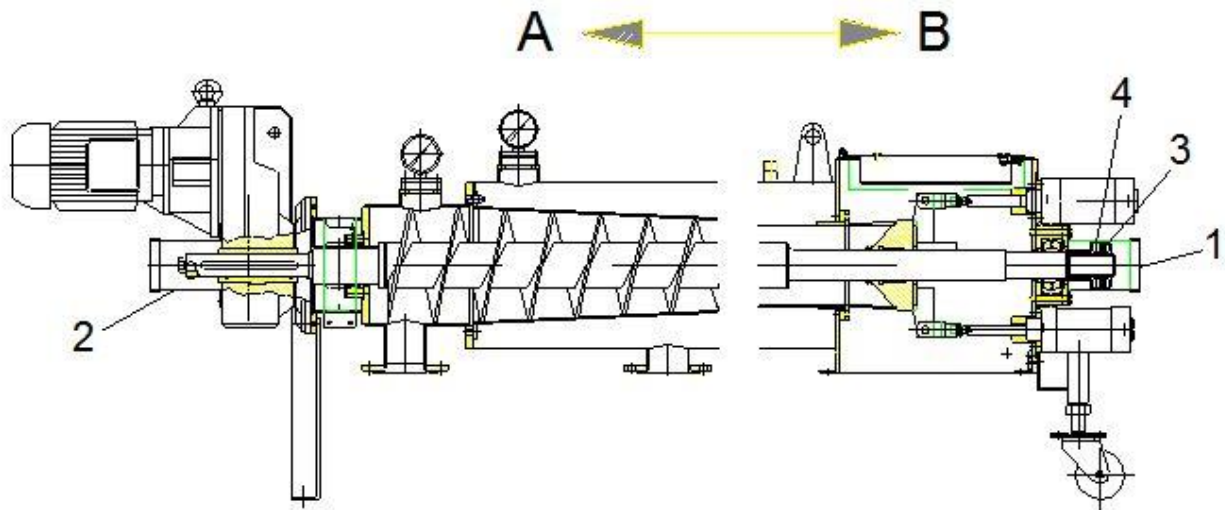
That is why the screening zone design is conical. This design allows to adjust the play by axial displacement of the screw.

This gap size is adjusted in the factory prior to shipment of the machine. Later re-adjustment is required when the upper screw plate edges are worn down to a certain measure and this becomes noticeable in the form of a pressure increase (see pressure sensors) or a throughput reduction.

The upper screw flight edges are armored as they are welded on with a special electrode, which prolongs the screw life significantly.

If, after several re-adjustments, further re-adjustment has become impossible, the screw needs a complete overhaul or replacement.

**The re-adjustment capacity is exhausted at**  $L_H = L_H \text{ factory setting} + \text{max. } 55 \text{ mm}$



### How to proceed with screw adjustment:

- Read the pressure differential and note it down.
- Switch off the sludge pump.
- Operate the STRAINPRESS® for some minutes in manual mode until the torque output has become constant and note down the value.
- Switch off the STRAINPRESS®.
- Open the protective hoods.
- Unlock the counter nuts.
- Tighten the nuts (approx. 1 turn). This will displace the screw for 2 mm in the direction of the discharge. Gap reduction between upper screw edges and screening zone screen per nut turn = 0.09 mm. A 10 mm axial screw adjustment results in a diameter change of 0.45 mm.
- Switch on the STRAINPRESS® for a short moment and look at the torque output. If it is still the same as before, go on with screw adjustment.

## NOTICE

Never re-adjust the screw so far that a scratch noise can be heard or the torque output increases. Otherwise, the wear would increase and result in a wrong regulation of the contact pressure by the pressure cone regulation system.

- Loosen the nuts (857) (one turn) if a scratch noise can be heard or if motor current consumption exceeds the normal no-load values.

When the no-load values have become normal again,

- lock the counter nuts.
- Measure  $L_H$  and  $L_V$  and keep records.
- Close the protective hoods.

**The machine is now ready to operate again!**

### 7.2.5 Operations log

Keep records of changes in operating conditions using the attached form.

**8 Trouble shooting and repair**

Fault	Possible cause	Repair
Decreasing throughput capacity	Poor screen surface cleaning Viscous sludge High DS content Decreasing pump efficiency.	Re-adjust the screw. Dilute the sludge. Agitate the sludge. Check the pump. Check the line system and shutoff devices.
Increase in pressure difference	Poor screen surface cleaning Viscous sludge High DS content	Re-adjust the screw. Mix and dilute the sludge.
Increase in torque output / overload	The contact pressure on the pressure cone is too high. Coarse material accumulation in the screening zone.	Check the pneumatic system. Deplete the STRAINPRESS® without sludge input and with the pressure cone open. Reduce pump performance.
Sludge breakthrough	The contact pressure on pressure cone is too low. The grease content is too high. Insufficient net-forming coarse material The counterpressure is too high. The throughput is too high.	Check the pneumatic system. Check the sludge composition. Check the line system after the STRAINPRESS®. Reduce delivery capacity.
Reduced solids discharge. Hard plug.	The contact pressure on pressure cone is too high. Poor screen cleaning. The coarse material content of the sludge is very low.	Check the pneumatic system. If required, deplete the machine. Re-adjust the screw. Adjust the operation mode, e.g. pressure control.

9 Maintenance and Repair

**⚠ CAUTION**

Enclosed rooms of wastewater treatment plants that must be entered for service and maintenance have to be aerated in a way that prevents a dangerous explosive atmosphere, lack of oxygen and presence of harmful concentrations of gas or vapour.

**⚠ CAUTION**


The chapter maintenance and repair is intended for skilled staff only. Any maintenance or repair work must be performed by skilled staff only. Skilled staff has to be equipped with personal protective gear (such as gloves, etc.).

**Skilled persons**

Skilled persons are persons that are able to evaluate assigned jobs and recognize possible risks, due to their professional skills, expertise and experience and knowledge of corresponding standards.

**This definition follows EN 60204-1.**

Regular cleaning and plant maintenance is required to ensure trouble-free plant operation.

	<p><b>⚠ CAUTION</b></p>
<p>Always wear protective glasses and rubber gloves if harmful materials have been processed by the machine.</p>	

**⚠ CAUTION**

It is essential to proceed as described under 3.1.4 when shutting down the machine prior to performing maintenance, repair or cleaning work. Use only tools and means that are expressly intended for such work.


Observe the following instructions when performing maintenance or repair work on the machine to avoid damage to the machine or injuries.

- Prior to performing any repair work, shut off a wide area around the machine.
- Switch off all voltage sources and secure the voltage sources to prevent they are unintentionally switched on again.
- Disconnect all pneumatic parts from air supply.
- Secure all supply and discharge units (pumps) against switch-on.
- Make sure there is no fluid pressure on the machine.
- Never use any other than the specified operating media.
- Never use any other than the spare parts specified in our spare parts lists.
- Read also the chapter General Safety Instructions.


9.1 Cleaning and inspection work

<b>NOTICE</b>
Check the potential equalisation regularly, as described in chapter 3.3, Incorporated safety systems!

**Weekly control work without interference in the machine:**

 <b>CAUTION</b>
There is an increased risk of injury if any guards or separating protective equipment (e.g. covers) are open. Keep therefore a safety distance of at least one metre from any dangerous areas (e.g. moving parts and openings).

- Check the mobility of the pressure cone.
- Check the screws shaft in the pressure cone area on tressings.
- Check the sludge probe in the discharge casing optically on dirt.
- Check the function of the sludge probe by a water jet.
- Check the function of the pneumatic control.

 <b>CAUTION</b>
Before carrying out further work, the shutdown procedure described in section 3.1.4 must be observed.

**Monthly cleaning and inspection work:**


- Adjust the screw position.
- Check the dimensions LV and LH. Check if the screw joint between the two screw parts is tight coupled.
- Drain the condensate from the pneumatic lines.

A replacement screw should be ordered when the measure  $L_H$  is 40 mm. The worn screw can be returned to the supplier for repair in his factory when required. Longer standstills are avoided in this way.

**Yearly:**

- Inspection of the screening and press zone. At least once a year the STRAINPRESS® should be opened to check the screening and press zone for sediments and clean it. If required, replace the intermediate ring and O-rings.

If an unusual noise occurs, open the STRAINPRESS® and inspect the screening and press zone, independent of the specified maintenance intervals.

 <b>CAUTION</b>
<b>Never use a high pressure unit to clean electrical plant equipment!</b>

<b>NOTICE</b>
Keep records of changes in operating statuses using the attached form.

## 9.2 Inspections and preventive maintenance

### 9.2.1 Operating media and lubricant replacement

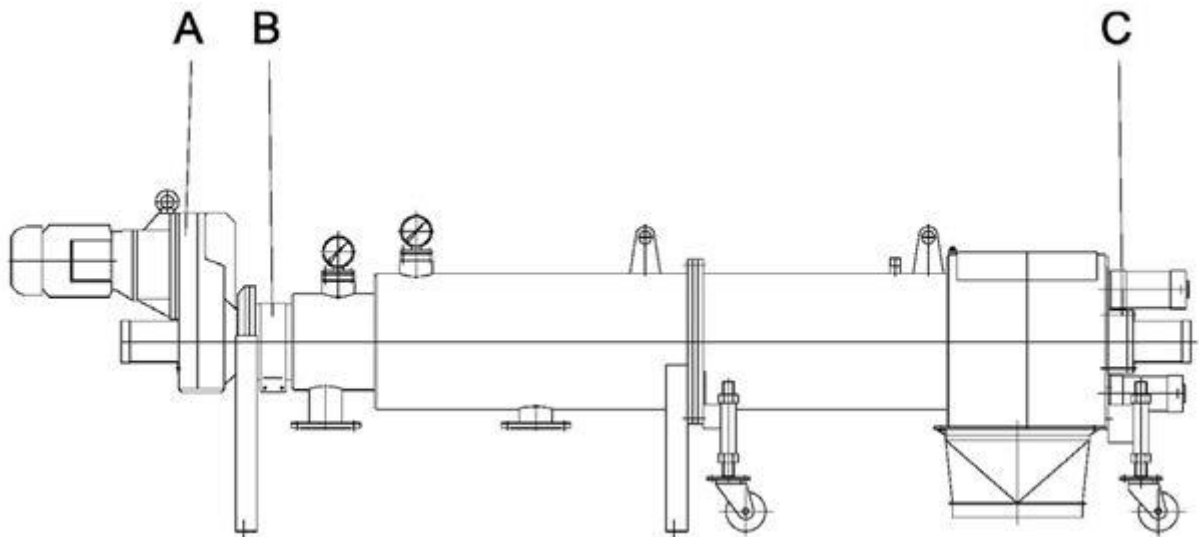
#### **Gear motor:**

The machine is equipped with a gear motor, the technical data and required lubricant amounts of which can be taken from the attached motor data sheet. The required lubricant amount is additionally specified on the identification plate. If two amounts are indicated, the first refers to the main drive and the second to the intermediate stage.

An operating manual for the drive motor can be found in the appendix. The approved lubricants are listed in this operating manual.

Under normal operational conditions it is recommended to replace the lubricant after approx. 15000 operation hours. Independent of the operation time, lubricant replacement is recommended after 3 years at the latest.

#### **STRAINPRESS® lubrication:**



Gear motor (A) lubricant replacement: Please observe the above instructions.

Lubrication point	Interval	(Proposed) lubricant
Discharge side screw shaft bearing (C)	monthly or every 500 operating hours 5 g lubricant Greasing while the screw is in operation	Plantogel 2 S
Inlet side oil seal (B)	monthly or every 500 operating hours 5 g lubricant (620) max. 5 bar Greasing while the screw is in operation	Plantogel 2 S

Schmierstoffspezifikation nach DIN 51502: KPE 2 K-30  
 Schmierstoffspezifikation nach DIN 51519: ISO-VG 100

**9.3 Mounting and dismounting screens and screws**

**⚠ CAUTION**

Before carrying out further work, the shutdown procedure described in section 3.1.4 must be observed.

**⚠ CAUTION**

Pressure fed sludge and pneumatic lines must be shut off and relieved before opening the machine.

**NOTICE**

Up to 200 l sludge can run out of the half casings when the machine is disassembled. Remove therefore the sludge before disassembling the machine using the customer-provided drain valve in the outlet line.

These auxiliary means and special tools facilitate maintenance work:

- Mounting rail above the machine's longitudinal axis
- Lifting device of sufficient bearing capacity
- Mounting set (available as accessories)



The heaviest individual machine parts and their weight:

SP 290:	Press zone casing on rollers (filling weight):	approx. 450 kg
	Screw shafts:	approx. 100 kg each
	Screen baskets:	approx. 30 kg each
SP 430:	Press zone casing on rollers (filling weight):	approx. 850 kg
	Screw shafts screening zone:	ca. 160 kg
	Screw shafts press zone:	ca. 100 kg
	Screen baskets:	approx. 40 kg each

### 9.3.1 Separation of the screening and press zone

#### Disassembly:

- Open the protective hoods.
- Measure LH and LV and note down the measurements. They are required for re-assembly.
- Unlock the counter nuts. Turn both nuts back (approx. 2 – 3 turns).
- Loosen the screw joints of the casing between the screening and press zone.
- Mount the holding fixture for the screw shaft.



- Loosen the fixing screw beside the pull rod.
- Turn the pull rod (014) to the left until the screening and press zone are disconnected. The press zone can now be removed and both machine parts are easily accessible.

### **Re-assembly:**

- Attach the press zone to the screening zone. Check with the centring pins if the press part position has the right level. If required, adjust the swivel rollers accordingly.
- Replace the sealing rings and the intermediate ring.
- Clean the screw shaft journal and the thread of the pull rod.
- Lubricate the screw shaft journal and the thread of the pull rod with an assembly paste to avoid pressing and fretting corrosion.
- Screw-join both screws by turning the pull rod.
- Firmly connect the casing with the four screws.
- Check, through the plugs in the inlet chamber, if the screening zone surface has a little play (0.5 - 1.0 mm) inside the screening zone casing. Alter the width of the intermediate rings if the screening zone surface is mounted with too much tension or too much play.
- Re-tighten the pull rod in order to ensure the joint between the two screw parts is complete.
- Tighten the fixing screw beside the pull rod.
- Dismount the holding fixture for the screw shaft.
- Tighten the nuts until the measure LH is the same as before disassembly.
- Measure LV for checking purposes. Compare the measurement with the measure before disassembly.
- Close the protective hoods.

## **9.3.2**

### **Screening zone**

#### **How to dismantle the screen:**

- Separate the machine as described above.
- Screw out the plug below the pressure sensors in the inlet chamber.
- Insert a rod through the thread hole of the plug. Strike on it in order to loosen the screening zone screen. Pull the screen by hand out of the screening zone.
- Change the screen when the wall thickness is less than 1,5 mm on the weakest part.

#### **Re-assembly of the screen:**

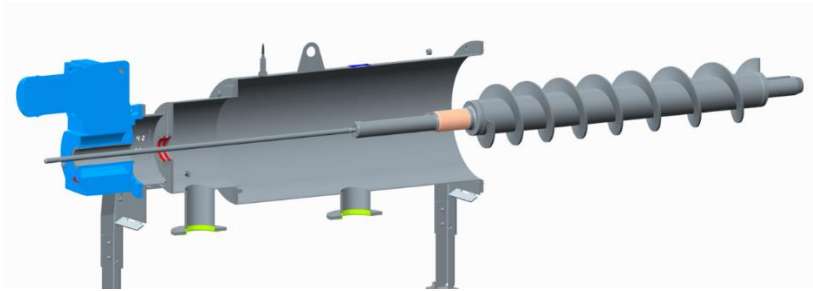
- Compare the length of the new and worn screen. If the difference in length exceeds 1 mm, the intermediate ring must be adjusted.
- Push the screening zone screen into the screening zone and push it onto the three retaining pins in the inlet chamber.
- Screw in the plug.

#### **How to dismantle the screw:**

- Separate the machine as described above.
- Dismount the screen as described above.
- Screw out the fixing screw beside the pull rod.
- Pull the coupling rod out of the screw.

### Re-assembly of the screw:

- Assembly by proceeding in reverse order.
- Use the coupling rod for pulling the screw into the gear box.



- Remember to mount new sealing rings and a new intermediate ring.

### 9.3.3

#### Press zone

When shutting down the STRAINPRESS® it is not possible to completely deplete the machine because the solids plug remains there. Since the screen and screw become wedged together by the solids plug, it is reasonable to pull out the screen together with the screw!

- Separate the screening and press zone as described above.
- Pull the press zone screen along with the press screw out of the press zone casing.
- Macerate the solids plug from outside with a high pressure cleaner. Slide or knock the screen off the screw, e.g. in vertical position.

#### How to dismantle the screen:

- Separate the machine as described above.
- Remove the intermediate flange and intermediate ring.
- Force the press zone screen out of the press zone casing, using the (optionally) supplied turning handles. Pull the screen out.
- Change the screen when the wall thickness is less than 1,5 mm on the weakest part.

#### Re-assembly of the screen:

- Insert the screen into the press zone. The marks on the flange of the press zone screen and on the casing should coincide.
- Disassembly by proceeding in reverse order.

#### Dismounting the press screw:

- Separate the machine as described above.
- Push back the pneumatic cylinder.
- Screw off the nuts.
- Remove the spacer bushing.
- Wrap an adhesive tape around the exposed fine thread of the screw shaft for its protection.
- Use adhesive tape to safely fix the guard rings on the screw shaft and secure them against loss.
- Carefully pull out the screw through the bearing and pressure cone.

#### Press screw installation:

- If necessary, replace the sealing ring in the pressure cone. If necessary, replace the complete pressure cone and the sealing ring(s).
- Clean and lubricate the running surface of the pressure cone.
- Insert the screw with the guard ring into the press zone.

Further assembly by proceeding in reverse order.

## 9.3.4 Spares, wear parts

### a) Wear parts

Our guarantee does not include wearing parts that are subject to natural wear during operation. Wear parts are parts which are subject to increased wear due to their function. The level of wear depends greatly on the conditions of use, operating life and maintenance of the system.

These are the main wear parts of the plant:

1. Screw shafts
2. Screen baskets
3. Sealings
4. Intermediate ring
5. Pressure cone
6. Guard ring

### b) Spare parts

For further spare parts, such as gear motor etc., refer to the spare parts list in the appendix. Please provide the following details when ordering spare parts:

Type of machine

Size

Order number = machine number

Year of manufacture

Operating voltage of the electrical part

Order number from the spare part list (see appendix)

Required number of units

Delivery address

## 9.3.5 Regular tests of machines subject to ATEX – Recurring tests and permanent control

The regular tests for maintenance of the plant's nominal condition shall include after every 3000 operation hours, at least however after 2 years, checkup of the components listed below. Replace the components, if they show signs of an unacceptable operating condition.

Operating hours	Interval	Subject	Recommended method
3000	2 years	Operating condition: self-aligning roller bearing	Check for bearing play. (visual inspection)

## NOTICE

Additionally observe the separate operating instructions for electro motors, drives and bearings for maintenance.



## CAUTION

Repair or extensive maintenance work on machines with ex protection should be performed in a separate room on the dismantled machine.

## 10 Shutdown

In order to avoid injury, damage to machinery and environmental damage when decommissioning the machine, the following safety guidelines must always be observed:

- The machine must only be decommissioned by authorised, qualified personnel.
- Please contact the manufacturer if you have questions concerning the disposal of the machine.
- Take care of environmentally sound disposal of operating media, lubricants and auxiliary material. (e.g. drive motor oil fill) – Observe the regulations for eco-friendly waste disposal or recycling!
- The machine must only be lifted at the points specified for the purpose.
- Only the lifting equipment and accessories listed here must be used for lifting the machine and parts of the machine.
- Also refer to the chapter Transportation.
- Also refer to the chapter General Safety Instructions.

### 10.1 Temporary shutdown

- Deplete the plant and the feed and discharge lines.
- Relieve the pressure in the pneumatic lines.
- Prior to a longer shutdown, clean the plant with a high-pressure unit.
- Clean the humidity probe in the discharge casing.
- Release the screw shaft.
- If the machine is installed outdoors the motor should be covered (in order to avoid ingress of water) but not wrapped. Otherwise, water may enter the terminal box.
- It is recommended to change the gearbox oil prior to start-up after a several-year shutdown.

### 10.2 Final decommissioning / disposal

Qualified staff only is authorized to perform electrical and mechanical shutdowns.

Prior to a final shutdown, follow the instructions for a temporary shutdown and the following additional instructions:

- Drain the gearbox oil. Disposal of gearbox oil: Observe the regulations for eco-friendly waste disposal!
- Clean the machine
- Separate materials
  - Metals are fully recyclable
  - Plastics are partially recyclable

## 11 Additional information

Do you have any further questions or requests? We will be happy to assist you.

Our company address:

Huber Technology, Inc.  
9735 NorthCross Center Court STE A  
Huntersville, NC 28078

Phone: 1-704-949-1010  
Fax: 1-704-949-1020  
E-mail: [huber@hhusa.net](mailto:huber@hhusa.net)

You can contact our central customer service by:

Phone: 1-877-US HUBER  
E-mail: [service@hhusa.net](mailto:service@hhusa.net)  
[parts@hhusa.net](mailto:parts@hhusa.net)

We will help you to quickly find the right technical expert to answer your questions.

You can also visit us online at: [huber-technology.com](http://huber-technology.com)

You can also find up-to-date information on our service division there.

Our range of services includes **preventive maintenance, maintenance, and rapid repairs**.  
Our service hotline is available **24 hours a day, 7 days a week**.

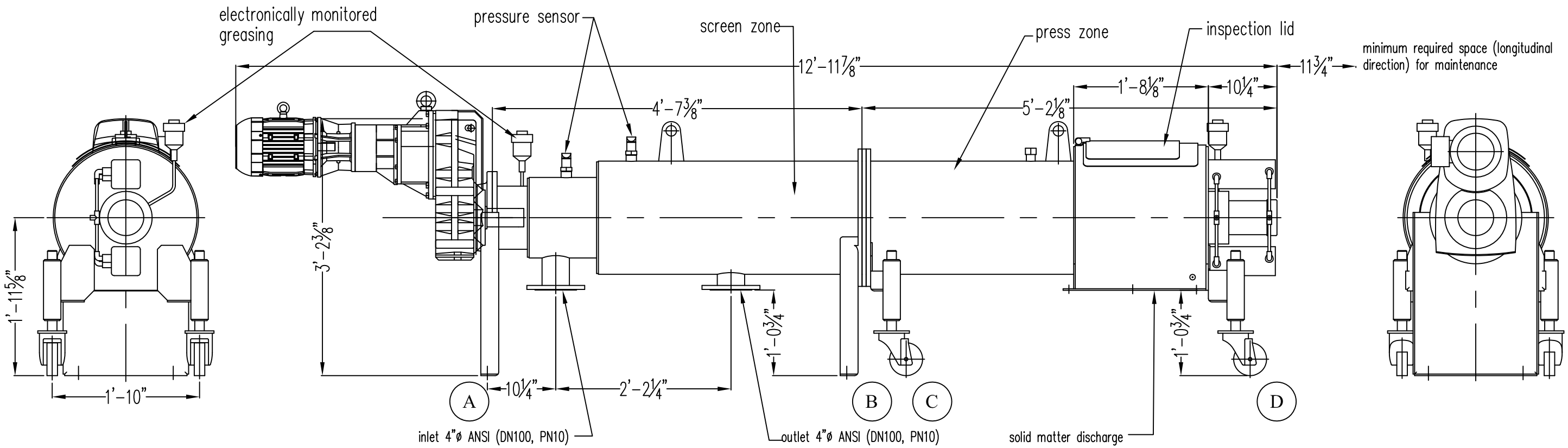
Our service department will provide you with the customer-oriented and reliable service that our customers have come to expect. Our qualified employees and skilled management offer you assistance with:

- **Installation and commissioning**
- **Advice, information and training of operating personnel**
- **Maintenance at regular intervals**
- **System optimisation**
- **Maintenance of product performance**
- **Repairs and standard spare parts within 48 hours**

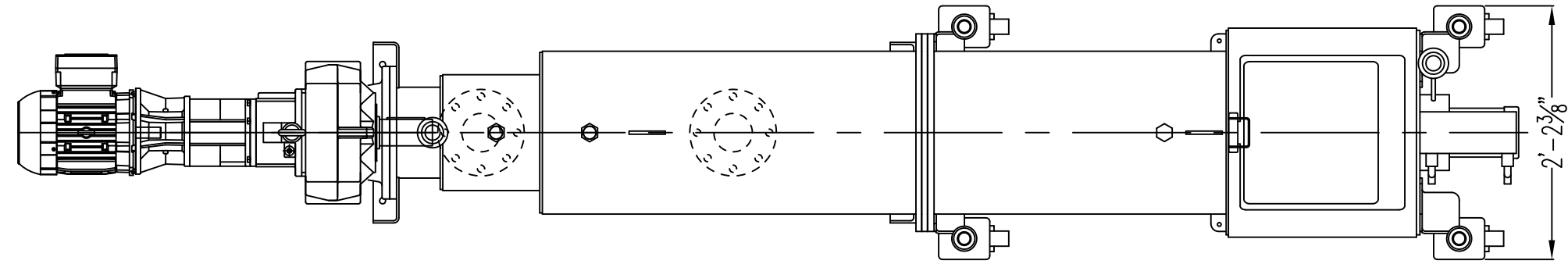
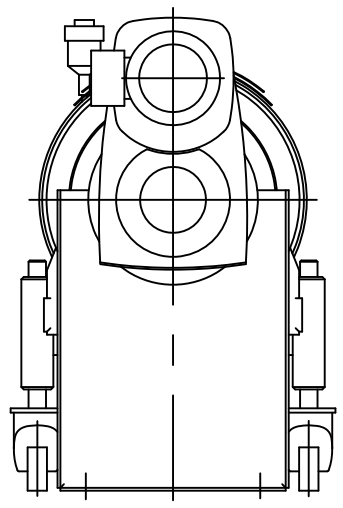
This comprehensive range of services ensures that your system can be operated safely and reliably. This is an important aspect for municipalities and industry. The support provided by our service department means that you can more effectively carry out the task of maintaining the functionality of your system.

# Section 4.0

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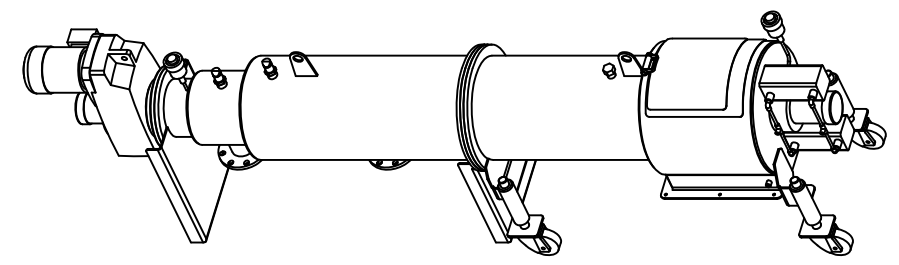
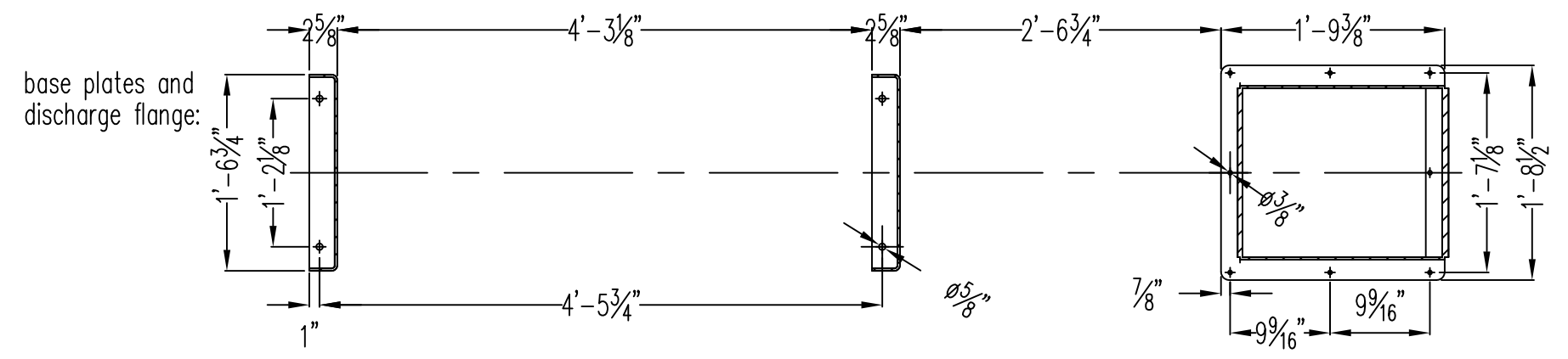
minimum required space (longitudinal direction) for maintenance



weight: 690 kg / 1518 lb  
load distribution at point:

A	B	C	D
≈ 35 %	≈ 20 %	≈ 20 %	≈ 25 %

inlet / outlet flange drilled according to DIN and ANSI (4")



**HUBER**  
**TECHNOLOGY**

9735 NorthCross Center Court, Suite A  
Huntersville, NC 28078  
Tel. 704-949-1010  
info@huber-technology.com

Strainpress ® SP4

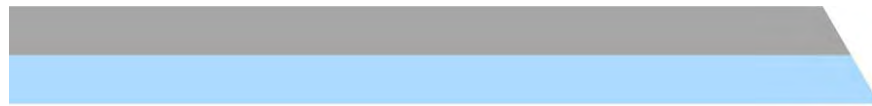
Fig No. 1/1	Dimensional Sheet	Scale: 3/4" = 1'-0"
Project No.		Drawing No. SP4_2011.dwg

# Section 5.0

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**Motor Data Sheet SK5382AF- 184T**

Gearbox:	NORD
Motor:	WEG
Enclosure:	TEFC
Explosion Proof Rating:	Class 1, Division 2, Group D
Gearbox:	SK5382 – 184T
Motor:	184TC
Horsepower (HP):	5.0
Motor Speed (RPM):	1755
Output Shaft Speed (RPM):	10.0
Duty:	Constant Speed
Output Shaft Torque (lbf-in):	24780
Hertz/Phase/Voltage:	60/3/230/460
Full Current Load (A):	7.2/3.6
Weight (lb):	130
Service Factor:	1.15
Efficiency:	89.5%
Maximum Ambient Temperature:	40°C
Winding Material:	Copper
Frame Material:	Cast Iron
Insulation	Class: F
NEMA Design Code:	B
Color:	Sky blue (RAL 5015)



## GEARBOX APPENDIX INFORMATION

### TYPE NORD SK 5382

# ATEX

## Operating and Maintenance Manual



Explosion-proof gearunits and gearmotors



B2000  
23/2008

GB

# NORD Gear



## Company Overview

Since 1965, NORD Gear has grown to global proportions on the strength of product performance, superior customer service, and intelligent solutions to a never ending variety of industrial challenges.

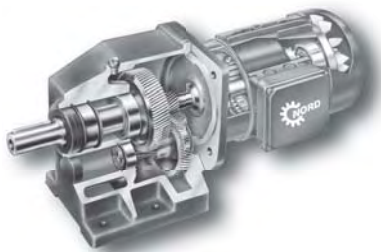
All mechanical and electrical components of a drive are available from NORD Gear. Our products cover the full range of drive equipment: helical in-line, Clincher™ shaft-mount, helical-bevel, helical-worm gearboxes, motors and AC drives from 1/6 hp to 250 hp, with torques from 90 lb-in to 900,000 lb-in.

But NORD Gear does far more than manufacture the world's finest drive components. We provide our customers with optimum drive configurations for their specific purposes, providing each and every one of them with truly complete and efficient systems at a price/quality ratio unmatched in today's fast-changing markets.

NORD Gear makes its wide range of products easily available through a global network that provides all customers with prompt delivery and expert support services to consistently exceed customer expectations. We are firmly committed to being totally responsive to the ideas and specifications of every customer, anywhere in the world.

### UNICASE™

NORD heavy-duty, one-piece housings are precisely machined to exacting standards. Internal reinforcements further increase strength and rigidity. All bearings and seal seats are contained within the casting, eliminating splits or bolt-on carriers that can weaken the housing and allow oil leakage. Bores and mounting faces are machined in one step, producing extremely precise tolerances — thus ensuring accurate positioning of gear teeth, bearings and seals, and longer life for all components.



### Benefits

- Leak-free design
- Quiet operation
- High output torque capabilities
- Extended lubrication life
- Longer gear and bearing life
- Superior dependability/low maintenance/longer life

## High-Performance Motors & Brakemotors

NORD motors are designed to run cool for longer service life. Low rotor inertia and high starting torque allow peak performance in the most difficult applications for inverter and vector duty per NEMA MG 1-1998 Section 31.4.4.2 voltage spikes. Our motors are internationally accepted, conforming to North American NEMA MG 1 and international IEC electrical specifications. High performance options include brakes, encoders, and forced cooling fans.



## Short, On-Time Delivery

As a NORD customer, you can rest assured that your order will be delivered on time. Because NORD has both decentralized assembly and manufacturing operations and a linked global network, we offer our customers:

- Fast, reliable responses
- Greater product versatility
- Shorter lead times
- Timely shipping
- Rapid delivery

## Quality

Quality is assured at NORD assembly and manufacturing facilities, based on ISO 9000 standards — from careful inspection of incoming materials to closely monitored machining operations including gear cutting, turning, hardening & grinding as well as finishing & assembly.





## NORD 911

Trouble? Just call 715-NORD-911 (in Canada, 905-796-3606). Emergency service is available 24 hours a day, 7 days a week. We'll answer your call, ship the parts, or build a unit and have it shipped directly to you to provide what you need, when you need it.



## Manufacturing

NORD continually invests in research, manufacturing and automation technology. This is to ensure the highest possible quality at affordable prices. NORD invests heavily in our North American facilities as well as our factories around the world. Recent examples include expanding our Waunakee factory and adding numerous new large gear unit assembly cells. In our Glindede, Germany gear factory we added a state-of-the-art Vacuum multi-chamber carburization system.



## Global Availability

From Shanghai to Charlotte, and all points between, NORD reaches customers around the world. Deliveries, service, and product support are close at hand, regardless of your location.

## Worldwide Standards

NORD products are designed and manufactured based on the latest North American and global standards.



## Increased North American Presence

NORD covers North America with over 30 district offices and over 500 distributor branches. NORD operates a manufacturing and assembly facility in Waunakee, WI, Charlotte, NC, Corona, CA, Brampton, ON, and Monterrey, Mexico, resulting in an ever-increasing capacity in the United States and Canada and giving our customers the shortest lead times in the industry.

## Energy Efficiency

Lowering your operating costs is one of our greatest goals! NORD research and development focuses on energy efficiency, with gearboxes, motors, and frequency inverters designed for lower energy consumption. Our fully diverse line of in-line or right-angle units and motors has been developed to suit your needs.

## Modular Design

NORD's modular design philosophy provides you with a competitive edge by allowing you to configure drive systems to exactly fit your applications.

More than 20,000,000 combinations of totally unique gearmotors and speed reducers are possible – assembled in-line or right-angle, mounted by foot or flange, featuring solid or hollow shafts with either metric or inch shaft extensions – to give you complete freedom to specify a drive solution that's perfect for you.

## Benefits

- More output speeds
- More mounting arrangements/  
Greater flexibility
- Fewer gear stages/Lower cost
- Metric and inch products

NORD engineers stand ready to assist you with your custom applications. Most standard drives can be modified to your purposes, and custom designs can be developed for special applications.

# Engineering NORD Service Factor



## Mass Acceleration Service Factor

The mass acceleration factor ( $m_{af}$ ) uses a ratio of the load inertia to motor inertia. This method of service factor calculation can be used for both gearmotors and speed reducers and is valid for helical and helical-bevel gear units. For helical-worm units additional factors will need to be taken into account including an ambient temperature factor and duty cycle factor.

Short-term and infrequent torque impulses significantly influence the load and selection of a gear unit. The gear unit service factor,  $f_B$ , takes this and other affects on the gear unit into account.

The mass acceleration factor,  $m_{af}$ , represents the relationship between external low-speed output side and high-speed input side masses. The mass acceleration factor significantly influences the level of torque impulses in the gear unit upon start-up and braking procedures, and upon vibration. The external mass moments of inertia also include the load, such as the material transported on conveyor belts. We ask you to consult with NORD if the  $m_{af} > 10$ , if there is a large play in transfer elements, vibration in the system, uncertainty regarding the load classification, or you are in doubt.

For applications with relatively high external mass moments of inertia,  $m_{af} > 2$  (i.e. travel drives, slewing gears, rotary tables, gear drives, agitators, and surface aerators), we recommend breaking torque that does not exceed 1.2 times the rated motor torque. If a higher breaking torque is to be used, this must be considered when selecting the gear unit.

1. Calculate mass acceleration factor:

$$m_{af} = \frac{J_{load}}{J_{motor}} \times \left( \frac{1}{\text{reducer ratio}} \right)^2$$

$J_{load}$  = External load inertia including all components of the system outside of the reducer

$J_{motor}$  = Motor inertia. For NORD motors see pages 712-718

**If  $m_{af} \leq 0.25$  use curve A (uniform operation)**

Light conveyor screws, fans, assembly lines, light conveyor belts, small agitators, elevators, cleaning machines, filling machines, inspection machines, belt conveyors.

**If  $0.25 < m_{af} \leq 3.00$  use curve B (moderate shocks)**

Coilers, feed-mechanism drivers for woodworking machines, dumbwaiters, balancing machines, thread cutting machines, medium-sized agitators and mixers, heavy conveyor belts, winches, sliding doors, manure scrapers, packing machines, concrete mixers, overhead crane traveling mechanisms, mills, bending machines, gear pumps.

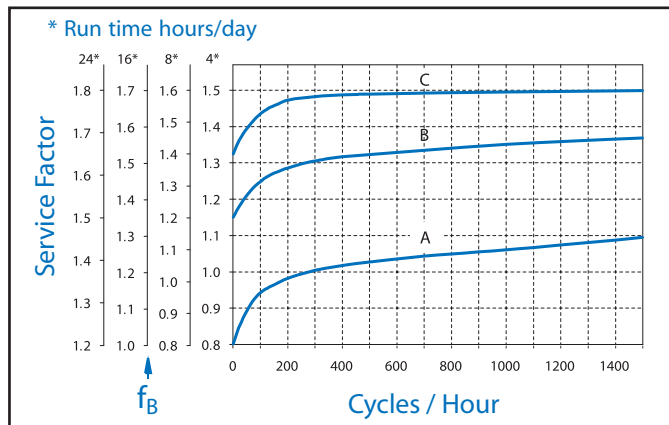
**If  $3.01 \leq m_{af} < 10.00$  use curve C (heavy shocks)**

Heavy mixers, shears, presses, centrifuges, rolling stands, heavy winches and lifts, grinding mills, stone crushers, bucket elevators, punching machines, hammer mills, eccentric presses, folding machines, roller tables, tumbling barrels, vibrators, shredders.

2. Determine the cycles/hour. A cycle is a start or hard stop, where a hard stop decelerates the motion of the system when a mechanical brake is activated.

3. Determine the run time in hours/day.

4. Using the chart; locate the cycles/hour on the horizontal axis and move vertically up to intersect curve A, B, or C based on the  $m_{af}$ . From the intersection point, move horizontally left to the service factor  $f_B$  based on the run time in hours/day.



**EXAMPLE for Inline, Shaft mount, or Bevel gearmotor:**

A smooth running conveyor operates 24 hours/day with 500 cycles/hour. The calculated  $m_{af} = 0.16$ , therefore use curve A for this type of application.

From the chart, find 500 cycles/hour and follow the axis vertically up until you intersect curve A. From the intersection point, move horizontally left to find the service factor  $f_B = 1.4$  based on 24 hours/day operation. Consult the selection pages of the catalog to find a gearmotor with a service factor  $f_B = 1.4$  or greater.



# Engineering NORD Service Factor

### EXAMPLE for Helical-worm gearmotor:

A coiler operates 16 hours/day with 300 cycles/hour with a calculated  $m_{af} = 2.5$ . Ambient temperature is 120°F and the unit operates 18 minutes per hour.

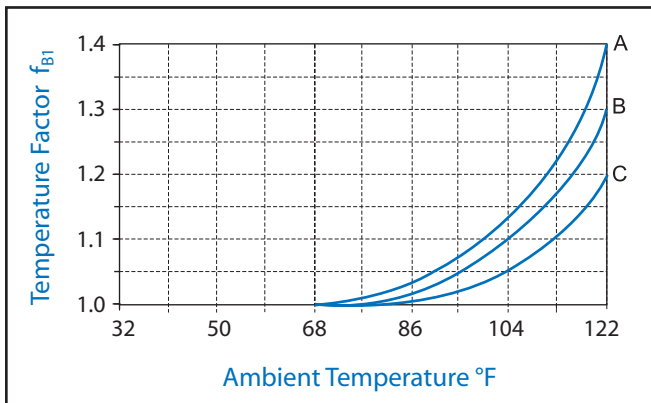
From the chart, find 300 cycles/hour and follow the axis vertically up until you intersect curve B. From the intersection point, move horizontally left to find the service factor  $f_B = 1.5$  based on 16 hours/day operation.

The service factor  $f_B$  for helical-worms must be modified for the ambient temperature factor  $f_{B1}$  and duty cycle factor  $f_{B2}$ .

The combined service factor

$$f_{Bcombined} = f_B \times f_{B1} \times f_{B2}$$

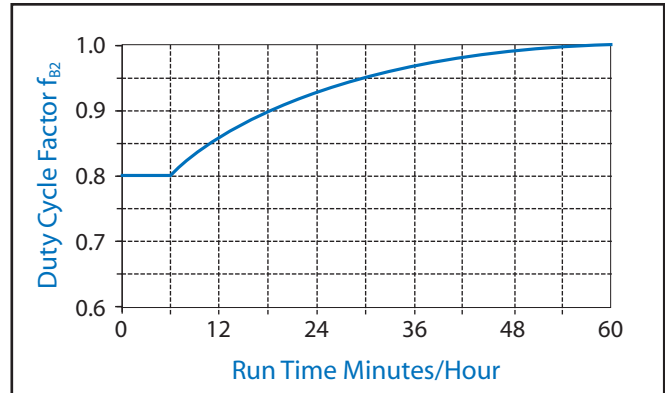
To find the ambient temperature factor  $f_{B1}$  use the following chart based on ambient temperature.



To find the duty cycle factor  $f_{B2}$  use the following chart based on how many minutes per hour the unit is running.

In this example,

$$f_{Bcombined} = (f_B = 1.50) \times (f_{B1} = 1.30) \times (f_{B2} = 0.90) = 1.76$$



When selecting worm gear reducers, multi-thread (multi-start) worms must be used where shock loading exists and where the driven machine may back-drive the gearbox for short periods. Multi-thread worms have  $z_1$  (number of threads) greater than or equal to 2.

- $m_{af} \leq 0.25$  all numbers of worm threads ( $z_1$ ) are possible
- $m_{af} \leq 3.00$   $z_1 \geq 3$  is recommend
- $m_{af} \leq 10.00$   $z_1 \geq 6$  is recommend

Refer to the worm reducer selection pages in this catalog (pages ) and find the any ratio with  $z_1 \geq 3$ . Then refer to the gearmotor selection pages and choose a gearmotor with a service factor of 1.76 or greater.

# Engineering AGMA Service Classes



## AGMA Selection Method

### Germotors

Before a gearmotor is selected, an application class number must be determined. Since application classification represents the normal relationship between gear design power rating and the maximum potential transmitted power, it is suggested that the application class number be applied to the nameplate rating of the electric motor. The application class numbers are I, II, and III. Their relationship to service factor is:

Class Numbers	$f_B$
I	1.0 - 1.39
II	1.4 - 1.99
III	$\geq 2.0$

Application class numbers may be selected from the table. Some operational characteristics that affect an application's classification are:

- **Starting conditions:** Starting conditions where peak loads exceed 200 percent of rated load, applications with frequent starts and stops and reversing applications require special analysis. Rated load is defined as the unit rating with an application class number of I (1.0 - 1.39 service factor).
- **Overloads:** Loads in excess of the rated load are considered overloads. Overload can be of momentary duration, periodic, quasi-steady state, or vibratory in nature. The magnitude and the number of stress cycles require special analysis to prevent low cycle fatigue or yield stress failure. Applications with high torque motors, motors for intermittent operation and applications where extreme repetitive shock occurs or where high-energy loads must be absorbed as when stalling require special consideration.
- **Brake equipped applications:** When a gear drive is equipped with a brake that is used to decelerate the motion of the system, select the drive based on the brake rating or the equivalent power, whichever is greater. If the brake is located on the output shaft of the gear drive, special analysis is required.
- **Reliability and life requirement:** Applications requiring a high degree of reliability or unusually long life should be given careful consideration by the user and NORD GEAR before assigning an application class number. High reliability and life should be addressed by using an increased safety factor agreed to between NORD and the purchaser.

Synchronous motors, certain types of high torque induction motors and generator drives require special analysis. Synchronous motors have high transient torque during starting and restarting after they trip out momentarily.

Induction motors of special high slip design can produce extremely high starting torque. High torque loads are produced when the motor trips out for a very short time and then the trip re-closes.

Generators have extremely high loads when they are out of phase with the main system and when there are across the line short circuits.

Adjustments to the gear drive selection may be necessary when one or more of the following conditions exist:

- Ambient conditions. Extremes of temperature and environment.
- Lubrication. Any lubricant not in accordance with NORD's recommendations.
- Misalignment and distortions due to inadequate foundations.
- Reversing applications.
- High-risk applications involving human safety.

The purpose of this table is to provide a guide in the selection and application of gear drives designed and rated in accordance with AGMA Standard 6009.

The service factor table has been developed from the experience of manufacturers and users of gear drives for use in common applications and has been found to be generally satisfactory for the listed industries when gears are applied using AGMA standards. It is recommended that the user and NORD Gear agree upon class numbers for special applications when variations of the table may be required.



# Engineering AGMA Service Classes

Application	Load Duration		
	Up to 3 hrs per day	3-10 hrs per day	Over 10 hrs per day
<b>PLASTICS INDUSTRY – PRIMARY PROCESSING</b>			
Intensive Internal Mixers			
Batch Mixers	III	III	III
Continuous Mixers	II	II	II
Batch Drop Mill – 2 smooth rolls	II	II	II
Continuous Feed, Holding & Blend Mill Calendars	II	II	II
<b>PLASTICS INDUSTRY – SECONDARY PROCESSING</b>			
Blow Molders	II	II	II
Coating	II	II	II
Film	II	II	II
Pipe	II	II	II
Pre-Plasticizers	II	II	II
Rods	II	II	II
Sheet	II	II	II
Tubing	II	II	II
<b>PULLERS – BARGE HAUL</b>	II	II	II
<b>PUMPS</b>			
Centrifugal	I	I	II
Proportioning	II	II	II
Reciprocating			
Single Acting, 3 or more cylinders	II	II	II
Double Acting, 2 or more cylinders	II	II	II
Rotary			
Gear Type	I	I	II
Lobe	I	I	II
Vane	I	I	II
<b>RUBBER INDUSTRY</b>			
Intensive Internal Mixers			
Batch Mixers	III	III	III
Continuous Mixers	II	II	II
Mixing Mill			
2 smooth rolls	II	II	II
1 or 2 corrugated rolls	III	III	III
Batch Drop Mill – 2 smooth rolls	II	II	II
Cracker Warmer – 2 roll, 1 corrugated roll	III	III	III
Cracker – 2 corrugated rolls	III	III	III
Holding, Feed & Blend Mill – 2 rolls	II	II	II
Refiner – 2 rolls	II	II	II
Calendars	II	II	II
<b>SAND MULLER</b>	II	II	II
<b>SEWAGE DISPOSAL EQUIPMENT</b>			
Bar Screens	II	II	II
Chemical Feeders	II	II	II
Dewatering Screens	II	II	II
Scum Breakers	II	II	II
Slow or Rapid Mixers	II	II	II
Sludge Collectors	II	II	II
Thickener	II	II	II
Vacuum Filters	II	II	II

Application	Load Duration		
	Up to 3 hrs per day	3-10 hrs per day	Over 10 hrs per day
<b>SCREENS</b>			
Air Washing	I	I	II
Rotary – Stone or Gravel	II	II	II
Traveling Water Intake I	I	I	I
<b>SCREW CONVEYORS</b>			
Uniformly loaded or Fed	I	I	II
Heavy Duty	I	II	II
<b>SUGAR INDUSTRY</b>			
Beet Slicer	III	III	III
Cane Knives	II	II	II
Crushers	II	II	II
Mills (low speed end)	III	III	III
<b>TEXTILE INDUSTRY</b>			
Batchers	II	II	II
Calendars	II	II	II
Cards	II	II	II
Dry Cans	II	II	II
Dyeing Machinery	II	II	II
Looms	II	II	II
Mangles	II	II	II
Nappers	II	II	II
Pads	II	II	II
Slashers	II	II	II
Soapers	II	II	II
Spinners	II	II	II
Tenter Frames	II	II	II
Washers	II	II	II
Winders	II	II	II

**Notes to GERMOTOR SERVICE FACTOR table:**

- 1) The class numbers listed for paper mill applications are consistent with those shown in TAPPI (Technical Association of Pulp and Paper Industry) Technical Information Sheet O406-18 1967, Service Factors for Gears on major Equipment in the Paper and Pulp Industry.
- 2) Anti-friction bearings only.
- 3) A Class Number of I may be applied at base speed of a supercalendar operating over a speed range of part-range constant horsepower and part-range constant torque where the constant horsepower speed range is greater than 1.5 to 1. A Class Number of II is applicable to supercalendars operating over the entire speed range at constant torque or where the constant horsepower speed range is less than 1.5 to 1.

# Engineering AGMA Service Factors



## Speed Reducers

Before an enclosed speed reducer or increaser can be selected for any application, an equivalent unit power rating (service factor = 1.0) must be determined. This is done by multiplying the specified power by the service factor. Since the service factor represents the normal relationship between the gear unit rating and the required application power, it is suggested that the service factor be applied to the nameplate rating of the prime mover or driven machine rating, as applicable.

NORD GEAR and the user must agree upon which power, prime mover rating or driven machine requirements, should dictate the selection of the gear drive. It is necessary that the gear drive selected have a rated unit capacity equal to or in excess of this "equivalent unit power rating".

All service factors listed are 1.0 or greater. Service factors less than 1.0 can be used in some applications when specified by the user and agreed to by NORD GEAR.

The REDUCER SERVICE FACTOR table should be used with caution, since much higher values have occurred in some applications. Values as high as ten have been used. On some applications up to six times nominal torque can occur, such as: Turbine/Generator drives, Heavy Plate and Billet rolling mills.

It has been developed from the experience of manufacturers and users of gear drives for use in common applications. It is suggested that service factors for special applications be agreed upon by the user and NORD GEAR when variations of the values in the table may be required.

Service factors shown are for reducers driven by motors (electric or hydraulic) and turbines (steam or gas) according to AGMA 6010. When the driver is a single cylinder or multi-cylinder engine, the service factors from the table must be modified for the appropriate type of prime mover.

As an example, if the application is a centrifugal blower, the service factor from the REDUCER SERVICE FACTOR table is 1.25 for a motor or turbine. The CONVERSION TABLE changes this value to 1.75 for a single cylinder engine and 1.50 for a multi-cylinder engine.

**CAUTION:** Any user of enclosed gear drives should make sure that the latest available information affecting the selection of a gear drive is used. When better load intensity data is available on the driving or driven equipment, this should be considered when a service factor is selected.

**Conversion Table**

Electric Motor, Steam & Gas Turbines, Hydraulics	Single-Cylinder Engines	Multi-Cylinder Engines
1.00	1.50	1.25
1.25	1.75	1.50
1.50	2.0	1.75
1.75	2.25	2.00
2.00	2.50	2.25
2.25	2.75	2.50
2.50	3.00	2.75
2.75	3.25	3.00
3.00	3.50	3.25

Application	Load Duration		
	Up to 3 hrs per day	3-10 hrs per day	Over 10 hrs per day
<b>AGITATORS (mixers)</b>			
Pure Liquids	1.00	1.00	1.25
Liquids and Solids	1.00	1.25	1.50
Liquids – Variable Density	1.00	1.25	1.50
<b>BLOWERS</b>			
Centrifugal	1.00	1.25	1.50
Lobe	1.00	1.25	1.50
Vane	1.00	1.00	1.25
<b>BREWING AND DISTILLING</b>			
Bottling Machinery	1.00	1.00	1.25
Brew Kettles – Continuous Duty	1.00	1.00	1.25
Cookers – Continuous Duty	1.00	1.00	1.25
Mash Tubs – Continuous Duty	1.00	1.00	1.25
Scale Hopper – Frequent Starts	1.00	1.25	1.50
<b>CAN FILLING MACHINES</b>	1.00	1.00	1.25
<b>CAR DUMPERS</b>	1.25	1.50	1.75
<b>CAR PULLERS</b>	1.00	1.25	1.50
<b>CLARIFIERS</b>	1.00	1.00	1.25
<b>CLASSIFIERS</b>	1.00	1.25	1.50
<b>CLAY WORKING MACHINERY</b>			
Brick Press	1.25	1.50	1.75
Briquette Machine	1.25	1.50	1.75
Pug Mill	1.00	1.25	1.50
<b>COMPACTORS</b>	1.50	1.75	2.00
<b>COMPRESSORS</b>			
Centrifugal	1.00	1.00	1.25
Lobe	1.00	1.25	1.50
Reciprocating, Multi-Cylinder	1.00	1.25	1.50
Reciprocating, Single-Cylinder	1.25	1.50	1.75
<b>CONVEYORS – GENERAL PURPOSE</b>			
Uniformly loaded or fed	1.00	1.00	1.25
Not uniformly fed	1.00	1.25	1.50
Reciprocating or shaker	1.25	1.50	1.75
<b>CRANES</b>			
Dry dock			
Main hoist	1.25	1.50	1.75
Auxilliary hoist	1.25	1.50	1.75
Boom hoist	1.25	1.50	1.75
Slewing drive	1.25	1.50	1.75
Traction drive	1.50	1.50	1.50
Industrial Duty			
Main hoist	1.00	1.25	1.50
<b>CRUSHER</b>			
Stone or ore	1.50	1.75	2.00



# Engineering AGMA Service Factors

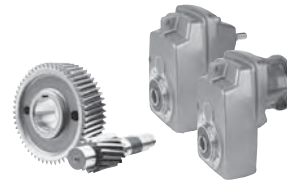
Application	Load Duration		
	Up to 3 hrs per day	3-10 hrs per day	Over 10 hrs per day
<b>RUBBER INDUSTRY</b>			
Intensive Internal Mixers			
Batch Mixers	1.50	1.75	1.75
Continuous Mixers	1.25	1.50	1.50
Mixing Mill			
2 smooth rolls	1.50	1.50	1.50
1 or 2 corrugated rolls	1.75	1.75	1.75
Batch Drop Mill – 2 smooth rolls	1.50	1.50	1.50
Cracker Warmer – 2 roll, 1 corrugated roll	1.75	1.75	1.75
Cracker – 2 corrugated rolls	1.75	1.75	1.75
Holding, Feed & Blend Mill – 2 rolls	1.25	1.25	1.25
Refiner – 2 rolls	1.50	1.50	1.50
Calendars	1.50	1.50	1.50
<b>SAND MILLER</b>	1.00	1.25	1.50
<b>SEWAGE DISPOSAL EQUIPMENT</b>			
Bar Screens	1.00	1.00	1.25
Chemical Feeders		1.00	1.25
Dewatering Screens	1.00	1.25	1.50
Scum Breakers	1.00	1.25	1.50
Slow or Rapid Mixers	1.00	1.25	1.50
Sludge Collectors	1.00	1.00	1.25
Thickener	1.00	1.25	1.50
Vacuum Filters	1.00	1.25	1.50
<b>SCREENS</b>			
Air Washing	1.00	1.00	1.25
Rotary – Stone or Gravel	1.00	1.25	1.50
Traveling Water Intake I	1.00	1.00	1.25
<b>SCREW CONVEYORS</b>			
Uniformly loaded or Fed			
Heavy Duty			
<b>SUGAR INDUSTRY</b>			
Beet Slicer	1.50	1.50	1.75
Cane Knives	1.50	1.50	1.50
Crushers	1.50	1.50	1.50
Mills (low speed end)	1.50	1.50	1.50

Application	Load Duration		
	Up to 3 hrs per day	3-10 hrs per day	Over 10 hrs per day
<b>TEXTILE INDUSTRY</b>			
Batchers	1.00	1.25	1.50
Calendars	1.00	1.25	1.50
Cards	1.00	1.25	1.50
Dry Cans	1.00	1.25	1.50
Dyeing Machinery	1.00	1.25	1.50
Looms	1.00	1.25	1.50
Mangles	1.00	1.25	1.50
Nappers	1.00	1.25	1.50
Pads	1.00	1.25	1.50
Siashers	1.00	1.25	1.50
Soapers	1.00	1.25	1.50
Spinners	1.00	1.25	1.50
Tenter Frames	1.00	1.25	1.50
Washers	1.00	1.25	1.50
Winders	1.00	1.25	1.50

**Notes to REDUCER SERVICE FACTOR table:**

- 1) Service factors for paper mill applications are applied to the nameplate rating of the electric motor at the motor rated based speed.
- 2) Anti-friction bearings only. Use 1.5 for sleeve bearings.
- 3) A service factor of 1.0 may be applied at base speed of a super calender operating over-speed range of part range constant horsepower, part range constant torque where the constant horsepower speed range is greater than 1.5 to 1. A service factor of 1.25 is applicable to super calenders operating over the entire speed range at constant torque or where the constant horsepower speed range is less than 1.5 to 1. Explanatory notes.

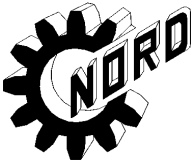
# SK 5382, SK 5282/12 NEMA-C + W Ratings & Combinations



Model Type	Gear Ratio	Output Speed	Output Torque*	Maximum input power <sup>◇</sup> Solid input shafts type "W"				NEMA C-Face* Available Combinations										
				i <sub>tot</sub>	n <sub>2</sub> 1750 rpm	T <sub>2max</sub> [lb-in]	Input Speed				56C	140TC	180TC	210TC	250TC	280TC	320TC	360TC
							1750 rpm	1150 rpm	875 rpm	580 rpm								
SK 5382	82.72	21	24736	7.50	4.95	3.75	2.48	X	X	X	X*							
	91.71	19	25665	7.50	4.95	3.75	2.48	X	X	X	X*							
	117.37	15	24338	5.79	3.82	2.90	1.91	X	X	X	X*							
	138.82	13	28320	5.84	3.86	2.92	1.93	X	X	X	X*							
	153.92	11	28320	4.94	3.26	2.47	1.63	X	X	X*	X*							
	171.27	10	24780	3.93	2.59	1.97	1.30	X	X	X*	X*							
	202.57	8.6	28320	3.86	2.55	1.93	1.28	X	X	X*	X*							
	248.70	7.0	28320	3.15	2.08	1.57	1.04	X	X	X*	X*							
	269.99	6.5	23895	2.46	1.63	1.23	0.81	X	X	X*	X*							
	331.48	5.3	28320	2.38	1.57	1.19	0.79	X	X	X*	X*							
	<b>361.69</b>	4.8	24780	1.89	1.25	0.94	0.62	X	X*									
	<b>427.79</b>	4.1	28320	1.84	1.22	0.92	0.61	X	X*									
	<b>525.20</b>	3.3	28320	1.48	0.98	0.74	0.49	X	X*									
	<b>570.18</b>	3.1	24780	1.22	0.80	0.61	0.40	X	X*									
	<b>700.03</b>	2.5	28320	1.12	0.74	0.56	0.37	X	X*									
	<b>936.45</b>	1.9	23895	0.72	0.48	0.36	0.24	X*	X*									
	<b>1367.08</b>	1.3	23895	0.49	0.33	0.25	0.16	X*	X*									
SK 5282/12	142.18	12	26550	5.00	3.30	2.50	1.65	X	X	X								
	174.55	10	26550	4.21	2.78	2.11	1.39	X	X	X*								
	232.66	7.5	26550	3.16	2.09	1.58	1.04	X	X	X*								
	273.15	6.4	26550	2.70	1.78	1.35	0.89	X	X	X*								
	338.35	5.2	26550	2.19	1.45	1.10	0.72	X	X	X*								
	448.15	3.9	26550	1.64	1.08	0.82	0.54	X	X*	X*								
	550.94	3.2	26550	1.35	0.89	0.67	0.44	X	X*	X*								
	689.45	2.5	26550	1.05	0.70	0.53	0.35	X	X*	X*								
	862.46	2.0	26550	0.90	0.59	0.45	0.30	X*	X*	X*								
	1095.71	1.6	26550	0.73	0.48	0.36	0.24	X*	X*									
	<b>1334.62</b>	1.3	26550	0.60	0.40	0.30	0.20	X*	X*									
	<b>1805.75</b>	0.97	26550	0.46	0.31	0.23	0.15	X*										
	<b>2217.67</b>	0.79	26550	0.39	0.26	0.19	0.13	X*										
	<b>2772.22</b>	0.63	26550	0.32	0.21	0.16	0.11	X*										

\* Caution - The motor power may exceed the gear unit's mechanical torque capacity  
 ◇ The mechanical power limit of the solid input shaft type "W" may limit the reducer rating.  
 All ratings are mechanical. See page 14 for thermal considerations.

<b>lb</b>	<b>W</b>	<b>56C</b>	<b>140TC</b>	<b>180TC</b>	<b>210TC</b>
<b>SK 5382</b>	265	260	269	278	278
<b>SK 5282/12</b>	231	326	243	258	-



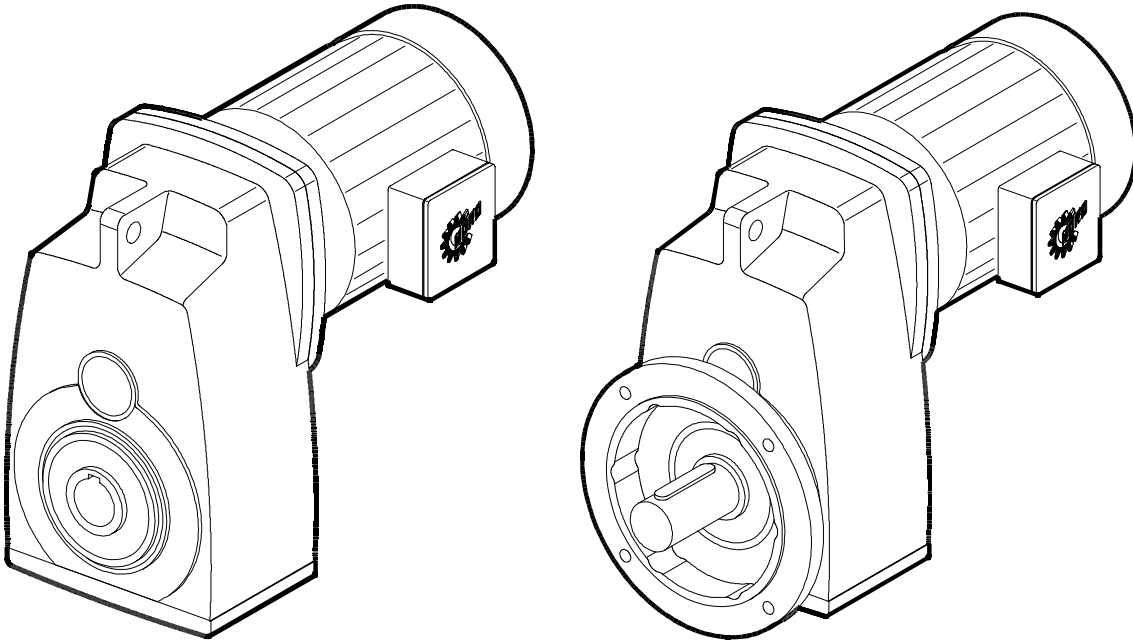
# UNICASE® Shaft Mount Gearboxes Installation and Maintenance Instructions

BIM 1020

USA

CDN

Retain These Safety Instructions For Future Use



## INSPECTION OF UNIT

Thoroughly inspect the equipment for any shipping and handling damage before accepting shipment from the freight company. If any of the goods called for in the bill of lading or express receipt are damaged or the quantity is short, do not accept until the freight or express agent makes an appropriate notation on your freight bill or express receipt. If any concealed loss or damage is discovered later, notify your freight carrier or express agent at once and request him to make an inspection. We will be very happy to assist you in collecting claims for loss or damage during shipment; however, this willingness on our part does not remove the transportation company's responsibility in reimbursing you for collection of claims or replacement of material. Claims for loss or damage in shipment must not be deducted from the NORD Gear invoice, nor should payment of the NORD Gear invoice be withheld awaiting adjustment of such claims, as the carrier guarantees safe delivery.

If considerable damage has been incurred and the situation is urgent, contact the nearest NORD Gear Sales Office for assistance. Please keep a written record of all communications.

## RECORD NAMEPLATE DATA

Locate the gear reducer nameplate and record all nameplate data for future reference.

SK \_\_\_\_\_ S/N \_\_\_\_\_

RATIO \_\_\_\_\_ MAX TORQUE \_\_\_\_\_ RPM \_\_\_\_\_ MTG. POS \_\_\_\_\_

## STORAGE

### PROPER STORAGE UNTIL INSTALLED

Keep unit in a dry, temperature controlled area. If stored other than said, long term storage methods must be applied to the unit including complete fill with lubricant. Protect machined surfaces and rotate shafts periodically. Prior to putting unit into service, drain lubricant and refill to proper level as determined by the mounting position.

### PROPER HANDLING OF THE UNIT

Exercise care to prevent damage to the unit when moving. Lift only at designed lifting points. Do not attach other machinery and lift by the unit lifting points. The lifting points are to be used to lift the unit only. Insure that adequate safety measures are taken to protect personnel during transportation. Protect the mounting surface from damage.

## INSTALLATION OF UNIT

To ensure long service and dependable performance, an enclosed gear drive must be rigidly supported and the shafts accurately aligned. The following describes the minimum precautions required to accomplish this end.

### FOUNDATION

The responsibility for the design and construction of the foundation lies with the user. The foundation must be adequate to withstand normal operating loads and possible overloads while maintaining alignment to attached system components under such loads.

### MOUNTING POSITION

Unless a unit is specifically ordered for inclined mounting, the foundation must be level and flat. The lubrication system may not operate properly if the unit is not mounted in the position for which it is designed. It may be desirable to elevate the foundation to facilitate oil drainage.

### CONCRETE FOUNDATION

If a concrete foundation is used, steel mounting pads and bolts of sufficient size to distribute the stress into the concrete should be grouted into the foundation.

### STEEL FOUNDATION

If a structural steel foundation is used (i.e. wide flange beams or channels), a base plate or sole plate of suitable thickness should be used and should extend under the entire unit.

### FOOT MOUNTED UNITS

Use shims under the feet of the unit to align the output shaft to the driven equipment. Make sure that all feet are supported so that the housing will not distort when it is bolted down. Improper shimming will reduce the life of the unit and may cause failure. Dowel pins may be installed to prevent misalignment and ensure proper realignment if removed for service.

### SHAFT MOUNTED UNITS

Shaft mounted drives should be mounted as close to the driven equipment bearing support as possible to minimize bearing loads due to overhung load. Design of the joint connection between the torque reaction arm and the foundation is the user's responsibility.

#### Hollow Shaft Diameter tolerance

Metric (mm)

- $\leq \varnothing 18 = +0.018/-0.000$
- $> \varnothing 18 \leq \varnothing 30 = +0.021/-0.000$
- $> \varnothing 30 \leq \varnothing 50 = +0.025/-0.000$
- $> \varnothing 50 \leq \varnothing 80 = +0.030/-0.000$
- $> \varnothing 80 \leq \varnothing 120 = +0.035/-0.000$
- $> \varnothing 120 \leq \varnothing 180 = +0.040/-0.000$

Inch

- $\leq \varnothing 4.375 = +0.0010 / -0.0000$
- $> \varnothing 4.375 = +0.0015 / -0.0000$

#### Customer shaft diameter tolerances with keyed hollow shafts

Metric (mm)

- $\leq \varnothing 18 = +0.000/-0.011$
- $> \varnothing 18 \leq \varnothing 30 = +0.000/-0.013$
- $> \varnothing 30 \leq \varnothing 50 = +0.000/-0.016$
- $> \varnothing 50 \leq \varnothing 80 = +0.000/-0.019$
- $> \varnothing 80 \leq \varnothing 120 = +0.000/-0.022$
- $> \varnothing 120 \leq \varnothing 180 = +0.000/-0.025$

Inch

- $\leq \varnothing 1.500 = +0.000/-0.002$
- $> \varnothing 1.500 \leq \varnothing 2.500 = +0.000/-0.003$
- $> \varnothing 2.500 \leq \varnothing 7.000 = +0.000/-0.004$

Shaft finish to be 125 micro inches or smoother.

#### Customer shaft diameter tolerance with Shrink Disc fit h6

Metric (mm)

- $\leq \varnothing 18 = +0.000/-0.011$
- $> \varnothing 18 \leq \varnothing 30 = +0.000/-0.013$
- $> \varnothing 30 \leq \varnothing 50 = +0.000/-0.016$

- $> \varnothing 50 \leq \varnothing 80 = +0.000/-0.019$
- $> \varnothing 80 \leq \varnothing 120 = +0.000/-0.022$
- $> \varnothing 120 \leq \varnothing 180 = +0.000/-0.025$

Inch

- $\leq \varnothing 0.750 = +0.0000/-0.0004$
- $> \varnothing 0.750 \leq \varnothing 1.125 = +0.0000/-0.0005$
- $> \varnothing 1.125 \leq \varnothing 2.000 = +0.0000/-0.0006$
- $> \varnothing 2.000 \leq \varnothing 3.000 = +0.0000/-0.0007$
- $> \varnothing 3.000 \leq \varnothing 4.750 = +0.0000/-0.0008$
- $> \varnothing 4.750 \leq \varnothing 7.000 = +0.0000/-0.0010$

Shaft finish to be 125 micro inches or smoother.

#### Customer shaft diameter tolerance with Shrink Disc fit f6 (looser fit)

Metric (mm)

- $\leq \varnothing 18 = -0.016/-0.024$
- $> \varnothing 18 \leq \varnothing 30 = -0.020/-0.029$
- $> \varnothing 30 \leq \varnothing 50 = -0.025/-0.036$
- $> \varnothing 50 \leq \varnothing 80 = -0.030/-0.043$
- $> \varnothing 80 \leq \varnothing 120 = -0.036/-0.051$
- $> \varnothing 120 \leq \varnothing 180 = -0.043/-0.061$

Inch

- $\leq \varnothing 0.750 = -0.0006/-0.0011$
- $> \varnothing 0.750 \leq \varnothing 1.125 = -0.0008/-0.0013$
- $> \varnothing 1.125 \leq \varnothing 2.000 = -0.0010/-0.0016$
- $> \varnothing 2.000 \leq \varnothing 3.000 = -0.0012/-0.0019$
- $> \varnothing 3.000 \leq \varnothing 4.750 = -0.0014/-0.0023$
- $> \varnothing 4.750 \leq \varnothing 7.000 = -0.0017/-0.0027$

Shaft finish to be 125 micro inches or smoother

### FLANGE MOUNTED UNITS

If a structural steel foundation is used (i.e. wide flange beams or channels), a base plate or sole plate of suitable thickness should be used and should extend under the entire unit. If a bulk head plate is used it should be of proper strength to minimize buckling distortions.

#### Flange Pilot 'AK' or 'AK1' tolerance

Metric (mm)

- $> \varnothing 50 \leq \varnothing 80 = +0.012/-0.007$
- $> \varnothing 80 \leq \varnothing 120 = +0.013/-0.009$
- $> \varnothing 120 \leq \varnothing 180 = +0.014/-0.011$
- $> \varnothing 180 \leq \varnothing 230 = +0.016/-0.013$
- $> \varnothing 230 \leq \varnothing 315 = +0.000/-0.032$
- $> \varnothing 315 \leq \varnothing 400 = +0.000/-0.036$
- $> \varnothing 400 \leq \varnothing 500 = +0.000/-0.040$

Inch

- $> \varnothing 1.969 \leq \varnothing 3.150 = +0.005/-0.0003$
- $> \varnothing 3.150 \leq \varnothing 4.724 = +0.005/-0.0004$
- $> \varnothing 4.724 \leq \varnothing 7.087 = +0.006/-0.0004$
- $> \varnothing 7.087 \leq \varnothing 9.055 = +0.006/-0.0005$
- $> \varnothing 9.055 \leq \varnothing 12.402 = +0.000/-0.0013$
- $> \varnothing 12.402 \leq \varnothing 15.748 = +0.000/-0.0014$
- $> \varnothing 15.748 \leq \varnothing 19.685 = +0.000/-0.0016$

### BOLT STRENGTH

Bolt size, strength and quantity should be verified to insure proper torque reaction capacity whatever the mounting arrangement.

### LUBRICATE SHAFTS

Both the hollow shaft and the driven shaft should be liberally lubricated before assembly. The unit must slide freely onto the driven shaft. Do not hammer or force the unit into place. For shrink disc, follow instructions below.

### AXIAL RETENTION

Each drive shaft must be retained in place relative to the gear reducer. Or each gear reducer must be retained in place relative to the drive shaft. Either way NORD recommends the use of shaft shoulders, locking collars or FIXING ELEMENTS to axially retain the shaft or gear reducer in position.

### SET SCREWS

If set screws are used for axial retention, they should be tightened evenly. Flats may be filed on the driven shaft and a thread-locking adhesive used for more position retention.

### SNAP RING RETENTION

Placing external snap rings on drive shafts must be performed with caution. The groove, which the snap ring fits into, may weaken the drive shaft causing premature failure. NORD does not recommend this type of shaft retention.

### THRUST PLATE

In applications, which are subject to high vibratory loads, a thrust plate will provide greater resistance to axial movement. Follow the manufacturer's recommendations for assembly.

### SHRINK DISC

If a shrink disc is used to secure a reducer hollow shaft to the driven shaft, follow this assembly procedure. Start with the shrink disc mounted onto the extension of the hollow shaft disc locking bolts loosened.

1. Clean reducer bore and mating solid shaft to be free of any lubricants or dirt.
2. Slide reducer onto the solid shaft until it is about half way through.
3. Lubricate the remaining portion of the solid shaft with a #2 grease or similar lubricant. This part will be located under the bronze bushing. **Do not install grease under the shrink disc gripping area.** Finish installing the solid shaft into the reducer hollow bore.
4. Finger tighten all shrink disc bolts. Now, moving a circular pattern, tighten each shrink disc locking bolt 1/4 to 1/2 turn. **Do not use criss cross pattern.** Continue tightening in the same circular direction with 1/4 or 1/2 turn increments until all bolts reach the specified bolt tightening torque. Bolt tightening torque is shown on the shrink disc label for the particular unit.
5. Run unit for 24 hours, then retighten shrink disc locking bolts to the proper bolt torque as indicated above.

### TORQUE REACTION ARM

On the shaft mount 'Clincher', torque is reacted through the integral torque tab, which is part of the casting. Commonly, NORD's optional RUBBER BUFFER bushings are installed on each side of the integral torque tab to dampen torque shocks and allow for mis-alignment received from the machinery during operation.

Torque arm connection fabrications should always be mounted perpendicular to a line through the output shaft center and the point at attachment of the torque arm to the unit housing. In this position the minimum load on the attachment structure arm will be experienced. The attachment structure must be rigid and may not deflect under any load. Doing so will place extra loads on the output bearings of the reducer.

### PRIME MOVER MOUNTING

Align the prime mover to the reducer-input shaft using shims under the feet. Make sure that the feet are supported. Dowel the prime mover to its foundation.

### SHAFT CONNECTIONS

When connecting shafts to either the input or output of the reducer, consider the following instructions.

### FITS

Clearance or interference fits for coupling hubs should be in accordance with ANSI/AGMA 9002-A86 or as follows.

### Output and Input shaft Diameter tolerance

Metric (mm)	$\leq \varnothing 18 = +0.012/+0.001$
	$> \varnothing 18 \leq \varnothing 30 = +0.015/+0.002$
	$> \varnothing 30 \leq \varnothing 50 = +0.018/+0.002$
	$> \varnothing 50 \leq \varnothing 80 = +0.030/+0.011$
	$> \varnothing 80 \leq \varnothing 120 = +0.035/+0.013$
	$> \varnothing 120 \leq \varnothing 180 = +0.040/+0.015$

Inch

	$\leq \varnothing 1.750 = +0.0000/-0.0005$
	$> \varnothing 1.750 = +0.0000/-0.0010$

### Output and Input shaft Drill and tap shaft end

Metric (mm)	$\leq \varnothing 16 = M5$
	$> \varnothing 16 \leq \varnothing 21 = M6$
	$> \varnothing 21 \leq \varnothing 24 = M8$
	$> \varnothing 24 \leq \varnothing 30 = M10$
	$> \varnothing 30 \leq \varnothing 38 = M12$
	$> \varnothing 38 \leq \varnothing 50 = M16$
	$> \varnothing 50 \leq \varnothing 85 = M20$
	$> \varnothing 85 \leq \varnothing 130 = M24$

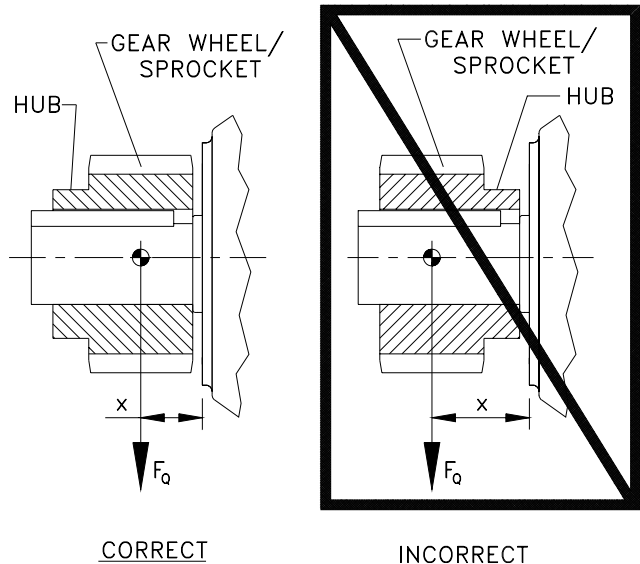
Inch

	$\leq \varnothing 0.438 = \#10-24 \times 0.4 \text{ deep}$
	$> \varnothing 0.438 \leq \varnothing 0.813 = 1/4-20 \times 0.6 \text{ deep}$
	$> \varnothing 0.813 \leq \varnothing 0.938 = 5/16-18 \times 0.7 \text{ deep}$
	$> \varnothing 0.938 \leq \varnothing 1.125 = 3/8-16 \times 0.9 \text{ deep}$
	$> \varnothing 1.125 \leq \varnothing 1.375 = 1/2-13 \times 1.1 \text{ deep}$
	$> \varnothing 1.375 \leq \varnothing 1.875 = 5/8-11 \times 1.4 \text{ deep}$
	$> \varnothing 1.875 \leq \varnothing 3.250 = 3/4-10 \times 1.7 \text{ deep}$
	$> \varnothing 3.250 = 1-8 \times 2.2 \text{ deep}$

Outboard pinion and sprocket fits should be as recommended by the pin sprockets with interference fits should be heated according to the manufacturer's recommendations, generally 250°F to 300°F, (120°C to 150°C) before assembling to the shaft.

### LOCATION

Coupling hubs should be mounted flush with the shaft ends, unless specifically ordered for overhung mounting. Pinions,



sprockets and sheaves should be mounted as close as possible to the unit housing to minimize bearing loads and shaft deflections.

### COUPLING ALIGNMENT

Shaft couplings should be installed according to the coupling manufacturer's recommendations for gap, angular and parallel alignment. In many installations, it is necessary to allow for thermal and mechanical shaft movement when determining shaft alignment. The coupling manufacturer's recommendations should be followed.

### AXIAL DISPLACEMENT

The gap between shaft ends should be the same as the specified coupling gap unless overhung mounting of the coupling hub is specified. The coupling gap and shaft gap must be sufficient to accommodate any anticipated thermal or mechanical axial movement.

### ANGULAR ALIGNMENT

Insert a spacer or shim stock equal to the required coupling gap between the coupling hub faces and measure the clearance using feeler gauges. Repeat this at the same depth at 90-degree intervals to determine the amount of angular misalignment.

### PARALLEL ALIGNMENT

Mount a dial indicator to one coupling hub, and rotate this hub, sweeping the outside diameter of the other hub. The parallel misalignment is equal to one-half of the total indicator reading. Another method is to rest a straight edge squarely on the outside diameter of the hubs at 90-degree intervals and measure any gaps with feeler gauges. The maximum gap measurement is the parallel misalignment.

### CHECKING ALIGNMENT

After both angular and parallel alignments are within specified limits, tighten all foundation bolts securely and repeat the above procedure to check alignment. If any of the specified limits for alignment are exceeded, realign the coupling.

### SPROCKET OR SHEAVE ALIGNMENT

Align the sheaves or sprockets square and parallel by placing a straight edge across their faces. Alignment of bushed sheaves and sprockets should be checked after bushings have been tightened. Check horizontal shaft alignment by placing a level vertically against the face of the sheave or sprocket. Adjust belt or chain tension per the manufacturer's specified procedure.

### OUTBOARD PINION ALIGNMENT

Align the pinion by adjusting the gear tooth clearance according to the manufacturer's recommendations and checking for acceptable outboard pinion tooth contact. The foundation bolts may have to be loosened and the unit moved slightly to obtain this contact. When the unit is moved to correct tooth contact, the prime mover should be realigned.

### RECHECK ALIGNMENT

After a period of operation, recheck alignment and adjust as required.

1. Properly install unit on a rigid foundation
  - adequately supported
  - securely bolted into place
  - leveled so as not to distort the gear case
2. Properly install couplings suitable for the application and connected equipment.
3. Ensure accurate alignment with other equipment.
4. Furnish and install adequate machinery guards as needed to protect operating personnel and as required by the applicable standards of the Occupational Safety and Health Administration (OSHA), and by other applicable safety regulations;
5. Ensure that driving equipment is running in the correct direction before coupling to reducers with backstops (designed to operate only in a specific direction) or machinery designed to operate only in one direction.

### CHANGES IN PERFORMANCE SPECIFICATIONS

Owner has the responsibility to consult with NORD GEAR if such items such as applied loads, operating speeds or other operating conditions have changed.



### **WARNING:**

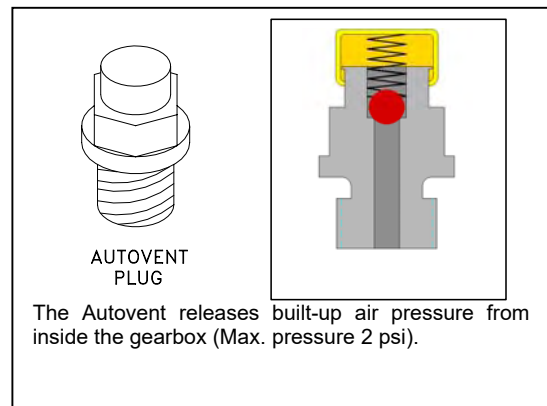
LOCK OUT POWER before any maintenance is performed. Make absolutely sure that no voltage is applied while work is being done on the gearbox.

### START-UP

1. Ensure that switches, alarms, heaters, coolers and other safety and protection devices are installed and operational for their intended purpose.
2. Verify that the installed mounting position is the same as the nametag mounting position. If not, adjust the oil level accordingly and relocate the vent plug, fill plug and drain plug according to the mounting position. See following.

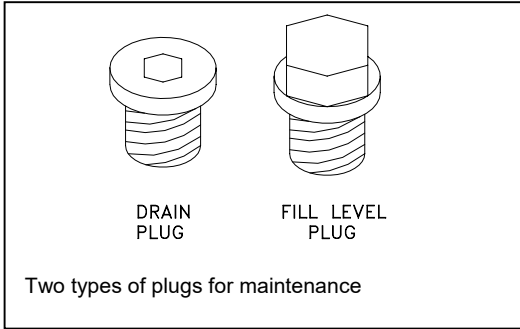
### AUTOVENT PLUG

The Autovent plug is brass in color and will be located at the highest point on the gearbox. It operates like a check-valve to allow the reducer to relieve internal pressure while preventing lubricant contamination during cooling. A spring presses a ball or plunger against a machined orifice until pressure exceeds 2 psi. Above 2 psi the air is allowed to escape depressurizing the gearcase. When internal pressure drops below 2 psi, the autovent re-seals closing the unit to the outside environment. After shutdown, the reducer cools along with the air inside the reducer. The unit will temporarily maintain a slight vacuum until normalization occurs. NORD Gear supplies an Autovent as a standard feature.



**FILL LEVEL & DRAIN PLUGS**

The drain plugs are metric socket head cap screws. They will be located at the lowest part of the gearbox for ease of draining. The fill level plug is a hex head cap screw. It will be located between the Autovent and drain plug. Both types of plugs will have gaskets included to prevent oil from leaking.



**LUBRICANT**

All NORD reducers are shipped from the factory properly filled with lubricant and all plugs are installed according to the mounting position given on the reducer nametag. Acceptable oil fill level is within 1/2 inch of the bottom of the fill plug threads.

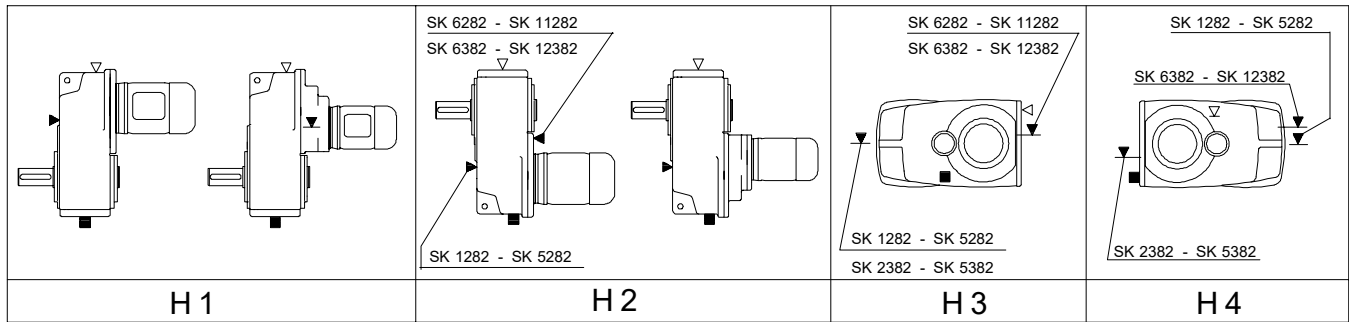
**OPERATION AND MAINTENANCE CHECKLIST**

1. Operate the equipment as it was intended to be operated
2. Do not overload.
3. Run at correct speed.
4. Maintain lubricant in good condition and at proper level.
5. Dispose of used lubricant in accordance with applicable laws and regulations.
6. Apply proper maintenance to attached equipment at prescribed intervals recommended by the manufacturer.
7. Perform periodic maintenance of the gear drive as recommended by NORD.

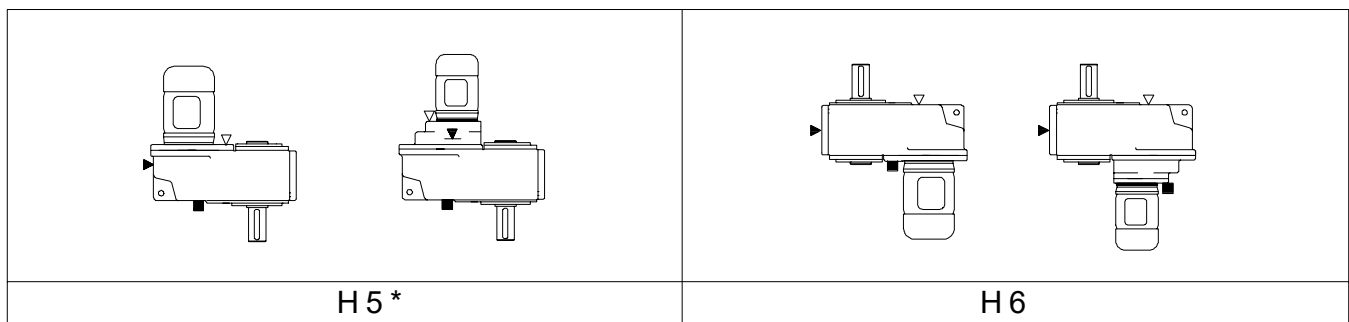
**MOUNTING POSITIONS**

These charts detail the mounting positions for horizontal and vertical mounting. The Autovent, oil fill plug and drain plug are indicated on each mounting position picture. The factory set mounting position and plug locations match that shown on the gearbox nametag. For mounting orientations other than shown consult NORD Gear.

Horizontal position



Vertical position



Symbols:



\* Mounting position H5 with lubricant expansion unit recommended

**SK0182NB & SK1382NB have no vent or drain plugs. They are filled with synthetic oil so the units are "Lubed for Life".**

## MAINTENANCE

Mineral lubricant should be changed every 10,000 service hours or after two years. For synthetic oils, the lube should be changed every 20,000 service hours or after four years. In case of extreme operating (e.g. high humidity, aggressive environment or large temperature variations), shorter intervals between changes are recommended.







### OIL SPECIFICATIONS

NORD supplies all reducers filled with oil from the factory. Consult the sticker adjacent to the fill plug to determine the type of lubricant installed at the factory. Standard lubricant is ISO VG220 mineral-based oil. However, some units have special lubricants designed to operate in certain environments or to extend the service life of the lubricant. If in doubt about which lubricant is needed, contact NORD Gear.

#### STANDARD OIL – ISO VG220

Ambient Temperature	Formulation
20 to 104°F (-5 to 40°C)	Mineral

#### TYPICAL OILS

Viscosity ISO NLGI	Formulation	Service Temperature Range						
VG 460	Conventional Mineral	20°C to +50°C 68F to +122°F	Mobilgear 634	Omala 460	7EP	Klüberoil GEM 1-460	Energol GR-XP 460	Tribol 1100/460
	Synthetic PAO	-30°C to +80°C -22°F to +176°F	Mobil SHC 634	Omala 460 HD	Isolube EP 460	Klübersynth EG 4-460	N/A	Tribol 1510/460
VG 320	Conventional Mineral	0°C to +30°C 32°F to +86°F	Mobilgear 632	Omala 320	6EP	Klüberoil GEM 1-320	Energol GR-XP 320	Tribol 1100/320
	Synthetic PAO	-35°C to +80°C -31°F to +176°F	Mobil SHC 632	Omala 320 HD	Isolube EP 460	Klübersynth EG 4-320	N/A	Tribol 1510/320
VG 220	Conventional Mineral	-5°C to +40°C +20°F to +104°F	Mobilgear 630	Omala 220	5EP	Klüberoil GEM 1-220	Energol GR-XP 220	Tribol 1100/220
	Synthetic PAO	-34°C to +80°C -30°F to +176°F	Mobil SHC 630	Omala 220 HD	Isolube EP 220	Klübersynth EG 4-220	N/A	Tribol 1510/220
VG 150 & VG 100	Conventional Mineral	-15°C to +25°C 5°F to +77°F	Mobilgear 629	Omala 100	4EP	Klüberoil GEM 1-150	Energol GR-XP 100	Tribol 1100/100
	Synthetic PAO	-37°C to +10°C -35°F to +50°F	Mobil SHC 629	Omala 150 HD	Isolube EP 150	Klübersynth EG 4-150	N/A	N/A
VG 68	Conventional Mineral	-15°C to +25°C 5°F to +77°F	Mobilgear 626	Omala 68	2EP	Klüberoil GEM 1-68	Energol GR-XP 68	Tribol 1100/68
	Synthetic PAO	-40°C to +10°C -40°F to +50°F	Mobil SHC 626	N/A	Isolube EP 68	N/A	N/A	N/A
VG 32	Synthetic PAO	-40°C to +10°C -40°F to +50°F	Mobil SHC 624	N/A	N/A	Klüber-Summit HySyn FG-32	N/A	N/A

PAO = Poly Alpha Olefin

#### SPECIAL PURPOSE LUBRICANTS

Ambient Temperature	Formulation	Manufacturer	Oil Brand Name
20 to 104°F (-5 to 40°C)	Food Grade Oil - Synthetic	Chevron	FM ISO 220
20 to 104°F (-5 to 40°C)	Food Grade Oil - Synthetic	OilJAX	Magnaplate 85W140-FG
5 to 125°F (-20 to 50°C)	Fluid Grease	Mobil	Mobilux EP023
-30 to 140°F (-35 to 60°C)	Fluid Grease - Synthetic	Mobil	Mobilith SHC 007
-30 to 140°F (-35 to 60°C)	Fluid Grease - Synthetic	Shell	Albida LC

#### STANDARD BEARING GREASE – NLGI 2EP Lithium

Ambient Temperature	Formulation
-20 to 140°F (-30 to 60°C)	Mineral

#### OPTIONAL BEARING GREASES

Ambient Temperature	Formulation	Manufacturer	Grease Brand Name
-40 to 230°F (-40 to 110°C)	Synthetic	Shell	Aeroshell 6
-40 to 230°F (-40 to 110°C)	Food Grade - Synthetic	Lubriplate	SFL1

**LUBRICANT CAPACITY**

Each reducer has the oil level and oil quantity adjusted according to the mounting position shown in the tables. When replacing the oil, consult the tables below to determine the proper amount of oil to be installed according to the reducer size and mounting position. Note that this is approximate and the final level will be adjusted when the reducer is installed. Acceptable oil fill level is within 1/2 inch of the bottom of the fill plug threads.

**LUBRICATION CAPACITY - SHAFT MOUNT 'CLINCHER' GEARBOXES**

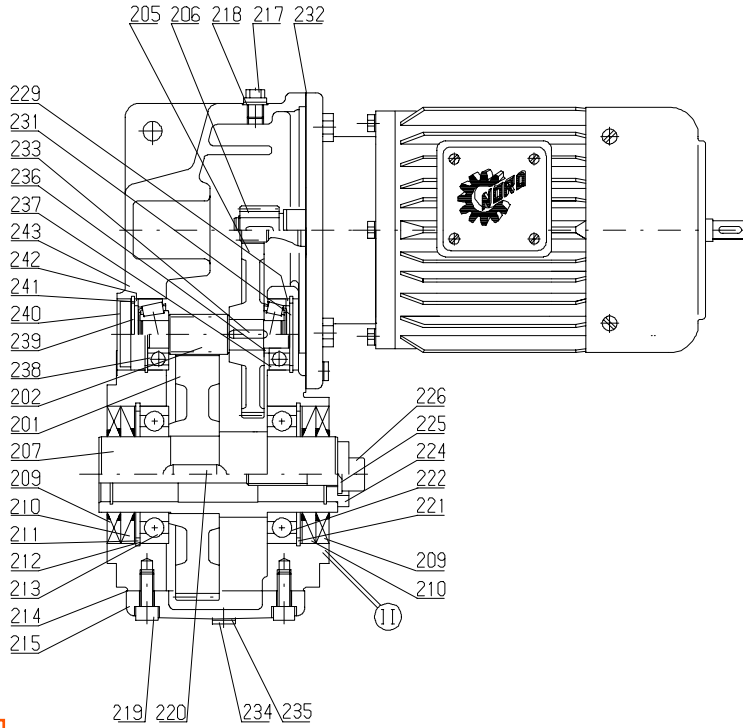
		MOUNTING POSITION					
		Horizontal				Vertical	
		H1	H2	H3	H4	H5	H6
<b>SK 0182NB</b>	quarts	0.42	0.63	0.53	0.53	0.58	0.58
	liters	0.40	0.60	0.50	0.50	0.55	0.55
<b>SK0282NB</b>	quarts	0.74	0.85	0.95	0.95	1.16	1.06
	liters	0.70	0.80	0.90	0.90	1.10	1.00
<b>SK 1282</b>	quarts	0.95	0.95	1.00	1.00	1.27	1.37
	liters	0.90	0.90	0.95	0.95	1.20	1.30
<b>SK 2282</b>	quarts	1.74	2.01	1.90	1.90	2.11	2.54
	liters	1.65	1.90	1.80	1.80	2.00	2.40
<b>SK 3282</b>	quarts	3.33	3.44	3.33	3.33	4.33	4.33
	liters	3.15	3.25	3.15	3.15	4.10	4.10
<b>SK 4282</b>	quarts	4.97	5.02	4.97	4.97	5.71	6.45
	liters	4.70	4.75	4.70	4.70	5.40	6.10
<b>SK 5282</b>	quarts	7.93	7.93	7.61	7.61	9.30	9.30
	liters	7.50	7.50	7.20	7.20	8.80	8.80
<b>SK 6282</b>	quarts	18.0	12.7	14.8	10.6	18.5	14.8
	liters	17.0	12.0	14.0	10.0	17.5	14.0
<b>SK 7282</b>	quarts	26.4	21.1	22.2	16.9	28.5	22.2
	liters	25	20	21	16	27	21
<b>SK 8282</b>	quarts	39.1	31.7	32.8	32.8	43.3	34.9
	liters	37	30	31	31	41	33
<b>SK 9282</b>	quarts	78.2	58.1	62.4	72.9	76.1	74.0
	liters	74	55	59	69	72	70
<b>SK 10282</b>	quarts	95	42	87	63	95	95
	liters	90	40	82	60	90	90
<b>SK 11282</b>	quarts	174	153	148	106	206	169
	liters	165	145	140	100	195	160

		MOUNTING POSITION					
		Horizontal				Vertical	
		H1	H2	H3	H4	H5	H6
<b>SK 1382NB</b>	quarts	1.37	1.48	2.01	2.11	2.22	2.43
	liters	1.30	1.40	1.90	2.00	2.10	2.30
<b>SK 2382</b>	quarts	1.80	2.01	1.59	1.59	3.28	2.75
	liters	1.70	1.90	1.50	1.50	3.10	2.60
<b>SK 3382</b>	quarts	4.33	3.49	3.49	3.49	5.92	4.33
	liters	4.10	3.30	3.30	3.30	5.60	4.10
<b>SK 4382</b>	quarts	6.24	5.18	5.18	5.18	8.77	7.19
	liters	5.90	4.90	4.90	4.90	8.30	6.80
<b>SK 5382</b>	quarts	13.21	7.08	8.77	8.77	14.80	12.68
	liters	12.50	6.70	8.30	8.30	14.00	12.00
<b>SK 6382</b>	quarts	17.4	10.1	13.2	14.8	19.0	13.7
	liters	16.5	9.6	12.5	14.0	18.0	13.0
<b>SK 7382</b>	quarts	23.3	16.9	20.1	24.3	26.4	21.1
	liters	22	16	19	23	25	20
<b>SK 8382</b>	quarts	35.9	26.4	31.7	37.0	40.2	33.8
	liters	34	25	30	35	38	32
<b>SK 9382</b>	quarts	77.2	47.6	63.4	68.7	78.2	74.0
	liters	73	45	60	65	74	70
<b>SK 10382</b>	quarts	90	77	85	85	93	93
	liters	85	73	80	80	88	88
<b>SK 11382</b>	quarts	169	148	143	164	222	164
	liters	160	140	135	155	210	155
<b>SK 12382</b>	quarts	169	148	143	164	222	164
	liters	160	140	135	155	210	155

Note: Filling quantities are approximate figures. Oil level must be checked according to oil level plug after final installation. Acceptable oil fill level is within 1/2 inch of the bottom of the fill plug threads. For mounting angles not shown, consult factory.

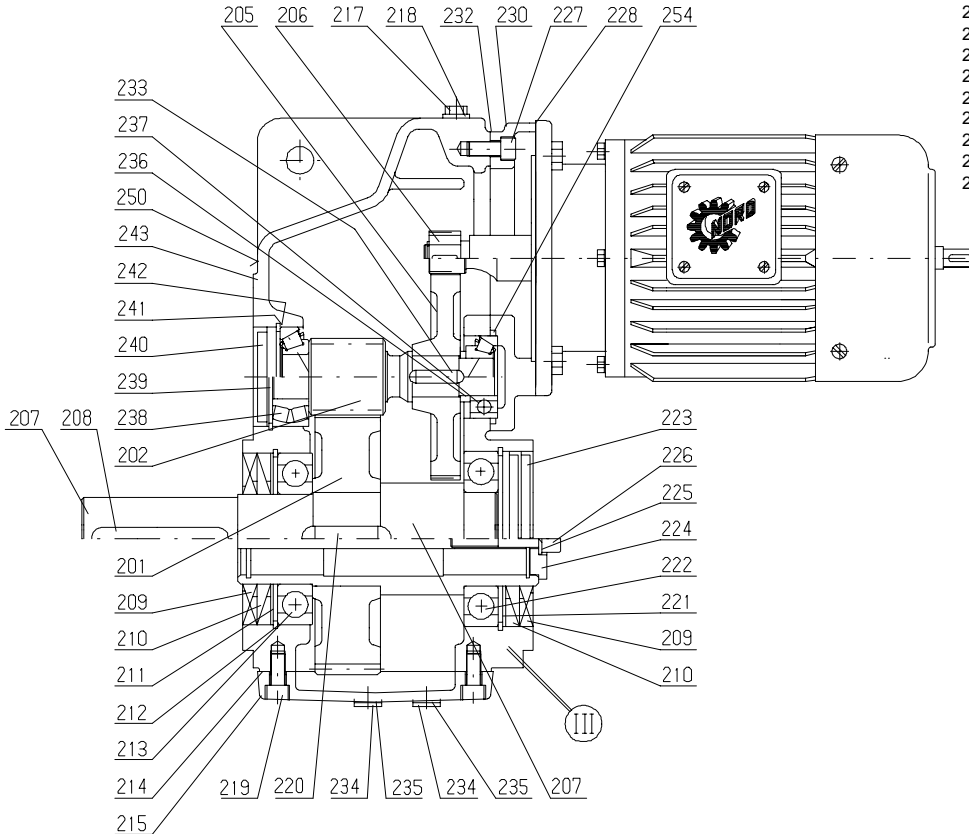
## PARTS LIST

SK1282 - SK5282



- 201 Driven gear
- 202 Pinion shaft
- 205 Driving gear
- 206 Driving pinion
- 207 Output shaft (Hollow shaft )
- 208 Key
- 209 Shaft seal
- 210 Shaft seal
- 211 Circlip
- 212 Shim
- 213 Ball bearing
- 214 Seal
- 215 Gear case cover
- 217 Vent plug
- 218 Seal
- 219 Socket head screw
- 220 Key
- 221 Circlip
- 222 Ball bearing
- 223 Locking cap
- 224 Washer
- 225 Washer
- 226 Socket head screw
- 227 Socket head screw
- 228 Seal
- 229 Supporting disc
- 230 Gearbox cover
- 231 Circlip
- 232 Seal
- 233 Key
- 234 Drain plug
- 235 Seal
- 236 Supporting disc
- 237 Pinion shaft bearing
- 238 Pinion shaft bearing
- 239 Circlip
- 240 Locking cap
- 241 Shim
- 242 Supporting disc
- 243 Gear case
- 250 Locking cap
- 254 Spacer

SK6282 - SK11282



### RECOMMENDED SPARE PARTS

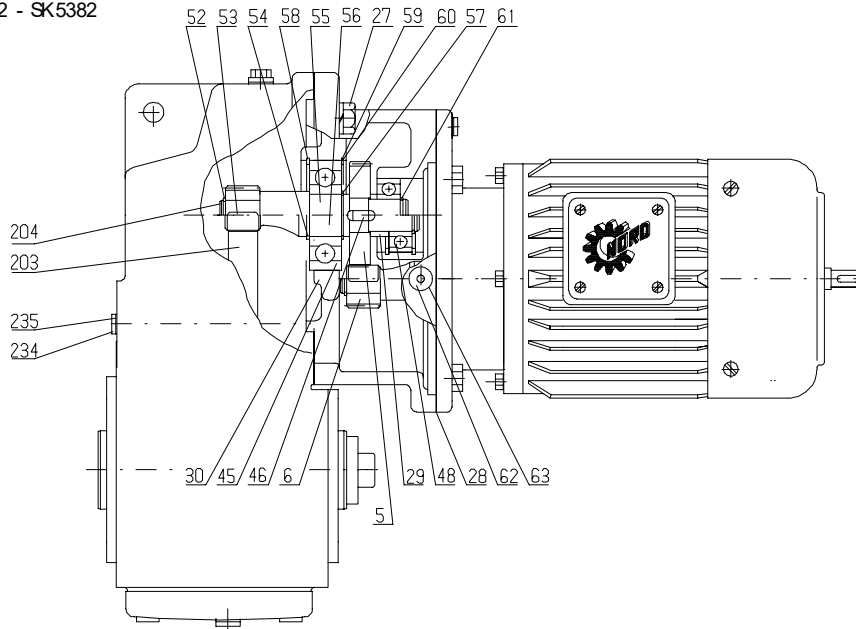
Bearings – *all*      Gaskets – *all*      Shims – *all*  
 Seals – *all*      Seal Plugs – *all*

### IMPORTANT!

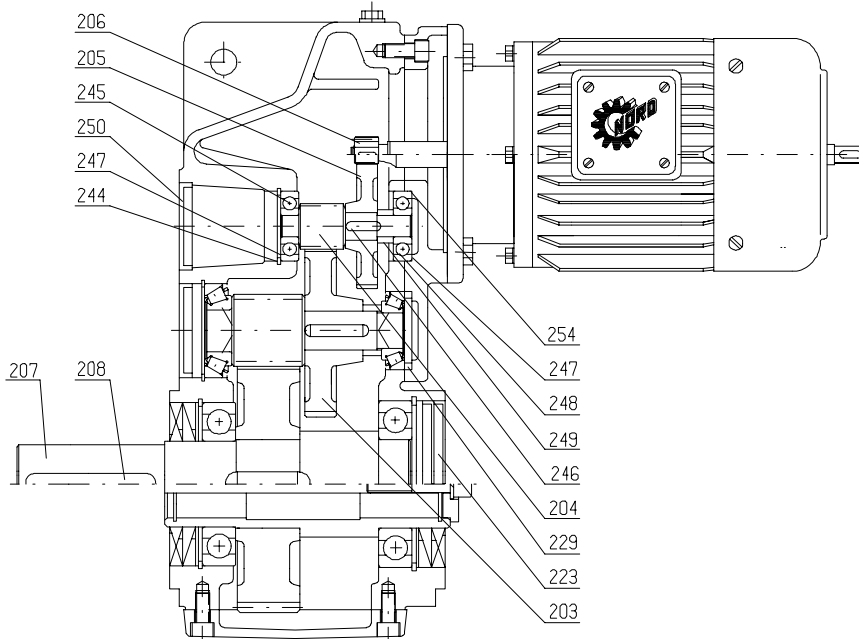
When ordering parts, it is necessary to have the **NORD SERIAL NUMBER** from the unit the parts are for. The serial number will dictate the correct parts for that particular unit. The gearbox nameplate will have the serial number on it.

## PARTS LIST

SK 1382 - SK 5382



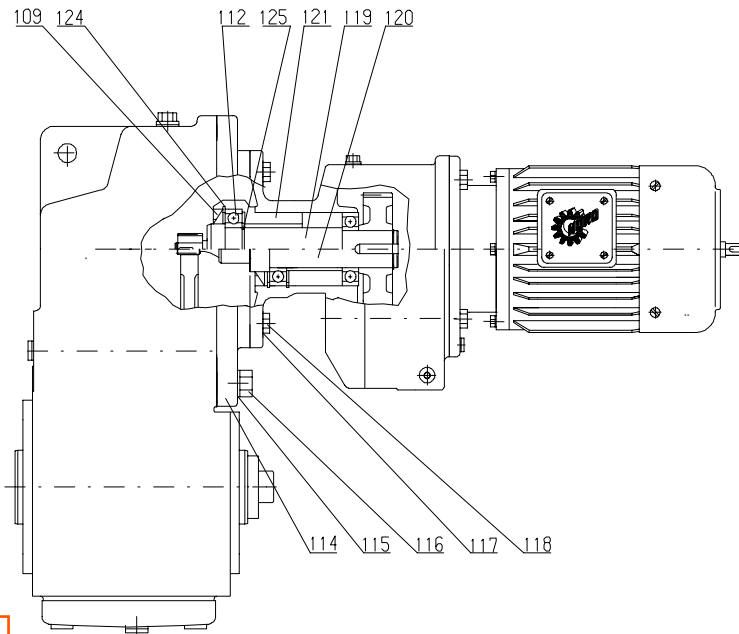
SK 6382 - SK 11382



- 5 Driving gear
- 27 Hexagon screw
- 28 Seal
- 29 Supporting disc
- 30 Third reduction gearcase
- 45 Ball bearing
- 46 Key
- 48 Ball bearing
- 52 Circlip
- 53 Key
- 54 Circlip
- 55 Intermediate shaft, plain
- 56 Intermediate shaft, gearcut
- 57 Circlip
- 58 Circlip
- 59 Shim
- 60 Circlip
- 61 Circlip
- 62 Drain plug
- 63 Seal
- 203 Driving gear
- 204 Pinion shaft SK 6382 - SK 9382
- 206 Driving pinion
- 207 Output shaft
- 208 Key
- 223 Locking cap
- 229 Supporting disc
- 234 Drain plug
- 235 Seal
- 244 Circlip
- 245 Ball bearing
- 246 Key
- 247 Shim
- 248 Ball bearing
- 249 Supporting disc
- 250 Locking cap
- 254 Spacer

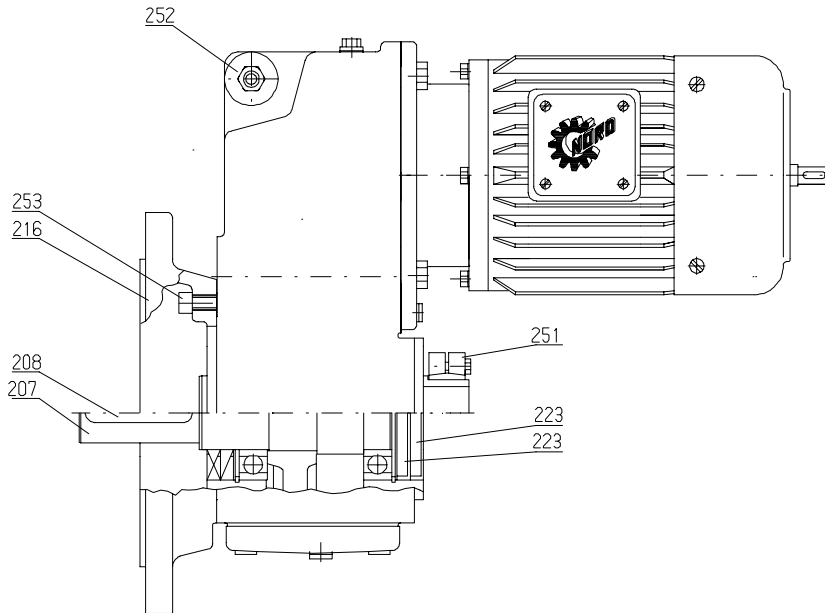
# PARTS LIST

SK1282/02 - SK 11382/52



- 109 Shaft seal
- 112 Ball bearing
- 114 Intermediate flange
- 115 Washer
- 116 Hexagon screw
- 117 Washer
- 118 Hexagon screw
- 119 Intermediate shaft, plain
- 120 Intermediate shaft, gearcut
- 121 Bearing sleeve
- 124 Circlip
- 125 Circlip
- 207 Output shaft
- 208 Key
- 216 Flange
- 223 Locking cap
- 251 Shrink disc connector
- 252 Torque arm
- 253 Socket head screw

SK1282 - SK 11282  
SK1382 - SK 11382



## NOTES

## TROUBLE SHOOTING

PROBLEM WITH THE REDUCER		POSSIBLE CAUSES	SUGGESTED REMEDY
Runs Hot	Overloading	Load exceeds the capacity of the reducer	Check rated capacity of reducer, replace with unit of sufficient capacity or reduce load
	Improper lubrication	Insufficient lubrication	Check lubricant level and adjust up to recommended levels
		Excessive lubrication	Check lubricant level and adjust down to recommended levels
		Wrong lubrication	Flush out and refill with correct lubricant as recommended
Runs Noisy	Loose foundation bolts	Weak mounting structure	Inspect mounting of reducer. Tighten loose bolts and/ or reinforce mounting and structure
		Loose hold down bolts	Tighten bolts
	Worn RV Disc	Overloading unit may result in damage to disc	Disassemble and replace disc. Recheck rated capacity of reducer.
	Failure of Bearings	May be due to lack of lubricant	Replace bearing. Clean and flush reducer and fill with recommended lubricant.
		Overload	Check rated capacity of reducer.
Insufficient Lubricant	Level of lubricant in the reducer not properly maintained.	Check lubricant level and adjust to factory recommended level.	
Output Shaft Does Not Turn	Internal parts are broken	Overloading of reducer can cause damage.	Replace broken parts. Check rated capacity of reducer.
		Key missing or sheared off on input shaft.	Replace key.
		Coupling loose or disconnected.	Properly align reducer and coupling. Tighten coupling.
Oil Leakage	Worn Seals	Caused by dirt or grit entering seal.	Replace seals. Autovent may be clogged. Replace or clean.
		Overfilled reducer.	Check lubricant level and adjust to recommended level.
		Autovent clogged.	Clean or replace, being sure to prevent any dirt from falling into the reducer.
		Improper mounting position, such as wall or ceiling mount of horizontal reducer.	Check mounting position. Name tag & verify with mounting chart in manual.

### NORD Gear Corporation

National Customer Service Toll Free 888-314-6673

[www.nord.com](http://www.nord.com)

### NORD Gear Limited

Toll Free in Canada 800-668-4378

#### WEST

1121 Railroad Street  
Building 101  
Corona, CA 92882  
Phone 951-279-2600  
Fax 888-408-6673

#### MIDWEST

PO Box 367  
800 Nord Drive  
Waunakee, WI 53597  
Phone 608-849-7300  
Fax 800-373-6673

#### SOUTH

100 Forsyth Hall Dr.  
Building 100B  
Charlotte, NC 28273  
Phone 704-529-1255  
Fax 888-259-6673

#### CANADA

41 West Drive  
Brampton, Ontario L6T 4A1  
Phone 905-796-3606  
Fax 905-796-8130

MOTOR APPENDIX INFORMATION  
TYPE WEG 5.0HP 184T



Huber Technology, Inc.

No.:

Date: 31-MAY-2013

Customer :

TECHNICAL PROPOSAL  
Three-phase induction motor - Squirrel cage rotor

Product line : Three-Phase : Explosion Proof - NEMA Premium

Catalog Number : 00518XT3ER184TC

List Price :

Notes:

Performed by:

Checked:



Huber Technology, Inc.

No.:

Date: 31-MAY-2013

### DATA SHEET Three-phase induction motor - Squirrel cage rotor

Customer :  
Product line : Three-Phase : Explosion Proof - NEMA Premium

Frame : 184T  
Output : 5 HP  
Frequency : 60 Hz  
Poles : 4  
Full load speed : 1755  
Slip : 2.50 %  
Voltage : 208-230/460 V  
Rated current : 14.5-13.1/6.57 A  
Locked rotor current : 108/53.9 A  
Locked rotor current (I<sub>L</sub>/I<sub>n</sub>) : 8.2  
No-load current : 7.20/3.60 A  
Full load torque : 14.8 lb.ft  
Locked rotor torque : 270 %  
Breakdown torque : 330 %  
Design : B  
Insulation class : F  
Temperature rise : 80 K  
Locked rotor time : 17 s (hot)  
Service factor : 1.15  
Duty cycle : S1  
Ambient temperature : -20°C - +40°C  
Altitude : 1000  
Degree of Protection : IP54  
Approximate weight : 130 lb  
Moment of inertia : 0.36948 sq.ft.lb  
Noise level : 56 dB(A)

	D.E.	N.D.E.
Bearings	6307 ZZ	6206 ZZ
Regreasing interval	---	---
Grease amount	---	---

Load	Power factor	Efficiency (%)
100%	0.79	89.5
75%	0.71	88.5
50%	0.59	86.5

Notes:

**Additional 120V Space Heater**

Performed by

Checked



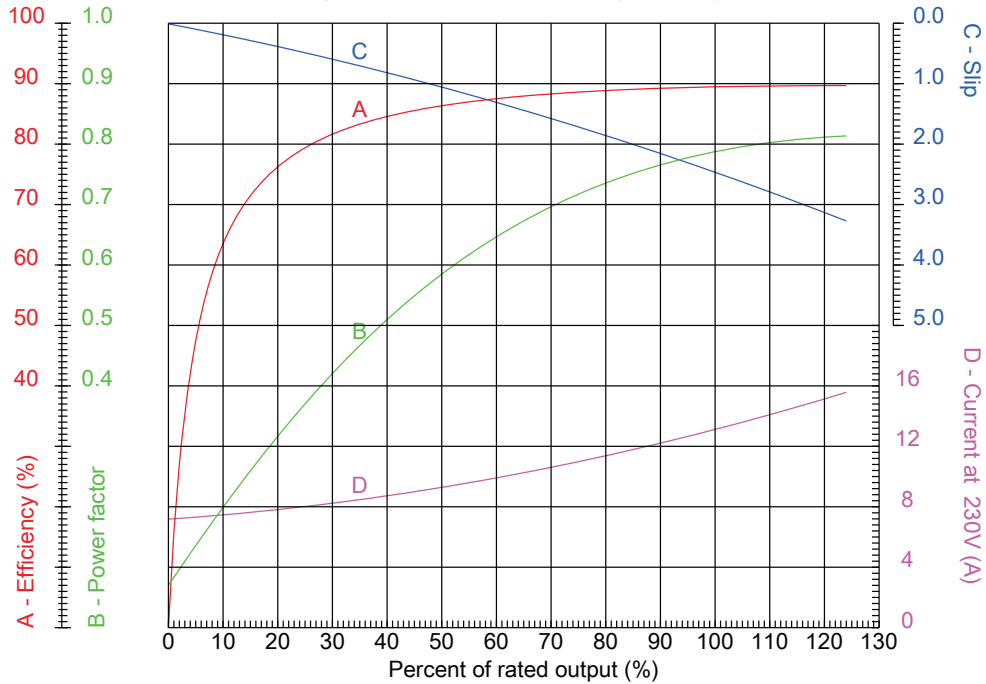
# Huber Technology, Inc.

No.:

Date: 31-MAY-2013

## PERFORMANCE CURVES RELATED TO RATED OUTPUT

Three-phase induction motor - Squirrel cage rotor



Customer :  
 Product line : Three-Phase : Explosion Proof - NEMA Premium

Frame : 184T	Locked rotor current (I <sub>L</sub> /I <sub>n</sub> ) : 8.2
Output : 5 HP	Duty cycle : S1
Frequency : 60 Hz	Service factor : 1.15
Full load speed : 1755	Design : B
Voltage : 208-230/460 V	Locked rotor torque : 270 %
Rated current : 14.5-13.1/6.57 A	Breakdown torque : 330 %
Insulation class : F	

Notes:

Performed by

Checked



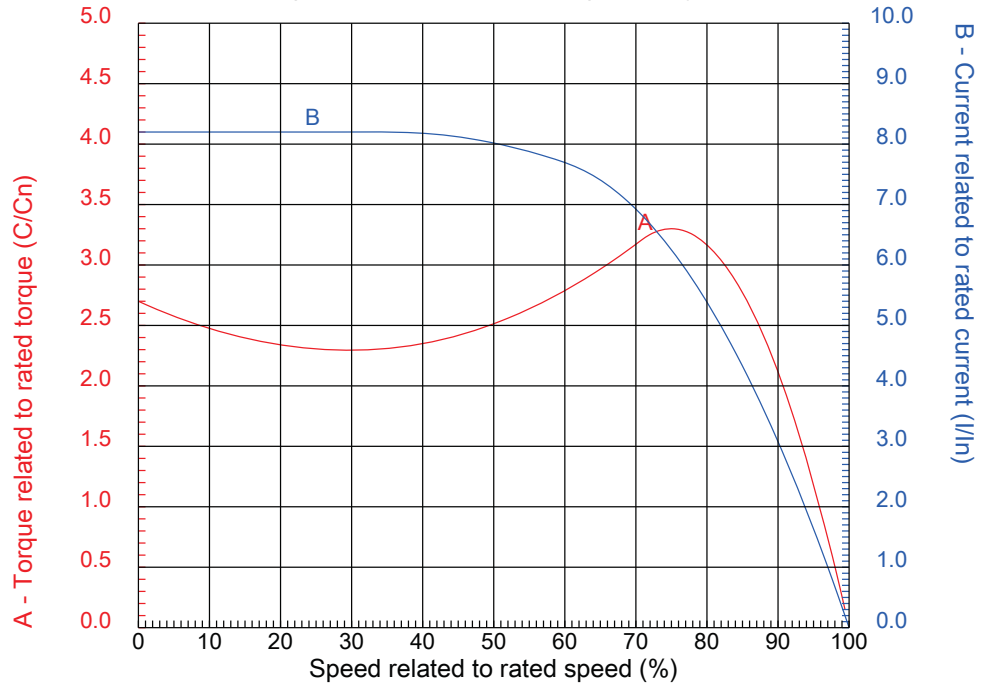
Huber Technology, Inc.

No.:

Date: 31-MAY-2013

CHARACTERISTIC CURVES RELATED TO SPEED

Three-phase induction motor - Squirrel cage rotor



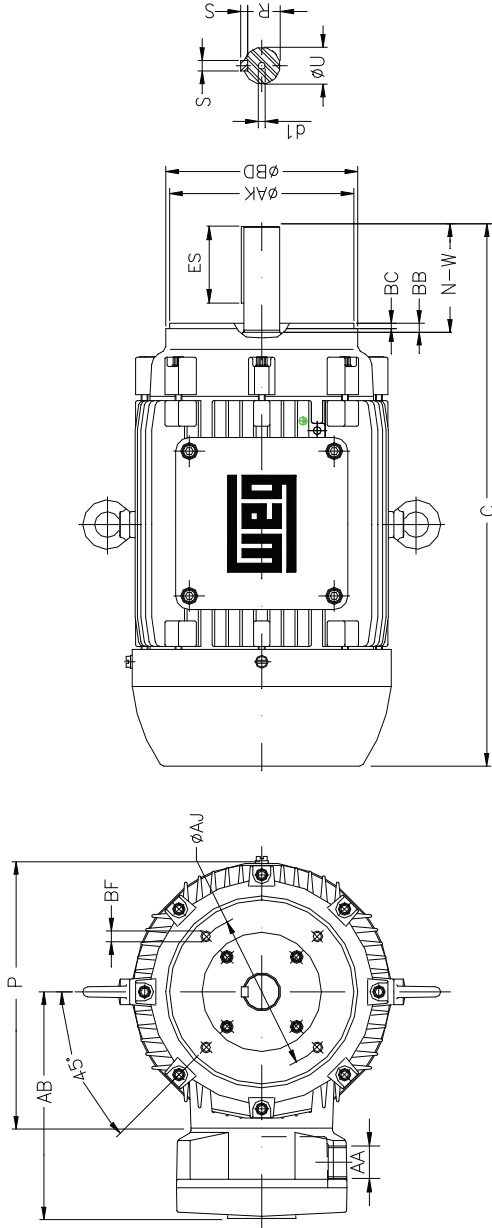
Customer	:	
Product line	:	Three-Phase : Explosion Proof - NEMA Premium

Frame	: 184T	Locked rotor current (I <sub>l</sub> /I <sub>n</sub> )	: 8.2
Output	: 5 HP	Duty cycle	: S1
Frequency	: 60 Hz	Service factor	: 1.15
Full load speed	: 1755	Design	: B
Voltage	: 208-230/460 V	Locked rotor torque	: 270 %
Rated current	: 14.5-13.1/6.57 A	Breakdown torque	: 330 %
Insulation class	: F		

Notes:

Performed by	Checked
--------------	---------

1 2 3 4 5 6 7 8



Notes:
Performed by:
Checked:
Customer:
Three-Phase : Explosion Proof - NEMA Premium
Three-phase induction motor Frame 184T - IP54
31-MAY-2013



P	ES	S	depth	N.W
8.909	1.969	0.250	0.250	2.750
U	R	AB	C	AA
1.125	0.984	8.240	15.862	NPT 3/4"
d1	d2	Flange	AJ	AK
A 4	A 4	FC-184	7.250	8.500
BD	BF	BB	BC	AH
8.875	UNC 1/2"x13	0.250	0.125	2.625

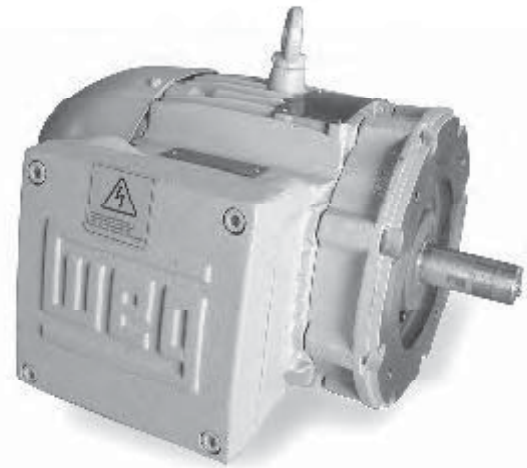
# Explosion Proof Motors - TEFC (IP54)

## World Energy Guardian™ - UL and CSA Approved - With 'C' Flange



The WEG line of World Energy Guardian™ motors are specially designed to meet or exceed ALL EPACT requirements for energy efficiency!

WEG explosion proof motors are suitable for applications requiring UL or CSA certification for hazardous locations. Thermally protected with thermostats, all motors manufactured are submitted to hydrostatic as well as other routine testing at the factory to ensure compliance to the required specifications.



### Standard Features

- 3 phase, 60Hz, 208-230/460, 460 or 575 V
- 143T up to 586/7 cast iron frame
- Squirrel cage rotor / Aluminum die cast
- Enclosure TEFC (IP54)
- All motors supplied with ball bearings except roller bearings in drive end for frames 404T and up, in IV, VI and VIII pole
- Class 'F' insulation
- Temperature rise: Class 'B' (80°C)
- Service factor: 1.15 (see electrical data for exceptions)
- Dimensions according to NEMA standard
- NEMA ratings design 'B'
- Continuous duty (S1)
- 104°F (40°C) ambient temperature
- Altitude: 3300 ft (1000 m)
- 1045 carbon steel shaft (4140 roller bearings motors)
- Usual mounting: F1
- Stainless steel nameplate
- Paint: Enamel alkyd resin base
- Color: RAL 5007 - Blue
- NPT threaded holes at T-Box
- Non sparking fan
- Thermostats

**Note:** Motors are tested according to IEEE 112 std. - method 'B' or C390 CSA

### Applications

- Gasoline
- Flour / feed mills
- Grain Elevators
- Fans
- Pumps
- Blowers
- Material Handling Equipment
- Other applications requiring motors UL or CSA listed for hazardous locations

### Optional Features

- Special voltages and frequency
- Stainless steel shaft
- Flanged motor
- F2 mounting

#### CSA and UL approved



**CSA approved - File LR 50962**  
Division I, class I, groups C and D  
Division I, class II, groups F and G



**ALSO ENERGY VERIFIED**  
CSA C390-93(+)

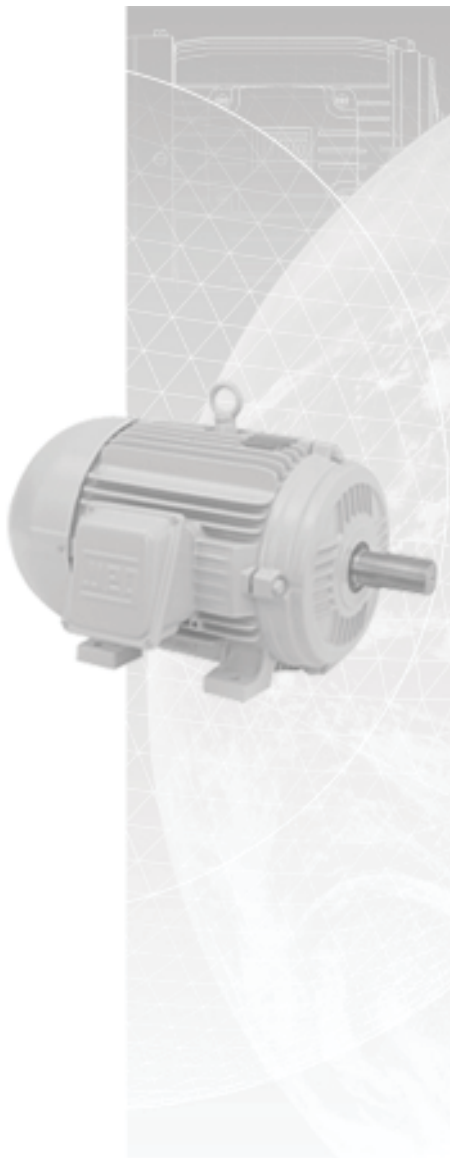
**UL approved - File E 87848**  
Temperature code T4  
Frame 143T up to 326T  
Division I, class I, groups C and D  
Division I, class II, groups F and G

**Frame 364T up to 505**  
Temperature code T3C  
Division I, class I, groups C and D  
Division I, class II, groups F and G\*  
\* For group G, Service Factor 1.0

**Frame 586/7**  
Temperature code T3C  
Division I, class I, groups C and D  
Division I, class II, group F

Electrical features on page .....	215
Mechanical tables on page .....	257
Flange options on page .....	258

# INSTALLATION AND MAINTENANCE MANUAL FOR NEMA LOW VOLTAGE ELECTRIC MOTORS



***T**he electric motor is the item of equipment most widely used by man in his pursuit of progress, as virtually all machines and many renowned inventions depend upon it.*

*By virtue of the prominent role the electric motor plays in the comfort and welfare of mankind, it must be regarded and treated as a prime power unit embodying features that merit special attention, including its installation and maintenance.*

*This means that the electric motor should receive proper attention.*

*Its installation and routine maintenance require specific care to ensure perfect operation and longer life of the unit.*

*THE WEG ELECTRIC MOTOR INSTALLATION AND MAINTENANCE MANUAL provides the necessary information to properly install, maintain and preserve the most important component of all equipment:*

*THE ELECTRIC MOTOR!*

*WEG*



## 2. Basic Instructions

### 2.1 Safety Instructions

All personnel involved with electrical installations, either handling, lifting, operation and maintenance, should be well-informed and up-to-date concerning the safety standards and principles that govern the work and carefully follow them.

Before work commences, it is the responsibility of the person in charge to ascertain that these have been duly complied with and to alert his personnel of the inherent hazards of the job in hand.

It is recommended that these tasks be undertaken only by qualified personnel and they should be instructed to:

- avoid contact with energized circuits or rotating parts,
- avoid by-passing or rendering inoperative any safeguards or protective devices,
- avoid extended exposure in close proximity to machinery with high noise levels,
- use proper care and procedures in handling, lifting, installing, operating and maintaining the equipment, and
- follow consistently any instructions and product documentation supplied when they do such work.

Before initiating maintenance procedures, be sure that all power sources are disconnected from the motor and accessories to avoid electric shock.

Fire fighting equipment and notices concerning first aid should not be lacking at the job site; these should be visible and accessible at all times.

### 2.2 Delivery

Prior to shipment, motors are factory-tested and balanced. They are packed in boxes or bolted to a wooden base.

Upon receipt, we recommend careful handling and a physical examination for damage which may have occurred during transportation.

In the event of damage and in order to guaranty insurance coverage, both the nearest WEG sales office and the carrier should be notified without delay.

### 2.3 Storage

Motors should be raised by their eyebolts and never by their shafts. It is important that high rating three-phase motors be raised by their eyebolts. Raising and lowering must be steady and joltless, otherwise bearings may be harmed.

When motors are not immediately installed, they should be stored in their normal upright position in a dry even temperature place, free of dust, gases and corrosive atmosphere.

Other objects should not be placed on or against them.

Motors stored over long periods are subject to loss of insulation resistance and oxidation of bearings.

**Bearings and lubricant deserve special attention during prolonged periods of storage. Depending on the length and conditions of storage it may be necessary to regrease or change rusted bearings. The weight of the rotor in an inactive motor tends to expel grease from between the**

**bearing surfaces thereby removing the protective film that impedes metal-to-metal contact.**

**As a preventive measure against the formation of corrosion by contact, motors should not be stored near machines which cause vibrations, and every 3 month their shafts should be rotated manually.**

Insulation resistance fluctuates widely with temperature and humidity variations and the cleanliness of components. When a motor is not immediately put into service it should be protected against moist, high temperatures and impurities, thus avoiding damage to insulation resistance.

If the motor has been in storage more than six month or has been subjected to adverse moisture conditions, it is best to check the insulation resistance of the stator winding with a megohmmeter.

If the resistance is lower than ten megohms the windings should be dried in one of the two following ways:

- 1) Bake in oven at temperatures not exceeding 194 degrees F until insulation resistance becomes constant.
- 2) With rotor locked, apply low voltage and gradually increase current through windings until temperature measured with thermometer reaches 194 degrees F. Do not exceed this temperature.

If the motor is stored for an extensive period, the rotor must be periodically rotated.

Should the ambient conditions be very humid, a periodical inspection is recommended during storage. It is difficult to prescribe rules for the true insulation resistance value of a machine as resistance varies according to the type, size and rated voltage and the state of the insulation material used, method of construction and the machine's insulation antecedents. A lot of experience is necessary in order to decide when a machine is ready or not to be put into service. Periodical records are useful in making this decision.

The following guidelines show the approximate values that can be expected of a clean and dry motor, at 40°C test voltage in applied during one minute.

Insulation resistance  $R_m$  is obtained by the formula:

$$R_m = V_n + 1$$

Where:  $R_m$  - minimum recommended insulation resistance in M W with winding at 40°C

$V_n$  - rated machine voltage in kV

In case the test is carried out at a temperature other than 40°C, the value must be corrected to 40°C using an approximated curve of insulation resistance v.s temperature of the winding with the aid of Figure 2.1; it's possible verify that resistance practically doubles every 10°C that insulating temperature is lowered.

Example:

Ambient temperature = 50°C  
Motor winding resistance at 50°C = 1.02 MΩ  
Correction to 40°C

$$R_{40^{\circ}\text{C}} = R_{50^{\circ}\text{C}} \times K_{50^{\circ}\text{C}}$$

$$R_{40^{\circ}\text{C}} = 1.02 \times 1.3$$

$$R_{40^{\circ}\text{C}} = 1.326 \text{ M}\Omega$$

The minimum resistance Rm will be:

$$R_m = V_n + 1$$

$$R_m = 0.440 + 1$$

$$R_m = 1.440 \text{ M}\Omega$$

On new motors, lower values are often attained due to solvents present in the insulating varnishes that later evaporate during normal operation. This does not necessarily mean that the motor is not operational, since insulating resistance will increase after a period of service.

On motors which have been in service for a period of time much larger values are often attained. A comparison of the values recorded in previous tests on the same motor under similar load, temperature and humidity conditions, serves as a better indication of insulation condition than that of the value derived from a single test. Any substantial or sudden reduction is suspect and the cause determined and corrective action taken.

Insulation resistance is usually measured with a MEGGER.

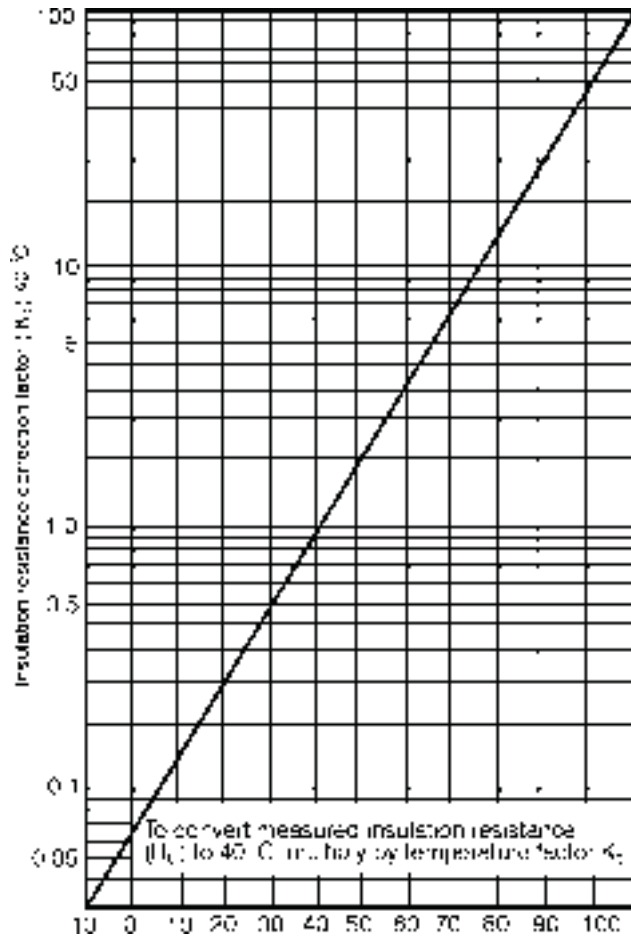
In the event that insulation resistance is inferior to the values derived from the above formula, motors should be subjected to a drying process.

This operation should be carried out with maximum care, and only by qualified personnel. The rate of temperature rise should not exceed 5°C per hour and the temperature of the winding should not exceed 105°C. An overly high final temperature as well as a fast temperature increase rate can each generate vapour harmful to the insulation.

Temperature should be accurately controlled during the drying process and the insulation resistance measured at regular intervals.

During the early stages of the drying process, insulation resistance will decrease as a result of the temperature increase, but the resistance will increase again when the insulation becomes dryer. The drying process should be extended until successive measurements of insulation resistance indicate that a constant value above the minimum acceptable value has been attained. It is extremely important that the interior of the motor be well ventilated during the drying operation to ensure that the dampness is really removed.

Heat for drying can be obtained from outside sources (an oven),



energization of the space heater (optional), or introducing a current through the actual winding of the motor being dried.

Winding Temperature (°C)

$$R_{40^{\circ}\text{C}} = R_t \times K_{t40^{\circ}\text{C}}$$

Figure 2.1.



### 3.2 Electrical Aspects

#### 3.2.1 Feed System

Proper electric power supply is very important. The choice of motor feed conductors, whether branch or distribution circuits, should be based on the rated current of the motors as per NFPA-70 Standard article 430.

Tables 4, 5 and 6 show minimum conductor gauges sized according to maximum current capacity and maximum voltage drop in relation to the distance from the distribution center to the motor, and to the type of installation (Overhead or in ducts).

To determine the conductor gauge proceed as follows:

a) Determine the current by multiplying the current indicated on the motor nameplate by 1.25 and then locate the resulting value on the corresponding table.

If the conductor feeds more than one motor, the value to be sought on the table should be equal 1.25 times the rated current of the largest motor plus the rated current of the other motors.

In the case of variable speed motors, the highest value among the rated currents should be considered.

When motor operation is intermittent, the conductors should have a current carrying capacity equal or greater, to the product of the motor rated current times the running cycle factor shown on Table 7.

**Table 7 - Running cycle factor**

Duty Classification	Motor short time rating			
	5min	15min	30 at 60min	Continuous
Short (operating valves, activating contacts etc)	1.10	1.20	1.50	-
Intermittent (passenger or freight elevators, tools, pumps, rolling bridges etc)	0.85	0.85	0.90	1.40
Cyclic (rolling mills, mining machines etc)	0.85	0.90	0.95	1.40
Variable	1.10	1.20	1.50	2.00

b) Locate the rated voltage of the motor and the feed network distance in the upper part of the corresponding table. The point of intersection of the distance column and the line referring to current will indicate the minimum required gauge of the conductor.

*Example:*

Size the conductors for a 15 HP, three-phase, 230V, 42A, motor located 200 feet from the main supply with cables laid in conduits.

- a) Current to be located:  $1.25 \times 42A = 52.5A$
- b) Closest value on table 6:55A
- c) Minimum gauge: 6 AWG

#### 3.2.2 Starting of Electric Motor

Induction motors can be started by the following methods:

##### Direct Starting

Whenever possible a three-phase motor with a squirrel cage rotor should be started directly at full supply voltage by means of a contactor (Connection diagram a). This method is called Direct-on-Line (DoL) starting.



Table 5 - Wire and cable gauges for three-phase motor installation - aerial conductors with 25cm spacing (voltage drop < 5%)

Supply Voltage	Distance of motor from distribution centre (feet)													
115	51	69	85	102	137	171	205	240	273	308	342	428	514	685
230	102	138	170	204	274	342	410	480	546	616	684	856	1028	1370
460	204	276	340	408	547	684	820	960	1092	1232	1368	1712	2056	2740
575	250	338	420	501	670	840	1010	1181	1342	1515	1680	2105	2530	3350
Current (A)	Cable gauge (conductor)													
15	14	14	14	12	12	10	10	10	8	8	8	6	6	4
20	14	14	12	12	10	10	8	8	8	6	6	4	4	2
30	14	12	10	8	8	8	6	6	4	4	4	2	2	1/0
40	12	10	10	8	8	6	4	4	4	2	2	2	2	2/0
55	10	10	8	8	6	4	4	2	2	2	1/0	2/0	3/0	--
70	8	8	6	6	4	2	2	2	1/0	1/0	2/0	3/0	--	--
100	6	6	4	4	2	2	1/0	2/0	3/0	4/0	4/0	--	--	--
130	4	4	4	2	1/0	1/0	2/0	4/0	--	--	--	--	--	--
175	2	2	2	1/0	2/0	3/0	--	--	--	--	--	--	--	--
225	1/0	1/0	1/0	2/0	3/0	--	--	--	--	--	--	--	--	--
275	2/0	2/0	2/0	4/0	--	--	--	--	--	--	--	--	--	--
320	3/0	3/0	3/0	4/0	--	--	--	--	--	--	--	--	--	--

Table 6 - Wire and cable gauges for three-phase motor installation (voltage drop < 5%) (in conduits)

Supply Voltage	Distance of motor from distribution centre (feet)												
115	85	102	120	137	171	205	240	273	308	342	428	514	
230	170	204	240	274	342	410	480	546	616	684	856	1028	
460	340	408	480	548	684	820	960	1092	1232	1368	1712	2056	
575	420	501	590	670	840	1010	1181	1342	1515	1680	2105	2530	
Current (A)	Cable gauge (conductor)												
15	12	12	12	10	10	8	8	8	6	6	6	4	
20	12	10	10	10	8	8	6	6	6	6	4	4	
30	10	8	8	8	6	6	6	4	4	4	2	2	
40	8	8	6	6	6	4	4	4	2	2	2	1/0	
55	6	6	6	4	4	4	2	2	2	1/0	1/0	1/0	
70	4	4	4	4	2	2	2	1/0	1/0	1/0	2/0	2/0	
95	2	2	2	2	2	1/0	1/0	1/0	1/0	2/0	3/0	4/0	
125	1/0	1/0	1/0	1/0	1/0	1/0	2/0	2/0	3/0	3/0	4/0	250M	
145	2/0	2/0	2/0	2/0	2/0	2/0	2/0	3/0	3/0	4/0	250M	300M	
165	3/0	3/0	3/0	3/0	3/0	3/0	3/0	3/0	4/0	4/0	250M	350M	
195	4/0	4/0	4/0	4/0	4/0	4/0	4/0	4/0	250M	250M	300M	350M	
215	250M	250M	250M	250M	250M	250M	250M	250M	250M	300M	350M	400M	
240	300M	300M	300M	300M	300M	300M	300M	300M	300M	300M	400M	500M	
265	350M	350M	350M	350M	350M	350M	350M	350M	350M	350M	500M	500M	
280	400M	400M	400M	400M	400M	400M	400M	400M	400M	400M	400M	--	
320	500M	500M	500M	500M	500M	500M	500M	500M	500M	500M	500M	--	

Note: The above indicated values are orientative. For guaranteed values, contact the Local Power Company.



There are DOL starter assemblies available combining a three-pole contactor, a bimetal relay (overload protection device), and a fuse (short circuit protection on branch circuit).

DOL starting is the simplest method, only feasible however, when the locked rotor current (LRC) does not influence the main electric supply lines.

Initial locked rotor current (LRC) in induction motors reach values six to eight times the value of the full load current. During starting by the DOL method, starting current can reach these high levels. The main electrical supply should be rated sufficiently, such that during the starting cycle no supply disturbance to others on the power network is caused by the voltage drop in the main supply.

This can be achieved under one of the following situations:

- The rated main supply current is high enough for the locked rotor current not to be proportionally high;
- Motor locked rotor current is low with no effect on the networks.
- The motor is started under no-load conditions with a short starting cycle and, consequently, a low locked rotor current with a transient voltage drop tolerable to other consumers.

### Starting with a compensating switch (auto-transformer starting)

Should direct on line starting not be possible, either due to restrictions imposed by the power supply authority or due to the installation itself, reduced voltage indirect starting methods can be employed to lower the locked rotor current. The single line connection diagram (C) shows the basic components of a compensating switch featuring a transformer (usually an auto-transformer) with a series of taps corresponding to the different values of the reduced voltage. Only three terminals of the motor are connected to the switch, the other being interconnected as per diagram, for the indicated voltage.

### Star-Delta starting

It is fundamental to star-delta starting that the three-phase motor has the necessary numbers of leads for both connections:

6 leads for Y/ $\Delta$   
or 12 leads for YY/ $\Delta\Delta$

All the connections for the various voltages are made through terminals in the terminal box in accordance with the wiring diagram that accompanies the motor. This diagram may be shown on the nameplate or in the terminal box.

The star-delta connection is usually used only in low-voltage motors due to normally available control and protection devices. In this method of starting the locked rotor current is approximately 30% of the original LRC. The locked rotor torque is reduced proportionally as well. For this reason, it is very important before deciding to use star-delta starting to verify if the reduced locked rotor torque in "STAR" connection is enough to accelerate the load.

### 3.2.3 Motor Protection

Motor circuits have, in principle, two types of protection: motor overload, locked rotor and protection of branch circuit from short circuits. Motors in continuous use should be protected from overloading by means of a device incorporated into the motor, or by an independent device, usually a fixed or adjustable thermal

relay equal or less than to the value derived from multiplying the rated feed current at full load by:

- 1.25 for motors with a service factor equal or superior to 1.15 or;
- 1.15 for motors with service factor equal to 1.0.

Some motors are optionally fitted with overheating protective detectors (in the event of overload, locked rotor, low voltage, inadequate motor ventilation) such as a thermostat (thermal probe), thermistor (PTC), RTD type resistance which dispense with independent devices.

**THERMOSTAT (THERMAL PROBE):** bimetallic thermal detectors with normally closed silver contacts. These open at pre-determined temperatures. Thermostats are series connected directly to the contactor coil circuit by two conductors.

**THERMISTORS:** Semi-conductor heat detectors positive temperature coefficient (PTC) that sharply change their resistance upon reaching a set temperature. Thermistors, depending upon the type, are series or parallel-connected to a control unit that cuts out the motor feed, or actuates an alarm system, in response to the thermistors reaction.

### Resistance temperature detectors (RTD) - PT 100

The resistance type heat detector (RTD) is a resistance element usually manufactured of copper or platinum.

The RTD operates on the principle that the electrical resistance of a metallic conductor varies linearly with the temperature. The detector terminals are connected to a control panel, usually fitted with a temperature gauge, a test resistance and a terminal changeover switch.

Subject to the desired degree of safety and the client's specification, three (one per phase) or six (two per phase) protective devices can be fitted to a motor for the alarm stems, circuit breaker or combined alarm and circuit breaker, with two leads from the terminal box to the alarm or circuit breaker system and four for the combined system (alarm and circuit breaker).

Table 9 compares the two methods of protection.

## 3.3 Start-up

### 3.3.1 Preliminary Inspection

Before starting a motor for the first time, it will be necessary to:

- Remove all locking devices and blocks used in transit and check that the motor rotates freely;
- Check that the motor is firmly secured and that coupling elements are correctly mounted and aligned.;
- Ascertain that voltage and frequency correspond to those indicated on the nameplate. Motor performance will be satisfactory with main supply voltage fluctuation within ten per cent of the value indicated on the nameplate or a frequency fluctuation within five per cent or, yet, with a combined voltage and frequency variance within ten per cent;

**Table 9 - Comparison between motor protection system**

- d) Check that connections are in accordance with the connection diagram shown on the nameplate and be sure that all terminal screws and nuts are tight;
- e) Check the motor for proper grounding. Providing that there are no specifications calling for ground-insulated installation, the motor must be grounded in accordance with prevalent standard for grounding electrical machines. The screw identified by the symbol should be used for this purpose. This screw is generally to be found in the terminal box or on one foot of the frame;
- f) Check that motor leads connecting with the mains, as well as the control wires and the overload protection device, are in accordance with Nema Standards;
- g) If the motor has been stored in a damp place, or has been stopped for some time, measure the insulating resistance as recommended under the item covering storage instructions;
- h) Start the motor uncoupled to ascertain that it is turning in the desired direction. To reverse the rotation of a three-phase motor, invert two terminal leads of the mains supply. High voltage motors bearing an arrow on the frame indicating rotation direction can only turn in the direction shown;

Causes of overheating	Current-based protection		Protection with probe thermistor in motor
	Fuse only	Fuse and thermal protector	
1. Overload with 1.2 times rated current	○	●	●
2. Duty cycles S1 to S8 IEC 34, EB 120	○	◐	●
3. Brakings, reversals and frequent starts	○	◐	●
4. Operating with more than 15 starts p/hour	○	◐	●
5. Locked rotor	◐	◐	●
6. Fault on one phase	○	◐	●
7. Excessive voltage fluctuation	○	●	●
8. Frequency fluctuation on main supply	○	●	●
9. Excessive ambient temperature	○	●	●
10. External heating caused by bearings, belts, pulleys etc.	○	○	●
11. Obstructed ventilation	○	○	●

Caption: ○ unprotected  
 ◐ partially protected  
 ● totally protected



### 3.3.2 The First Start-up

#### Three-Phase Motor with Cage Rotor

After careful examination of the motor, follow the normal sequence of starting operations listed in the control instructions for the initial start-up.

### 3.3.3 Operation

Drive the motor coupled to the load for a period of at least one hour while watching for abnormal noises or signs of overheating.

Compare the line current with the value shown on the nameplate.

Under continuous running conditions without load fluctuations this should not exceed the rated current times the service factor, also shown on the nameplate.

All measuring and control instruments and apparatus should be continuously checked for anomalies, and any irregularities corrected.

### 3.3.4 Stopping

#### *Warning:*

To touch any moving part of a running motor, even though disconnected, is a danger to life and limb.

- a) Three-phase motor with cage rotor:  
Open the stator circuit switch. With the motor at a complete stop, reset the auto-transformer, if any, to the "start" position;



**Table 11 - Bearing specifications by type of motor**

NEMA Frames	Mounting	Bearings	
		Front (D.E.)	Rear (O.D.E.)
Open drip proof motors			
B48 and C48	ALL FORMS	6203 Z	6202 Z
56 and A56		6203 Z	6202 Z
B56 and C56		6203 Z	6202 Z
D56 and F56H/G56H		6204 Z	6202 Z/ 6203 Z
Totally enclosed fan cooled motors			
143 T	ALL FORMS	6205 ZZ	6204 ZZ
145 T		6205 ZZ	6204 ZZ
182 T		6307 ZZ	6206 ZZ
184 T		6307 ZZ	6206 ZZ
W 182 T		6206 ZZ	6205 ZZ
W 184 T		6206 ZZ	6205 ZZ
213 T		6308 ZZ	6207 ZZ
215 T		6308 ZZ	6207 ZZ
W 213 T		6308 ZZ	6207 ZZ
W 215 T		6308 ZZ	6207 ZZ
254 T		6309-C3	6209 Z-C3
256 T		6309-C3	6209 Z-C3
W 254 T		6309-C3	6209 Z-C3
W 256 T		6309-C3	6209 Z-C3
284 T and TS		6311-C3	6211 Z-C3
286 T and TS		6311-C3	6211 Z-C3
324 T and TS		6312-C3	6212 Z-C3
326 T and TS		6312-C3	6212 Z-C3
364 T and TS		6314-C3	6314-C3
365 T and TS		6314-C3	6314-C3
404 T		NU 316-C3	6314-C3
404 TS		6314-C3	6314-C3
405 T		NU 316-C3	6314-C3
405 TS		6314-C3	6414-C3
444 T		NU 319-C3	6316-C3
444 TS		6314-C3	6314-C3
445 T		NU 319-C3	6316-C3
445 TS		6314-C3	6314-C3
447 T		NU 319-C3	6316-C3
447 TS		6314-C3	6314-C3
449 T		NU 322-C3	6319-C3
449 TS		6314-C3	6314-C3
504 T		NU 319-C3	6316-C3
504 TS		6314-C3	6314-C3
505 T		NU 319-C3	6316-C3
505 TS		6314-C3	6314-C3
5008 T		NU 322-C3	6319-C3
5008TS		6314-C3	6314-C3
586 T		NU 322-C3	6319-C3
586 TS		6314-C3	6314-C3
587 T	NU 322-C3	6319-C3	
587 TS	6314-C3	6314-C3	
Saw Arbor motor frame			
Saw Arbor motor frame	Mounting	Bearings	
		Front (D.E.)	Rear (O.D.E.)
80 S MS	B3	6307 ZZ	6207 ZZ
80 M MS		6307 ZZ	6207 ZZ
80 L MS		6307 ZZ	6207 ZZ
90 L MS		6308 ZZ	6208 ZZ



Table 12 - Bearing lubrication intervals and amount of grease

1 - SINGLE-ROW FIXED BALL BEARINGS

Bearings		Lubrication intervals (running hours)												Amount of grease (oz)
		II Pole		IV Pole		VI Pole		VIII Pole		X Pole		XII Pole		
		60Hz 3600 rpm	50Hz 3000 rpm	60Hz 1800 rpm	50Hz 1500 rpm	60Hz 1200 rpm	50Hz 1000 rpm	60Hz 900 rpm	50Hz 750 rpm	60Hz 720 rpm	50Hz 600 rpm	60Hz 600 rpm	50Hz 500 rpm	
S E R I E S	6200	12500	13800											0,07
	6201	11700	13000	16600	18400									0,07
	6202	10500	11900	15400	17100	19500								0,07
	6203	9800	11200	14500	16200	18500								0,11
	6204	8700	10100	13300	14800	17100	19100				> 20000			0,14
	6205	8000	9400	12600	14100	16200	18200	19300						0,14
	6206	7300	8700	12000	13400	15400	17200	18300						0,18
	6207	6600	8100	11400	12700	14500	16300	17300	19200					0,25
	6208	5900	7400	10800	12000	13700	15300	16300	18200					0,29
	6209	5300	6900	10400	11600	13400	15000	16000	17800					0,29
	6210	4900	6400	9700	11000	12900	14600	15600	17300					0,32
	6211	4300	5900	9500	10900	12700	14400	15300	17000					0,39
	6212	3800	5400	9300	10300	12400	14300	15200	16500					0,46
	6213	3100	4900	8900	10100	12200	14000	14800	16100					0,50
	6214	1100	2000	4100	5000	5900	6500	6900	7600					0,54
	6215	1000	1800	4400	5000	5600	6300	6700	7600					0,61
6216	700	1600	4100	4700	5700	6500	6800	7500					0,68	

1) Lubrication periodicity valid for NLG 1 and lithium based bearing lubricant.  
2) Bearings for motors of X and XII poles - Lubrication Intervals > 20,000.



## 4. Maintenance

A well-designed maintenance program for electric motors can be summed up as: periodical inspection of insulation levels, temperature rise, wear, bearing lubrication and the occasional checking of fan air flow.

Inspection cycles depend upon the type of motor and the conditions under which it operates.

### 4.1 Cleanliness

Motors should be kept clean, free of dust, debris and oil. Soft brushes or clean cotton rags should be used for cleaning. A jet of compressed air should be used to remove non-abrasive dust from the fan cover and any accumulated grime from the fan and cooling fins.

Oil or damp impregnated impurities can be removed with rags soaked in a suitable solvent.

Terminal boxes fitted to motors with IP55 protection should be cleaned; their terminals should be free of oxidation, in perfect mechanical condition, and all unused space dust-free.

Motors with IPW 55 protection are recommended for use under unfavourable ambient conditions.

### 4.2 Lubrication

Proper lubrication extends bearing life.

#### Lubrication Maintenance Includes:

- Attention to the overall state of the bearings;
- Cleaning and lubrication;
- Critical inspection of the bearings.

Motor noise should be measured at regular intervals of one to four months. A well-tuned ear is perfectly capable of distinguishing unusual noises, even with rudimentary tools such as a screw driver, etc., without recourse to sophisticated listening aids or stethoscopes that are available on the market.

A uniform hum is a sign that a bearing is running perfectly. Bearing temperature control is also part of routine maintenance. The temperature of bearings lubricated as recommended under item 4.2.2 should not exceed 70°C.

Constant temperature control is possible with the aid of external thermometers or by embedded thermal elements. WEG motors are normally equipped with grease lubricated ball or roller bearings. Bearings should be lubricated to avoid metallic contact of the moving parts, and also for protection against corrosion and wear. Lubricant properties deteriorate in the course of time and mechanical operation: furthermore, all lubricants are subject to contamination under working conditions.

For this reason lubricants must be renewed and any lubricant consumed needs replacing from time to time.

#### 4.2.1 Periodical Lubrication

WEG motors are supplied with sufficient grease for a long running

period. Lubrication intervals, the amount of grease and the type of bearing used in frames 140T to 580T are to be found in Tables 11, 12 and 13.

Lubrication intervals depend upon the size of the motor, speed, working conditions and the type of grease used.

#### 4.2.2 Quality and Quantity of Grease

##### **Correct lubrication is important!**

Grease must be applied correctly and in sufficient quantity as both insufficient or excessive greasing are harmful.

Excessive greasing causes overheating brought about by the greater resistance encountered by the rotating parts and, in particular, by the compacting of the lubricant and its eventual loss of lubricating qualities.

This can cause seepage with the grease penetrating the motor and dripping on the coils.

A lithium based grease is commonly used for the lubrication of electric motor bearings as it has good mechanical stability, is insoluble in water and has a drip point of approximately 200°C.

This grease should never be mixed with sodium or calcium based greases.

#### GREASES FOR MOTOR BEARINGS

For operating temperatures from - 20 to 130°C			
Frame	Supplier	Grease	Temperature range
143T-215T	Shell	Alvania R3	-20 to 130°C
254T to 586/7	Esso	Unirex N2	-30 to 165°C
Substitutes			
Supplier	Grease	Temperature Range	
Mobil	Mobilith SHC100	-40 to 177°C	
ESSO	Beacon 2	-20 to 130°C	
Atlantic	Litholine 2	-20 to 130°C	
Texaco	Multifak 2	-20 to 130°C	
Molikote	BG 20	-45 to 180°C	
Inisilikon	L5012	-20 to 200°C	

Note: When changing lubricant, please follow manufacturers instructions

#### 4.2.3 Lubricating Instructions

##### **a) Frame 140T to 210T motors**

Frame 140T to 210T size motors are not fitted with grease nipples. Lubrication is carried out during periodical overhauls when the motor is taken apart.

#### Cleaning and Lubrication of Bearings

With the motor dismantled and without extracting the bearings from the shaft, all existing grease should be removed and the bearings cleaned with Diesel oil, kerosene or other solvent, until thoroughly clean.

Refill the spaces between the balls or rollers and the bearing cages with grease immediately after washing. Never rotate bearings in their dry state after washing.

For inspection purposes apply a few drops of machine oil. During these operations maximum care and cleanliness is recommended to avoid the penetration of any impurities or dust that could harm the bearings. Clean all external parts prior to reassembly.

### b) Frame 360T to 580T Motors

Motors above 360T frame size are fitted with regreaseable bearing system.

The lubrication system from this frame size upwards was designed to allow the removal of all grease from the bearing races through a bleeder outlet which at the same time impedes the entry of dust or other contaminants harmful to the bearing.

This outlet also prevents injury to the bearings from the well-known problem of over-greasing.

It is advisable to lubricate while the motor is running, to allow the renewal of grease in the bearing case.

Should this procedure not be possible because of rotating parts in the proximity of the nipple (pulleys, coupling sleeves, etc.) that are hazardous to the operator the following procedure should be followed:

- Inject about half the estimated amount of grease and run the motor at full speed for approximately a minute; switch off the motor and inject the remaining grease.

The injection of all the grease with the motor at rest could cause penetration of a portion of the lubricant through the internal seal of the bearing case and hence into the motor.

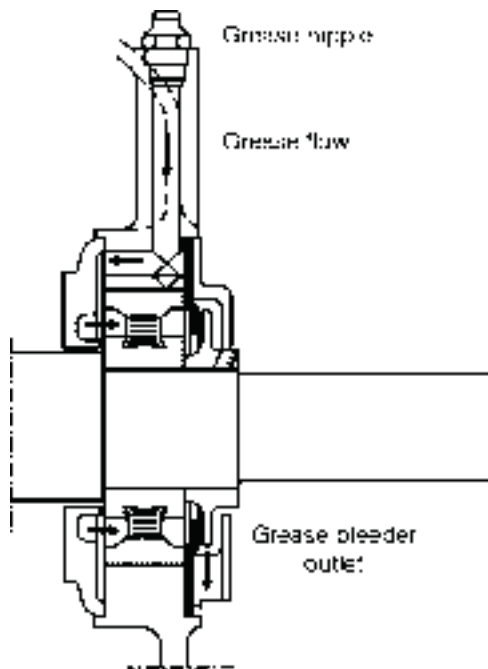


Figure 4.1 - Bearings and lubrication system

Nipples must be clean prior to introduction of grease to avoid entry of any alien bodies into the bearing.

For lubricating use only a manual grease gun.

### Bearing Lubrication Steps

1. Cleanse the area around the grease nipples with clean cotton fabric.
2. With the motor running, add grease with a manual grease gun until the lubricant commences to be expelled from the bleeder outlet, or until the quantity of grease recommended in Tables 12 or 13 has been applied.
3. Allow the motor to run long enough to eject all excess grease.

### 4.2.4 Replacement of Bearings

The opening of a motor to replace a bearing should only be carried out by qualified personnel.

Damage to the core after the removal of the bearing cover can be avoided by filling the gap between the rotor and the stator with stiff paper of a proper thickness.

Providing suitable tooling is employed, disassembly of a bearing is not difficult.

The extractor grips should be applied to the sidewall of the inner ring to be stripped, or to an adjacent part.

To ensure perfect functioning and to prevent injury to the bearing parts, it is essential that the assembly be undertaken under conditions of complete cleanliness and by competent personnel.

New bearings should not be removed from their packages until the moment of assembly.

Prior to fitting a new bearing, ascertain that the shaft has no rough edges or signs of hammering.

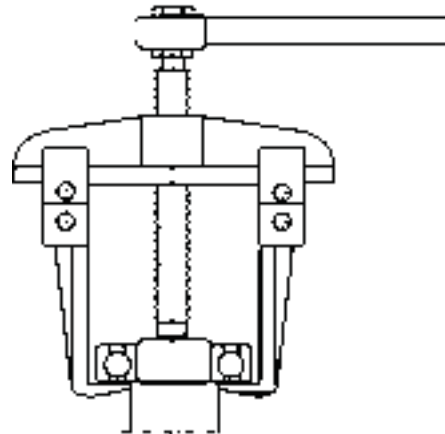


Figure 4.2 - A bearing extractor

During assembly bearings cannot be subjected to direct blows.

The aid used to press or strike the bearing should be applied to the inner ring.

### 4.3 Air Gap Checking (Large Rating Open Motors)

Upon the completion of any work on the bearings check the gap measurement between the stator and the rotor using the appropriate gazes.

The gap variation at any two vertically opposite points must be less than 10% of the average gap measurement.

### 4.4 Explosion Proof Motor Repair Steps

#### 4.4.1 Objective

In view of the heavy liability associated with burning of motors of this type, this product has been designed and manufactured to high technical standards, under rigid controls. In addition, in many areas it is required that explosion proof motors ONLY be repaired by licensed personnel or in licensed facilities authorized to do this type of work.

The following general procedures, safeguards, and guidelines must be followed in order to ensure repaired explosion proof motors operate as intended.

#### 4.4.2 Repair Procedure and Precautions

Dismantle the damaged motor with appropriate tools without hammering and/or pitting machined surfaces such as enclosure joints, fastening holes, and all joints in general.

The position of the fan cover should be suitably marked prior to removal so as to facilitate reassembly later on.

Examine the motor's general condition and, if necessary, disassemble all parts and clean them with kerosene. Under no circumstances should scrapers, emery papers or tools be used that could affect the dimensions of any part during cleaning.

Protect all machined parts against oxidation by applying a coating of vaseline or oil immediately after cleaning.

#### STRIPPING OF WINDINGS

This step requires great care to avoid knocking and/or denting of enclosure joints and, when removing the sealing compound from the terminal box, damage or cracking of the frame.

#### IMPREGNATION

Protect all frame threads by inserting corresponding bolts, and the joint between terminal box and frame, by coating it with a non-adhesive varnish (ISO 287 - ISOLASIL).

Protective varnish on machined parts should be removed soon after treating with impregnating varnish. This operation should be carried out manually without using tools.

#### ASSEMBLY

Inspect all parts for defects, such as cracks, joint incrustations, damaged threads and other potential problems.

Assemble using a rubber headed mallet and a bronze bushing after ascertaining that all parts are perfectly fitted.

Bolts should be positioned with corresponding spring washers and evenly tightened.

#### TESTING

Rotate the shaft by hand while examining for any drag problems on covers or fastening rings.

Carry out running tests as for standard motors.

#### MOUNTING THE TERMINAL BOX

Prior to fitting the terminal box all cable outlets on the frame should be sealed with a sealing compound (1<sup>st</sup> layer) and an Epoxy resin (ISO 340) mixed with ground quartz (2<sup>nd</sup> layer) in the following proportions:

340A resin	50 parts
340B resin	50 parts
Ground quartz	100 parts

Drying time for this mixture is two hours during which the frame should not be handled and cable outlets should be upwards.

When dry, see that the outlets and areas around the cables are perfectly sealed.

Mount the terminal box and paint the motor.

#### 4.4.3 Miscellaneous Recommendations

- Any damaged parts (cracks, pittings in machined surfaces, defective threads) must be replaced and under no circumstances should attempts be made to recover them.
- Upon reassembling explosion proof motors IPW55 the substitution of all seals is mandatory.
- Should any doubts arise, consult WEG.

## 5. Malfunctioning

Most malfunctions affecting the normal running of electric motors can be prevented by maintenance and the appropriate precautions. While ventilation, cleanliness and careful maintenance are the main factors ensuring long motor life, a further essential factor is the prompt attention to any malfunctioning as signalled by vibrations, shaft knock, declining insulation resistance, smoke or fire, sparking or unusual slip ring or brush wear, sudden changes of bearing temperatures.

When failures of an electric or mechanical nature arise, the first step to be taken is to stop the motor and subsequent examination of all mechanical and electrical parts of the installation.

In the event of fire, the installation should be isolated from the mains supply, which is normally done by turning off the respective switches.

In the event of fire within the motor itself, steps should be taken to restrain and suffocate it by covering the ventilation vents.

To extinguish a fire, dry chemical or CO<sub>2</sub> extinguishers should be used - never water.

### 5.1 Standard Three-Phase Motor Failures

Owing to the widespread usage of asynchronous three-phase motors in industry which are more often repaired in the plant workshops, there follows a summary of possible failures and their probable causes, detection and repairs.

Motors are generally designed to Class B or F insulation and for ambient temperatures up to 40°C.

Most winding defects arise when temperature limits, due to current overload, are surpassed throughout the winding or even in only portions thereof. These defects are identified by the darkening or carbonizing of wire insulation.

#### 5.1.1 Short Circuits Between Turns

A short circuit between turns can be a consequent of two coinciding insulation defects, or the result of defects arising simultaneously on two adjacent wires. As wires are randomly tested, even the best quality wires can have weak spots. Weak spots can, on occasion, tolerate a voltage surge of 30% at the time of testing for shorting between turns, and later fail due to humidity, dust or vibration. Depending on the intensity of the short, a magnetic hum becomes audible.

In some cases, the three-phase current imbalance can be so insignificant that the motor protective device fails to react. A short circuit between turns, and phases to ground due to insulation failure is rare, and even so, it nearly always occurs during the early stages of operation.

#### 5.1.2 Winding Failures

##### a) One burnt winding phase

This failure arises when a motor runs wired in delta and current fails in one main conductor.

Current rises from 2 to 2.5 times in the remaining winding with a

simultaneous marked fall in speed. If the motor stops, the current will increase from 3.5 to 4 times its rated value.

In most instances, this defect is due to the absence of a protective switch, or else the switch has been set too high.

##### b) Two burnt winding phases

This failure arises when current fails in one main conductor and the motor winding is star-connected. One of the winding phases remains currentless while the others absorb the full voltage and carry an excessive current.

The slip almost doubles.

##### c) Three burnt winding phases

###### *Probable cause 1*

Motor only protected by fuses; an overload on the motor will be the cause of the trouble.

Consequently, progressive carbonizing of the wires and insulation culminate in a short circuit between turns, or a short against the frame occurs.

A protective switch placed before the motor would easily solve this problem.

###### *Probable cause 2*

Motor incorrectly connected. For example: A motor with windings designed for 230/400V is connected through a star-delta switch to 400V connection.

The absorbed current will be so high that the winding will burn out in a few seconds if the fuses or a wrongly set protective switch fail to react promptly.

###### *Probable cause 3*

The star-delta switch is not commutated and the motor continues to run for a time connected to the star under overload conditions.

As it only develops 1/3 of its torque, the motor cannot reach rated speed. The increased slip results in higher ohmic losses arising from the Joule effect. As the stator current, consistent with the load, may not exceed the rated value for the delta connection, the protective switch will not react.

Consequent to increased winding and rotor losses the motor will overheat and the winding burn out.

###### *Probable cause 4*

Failures from this cause arise from thermal overload, due to too many starts under intermittent operation or to an overly long starting cycle. The perfect functioning of motor operating under these conditions is only assured when the following values are heeded:

- a) number of starts per hour;
- b) starting with or without load;
- c) mechanical brake or current inversion;
- d) acceleration of rotating masses connected to motor shaft
- e) load torque vs. speed during acceleration and braking.

The continuous effort exerted by the rotor during intermittent starting brings about heavier losses which provoke overheating.

Under certain circumstances with the motor idle there is a possibility that the stator winding is subjected to damage as a result of the

heating of the motor. In such a case, a slip ring motor is recommended as a large portion of the heat (due to rotor losses) is dissipated in the rheostat.

### 5.1.3 Rotor Failures

If a motor running under load conditions produces a noise of varying intensity and decreasing frequency while the load is increased, the reason, in most cases, will be an unsymmetrical rotor winding.

In squirrel-cage motors the cause will nearly always be a break in one or more of the rotor bars; simultaneously, periodical stator current fluctuations may be recorded. As a rule, this defect appears only in molded or die cast aluminum cages.

Failures due to spot heating in one or another of the bars in the rotor stack are identified by the blue coloration at the affected points. Should there be failures in various contiguous bars, vibrations and shuddering can occur as if due to an unbalance, and are often interpreted as such. When the rotor stack acquires a blue or violet coloration, it is a sign of overloading.

This can be caused by overly high slip, by too many starts or overlong starting cycles. This failure can also arise from insufficient main voltage.

### 5.1.4 Bearing Failures

Bearing damage is a result of overloading brought about by an overly taut belt or axial impacts and stresses.

Underestimating the distance between the drive pulley and the driven pulley is a common occurrence.

The arc of contact of the belt on the drive pulley thus becomes inadmissibly small and thereby belt tension is insufficient for torque transmission.

In spite of this it is quite usual to increase belt tension in order to attain sufficient drive.

Admittably, this is feasible with the latest belt types reinforced by synthetic materials.

However, this practice fails to consider the load on the bearing and the result is bearing failure within a short time.

Additionally there is the possibility of the shaft being subjected to unacceptably high loads when the motor is fitted with a pulley that is too wide.

### 5.1.5 Shaft Fractures

Although bearings traditionally constitute the weaker part, and the shafts are designed with wide safety margins, it is not beyond the realm of possibility that a shaft may fracture by fatigue from bending stress brought about by excessive belt tension.

In most cases, fractures occur right behind the drive end bearing.

As a consequence of alternating bending stress induced by a rotating shaft, fractures travel inwards from the outside of the shaft until the point of rupture is reached when resistance of the remaining shaft cross-section no longer suffices.

Avoid additional drilling the shaft (fastening screw holes) as such operations tend to cause stress concentration.

### 5.1.6 Unbalanced V-Belt Drives

The substitution of only one of a number of other parallel belts on a drive is frequently the cause of shaft fractures, as well as being malpractice.

Any used, and consequently stretched belts retained on the drive, especially those closest to the motor, while new and unstretched belts are placed on the same drive turning farther from the bearing, can augment shaft stress.

### 5.1.7 Damage Arising from Poorly Fitted Transmission Parts or Improper Motor Alignment

Damage to bearing and fracture in shafts often ensue from inadequate fitting of pulleys, couplings or pinions. These parts "knock" when rotating. The defect is recognized by the scratches that appear on the shaft or the eventual scalelike flaking of the shaft end.

Keyways with edges pitted by loosely fitted keys can also bring about shaft failures.

Poorly aligned couplings cause knocks and radial and axial shaking to shaft and bearings.

Within a short while these malpractices cause the deterioration of the bearings and the enlargement of the bearing cover bracket located on the drive end side.

Shaft fracture can occur in more serious cases.



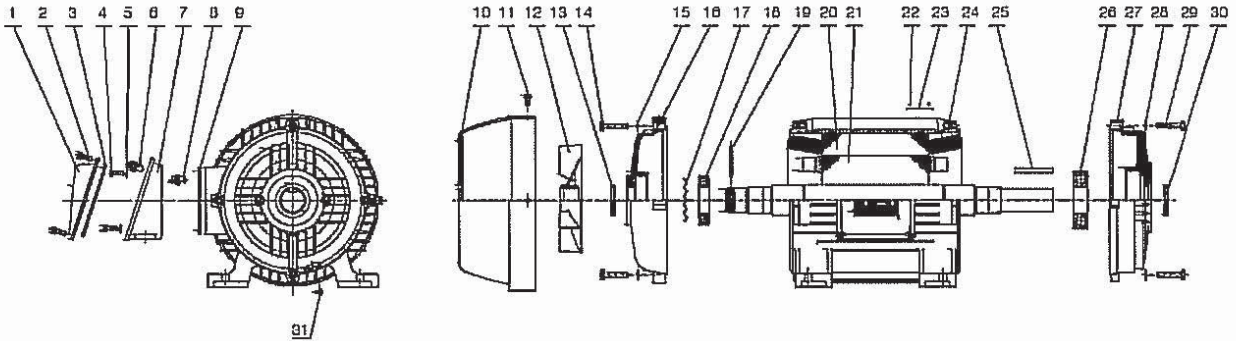
## 5.2 Troubleshooting

FAILURE	PROBABLE CAUSE	CORRECTIVE MEASURES
<b>Motor fails to start</b>	<ol style="list-style-type: none"> <li>1.No voltage supply</li> <li>2. Low voltage supply</li> <li>3. Wrong control connections</li> <li>4. Loose connection at some terminal lug</li> <li>5. Overload</li> </ol>	<ul style="list-style-type: none"> <li>• Check feed connections to control system and from this to motor.</li> <li>• Check voltage supply and ascertain that voltage remains within 10% of the rated voltage shown on the motor nameplate.</li> <li>• Compare connections with the wiring diagram on the motor nameplate.</li> <li>• Tighten all connections.</li> <li>• Try to start motor under no-load conditions. If it starts, there may be an overload condition or a blocking of the starting mechanism. Reduce load to rated load level and increase torque.</li> </ul>
<b>High noise level</b>	<ol style="list-style-type: none"> <li>1. Unbalance</li> <li>2. Distorted shaft</li> <li>3. Incorrect alignment</li> <li>4. Uneven air gap</li> <li>5. Dirt in the air gap</li> <li>6. Extraneous matter stuck between fan and motor casing</li> <li>7. Loose motor foundation</li> <li>8. Worn bearings</li> </ol>	<ul style="list-style-type: none"> <li>• Vibrations can be eliminated by balancing rotor. If load is coupled directly to motor shaft, the load can be unbalanced.</li> <li>• Shaft key bent; check rotor balance and eccentricity.</li> <li>• Check motor alignment with machine running.</li> <li>• Check shaft for warping or bearing wear.</li> <li>• Dismantle motor and remove dirt or dust with jet of dry air.</li> <li>• Dismantle motor and clean. Remove trash or debris from motor vicinity.</li> <li>• Tighten all foundation studs. If necessary, realign motor.</li> <li>• Check lubrication. Replace bearing if noise is excessive and continuous.</li> </ul>
<b>Overheating of bearings</b>	<ol style="list-style-type: none"> <li>1. Excessive grease</li> <li>2. Excessive axial or radial strain on belt</li> <li>3. Deformed shaft</li> <li>4. Rough bearing surface</li> <li>5. Loose or poorly fitted motor end shields</li> <li>6. Lack of grease</li> <li>7. Hardened grease cause locking of balls</li> <li>8. Foreign material in grease</li> </ol>	<ul style="list-style-type: none"> <li>• Remove grease bleeder plug and run motor until excess grease is expelled.</li> <li>• Reduce belt tension.</li> <li>• Have shaft straightened and check rotor balance.</li> <li>• Replace bearings before they damage shaft.</li> <li>• Check end shields for close fit and tightness around circumference.</li> <li>• Add grease to bearing.</li> <li>• Replace bearings.</li> <li>• Flush out housings and relubricate.</li> </ul>
<b>Intense bearing vibration</b>	<ol style="list-style-type: none"> <li>1. Unbalanced rotor</li> <li>2. Dirty or worn bearing</li> <li>3. Bearing rings too tight on shaft and/or bearing housing</li> <li>4. Extraneous solid particles in bearing</li> </ol>	<ul style="list-style-type: none"> <li>• Balance rotor statically and dynamically.</li> <li>• If bearing rings are in perfect condition, clean and relubricate the bearing, otherwise, replace bearing.</li> <li>• Before altering shaft or housing dimensions, it is advisable to ascertain that bearing dimensions correspond to manufacturer's specifications.</li> <li>• Take bearing apart and clean. Reassemble only if rotating and support surfaces are unharmed.</li> </ul>
<b>Overheating of motor</b>	<ol style="list-style-type: none"> <li>1. Obstructed cooling system</li> <li>2. Overload</li> <li>3. Incorrect voltages and frequencies</li> <li>4. Frequent inversions</li> <li>5. Rotor dragging on stator</li> <li>6. Unbalanced electrical load (burnt fuse, incorrect control)</li> </ol>	<ul style="list-style-type: none"> <li>• Clean and dry motor; inspect air vents and windings periodically.</li> <li>• Check application, measuring voltage and current under normal running conditions.</li> <li>• Compare values on motor nameplate with those of mains supply. Also check voltage at motor terminals under full load.</li> <li>• Exchange motor for another that meets needs.</li> <li>• Check bearing wear and shaft curvature.</li> <li>• Check for unbalanced voltages or operation under single-phase condition.</li> </ul>



## 6. Spare Parts and Component Terminology

### THREE-PHASE MOTORS IP55 NEMA - Frames 140T - W180T - 180T - 210T and W210T



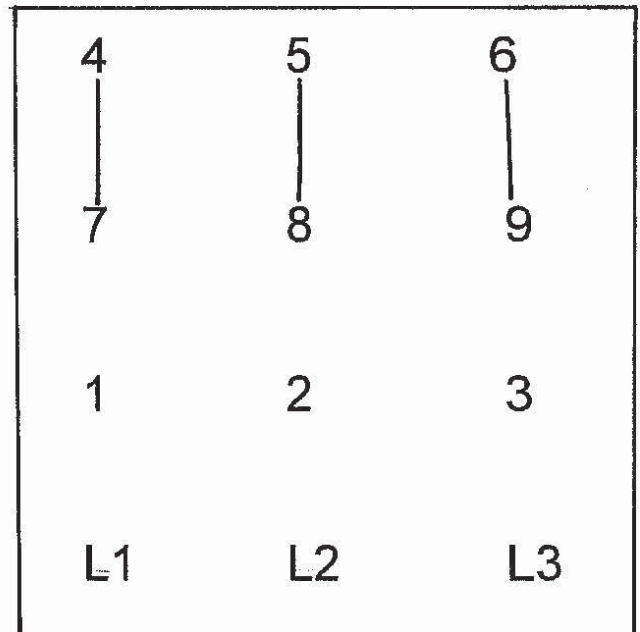
Part Nr.	Description
1	Terminal box cover
2	Terminal box cover fixing bolt
3	Terminal box cover gasket
4	Terminal box fixing bolt
5	Terminal box fixing washer
6	Terminal box grounding lug
7	Terminal box
8	Frame grounding lug
9	Terminal box o'ring gasket
10	Fan cover
11	Fan cover fixing bolt
12	Fan

Part Nr.	Description
13	V'Ring
14	Non-drive end endshield fixing bolt
15	Non-drive end endshield washer
16	Non-drive endshield
17	Spring washer
18	Non-drive bearing
19	Fan fixing pin
20	Wound stator
21	Rotor / shaft assembly
22	Nameplate fixing rivet
23	Nameplate
24	Frame

Part Nr.	Description
25	Shaft key
26	Drive end bearing
27	Drive endshield
28	Drive endshield washer
29	Drive end endshield fixing bolt
33	V'Ring
31	Drain plug

**WEG MOTOR CONNECTION DIAGRAM**

**FOR 460 VOLTS**

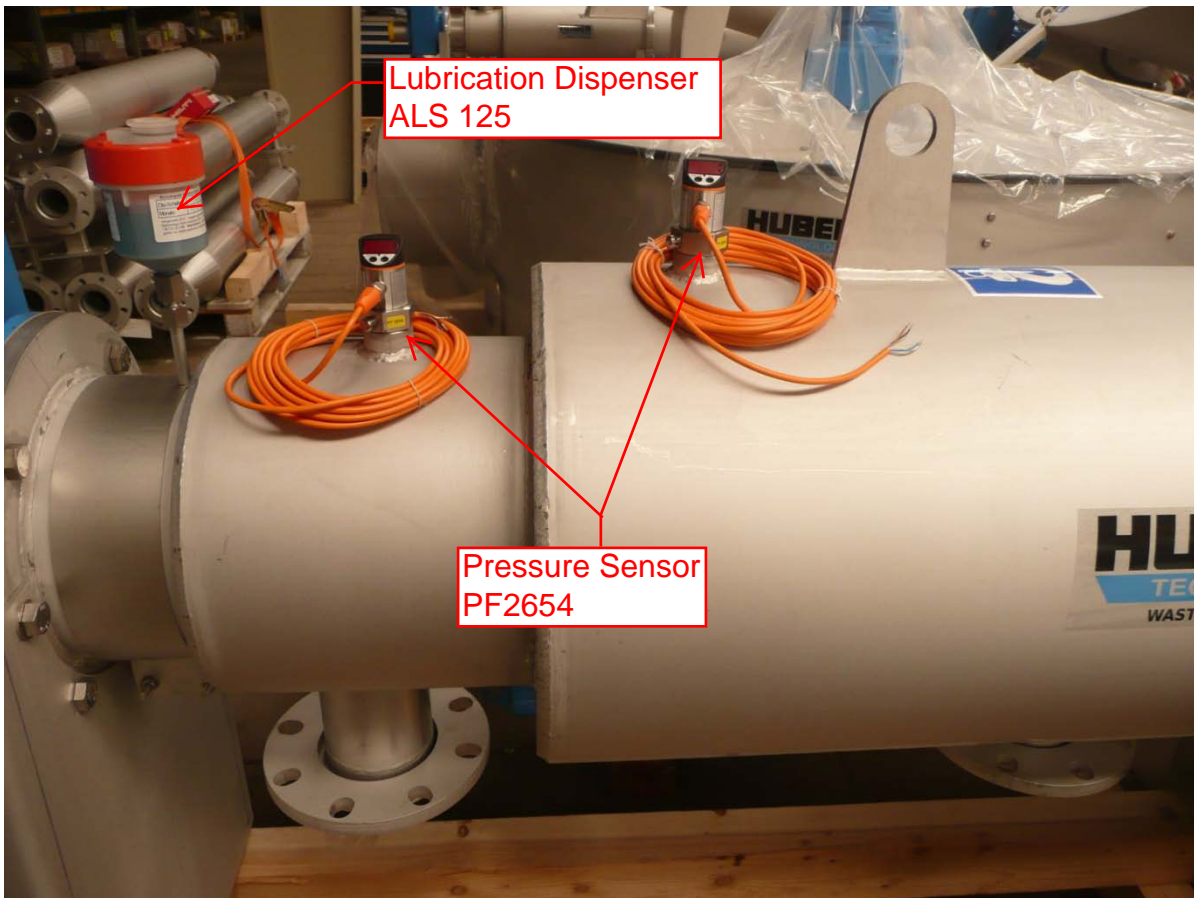


**Connect the wires together as indicated above for the voltages indicated. L1, L2, and L3 should be connected to wires 1, 2, and 3 in both cases.**

**The ground should be connected to the screw in the connection box.**

PRESSURE SENSOR  
LUBRICATION DISPENSER

APPENDIX INFORMATION



LUBRICATION DISPENSER  
ALS 125

APPENDIX INFORMATION

# Operating Instructions: ALS Type 125 Lubricator

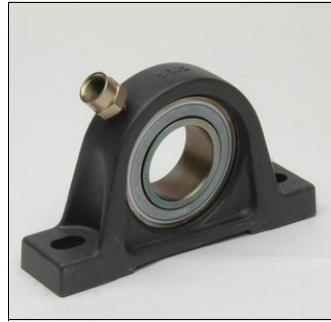
Electronically monitored greasing with microswitch setting



Pre-grease bearing with lever grease gun



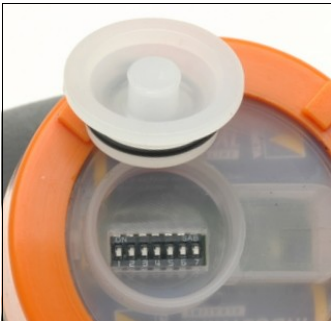
Remove grease nipple from bearing with wrench



Screw in adapter from G1/4 to M6x1, M8x1, M10x1, G1/8



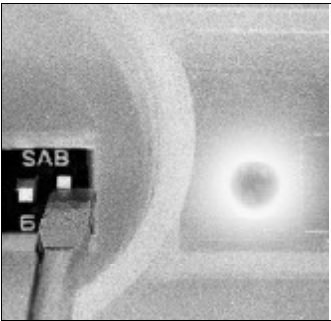
Screw on lubricator, standard thread G1/4



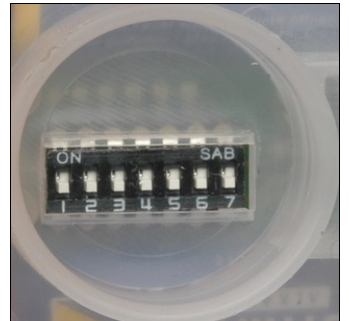
Remove protective lid and activate lubricator



Set DIP-switches to select grease discharge setting (see table)

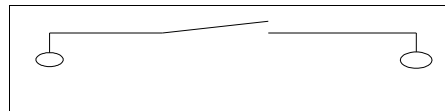


and select DIP-switch 7 to activate unit. Indicator light blinks approx. every 20 sec



To turn off: click all switches to bottom position

## Synchronisation with running machine



**Relay**

Settings of cable unit identical with standard-lubricator (see above). Extend cord and connect to limit switch or contactor with floating contact.

**No external power supply necessary.**

### Benefits:

- Varying of lubrication time or combinations of different grease discharge settings possible (see page 2 for setting combinations)
- Standard-type (without cable) with explosion-protection T3 resp. T4 (ATEX).

### Tip:

- Before screwing in the lubricator, make sure to pre-grease lubrication point first. With a grease gun for instance.
- Often a bearing is clogged or the grease inside has solidified. The pre-greasing ensures flawless and troublefree lubrication.

001

# **ALS Lubricators**

## **Type 125 and Type 475**

### **Technical manual**



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- 1. Notes on manual**
- 2. Safety instructions**
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  - 3.4 Characteristics and features
  - 3.5 Setup and operation
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- 6. Starting up**
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  - 6.4 Restart after idle time
  - 6.5 Synchronization with machine time
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- 7. Maintenance**
- 8. Accessories**
- 9. Dismounting and replacement**
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- 11. Troubleshooting**

## 1. Notes on manual

This manual contains important information regarding the ALS Lubricators Type 125 and Type 475 and serves the purpose to work conform with safety regulations of this product. This manual includes technical information about design, application, installation and disposal of ALS Lubricators. If you have any more questions, please contact ALS Automatic Lubrication Systems or an ALS distributor.

Following terms are used in this manual:

- Type 125: 100 cm<sup>3</sup> content
- Type 475: 460 cm<sup>3</sup> content

## 2. Safety instructions

These safety instructions do not claim to be exhaustive. If you have questions, comments or problems, please contact ALS Automatic Lubrication Systems, henceforth referred to as ALS. The ALS Lubricator has been manufactured according to today's state of the art technology and recognized safety regulations. It is imperative that the following safety instructions and warnings in this manual are observed in order to avoid possible personal injury or property damage.

- Please read this manual carefully before ALS Lubricator is put into operation.
- When reselling product, the technical manual must be sent with.
- The ALS technical manual can be downloaded from the ALS web page <http://www.als-info.com>
- The ALS technical manual is available in German and English. Distributors from other than English-speaking countries are obliged to translate the content correctly into respective language.

### 2.1 Application

- The ALS Lubricator is a technical working appliance, which was developed to counter abrasion and friction of machine components with systematic lubrication.
- The ALS Lubricator contributes to the safety of maintenance personnel, since automatic lubrication supply reduces the need to supervision potentially dangerous areas.
- The conventional application requires that this manual, especially chapter 2 regarding safety instructions, is completely read, understood and observed.
- The ALS Lubricator is a product in accordance with machinery directive 94/9/EG.
- Installation, starting up, operation and maintenance should be executed by qualified and trained personnel only. Qualified personnel must have fundamental mechanical skills, knowledge of respective technical terms as well as knowledge of engineering standards, regulations and accident control measures.

### 2.2 Warning notices and safety instructions

The warning notices in this manual warn of personal injury as well as property damage. Please take special notice of paragraphs that are marked with the symbol pictured below:



- Identifies danger for people's health that can lead to personal injuries.

### General safety instructions:

- Please observe country-specific regulations for accident prevention, environment protection and working environment.
- Use ALS Lubricator only if technical condition is impeccable.
- Check product for defects before use.
- The ALS Lubricator and its components must not be altered, opened or remodeled. Otherwise manufacturer warranty will expire.



- Opening of top cover, which is found on the up side of lubricator or removal of orange ring must only be carried out by qualified personnel.
- Please take note of safety data sheets for oils and greases.
- Use ALS Lubricator only in application area as indicated in technical data.
- Warranty voids if installation is faulty, device is not applied accordingly and/or operated inappropriately.
- Always cut off current supply before installation and/or dismantling.

### Safety instructions regarding handling of batteries:

- Battery substances must not come into contact with eyes, skin and clothing!
- Do not swallow leaking battery substances!
- Take note of safety data sheets!



- Temperature specifications of the batteries must be heeded. Do not throw into open fire!
- Do not open batteries!
- Do not recharge batteries!
- Do not use batteries other than specified by manufacturer!
- Batteries have to be disposed of according to country regulations!

### Safety instructions regarding installation and operation:



- Always wear protective gloves, protective clothing and eye protection during installation.
- During installation make sure that ALS lubricator and components are securely installed.
- During installation and maintenance on machines and systems the safety instructions and according operating instructions have to be observed at any time.
- Make sure that all gaskets and sealings have been correctly installed and are undamaged to prevent any intrusion of foreign substances.



- Make sure that all electrical connections are allocated or closed. Only operate when product is completely installed.

- Check lubricant feeding.

#### Safety instructions regarding maintenance:



- Do not use solvents or aggressive cleaning agents on ALS Lubricators.

- Avoid electrostatic charge by cleaning the ALS Lubricator with minimum pressure and an anti static cloth from the outside.

- The disposal of ALS Lubricators must be done according to country-specific regulations.

#### Operator's duties:

The operator of ALS Lubricators must keep his/her personnel updated on following topics:

- Observation and application of operating manual as well as legal requirements.
- Application of ALS Lubricator in accordance with intended operation and application.
- Observation of security instructions and operator's directives.
- Emergency procedures

### 2.3 Certificates

Our products have been tested by following testing institutes:

- The Fraunhofer Institute for Interfacial Engineering and Biotechnology
- FMPA Forschungs- und Materialprüfungsanstalt Baden-Württemberg (material testing laboratory)
- Bergbau-Versuchsstrecke BVS  
Institute for explosion protection for mines  
Certificate of conformity
- Testing laboratory ELMAC GmbH  
CE inspection document no. 76087-1BCD
- Physikalisch-Technische Bundesanstalt (PTB)  
Certificate of conformity
- EXAM BBG Prüf- und Zertifizier GmbH  
EC-Type Examination Certificate for potentially explosive areas.  
ATEX BVS 03 E 223 guideline 94/9/EG

### 3. Product description

#### 3.1 General

The ALS Lubricator is an electronically monitored lubricator, which is powered electrochemically and supplies lubricating points with oil or grease autonomously. The ALS Lubricator is simply screwed into the tapped bore of the previously removed greasing nipple or onto an extension line and dispenses the desired lubricant quantity according to the DIP-switch settings.

The ALS Lubricator is available in 2 sizes:

Description	Volume
ALS Type 125	100 cm <sup>3</sup>
ALS Type 475	460 cm <sup>3</sup>

The ALS Lubricator is also available with level control sensor and/or cable connection. For more detailed information, please take a look at page 12 „synchronization with machine running time“ and page 15 „accessories“.

#### 3.2 Employment

The ALS Lubricator is especially suitable for single point lubrication and/or lubrication points which are difficult to access. It is applicable on following lubricating points:

- rolling bearings and plain bearings
- linear guidances
- shafts and spindles
- chains and ropes
- gaskets
- open gear units

#### 3.3 Technical data

Type	125	475
Capacity	100 cm <sup>3</sup>	460 cm <sup>3</sup>
Dimensions: height x diameter	100 x 80 mm	150 x 115 mm
Connecting threads	G ¼	G ½
Net weight	ca. 230 g	ca. 570 g
Pressure	ca. 0,2 – 3 bar	ca. 0,2 – 3 bar
Operational voltage	3 V	3 V
Battery capacity	3000 mAh	6000 mAh
IP	64	64
Battery (standard)	Varta Electric Power 4006	Varta Electric Power 4006
Temperature range (approx.)	-30°C to +60°C	-30°C to +60°C
Relative humidity	30-80%, not condensing	30-80%, not condensing
Lubricating time, setting range	14 days to 18 months	14 days to 18 months
Ex-protection	BVS 03 ATEX E 223	BVS 03 ATEX E 223
Labeling	II 2G EEx ib IIC T4/T3 I m <sup>2</sup> EEX ib I (not with cable connection)	II 2G EEx ib IIC T4/T3 I m <sup>2</sup> EEX ib I (not with cable connection)

Considered standards and guidelines:

RL 94/9/ EG	Machines and protective systems according to the intended application in potentially explosive areas.
RL 98/37 EG	„Safety of machines“
RL 97/23 EG	„Safety of pressure equipment“
RL 89/336 EWG	„Electromagnetic compatibility“ EMV guideline

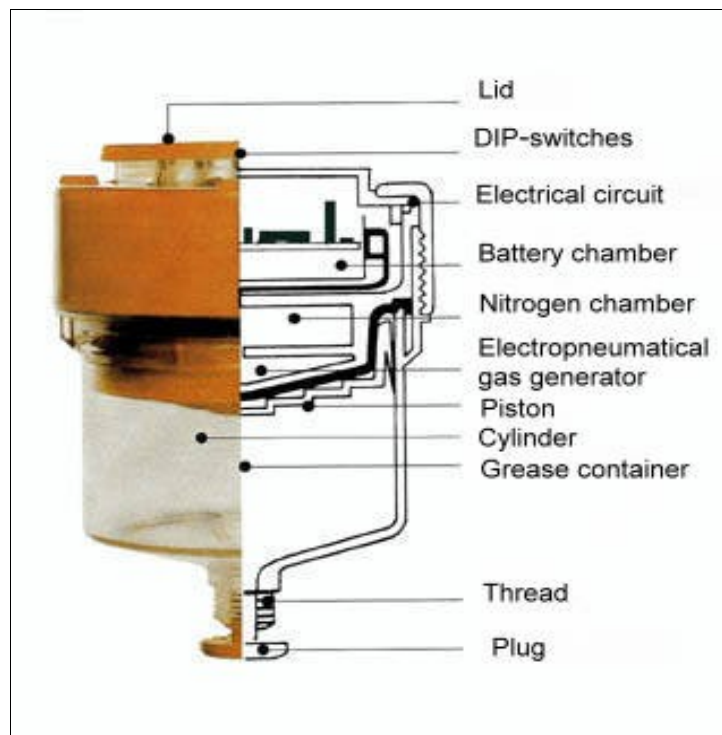
### 3.4 Characteristics and features

- ALS Lubricators are available empty or filled. Lubricant can be supplied by customer or ALS.
- Variable setting of lubricating period and/or lubricant quantity via DIP switches.
- Function control by means of red signal light (LED).
- Consistent pressure build-up from 0,2 bar to 3 bar.
- Weatherproof, splash-proof, corrosion-resistant.
- Temperature resistant from -30°C to +60°C.
- Visual control of fill level.
- Optional synchronization with machine running time.
- ALS Lubricators are explosion proof (models with cable connection excluded).
- Mountable in any required position.
- Optional design for underwater and wet areas.
- Simple and easy exchange of used lubricator with new one.
- ALS Lubricators are refillable and can be reused after exchange of battery chamber.
- Cost saving compared to manual lubrication.
- Increased productivity through reduced maintenance idle times of machines and systems.
- Increased operational safety.
- Bearing is sealed, as soon as ALS Lubricator is screwed in. Dust and moisture cannot penetrate bearing.
- Lubrication point and surroundings stay clean.

### 3.5 Setup and operation

The lubricator is activated with DIP switch no. 7. When the contact is closed an electro-chemical reaction is set off whereby nitrogen as an intermediate product is produced. This leads to a pressure build-up within the hermetically sealed nitrogen chamber. The built-up pressure is applied from bellows to piston. The piston experiences pressure and pushes out lubricant. The setting of the DIP switches determines how much lubricant is dispensed. There is a red signal light (LED) on top of the lubricator, which starts blinking in regular intervals of 30 s once the lubricator is activated and the circuit is closed. The signal light shows that the ALS Lubricator is in working order.

Cross section:



### 3.6 Liability

The information, data and guidelines in this technical manual corresponded to the latest status at the time of publication. Information, images and descriptions can differ from already delivered lubricators. Claims based on that cannot be asserted.

ALS is responsible for replacement of lubricator if product shows defects, technical changes excluded. Any further claims of the purchaser, especially claims for damages are excluded in as far as ALS did not cause the damage deliberately or grossly negligent. ALS will not assume liability for damages and breakdowns which are caused by inappropriate handling, improper application or disregard of the operating manual of the ALS Lubricator.

## 4. Storage



- storage conditions for ALS lubricator and its components:
  - relative humidity 30-80%, not condensing
  - no exposure to direct sunlight
  - storage temperature -10°C to +20°C
  - recommended storage time max. 3 months after purchase



- lubricant can leak out when not stored properly.
- store ALS lubricator with opening pointing downward.
- test ALS lubricator for leak tightness before storage.
- wrong storage can be cause for malfunctioning.

## 5. Installation



- Before installing ALS Lubricator on bearing, use standard grease gun and pump lubricant into bearing to remove any old and/or resinified grease. Remove greasing nipple.



- Now screw ALS lubricator into bearing. If you require a reducing piece from G1/4 to M 6x1, M 8x1, M 10x1 or G1/8 you will find a large selection in our ALS product catalog. If a remote installation to the lubricating point is required it should be prefilled with the same lubricant that will be used within the lubricator



- Remove protective lid and activate lubricator by setting desired DIP switch combinations and DIP switch 7. The lubrication takes place according to setting times (see page 13).

If operating temperatures should exceed +60°C, lubricator needs to be removed from heat source and connected via tubes. It is recommended to use pipe clamps for the fixation of ALS lubricators on machines, walls or similar. (see accessories page 15)

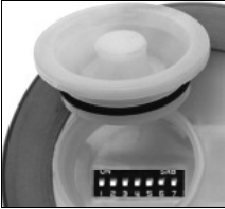


- ALS Lubricator may only be installed by qualified personnel (see general safety instructions, page 3).
- Always wear protective gloves, protective clothing and eye protection when installing).
- do not install ALS lubricator near vibration sources.
- do not install ALS lubricator near heat sources.
- When installing ALS lubricator outdoors, it is recommended to use protective cap.
- Do not install ALS lubricator in vicinity of electro-magnetic areas.

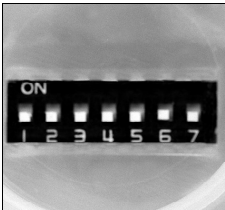
## 6. Starting up

### 6.1 Starting up ALS lubricator

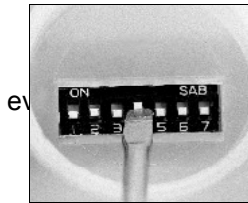
Before installing the ALS Lubricator, the lubricating point has to be pregreased using a hand grease gun in order to remove possible blockages or resinified oil or grease.



When the lubricator is installed on the lubricating point, take off the protective lid and switch on the lubricator. Therefore activate the DIP switches according to following instructions:



The labeling „ON“ only specifies the direction that one has to operate the switches in order to activate the lubricator. It does not describe the functioning of DIP switch 1. Switch all DIP switches into the „ON“ position (no. 1 – 7)  
The circuit is now closed and the pressure build-up is activated. This takes about 6-8 hours. As soon as lubricant is coming out, return DIP switches 1-6 into original position. DIP switch 7 stays in „ON“ position.



Select desired dispensing time and amount of lubricant required via the respective DIP switches (see table, page 13-14). A red signal light on top of the lubricator flashes about 30 sec. Replace protective lid on DIP switches. The lubricator is now activated.



- Check ALS Lubricator for exterior damages.
- Check installation of ALS lubricator.
- Check lubricant level regularly.
- Check whether setting of DIP switches is correct.
- Shield from direct excessive heat.

### 6.2 Application of extension lines

If extension lines to lubricating points should be necessary, prefill with same lubricant that is used for ALS lubricator. Do not mix different greases or oils!

Lubricant	max. length of line	min. inner diameter of line
Grease, paste	0,5 m	6 mm
Oil	2 m	6 mm

Length of feed lines always depends on penetration of grease and respectively viscosity of oil.

Apply only one ALS lubricator per lubricating point. If lubricating point requires more lubricant, use T-piece with 2 ALS lubricators.

### 6.3 Application of lubricants

ALS lubricators are available either empty or filled with lubricant. ALS lubricators can be filled with greases of NLGI class 2 and/or oils with viscosity ISO VG 46 to ISO VG 3000.

NOTE: oil filling: increase running time of lubricator to 44% more. In addition, install check valve with 0,2 bar in front on lubrication point. This keeps lines from emptying too fast.

Below, you will find a selection of standard lubricants which cover most applications. For further information regarding the right choice of lubricant or queries regarding special fillings, please do not hesitate to contact us.

Listing of standard greases and oils:

Product name	NLGI class / viscosity at 40°C	Temperature range / pourpoint	description
Multi-purpose grease	2	-30°C to +150°C	For rolling and plain bearings subject to changes in temperatures.
High temperature grease	1-2	-10°C to 180°C	For rolling and plain bearings subject to high operating temperatures.
Low temperature grease	2	-50°C to 150°C	For rolling and plain bearings subject to low temperatures.
Fluid grease	0	-20°C to 90°C	For single-line operation as well as central lubrication systems.
Bio-degradable grease	2	-20°C to 110°C	Non-polluting grease on plant-based oils.
Food grade grease USDA H1	1	-40°C to +180°C	Neutral in terms of color, smell and taste.
Multi-purpose oil 46	46	-24°C	Universally applicable hydraulic oil.
Slideway oil 220	220	-21°C	Non-aging oil with excellent adhesion properties.
Slideway oil 68	68	-27 °C	Non-aging oil with excellent adhesion properties.
Food grade oil USDA H1	220	-33°C	Neutral in terms of color, smell and taste.
Bio-degradable oil	68	-30°C	For almost all hydraulic systems, especially environment friendly.

### 6.4 Restart after idle time

The built-up pressure within the battery chamber is sustained for about 5 days. After restart of ALS lubricator, lubrication commences with a small time delay.

- Set DIP switch 7 in „ON“ position.
- Red signal light flashes.
- Reset lubrication time if necessary.

## 6.5 Synchronization with machine time

The ALS Type 125 cable lubricator is designed for machines with longer idle times. For example harvesters which are used during harvest season or emergency power units with limited running time. The ALS Type 125 cable lubricator is applied on machines which have idle times of approximately one week minimum to a maximum idle time of approximately 6 months. Longer idle times are possible but depend on individual appliances and circumstances. More details on demand.

### Installation:



The ALS Type 125 Cable Lubricator comes with a double-pole cable with angle plug and a water resistant, protective plastic cap. Once lubricator is installed on machine, the cable is connected to the machine switchboard.

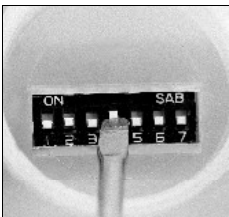
Requirement: potential-free contact (NOC).

No additional power supply necessary. Cable connection only through qualified personnel for reasons of safety and warranty. Recommended cable extension from lubricator to machine switchboard 5 meter. Keep away from disruptive sources such as strong electric motors or magnets.



- No ATEX explosion protection for lubricators with cable connection.
- Do not use additional external power supply!
- Connection of ALS Lubricator only to potential-free contact.
- Keep cables away from disruptive sources such as strong electric motors or magnets.

## 6.6 Setting of lubricant discharge



Start-up ALS lubricator as described in 6.1 and activate DIP switch combination according to desired lubricant discharge or discharge time.

NOTE: Lubricant output or discharge time can be reset at any time, even during the continuous operation of ALS lubricator.

- Running time and lubricant output of ALS lubricator can vary, if average temperature changes.
- Short-term changes in temperature have only little or no impact on total running time of ALS lubricator.
- Find DIP switch combinations for just the right lubricant discharge and/or lubricating time for ALS lubricators Type 125 and Type 475 on following pages.

**ALS lubricator Type 125**

DIP switch position	daily lubricant discharge	lubrication time
7	Switch for „ON“. Signal light flashes in short intervals.	
6	0,175 cm <sup>3</sup>	18 months
5	0,35 cm <sup>3</sup>	12 months
4	0,70 cm <sup>3</sup>	6 months
3	1,30 cm <sup>3</sup>	3 months
2	2,10 cm <sup>3</sup>	2 months
1	4,00 cm <sup>3</sup>	1 month
All switches activated	9,00 cm <sup>3</sup>	14 days
<b>Further combinations</b>		
5 + 4	1,05 cm <sup>3</sup>	121 days
5 + 3	1,74 cm <sup>3</sup>	71 days
4 + 3	2,08 cm <sup>3</sup>	57 days
5 + 4 + 3	2,35 cm <sup>3</sup>	51 days
5 + 2	2,45 cm <sup>3</sup>	52 days
4 + 2	2,60 cm <sup>3</sup>	45 days
3 + 2	3,48 cm <sup>3</sup>	35 days
5 + 3 + 2	3,83 cm <sup>3</sup>	28 days
4 + 3 + 2	4,16 cm <sup>3</sup>	30 days
5 + 4 + 3 + 2	4,53 cm <sup>3</sup>	27 days
4 + 1	4,80 cm <sup>3</sup>	24 days
3 + 1	5,56 cm <sup>3</sup>	23,5 days
2 + 1	6,26 cm <sup>3</sup>	20 days
5 + 2 + 1	6,61 cm <sup>3</sup>	19 days
3 + 2 + 1	7,65 cm <sup>3</sup>	17 days
5 + 3 + 2 + 1	8,00 cm <sup>3</sup>	16 days
4 + 3 + 2 + 1	8,33 cm <sup>3</sup>	15 days
5 + 4 + 3 + 2 + 1	8,70 cm <sup>3</sup>	14,5 days

ALS Lubricator Type 475

DIP switch position	daily lubricant output	lubrication time
7	Switch for „ON“. Red Signal light flashes in short intervals.	
6	0,60 cm <sup>3</sup>	18 months
5	1,20 cm <sup>3</sup>	12 months
4	2,50 cm <sup>3</sup>	6 months
3	4,50 cm <sup>3</sup>	3 months
2	7,50 cm <sup>3</sup>	2 months
1	14,00 cm <sup>3</sup>	1 month
All switches activated	34,00 cm <sup>3</sup>	14 days
<b>Further combinations</b>		
5 + 4	3,50 cm <sup>3</sup>	121 days
5 + 3	6,00 cm <sup>3</sup>	71 days
4 + 3	7,30 cm <sup>3</sup>	57 days
5 + 4 + 3	8,50 cm <sup>3</sup>	51 days
5 + 2	8,50 cm <sup>3</sup>	52 days
4 + 2	9,10 cm <sup>3</sup>	45 days
3 + 2	12,20 cm <sup>3</sup>	35 days
5 + 3 + 2	13,40 cm <sup>3</sup>	28 days
4 + 3 + 2	14,50 cm <sup>3</sup>	30 days
5 + 4 + 3 + 2	15,80 cm <sup>3</sup>	27 days
4 + 1	16,80 cm <sup>3</sup>	24 days
3 + 1	19,50 cm <sup>3</sup>	23,5 days
2 + 1	22,00 cm <sup>3</sup>	20 days
5 + 2 + 1	23,10 cm <sup>3</sup>	19 days
3 + 2 + 1	26,80 cm <sup>3</sup>	17 days
5 + 3 + 2 + 1	28,00 cm <sup>3</sup>	16 days
4 + 3 + 2 + 1	30,00 cm <sup>3</sup>	15 days
5 + 4 + 3 + 2 + 1	30,50 cm <sup>3</sup>	14,5 days

## 7. Maintenance

- ALS lubricator must not be opened!
- Make sure that lubricator is closed and sealed so no moisture can ingress during cleaning.
- Maintenance and cleaning of lubricator only on exterior of lubricator.
- Use damp cloth for cleaning of lubricator only.
- Do not use aggressive solvents or cleaning agents.
- Check lubricant level of ALS lubricator regularly.

## 8. Accessories

- Level control with sensor for ALS Type 125 and Type 475



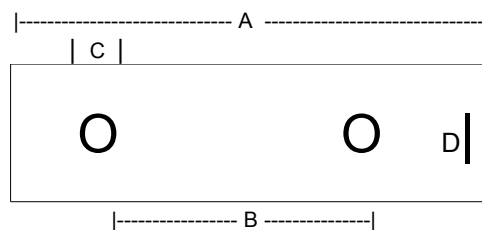
A magnetic ring is fit into the ALS cylinder. The magnetic sensor scans the piston level and delivers the signal "empty" to a signaling system. On transmitting signal "empty" about 5% lubricant is left in lubricator.

A lamp or a relay winding between Pin bk (black) and Pin bu (blue) could for instance be connected.

When circuit breaker is closed (yellow LED flashes), Pin bk (black) connects with + signal of voltage, max. power of 200mAH subject to 30 V. In this case lamps or relay windings between Pin Bk (black) and Pin Bu (blue) are supplied with current, which makes lamp flash or energizes relay.

When connecting relay, attach protection diode above relay winding. Thereby inductive voltage which is induced within relay is short circuited and can thereby not break down the switch (technical data on request).

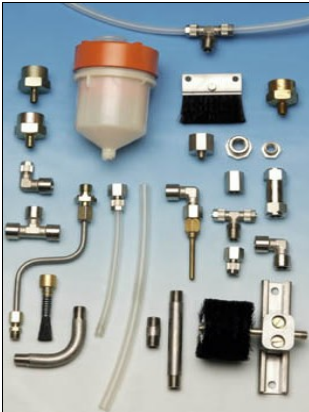
- Pipe clamp for fastening ALS Type 125 and Type 475



Fitting dimensions in mm

Type	A	B	C	D
125	112	95	6,5	16
475	128	105	8,5	25

- 
- Accessoires for ALS lubricator



ALS offers a wide variety of accessories for the ALS lubricator:

- fittings
- adapters
- bushings
- plastic- and high pressure hoses
- round brushes, flat brushes, roller brushes

For more information see ALS product catalog.

## 9. Dismounting and replacement

- Make sure lubricator and system are electroless and have zero-potential.
- Switch all DIP switches down (opposite of „ON“). Turn off lubricator.
- If lubricator is fastened with pipe clamp, loosen locking screw.
- Remove lubricator.
- Install new lubricator. Fasten locking screw.



- Avoid contact with lubricant. Lubricant can cause skin and mucosa irritations and can soil clothing.
  - Wear protective gloves, protective clothing and eye protection.
  - Outlet opening of used lubricator should face upwards when filled with oil and closed with sealing plug.
- 

## 10. Environment, disposal and recycling

- Dispose ALS Lubricators according to specific country regulations.
- Or sent ALS Lubricators back to ALS for disposal through certified waste management facility.
- Lubricant residues must be disposed of according to safety data sheet of respective lubricant.

## 11. Troubleshooting

Observation	possible causes	solution
No lubricant, LED does not flash	DIP-switch not activated	Set discharge time
	Lubricator empty	Change lubricator and/or refill
	Bearing is blocked	Grease bearing with grease gun or clean bearing
	Lubricator defect	Change lubricator, contact ALS
	Battery empty	Change lubricator, contact ALS
Water in lid	Formation of condensate	Change lubricator, send lubricator in for repair, contact ALS
	Aggressive cleaning through wet compressed air blasting	Change lubricator, send in lubricator for repair, contact ALS
Emptying of lubricator within short period of time	Wrong setting of DIP-switch combination	Adjust DIP-switch combination according to manual
Fill level doesn't change	Bearing is blocked	Grease bearing with grease gun or clean bearing
	DIP-switch not activated	Set desired DIP-switch combination
	Batteries empty	Change lubricator, send in lubricator for repair

The indications made represent the present state of development and knowledge of ALS Schmiertechnik. Subject to change. The products are subject to controls of manufacture and comply in full with the specifications set forth by our company, but due to the multitude of influencing factors, we cannot assume the warranty for the successful application in each individual case. Therefore, we recommend to perform field test. We strictly refuse any liability beyond replacement of lubricator.

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## PRESSURE SENSOR

PF 2654

## APPENDIX INFORMATION

Pressure sensors

**PF2654**

Combined pressure sensor  
PF26

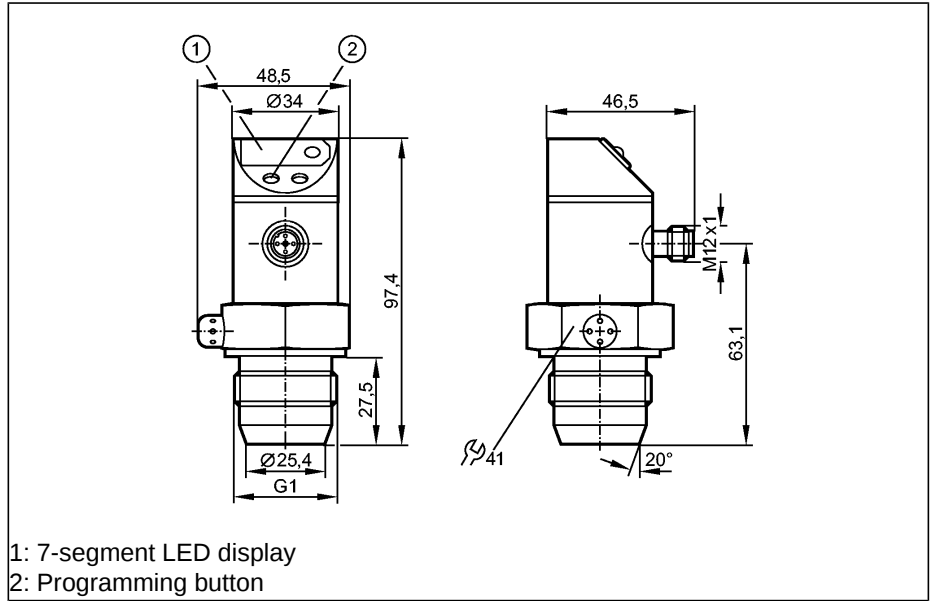
Connector  
Process connection G1 A

no dead space  
Freely rotatable housing 350°  
Zero and span adjustable  
Function programmable

2 outputs  
OUT1 = switching output  
OUT2 = switching output or analogue  
output

7-segment LED display

Measuring range  
-0.5...10 bar  
-7...145 PSI  
-50...1000 kPa



1: 7-segment LED display  
2: Programming button

Made in Germany



**Application**  
**Electrical design**  
**Output**

**Type of pressure: relative pressure**  
**Hygienic systems, viscous media and liquids with suspended particles**  
**Liquids and gases**  
**DC PNP/NPN**  
**2 x normally open / closed programmable or 1 x normally open / closed programmable + 1 x analogue (4...20 mA / 0...10 V; scaleable 1:4)**

Operating voltage	[V]
Current rating	[mA]
Short-circuit protection	
Reverse polarity protection	
Overload protection	
Integrated watchdog	
Voltage drop	[V]
Current consumption	[mA]

20...30 DC
2 x 250
pulsed
yes
yes
yes
< 2
< 60

Analogue output
Load for analogue output [ohms]
Pressure rating
Bursting pressure min.

4...20 mA / 0...10 V		
4...20 mA: max. (U <sub>b</sub> - 10 V) x 50 / 0...10 V: min. 2000		
50 bar	725 PSI	5000 kPa
150 bar	2175 PSI	15000 kPa

<b>Setting range</b>
Set point, SP
Reset point, rP
Analogue start point, ASP
Analogue end point, AEP
in steps of

-0.45...9.99 bar	-7 ...145 PSI	-45...999 kPa
-0.50...9.94 bar	-7 ...144 PSI	-50...994 kPa
-0.50...7.49 bar	-7 ...109 PSI	-50...749 kPa
2.00...9.99 bar	29 ...145 PSI	200...999 kPa
0.01 bar	1 PSI	1 kPa

Programming options

hysteresis / window function; N.O. / N.C; output polarity; current / voltage outputs; damping; calibration of displayed values; display can be rotated / deactivated; display unit

<b>Accuracy / deviations (in % of the span)</b>
<b>Turn down 1:1</b>
Characteristics deviation *)
Linearity

< ± 0.6
< ± 0.5

**PF2654**

Hysteresis	< ± 0.1
Repeatability **)	< ± 0.1
Long-term stability ***)	< ± 0.1
Temperature coefficients (TEMPCO) in the temperature range 0...80° C (in % of the span per 10 K)	
Greatest TEMPCO of the zero point	< ± 0.1
Greatest TEMPCO of the span	< ± 0.2

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**PF2654**

Power-on delay time [s]	0.2
Min. response time switching outputs [ms]	3
Damping for the switching output (dAP) [ms]	0; 10; 20;...100; 200;...4000
Switching frequency [Hz]	≤ 170
Response time analogue output [ms]	3
Damping for the analogue output (dAA) [ms]	0; 100; 500; 2000
Display unit	bar, PSI, kPa
Ambient temperature [°C]	-25...80
Medium temperature [°C]	-25...80
Storage temperature [°C]	-40...100
Protection	IP 67, III
Insulation resistance [MΩ]	> 100 (500 V DC)
Shock resistance	DIN IEC 68-2-27:50 g (11 ms)
Vibration resistance	DIN IEC 68-2-6:20 g (10...2000 Hz)
Switching cycles min.	100 million
EMC	EN 61000-4-2 ESD: 4 kV CD / 8 kV AD EN 61000-4-3 HF radiated: 10 V/m EN 61000-4-4 Burst: 2 kV EN 61000-4-6 HF conducted: 10 V
Housing materials	stainless steel 316L / 1.4404; PBT (Pocan); PC (Makrolon); PEI; EPDM/X (Santoprene); FPM (Viton)
Materials (wetted parts)	stainless steel 316L / 1.4404; ceramics (99.9 % Al <sub>2</sub> O <sub>3</sub> ); PTFE
Display	Switching status 2 x LED red Function display 7-segment LED display Measured values 7-segment LED display
Connection	M12 connector; gold-plated contacts
Weight [kg]	0.361
Remarks	*) linearity, incl. hysteresis and repeatability; (limit value setting to DIN 16086) **) with temperature fluctuations < 10 K ***) in % of the span per year The 3A authorisation is only valid if adapters with 3A authorisation are used for installation.

**Wiring**

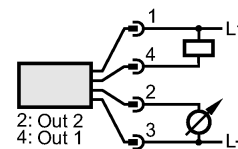
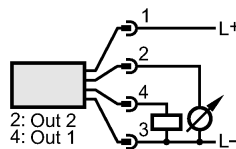
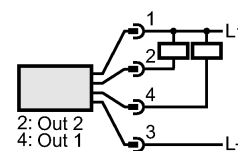
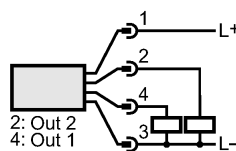
Programming of the output function (OUT1 / OUT2):

- Hno = hysteresis / normally open
- Hnc = hysteresis / normally closed
- Fno = window function / normally open
- Fnc = window function / normally closed

Complementary outputs:  
output 1: = Hno, output 2: = Hnc  
(with the same SP / rP)

Programming of the analogue output (OUT2):

- I = current output (4...20 mA)
- U = voltage output (0...10 V)



ifm electronic



**Bedienungsanleitung  
Operating instructions  
Notice utilisateurs**

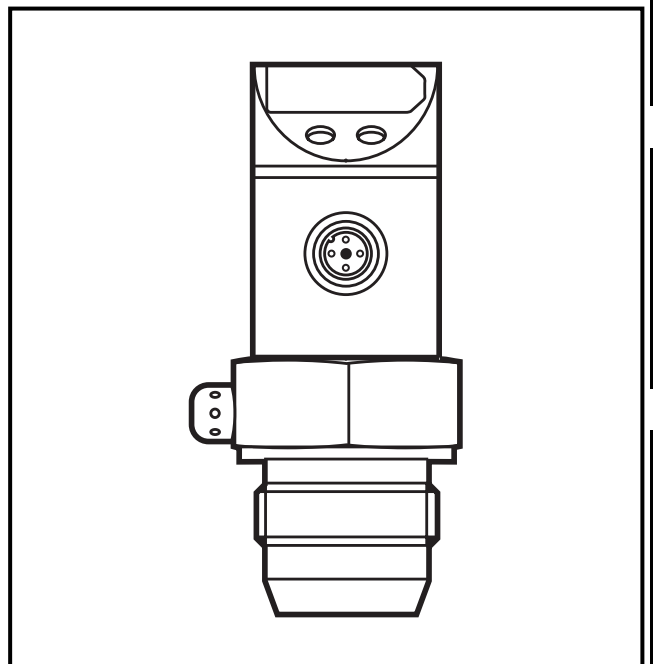
**efector<sup>®</sup>500<sup>®</sup>**

**Elektronischer  
Drucksensor**

**Electronic pressure  
sensor**

**Capteur de pression  
électronique**

**PF26**



**DEUTSCH**

**ENGLISH**

**FRANÇAIS**

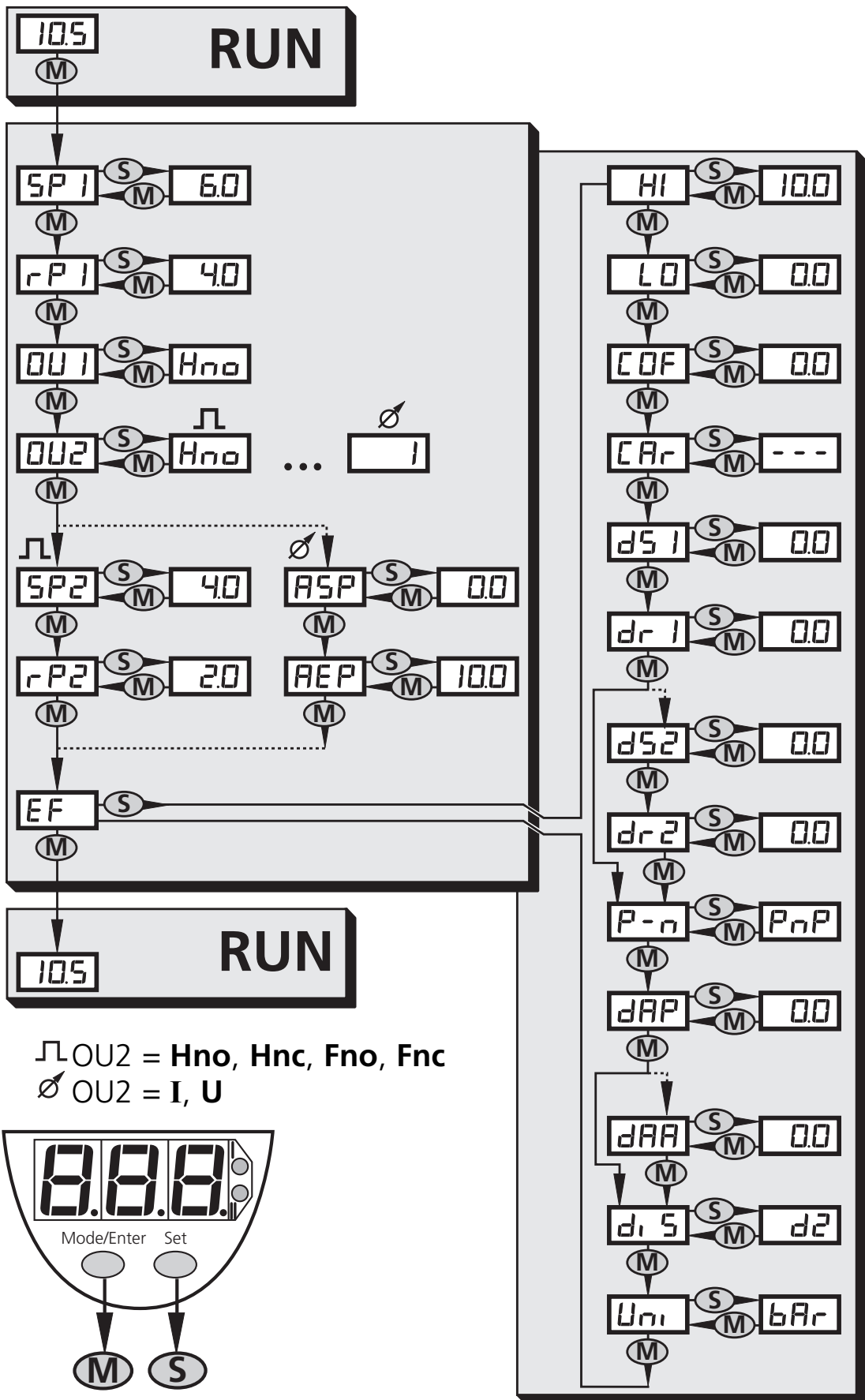
Sachnr. 704002/00 10/05

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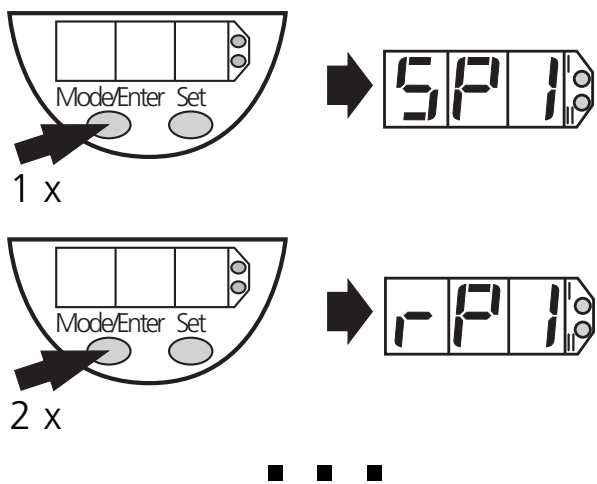
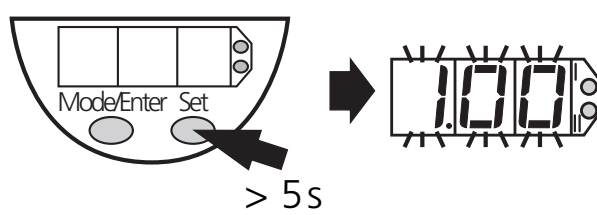
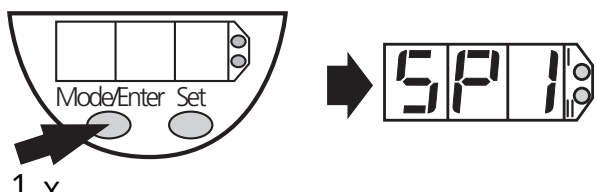
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# Menü-Übersicht / Menu structure / Structure du menu



## Programmieren / Programming / Programmation

<b>1</b>	 <p style="text-align: center;">■ ■ ■</p>	<p>Parameter aufrufen Select parameters Sélectionner les paramètres</p>
<b>2</b>		<p>Werte einstellen* Set Values* Régler la valeurs*</p>
<b>3</b>		<p>Werte bestätigen Acknowledgement of values Confirmer la valeur</p>

\*Wert verringern: Lassen Sie die Anzeige bis zum maximalen Einstellwert laufen. Danach beginnt der Durchlauf wieder beim minimalen Einstellwert.

\*Decrease the value: Let the display of the parameter value move to the maximum setting value. Then the cycle starts again at the minimum setting value.

\*Réduire la valeur du paramètre: Laisser l'affichage de la valeur du paramètre aller jusqu'à la valeur de réglage maximum. Ensuite le cycle recommence à la valeur de réglage minimum.

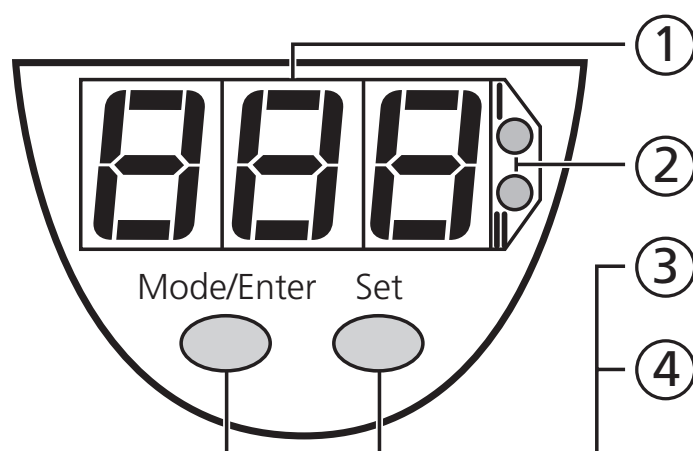
## Safety instructions

**Read the product description before installing the unit. Ensure that the product is suitable for your application without any restrictions.**

**Non-adherence to the operating instructions or technical data can lead to personal injury and/or damage to property.**

**In all applications check compliance of the product materials (see Technical data) with the media to be measured.**

## Controls and indicating elements



<b>①</b>	7-segment display	Display of the system pressure <sup>1)</sup> , display of parameters and parameter values.
<b>②</b>	2 x LED red	Switching status; lights if output I / II has switched.
<b>③</b>	Mode / Enter button	Selection of the parameters and acknowledgement of the parameter values.
<b>④</b>	Set button	Setting of the parameter values (scrolling by holding pressed; incremental by pressing briefly).

<sup>1)</sup> 3-digit display in the minus range: **-XX = -0,XX**

## Function and features

- The pressure sensor **detects the system pressure**,
- shows the current system pressure on its **display**,
- and generates **2 output signals** according to the set output configuration.

	Output 1	Output 2
Analogue output (only output 2)		<b>I:</b> 4 ... 20 mA
		<b>U:</b> 0 ... 10 V
Switching function (output 1 and output 2; function can be selected for each output separately)	hysteresis function / N.O. ( <b>Hno</b> )	
	hysteresis function / N.C. ( <b>Hnc</b> )	
	window function / N.O. ( <b>Fno</b> )	
	window function / N.C. ( <b>Fnc</b> )	
Output polarity (applies to both switching outputs)	p-switching ( <b>PnP</b> )	
	n-switching ( <b>nPn</b> )	

### Applications (Type of pressure: relative pressure):

Order no.		Measuring range	Permissible overl. pressure	Bursting pressure
PF2653	bar	-1.0 ... 25	100	350
	PSI	-15 ... 363	1 450	5 070
	MPa	-0.1 ... 2.5	10	35
PF2654	bar	-0.5 ... 10	50	150
	PSI	-7 ... 145	725	2 175
	kPa	-50 ... 1 000	5 000 (5 MPa)	15 000 (15 MPa)
PF2656	bar	-0.13 ... 2.50	20	50
	PSI	-1.8 ... 36.3	290	725
	kPa	-13 ... 250	2 000 (2 MPa)	5 000 (5 MPa)
PF2657	mbar	-50 ... 1 000	10 000 (10 bar)	30 000 (30 bar)
	PSI	-0.7 ... 14.5	145	450
	kPa	-5.0 ... 100	1 000 (1 MPa)	3 000 (3 MPa)
PF2609	bar	-0.99 ... 1.00	20	50
	inHg	-30 ... 30	590	1 475
	kPa	-99 ... 100	2 000 (2 MPa)	5 000 (5 MPa)



Avoid static and dynamic overpressure exceeding the given over-load pressure.

Even if the bursting pressure is exceeded only for a short time the unit can be destroyed (danger of injuries)!

## Operating modes

### Run mode

Normal operating mode

At power on the unit is in the Run mode. It carries out its measurement and evaluation functions and provides output signals according to the set parameters.

The display shows the current system pressure (can be deactivated; → page 30). The red LEDs indicate the switching state of the outputs.

### Display mode

Indication of parameters and the set parameter values

When the "Mode/Enter" button is pressed briefly, the unit passes to the Display mode which allows parameter values to be read. The internal sensing, processing and output functions of the unit continue as if in Run mode.

- The parameter names are scrolled with each pressing of the "Mode/Enter" button.
- When the "Set" button is pressed briefly, the corresponding parameter value is displayed for 15s. After another 15s the unit returns to the Run mode.

### Programming mode

Setting of the parameter values

While viewing a parameter value pressing the "Set" button for more than 5s causes the unit to enter the programming mode. You can alter the parameter value by pressing the "Set" button and confirm the new value by pressing the "Mode/Enter" button. The internal sensing, processing and output functions of the unit continue as if in Run mode with the original parameter values unless a new value is confirmed. The unit returns to the Run mode when no button has been pressed for 15s.

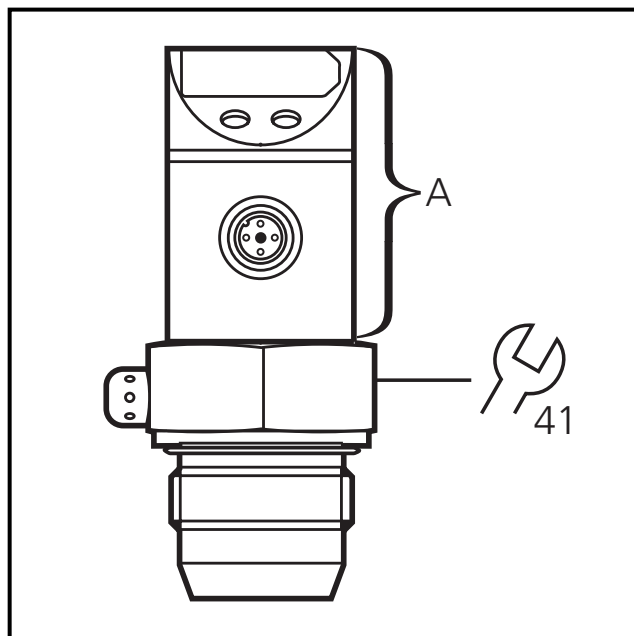
## Installation

 Before mounting and removing the sensor, make sure that no pressure is applied to the system.

1. Screw the sensor into a G1 process fitting.
2. Tighten the sensor with a spanner.

**Tightening torque: 20 Nm.**

The housing (A) is freely rotatable.



The unit is adaptable for various **G1 process fittings** (G1 adapters to be ordered separately as accessories).

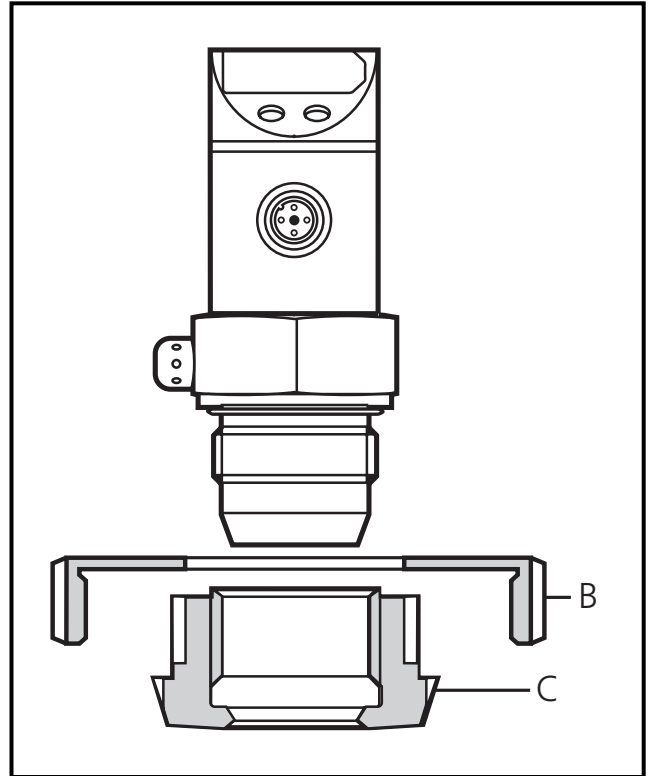
### **Welding adapter**

Weld the adapter first. Then mount the sensor.

## ifm process adapter

Mount adapter (C) to the sensor first, then sensor + adapter to the process connection by means of a nut, a clamping flange or similar (B).

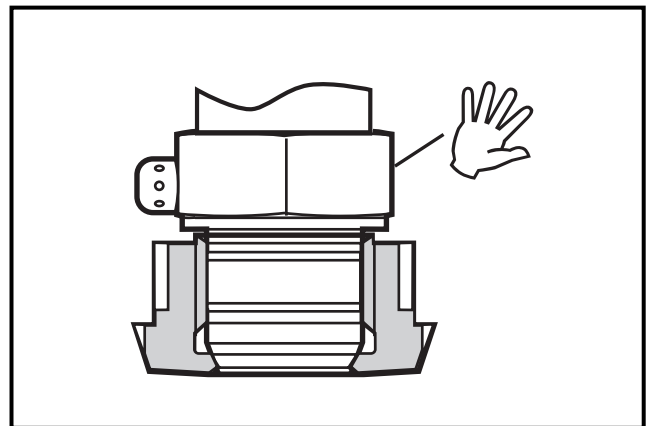
**NOTE:** A guarantee for a long-term stable sealing of the metal seal is only valid for once-only mounting.



## Mounting of the adapter

### Step 1

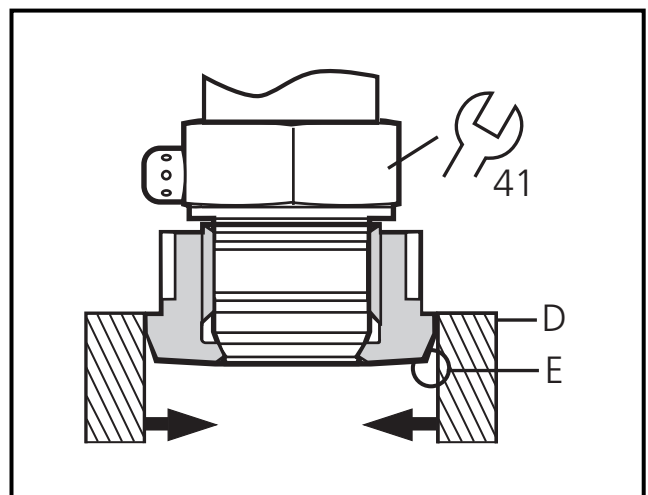
Screw the sensor into the adapter.



### Step 2

Clamp sensor and adapter into a clamping device (D). The sealing chamfers (E) must not be damaged. Tighten the sensor with a spanner.

**Tightening torque: 20Nm.**

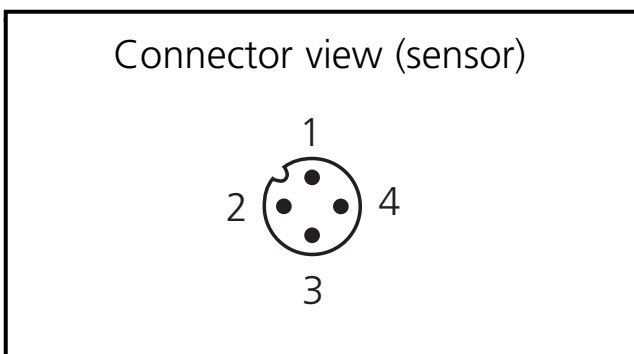
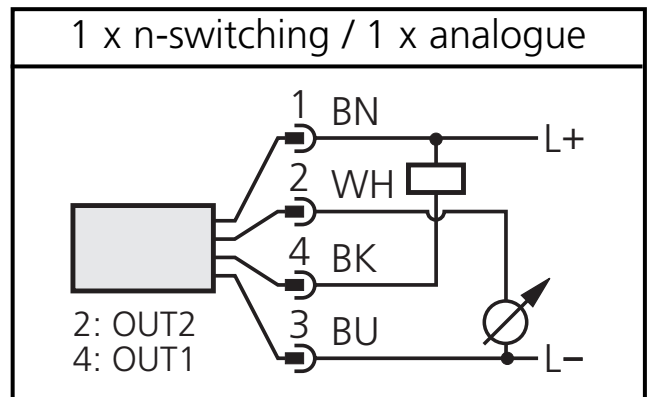
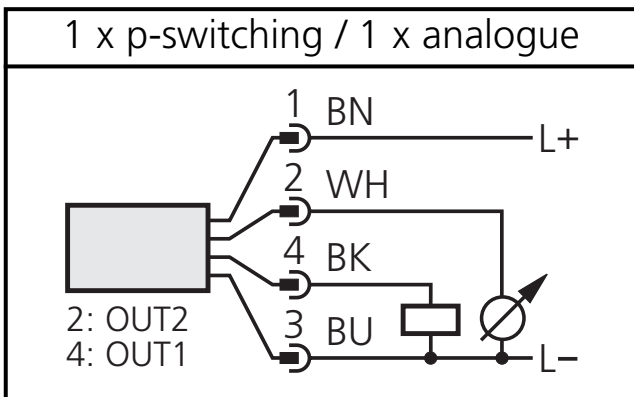
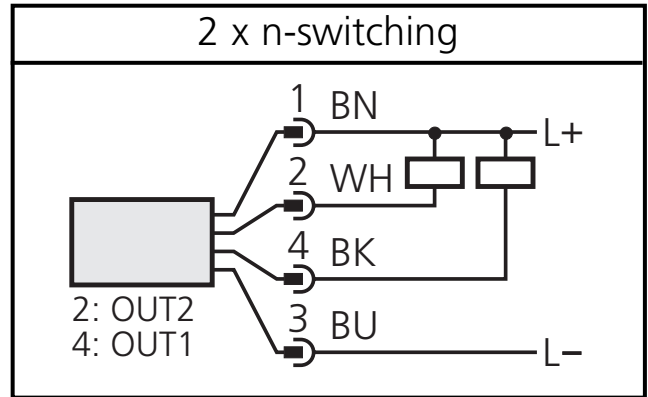
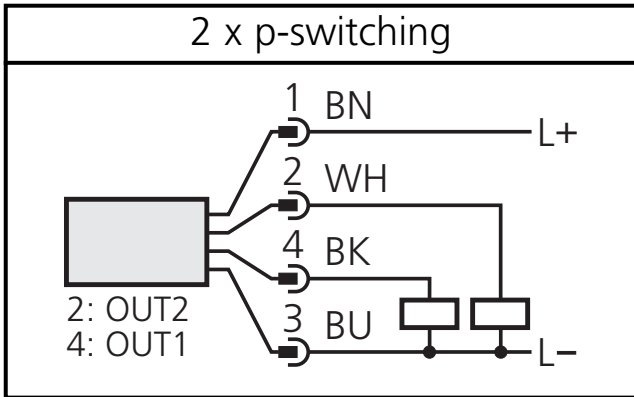


## Electrical connection



The unit must be connected by a suitably qualified electrician. The national and international regulations for the installation of electrical equipment must be observed. Voltage supply to EN50178, SELV, PELV.

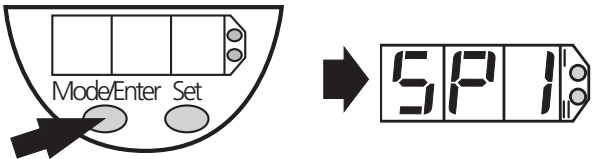
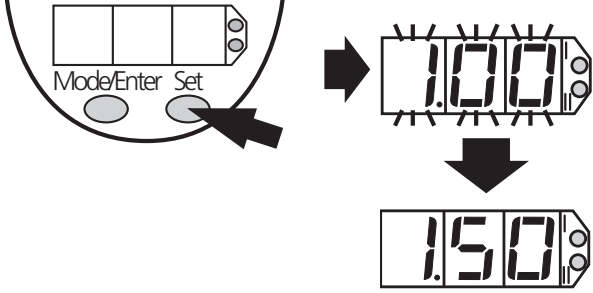
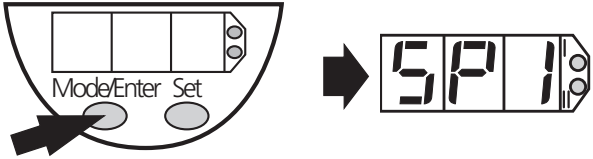
Disconnect power before connecting the unit as follows:



Core colours of ifm sockets:

- 1 = BN (brown),
- 2 = WH (white),
- 3 = BU (blue),
- 4 = BK (black).

## Programming

1		<p>Press the <b>Mode/Enter</b> button several times until the <b>respective parameter</b> is displayed.</p>
2		<p>Press the <b>Set</b> button and keep it pressed. The current <b>parameter value flashes</b> for 5s, <b>then the value is increased*</b> (incremental by pressing briefly or scrolling by holding pressed).</p>
3		<p>Press the <b>Mode/Enter</b> button <b>briefly</b> (= acknowledgement). The parameter is displayed again, the set <b>parameter value becomes effective</b>.</p>
4	<p><b>Change more parameters:</b> Start again with step 1.</p> <p><b>Finish programming:</b> Wait for 15s or press the Mode/Enter button until the current measured value is indicated again.</p>	

\*Decrease the value: Let the display of the parameter value move to the maximum setting value. Then the cycle starts again at the minimum setting value.

Select the display unit (**Uni**) **before** setting the switch points (SPx, rPx) or the limits for the analogue output signal (ASP, AEP). This avoids rounding errors generated internally during the conversion of the units and enables exact setting of the values.

If no button is pressed for 15s during the setting procedure, the unit returns to the Run mode with unchanged values.

The unit can be **electronically locked** to prevent unwanted adjustment of the set parameters: Press both pushbuttons for 10s (the unit must be in Run mode). Indication goes out briefly (acknowledgement of locking / unlocking).

Units are delivered from the factory in the unlocked state.

With the unit in the locked state **Loc** is indicated briefly when you try to change parameter values.

## Installation and set-up / operation

After mounting, wiring and setting check whether the unit operates correctly

Faults displayed during operation

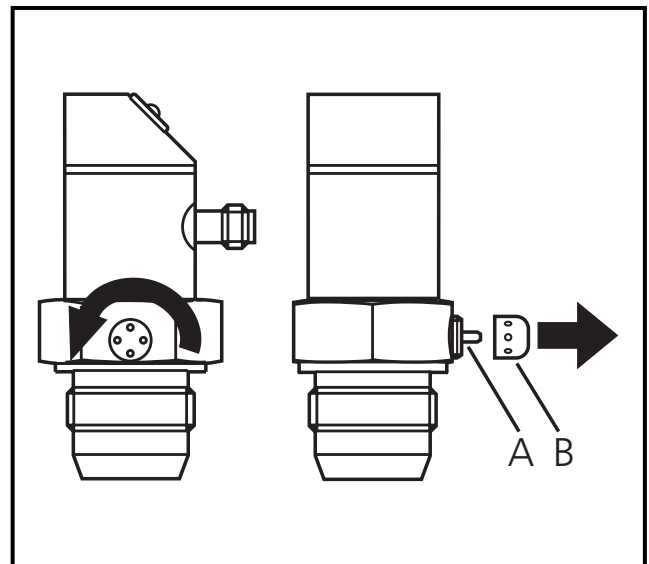
<b>OL</b>	Overload (above measuring range of the sensor).
<b>UL</b>	Underload (below measuring range of the sensor).
<b>SC 1</b>	Flashing: short circuit in the switching output 1*.
<b>SC 2</b>	Flashing: short circuit in the switching output 2*.
<b>SC</b>	Flashing: short circuit in both switching outputs*.

\*The output concerned is switched off as long as the short circuit exists.

### Cleaning of the filter cover

If viscous and residues producing media clog the filter cover of the sensor (and thus reduce the measuring accuracy slightly), you can clean it.

- Unscrew the filter cover (B) (use a pair of pliers with plastic-covered jaws for this). Clean the cover thoroughly.
- The vent (A) should only be cleaned by skilled personnel and with utmost care.



**⚠** Possible medium residues must not be compressed and pressed into the vent. This could clog the filter system and reduce the measuring accuracy of the sensor.

- Screw the filter cover again tightly.

The sensor is sufficiently protected against harsh ambient conditions (protection IP 67). The protection rating can be increased by a special accessory (order no. E30043).

## Technical information / Functioning / Parameters

### Adjustable parameters

<p>SP 1 SP 2</p>	<p><b>Switch-on point 1 / 2</b> Upper limit value at which the output changes its switching status. SP2 is active only if <b>OU2 = Hno, Hnc, Fno</b> or <b>Fnc</b>.</p>
<p>rP 1 rP 2</p>	<p><b>Switch-off point 1 / 2</b> Lower limit value at which the output changes its switching status. rPx is always lower than SPx. The unit only accepts values which are lower than SPx. Changing the switch-on point also changes the switch-off point (the distance between SPx and rPx remains constant). If the distance is higher than the new switch point, it is automatically reduced (rPx is set to the minimum setting value). rP2 is active only if <b>OU2 = Hno, Hnc, Fno</b> or <b>Fnc</b>. <b>Setting range for SPx / rPx:</b> → page 49.</p>
<p>OU 1</p>	<p><b>Configuration of output 1</b> 4 switching functions can be set: - <b>Hno</b> = hysteresis / normally open - <b>Hnc</b> = hysteresis / normally closed - <b>Fno</b> = window function / normally open - <b>Fnc</b> = window function / normally closed</p>
<p>OU2</p>	<p><b>Configuration of output 2</b> 4 switching functions and 2 analogue signals can be set: - <b>Hno</b> = hysteresis / normally open - <b>Hnc</b> = hysteresis / normally closed - <b>Fno</b> = window function / normally open - <b>Fnc</b> = window function / normally closed - <b>I</b> = analogue output 4 ... 20 mA - <b>U</b> = analogue output 0 ... 10 V</p>
<p>ASP</p>	<p><b>Analogue start point</b> Measured value at which 4 mA / 0V is provided. ASP is active only if <b>OU2 = I</b> or <b>U</b>.</p>
<p>AEP</p>	<p><b>Analogue end point</b> Measured value at which 20 mA / 10V is provided. Minimum distance between ASP and AEP = 25% (scaling factor 4). AEP is active only if <b>OU2 = I</b> or <b>U</b>. <b>Setting range for ASP / AEP:</b> → page 49.</p>

EF

### Enhanced functions

This menu item contains a submenu with additional parameters. You can access these parameters by pressing the SET button briefly.

HI  
LO

### Min-Max memory for system pressure

- HI: displays the highest measured pressure
- LO: displays the lowest measured pressure

Erase the memory:

- Press the "Mode/Enter" button until **HI** or **LO** is displayed.
- Press the "Set" button and keep it pressed until "- - -" is displayed.
- Then press the "Mode/Enter" button briefly.

COF

### Calibration offset

The internal measured value (operating value of the sensor) is offset against the real measured value.

- Setting range: -5 ... +5% of the value of the measuring range (with scaling as factory setting (ASP = 0% and AEP = 100%),
- in steps of 0.1% of the value of the measuring range.

CAr

### Calibration reset

Resets the calibration set by **COF** to the value set at the factory.

- Press the "Mode/Enter" button until **CAr** is displayed.
- Press the "Set" button and keep it pressed until "- - -" is displayed.
- Then press the "Mode/Enter" button briefly.

dS1  
dS2  
dr1  
dr2

### Delay time for the switching outputs

**dSx** = switch-on delay; **drx** = switch-off delay

The output does not immediately change its switching status when the switching condition is met but when the delay time has elapsed. If the switching condition is no longer met when the delay time has elapsed, the switching state of the output does not change.

- Setting range: 0 / 0.1 ... 50s adjustable in steps 01s (0 = delay time not active),
- indicated in seconds.

**dS2** and **dr2** are **not** active, if **OU2 = I** or **U**.

P-n

### Output polarity

2 options can be selected:

- **PnP** = positive switching
- **nPn** = negative switching

This setting applies to both switching outputs.

**dAP****Damping for the switching outputs**

Pressure peaks of short duration or high frequency can be filtered out.

dAP-value = response time between pressure change and change of the switching status in seconds (s).

- Setting range: 0 ... 4s (0 = dAP is not active),
- in steps of 0.01 s.

Correlation between switching frequency and dAP:  $f_{\max} = \frac{1}{2 \times \text{dAP}}$

**dAA****Damping for the analogue signal**

Pressure peaks of short duration or high frequency can be filtered out.

dAA-value = response time between pressure change and change of the switching status in seconds (s).

- Setting range: 0 (= dAA is not active) / 0.1 s / 0.5 s / 2 s.

dAA is active only if **OU2 = I** or **U**.

**d1 5****Setting of the display**

9 options can be selected:

**d1** = update of the measured value every 50 ms

**d2** = update of the measured value every 200 ms

**d3** = update of the measured value every 600 ms

The update interval only refers to the display. It has no effect on the outputs.

**ph** = display of the measured peak value remains for a short time (**peak hold**).

**rd1, rd2, rd3, rph** = display as d1, d2, d3, Ph; but rotated 180°.

**OFF** = In the Run mode the display of the measured value is deactivated. If one of the buttons is pressed, the current measured value is displayed for 15s. Another press of the Mode/Enter button opens the Display mode. The LEDs remain active even if the display is deactivated.

**Uni****Display unit**

The measured value and the values for SPx / rPx can be displayed in the following units:

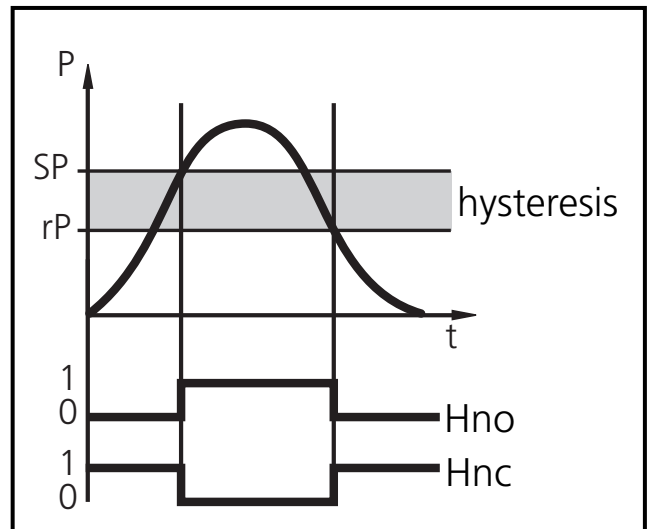
**bAr** (= bar / mbar), **PSI, PA** (= MPa / kPa), **inH** (= inHg).

Select the display unit **before** setting the switch points (SPx, rPx) and the limits for the analogue output signal (ASP, AEP). This avoids rounding errors generated internally during the conversion of the units and enables exact setting of the values.

**Setting at the factory: Uni = bAr.**

## Hysteresis function:

The hysteresis keeps the switching state of the output stable if the system pressure varies about the preset value. With the system pressure rising, the output switches when the switch-on point has been reached (SPx). With the system pressure falling the output does not switch back until the switch-off point (rPx) has been reached.

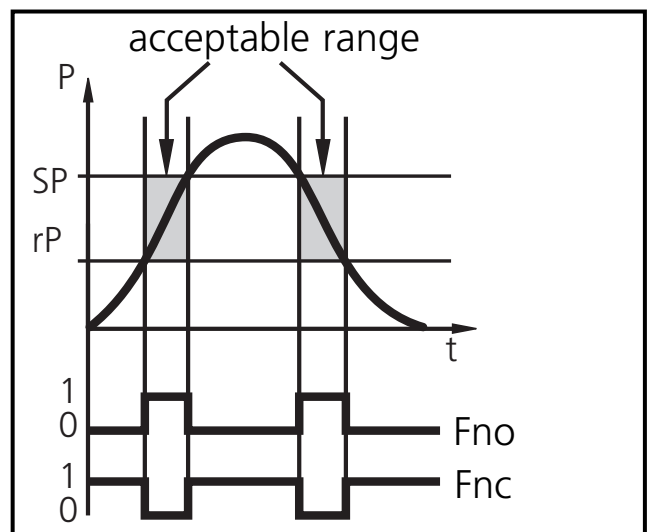


The hysteresis can be adjusted: First the switch-on point is set, then the switch-off point with the requested distance.

## Window function

The window function enables the monitoring of a defined acceptable range. When the system pressure varies between the switch-on point (SPx) and the switch-off point (rPx), the output is switched (window function / NO) or not switched (window function / NC).

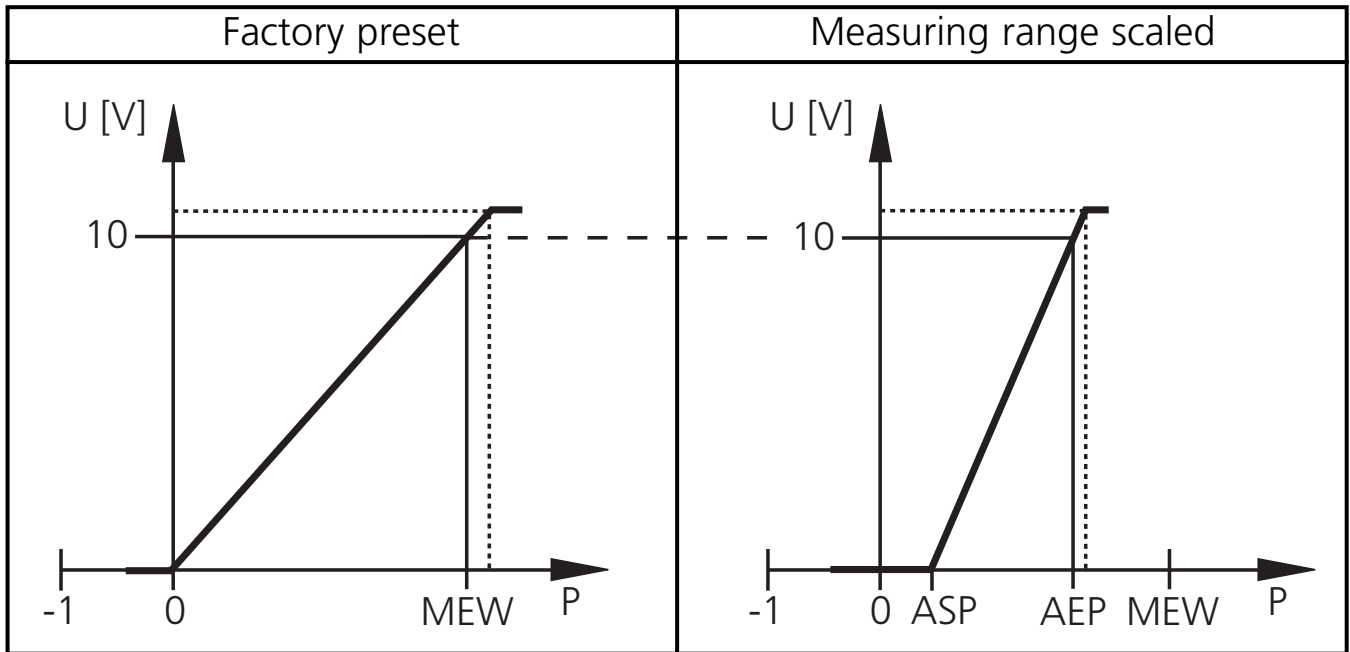
The width of the window can be set by means of the difference between SPx and rPx. SPx = upper value, rPx = lower value.



## Scaling the measuring range (analogue output)

- With the parameter "Analogue start point" (**ASP**) the measured value at which the output signal is 4 mA or 0 V is defined.
- With the parameter "Analogue end point" (**AEP**) the measured value at which the output signal is 20 mA or 10 V is defined.
- Minimum distance between ASP and AEP = 25 % of the final value of the measuring range (scaling factor 4).

## Voltage output 0 ... 10V



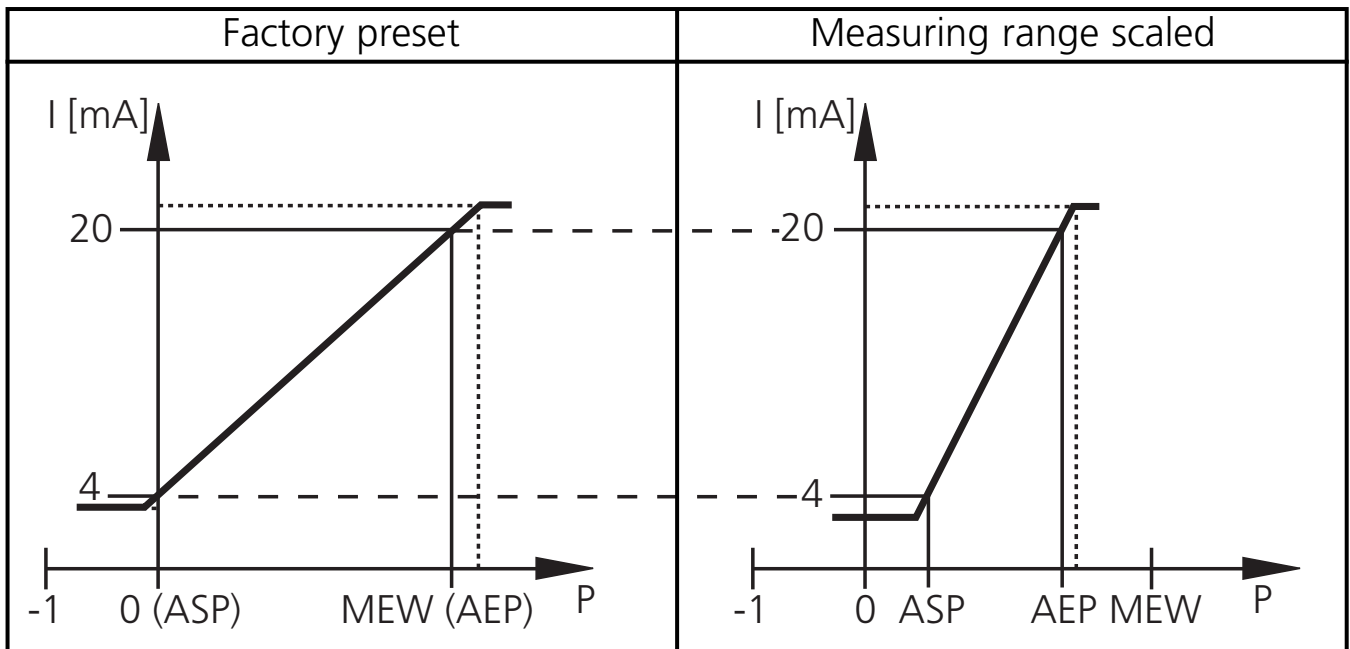
MEW = final value of the measuring range

The output signal is between 0 and 10V in the set measuring range.

It is also indicated:

System pressure above the measuring range: output signal > 10V.

## Current output 4 ... 20mA



MEW = final value of the measuring range

The output signal is between 4 and 20mA in the set measuring range.

It is also indicated:

- System pressure above the measuring range: output signal > 20mA.
- System pressure below the measuring range: output signal drops to max. 3.2mA (depending on the scaling).

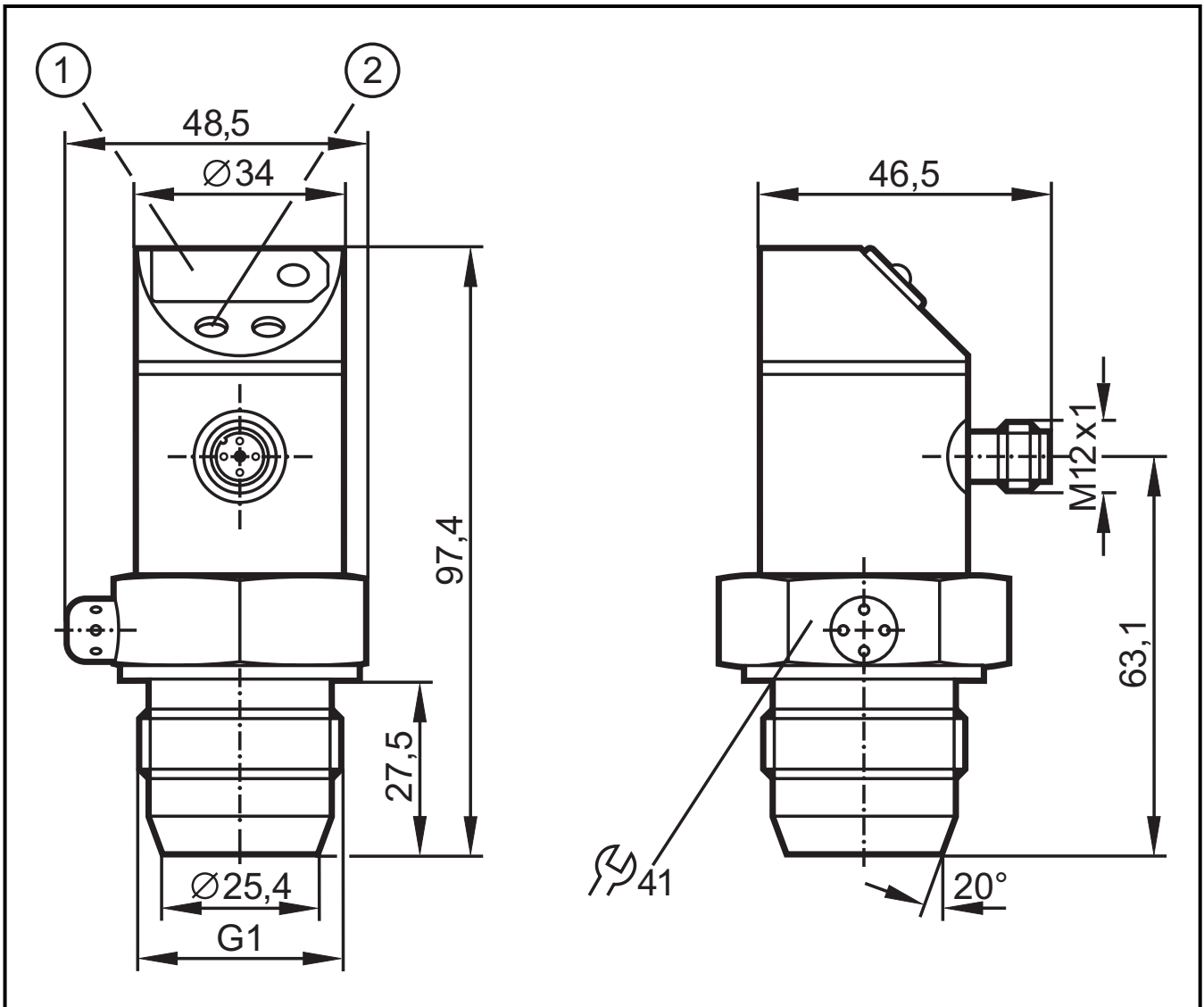
## Technical data

Operating voltage [V]	20 ... 30 DC
Current consumption [mA]	< 60
Current rating [mA]	2 x 250
Short-circuit protection, reverse polarity protection / overload protection Integrated Watchdog	
Voltage drop [V]	< 2
Power-on delay time [s]	0.2
Min. response time switching outputs [ms]	3
Switching frequency [Hz]	170 ... 0.125
Analog output (measuring range scalable)	4 ... 20 mA / 0 ... 10 V
Max. load current output [ $\Omega$ ]	$(U_B - 10) \times 50$ ; 700 at $U_B = 24V$
Min. load with voltage output [ $\Omega$ ]	2000
Min. response time analog output [ms]	3
Accuracy / deviations (in% of the span) <sup>1)</sup>	
- Characteristics deviation (linearity, incl. hysteresis and repeatability) <sup>2)</sup>	< $\pm 0.6$
- Linearity	< $\pm 0.5$
- Hysteresis	< $\pm 0.1$
- Repeatability (with temperature fluctuations < 10K)	< $\pm 0.1$
- Long-time stability (in% of the span per year)	< $\pm 0.1$
- Temperature coefficients (TEMPCO) in the compensated temperature range 0 ... +80°C (in% of the span per 10 K)	
- Greatest TEMPCO of the zero point	< $\pm 0.1$
- Greatest TEMPCO of the span	< $\pm 0.2$
Materials (wetted parts)	stainless steel (316S12); ceramics (99.9 % Al <sub>2</sub> O <sub>3</sub> ); PTFE
Housing material	stainless steel (316S12); Pohan; PC (Macrolon); PEI; EPDM/X (Santoprene); FPM (Viton)
Protection	IP 67 / III
Insulation resistance [ $M\Omega$ ]	> 100 (500 V DC)
Shock resistance [g]	50 (DIN / IEC 68-2-27, 11ms)
Vibration resistance [g]	20 (DIN / IEC 68-2-6, 10 - 2000 Hz)
Switching cycles min.	100 million
Operating temperature [°C]	-25 ... +80
Medium temperature [°C]	-25 ... +80
Storage temperature [°C]	-40 ... +100
EMC IEC 1000/4/2 ESD:	4 / 8 KV
IEC 1000/4/3 HF radiated:	10 V/m
IEC 1000/4/4 Burst:	2 KV
IEC 1000/4/6 HF conducted:	10 V

<sup>1)</sup> all indications are referred to a turn down of 1:1

<sup>2)</sup> limit value setting to DIN 16086

# Maßzeichnung / Scale drawing / Dimensions



1: 7-Segment-Anzeige  
2: Programmier Taste

1: 7-segment display  
2: programming button

1: visualisation digitale  
2: bouton poussoir

## Einstellbereiche / Setting ranges / Plages de réglage

Uni = bAr		SP1 / SP2		rP1 / rP2		ASP		AEP		ΔP
		min	max	min	max	min	max	min	max	
PF2653	bar	-0,8	25,0	-0,9	24,9	-1,0	18,8	5,3	25,0	0,1
PF2654	bar <sup>1)</sup>	-0,45	9,99	-0,50	9,94	-0,50	7,49	2,00	9,99	0,01
PF2656	bar <sup>1)</sup>	-0,11	2,50	-0,12	2,49	-0,13	1,88	0,50	2,50	0,01
PF2657	mbar	-45	999	-50	994	-50	749	200	999	1
PF2609	bar <sup>1)</sup>	-0,97	1,00	-0,99	0,98	-0,99	-0,20	-0,50	1,00	0,01

<sup>1)</sup>Anzeige **-.XX** = **-0,XX** / display **-.XX** = **-0.XX** / affichage **-.XX** = **-0,XX**

Uni = PSI		SP1 / SP2		rP1 / rP2		ASP		AEP		ΔP
		min	max	min	max	min	max	min	max	
PF2653	PSI	-12	363	-13	362	-15	272	76	363	1
PF2654	PSI	-7	145	-7	144	-7	109	29	145	1
PF2656	PSI	-1,6	36,3	-1,7	36,2	-1,8	27,2	7,3	36,3	0,1
PF2657	PSI	-0,7	14,5	-0,7	14,4	-0,7	10,9	2,9	14,5	0,1

Uni = inH		SP1 / SP2		rP1 / rP2		ASP		AEP		ΔP
		min	max	min	max	min	max	min	max	
PF2609	inHg	-29	30	-30	29	-30	-6	-15	30	1

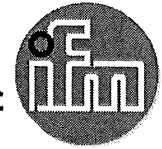
Uni = PA		SP1 / SP2		rP1 / rP2		ASP		AEP		ΔP
		min	max	min	max	min	max	min	max	
PF2653	MPa <sup>1)</sup>	-0,08	2,50	-0,09	2,49	-0,10	1,88	0,53	2,50	0,01
PF2654	kPa	-45	999	-50	994	-50	749	200	999	1
PF2656	kPa	-11	250	-12	249	-13	188	50	250	1
PF2657	kPa	-4,5	99,9	-5,0	99,4	-5,0	74,9	20,0	99,9	0,1
PF2609	kPa	-97	100	-99	98	-99	-20	-50	100	1

<sup>1)</sup>Anzeige **-.XX** = **-0,XX** / display **-.XX** = **-0.XX** / affichage **-.XX** = **-0,XX**

ΔP = Schrittweite / increments / incréments

**Eingestellte Parameter-Werte**  
**Set parameter values**  
**Valeurs de paramètre réglées**

SP 1		COF	
rP 1		dS 1	
OU 1		dr 1	
OU2		dS2	
SP2		dr 2	
rP2		P-n	
ASP		dAP	
REP		dAA	
		d1 5	
		Un1	



**ifm electronic**

# EG – Konformitätserklärung

**EC Declaration of Conformity**

**Déclaration de conformité CE**

**ifm electronic gmbh**

Friedrichstraße 1  
45128 Essen

Germany

Telefon: +49 (0)201 / 24 22- 0  
Telefax: +49 (0)201 / 24 22 - 1200  
Internet: www.ifm.com

Die EG-Konformitätserklärung  
gilt für folgende Geräte:

The EC declaration of  
conformity applies to the  
following units:

La déclaration de conformité  
CE s'applique aux appareils  
suivants:

## Elektronischer Drucksensor der Produktfamilie Electronic Pressure Sensor of the Product Family Capteur de pression électronique de la famille

**P●●●●●●●●●●G**

Wir bestätigen die  
Übereinstimmung mit den  
grundlegenden Anforderungen  
der europäischen Richtlinie(n):

We confirm the conformity to  
the essential requirements of  
the European directive(s):

Nous confirmons la conformité  
aux exigences essentielles de  
la (des) directive(s)  
européenne(s):

**2004/108/EG  
2006/95/EG**

**2004/108/EC  
2006/95/EC**

**2004/108/CE  
2006/95/CE**

Folgende Norm(en) wurde(n)  
angewandt:

The following standard(s) was  
(were) applied:

La (Les) norme(s) suivante(s) a  
(ont) été appliquée(s):

**EN 61000-6-2 : 2005 + Corr. 2005  
EN 61000-6-3 : 2007  
EN 50178 : 1997**

*Dressbronn 3.11.09*

(Ort und Datum der Ausstellung)

(Place and date of issue)

(Lieu et date de l'établissement)

(Unterschrift) i. V. Alfred Wagner

(Signature) Entwicklungsleiter

(Signature)

Dokument-Nr.: 8000532

MOISTURE SENSOR  
BAUMER LBFS-A3121.0



## Special Features

- Wetted parts in stainless steel and PEEK
- Compact design
- Precise switching point with no requirement for calibration
- Process temperature -40... 115 °C
- Measures media with DK-values >1.5 (DK = Dielectrical Constant)
- Blue LED switch indicator
- Maintenance free
- Suitable for media separation
- Configurable by FlexProgrammer 9701
- ATEX approval for gas and dust
- WHG (leakage and overflow) Approval



## Technical Data

### Sensor

Radiated signal	100...180 MHz
Process connection	Refer to dimensional drawings
Insulating material	PEEK

### Mechanical data

Housing	Stainless Steel
Amb. temperature	-40...85 °C
Process temperature	-40...115 °C Max. 130 °C for < 1 hour, T <sub>amb</sub> 40 °C

Protection class IP67 (IEC 529)

Media pressure Max. 100 bar

Vibrations IEC 60068-2-6, GL test2

Installation Any position

Surface roughness wetted parts  
Stainless Steel Ra < 0.8 µm  
PEEK Ra < 0.05 µm

### Electrical connection

Cable	5 meter, 4 wire
Plug M12	Plastic or Stainless steel 304

### Other electrical data

Power supply	12...30 VDC, 35 mA max.
Damping	0...10 sec.
Power-up time	<2 sec.
Hysteresis	± 1 mm
Repeatability	± 1 mm
Reaction time	0.1 sec. (100 mS)
Reverse polarity protection	Yes

### Disposal of product and packing

According to national laws or by returning to Baumer

### EMC data and packing

Immunity	EN 61326
Emission	EN 61326

### ATEX data

Internal inductivity	L <sub>i</sub> ≤ 10 µH
Internal capacity	C <sub>i</sub> ≤ 43 nF
Barrier data	U ≤ 30 VDC ; I < 0.1 A ; P < 0.75 W

### Approval Ex ia IIC T5, ATEX II 1G

Supply range	12...30 VDC
Temperature class	T1...T4: -40 < T <sub>amb</sub> < 85 °C T1...T5: -40 < T <sub>amb</sub> < 74 °C

### Approval Ex ta IIIC T100 Da, ATEX II 1D

Supply range	12...30 VDC
Temperature class	T100 °C: -40 < T <sub>amb</sub> < 85 °C

### Approval Ex nA II T5, ATEX II 3G

Supply range	12,5...30 VDC
Temperature class	T1...T5: -40 < T <sub>amb</sub> < 85 °C

### Output

Output (active)	Max. 20 mA, short-circuit and high-temperature protected
Output type	PNP or NPN
Output polarity	NO and NC
Active "High"	PNP (VDC -1.5V) ± 0.5V ; Rload 10 kOhm
Active "Low"	NPN (-VDC +1.5V) ± 0.5V ; Rload 10 kOhm
Off leak current	± 100µA Max.

### Factory Settings

Damping	0.1 sec.
---------	----------

### Approvals/conformities

Approvals/conformities	EN 1935/2004, EN 10/2011 DNV Marine Approval EN 50155 Railway 3A, EHEDG, FDA, WHG (leakage and overflow) UL listed, E36692
------------------------	--

## Description

The Level Switch LBFS is designed to detect levels in tanks, for media separation and provide empty-pipe detection or dry-run protection for pumps.

A high frequency sweep signal is radiated from the sensor tip into the tank. The media will act as a virtual capacitor, which together with a coil in the sensor head, will form a circuit creating the switch point signal. This virtual capacitance will depend of the di-electric value DK (Dielectrical Constant) of the media.

Two output signals are available, Normally Open (NO) and Normally Closed (NC). By means of the FlexProgrammer 9701, a damping of the output signal can be activated in case of a fluctuating media level, e.g. during tank filling. Additionally the output signals NO and NC can be reversed.

The measurement is precise and unaffected by the mounting position in the tank. In the Flex-software a compensation for foam, bubbles and condensate as well as sticky media can be set.

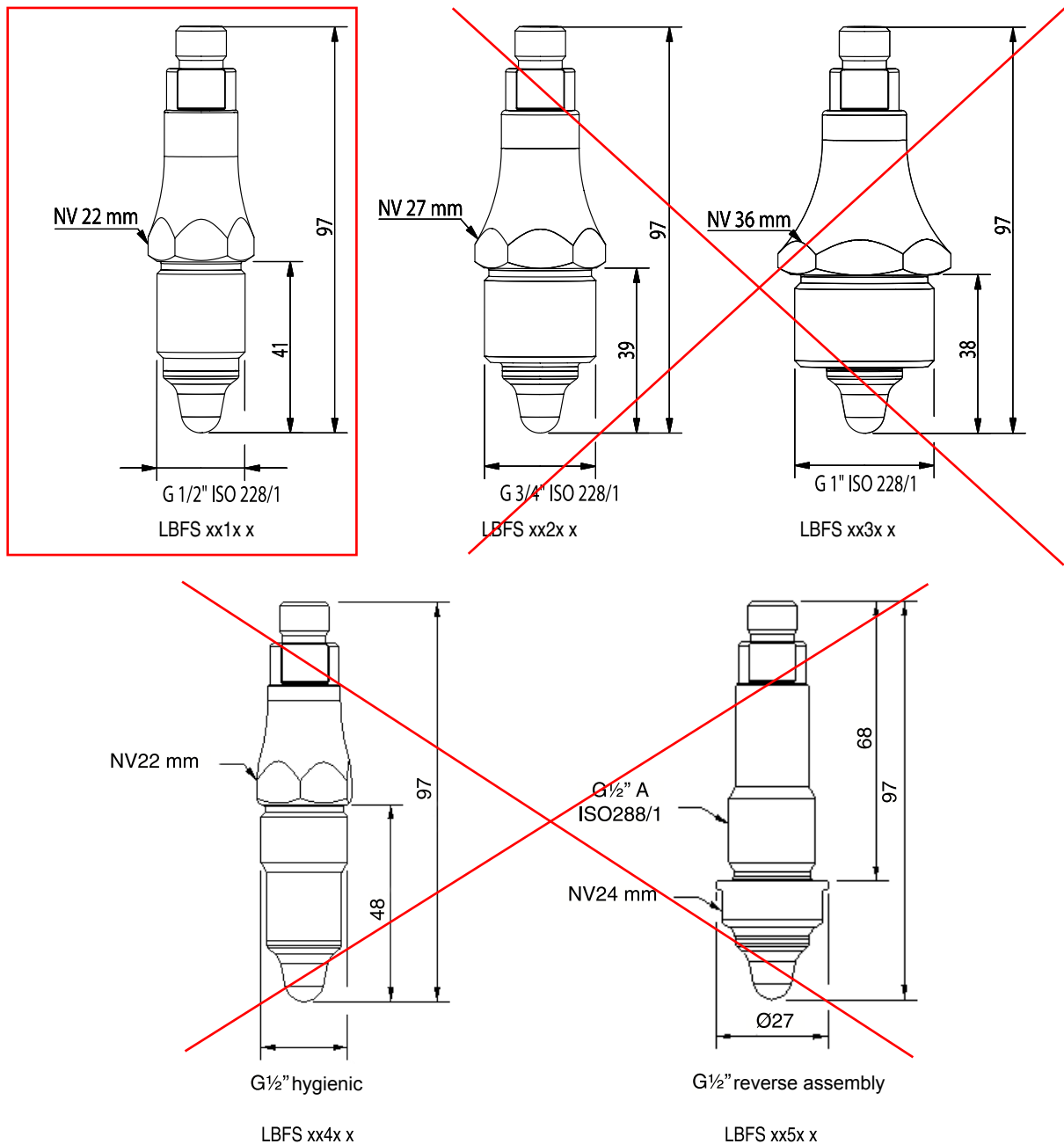
The Flex-software also features an adjustment facility making the user able to adjust the sensor to a specific media.

The Level Switch LBFS measures liquids such as water and oil. Even dry media can be measured, eg. coal dust or plastic granulate.

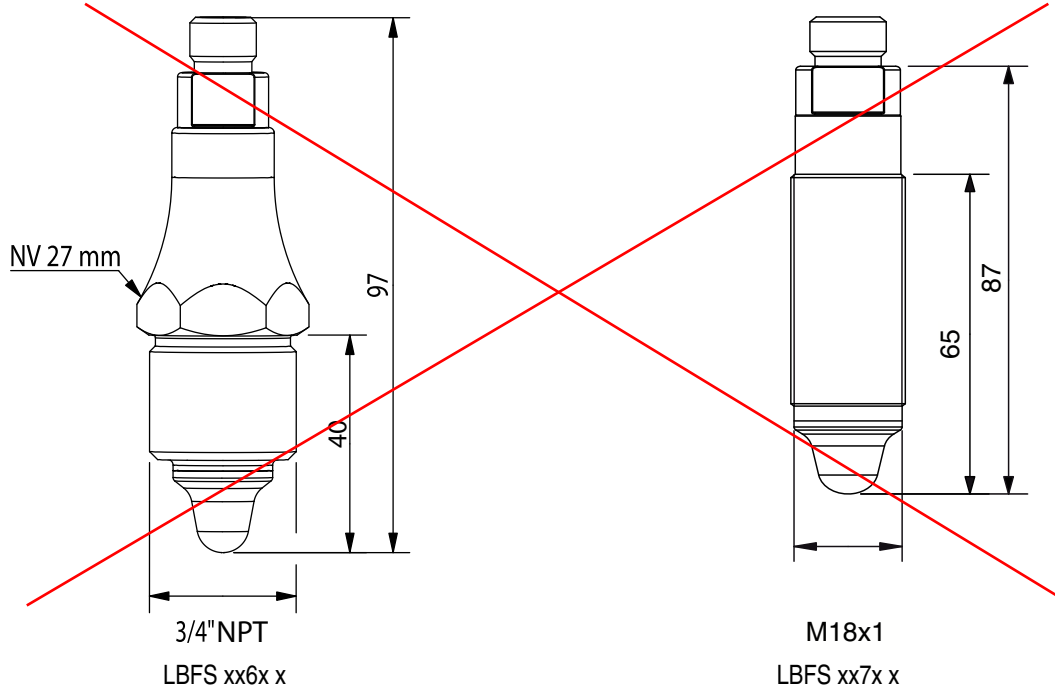
Level Switch LBFS can be delivered with PNP output as well as NPN output.

The process connection can easily be sealed by use of PTFE tape or by use of special welding adapter for the hygienic edition.

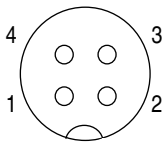
## Dimensional Drawings



## Dimensional Drawings



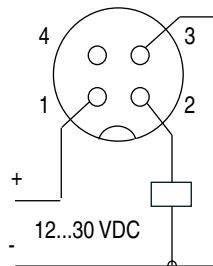
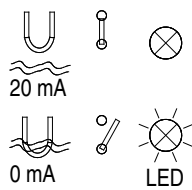
## Electrical Connection



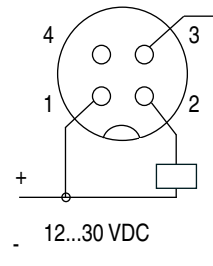
M12 plug	Cable	Function
1	Brown	+ VDC
2	White	Normally closed
3	Blue	- VDC
4	Black	Normally open

## Electrical Installation

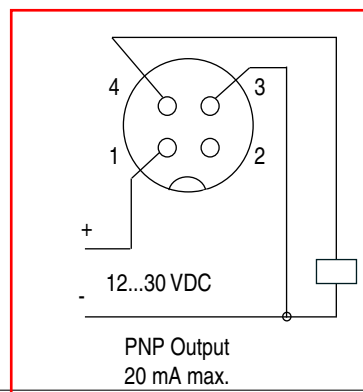
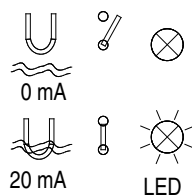
### Normally Closed



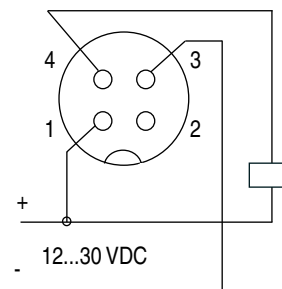
PNP Output  
20 mA max.



NPN Output  
20 mA max.



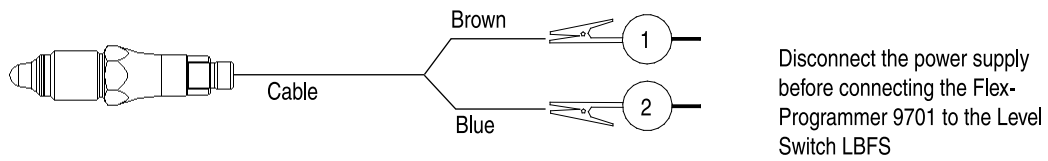
PNP Output  
20 mA max.



NPN Output  
20 mA max.

## Configuration

### FlexProgrammer 9701



## Accessories

### FlexProgrammer 9701



The FlexProgrammer 9701 is a dedicated tool to configure Baumer configurable products

**Type N° 9701-0001 comprises:**  
FlexProgrammer  
USB cable  
CD with the FlexProgram software

### Accessories examples

**LB020**



**CAM023**



ISO 2852 clamp

**VAM023**



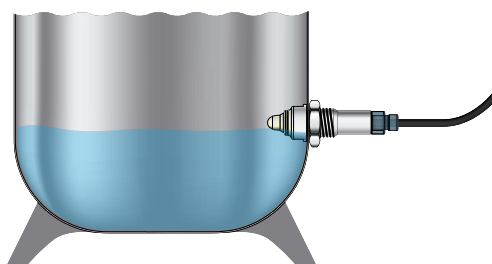
Varivent

**PM023**

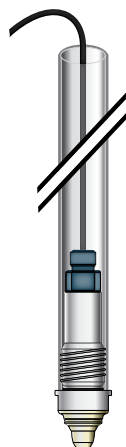


G½ hygienic welding sleeve in AISI 316

## Application



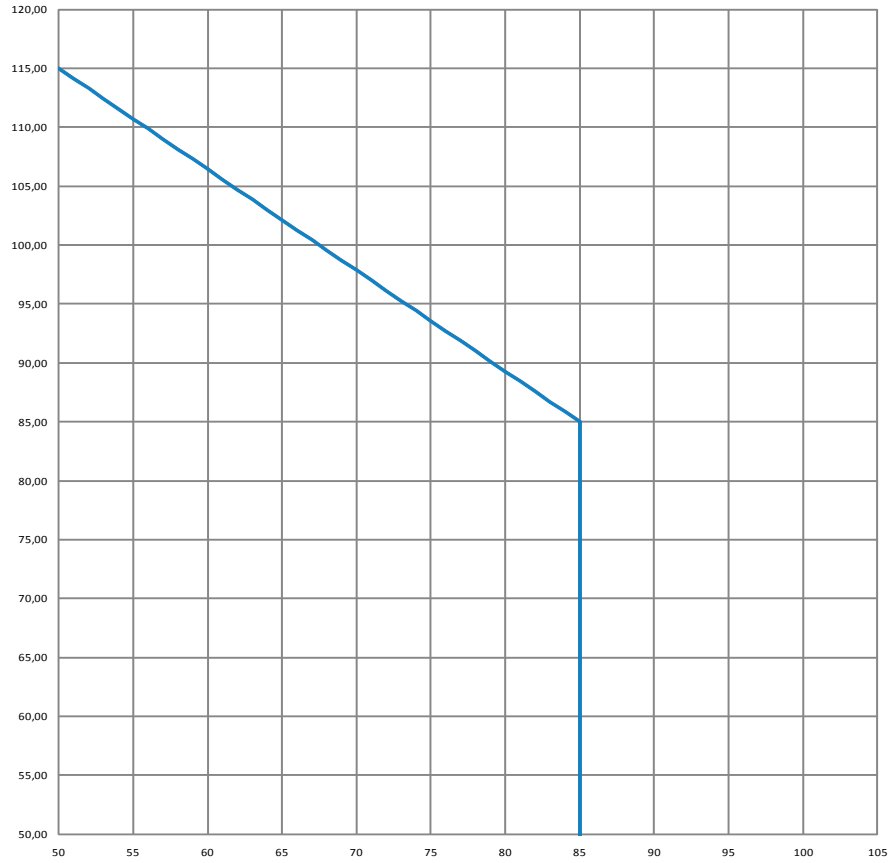
LBFS xx5x x



LBFS xx5x x

## Media Temperature versus Ambient Temperature

Media Temperature  
°C



Ambient Temperature

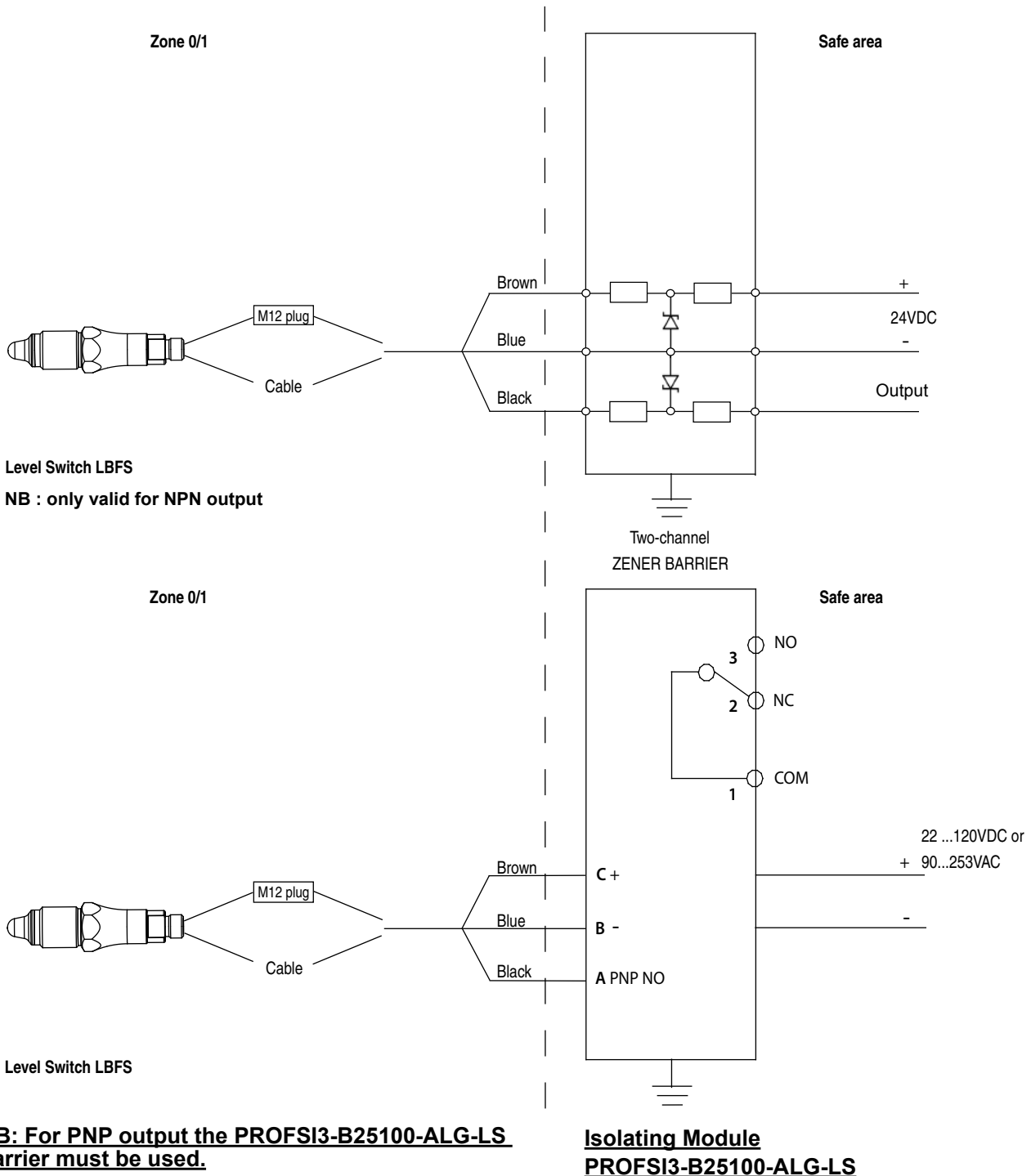
## Ex ia IIC T5, ATEX II 1G - Installation

A Level Switch LBFS 1xxx x is Ex ia IIC T5, ATEX II 1G approved for application in hazardous areas in accordance with the current EU directives. The product must be installed in accordance with prevailing guidelines for zone 0 with a barrier.

A certified Ex ia isolation barrier with the maximum values  $U_{max} = 30\text{VDC}$  ;  $I_{max} = 0.1\text{A}$  ;  $P_{max} = 0.75\text{W}$  must be used. Use the isolating module PROFSI 3-B25100-ALG-LS (for PNP output only) or a ZENER Barrier (for NPN output only) as shown below (see installation manual for special instructions).

### Ex-data

Supply range	24...30 VDC
Temperature class	T1...T4: $-40 < T_{amb} < 85\text{ }^{\circ}\text{C}$ T1...T5: $-40 < T_{amb} < 74\text{ }^{\circ}\text{C}$
Internal inductivity	$L_i < 10\text{ }\mu\text{H}$
Internal capacity	$C_i < 43\text{ nF}$
Barrier data	$U < 30\text{ VDC}$ ; $I < 0.1\text{ A}$ ; $P < 0.75\text{ W}$



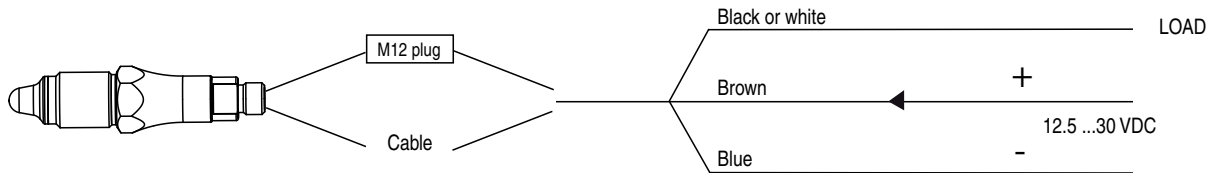
## Ex ta IIIC T100 Da, ATEX II 1D - Installation

A Level Switch LBFS 2xxx x Ex ta IIIC T100 Da, ATEX II 1D approved for application in hazardous areas in accordance with the current EUDirectives.

The product must be installed in accordance with prevailing guidelines for zone 20 without a barrier.

### Ex-data

Supply range	12.5...30 VDC, max. 100 mA
Temperature class	T100



### Level Switch LBFS

NB : The cable must be fixed to an external strain relief not more than 5 cm from the Level Switch. Only IP 67 compliant cable must be used for installation.  
See below.

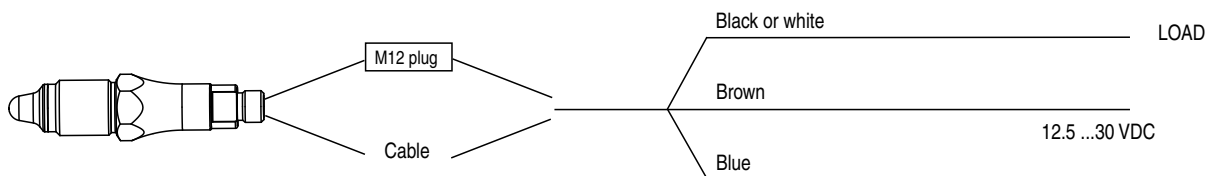
## Ex nA II T5, ATEX II 3G - Installation

A Level Switch LBFS3 xxx x is Ex nA II T5, ATEX II 3G approved for application in hazardous areas in accordance with the current EUDirectives.

The product must be installed in accordance with prevailing guidelines for zone 2 without a barrier.

### Ex-data

Supply range	12.5...30 VDC, Max. 0.1A
Temperature class	T1...T5



### Level Switch LBFS

## Ordering details

		-				
<b>Model</b>						
<b>Level Switch</b>		<b>LBFS</b>				
<b>Safety</b>	5' digit					
Standard						0
Ex ia IIC T5, ATEX II 1G (Gas) <sup>(6)</sup>						1
Ex ta IIIC T100 Da, ATEX IIIC 1D (Dust) <sup>(2)</sup>						2
Ex nA II T5, ATEX II 3G						3
Ex ia IIC T5 / Ex ta IIIC T100 Da (combined gas/dust) <sup>(2)</sup>						4
UL listed, E36692 <sup>(2)</sup>						<b>A</b>
<b>Electrical Connection</b>	6' digit					
Plug, M12 plastic with LED						1
Cable 5 meter <sup>(3)</sup>						2
Plug, M12, stainless steel, without LED						<b>3</b>
<b>Process Connection</b>	7' digit					
G1/2"						<b>1</b>
G3/4"						2
G1"						3
G1/2" hygienic (for Accessories Universal) 3A / EHEDG <sup>(5)</sup>						4
G1/2" for reverse assembly, glasfiber-aramide-NBR flat seal included <sup>(1)</sup>						5
3/4" NPT <sup>(4)</sup>						6
M18x1						7
<b>Process Connection material</b>	8' digit					
Stainless Steel 1.4301 - AISI 304						1
Stainless Steel 1.4404 - AISI 316L						<b>2</b>
<b>Output Configuration</b>	9' digit					
PNP output						<b>1</b>
NPN output						2
<b>Configuration</b>	10' digit					
No configuration						<b>0</b>
Configuring according to customer specification						C

(1) Max. 85 °C media temperature

(2) Not valid with "cable connection"

(3) Max ambient temperature 70 °C

(4) Only available in AISI 304

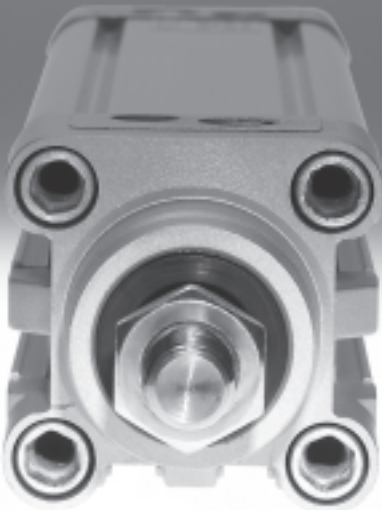
(5) Only available in AISI 316L

(6) For PNP output the barrier module PFOFSI3-B25100-ALG-LS is required for funtional purposes. For NPN output a standard barrier may be used.

PNEUMATIC COMPONENTS  
PNEUMATIC CYLINDER FESTO DNC-100-100-PPV

APPENDIX INFORMATION

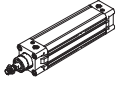
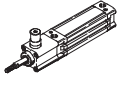
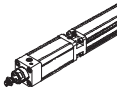
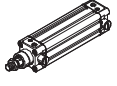
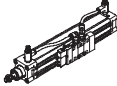
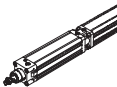
Standard cylinders DNC, ISO 15552



# Standard cylinders DNC, ISO 15552

Product range overview



Function	Design	Type	Piston Ø	Stroke	Position sensing	Protection against rotation	Through/hollow piston rod	Extended male piston rod thread	Female piston rod thread	Special piston rod thread	
			[mm]	[mm]							A
Double-acting	Basic version										
		DNC	32, 40, 50, 63, 80, 100, 125	25, 40, 50, 80, 100, 125, 160, 200, 250, 320, 400, 500	10 ... 2,000	■	■	■	■	■	■
	Standard hole pattern, with clamping unit										
		DNC-KP	32, 40, 50, 63, 80, 100, 125	–	10 ... 2,000	■	■	■ S2	■	■	■
		DNCKE	40, 63, 100	–	10 ... 2,000	■	–	–	–	–	–
	Standard hole pattern, with end-position locking										
		DNC-...EL	32, 40, 50, 63, 80, 100	–	10 ... 2,000	■	–	■ S2	■	■	■
Standard hole pattern, cylinder/valve combination											
	DNC-V1 ... V6	32, 40, 50, 63, 80, 100	–	100 ... 2,000	■	■	■	■	■	■	
Standard hole pattern, tandem cylinder											
	DNCT	32, 40, 50, 63, 80, 100, 125	–	2 ... 500 3 ... 500	■	–	–	–	–	–	

# Standard cylinders DNC, ISO 15552

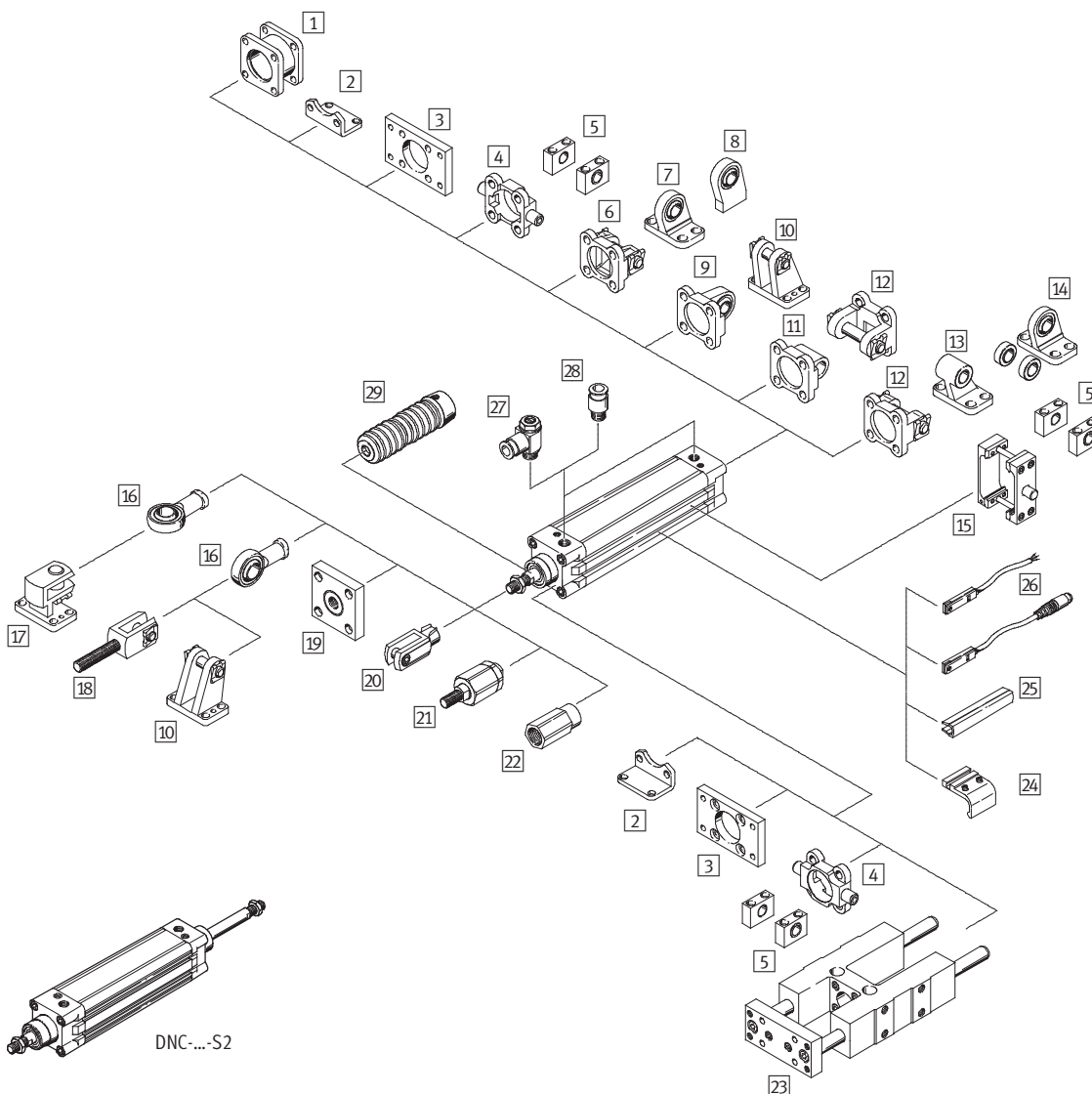
Product range overview



Type	Special spanner flats	Extended piston rod	Smooth anodised piston rod	Heat-resistant seals to max. 120 °C	Slow speed (constant motion)	Low friction	High corrosion protection	Dust protection	Low temperature	Cylinder/valve combination	→ Page/Internet
	K7	K8	K10	S6	S10	S11	R3	R8	TT	V1 ... V6	
<b>Basic version</b>											
DNC	■	■	■	■	■	■	■	■	■	-	9
<b>Standard hole pattern, with clamping unit</b>											
DNC-KP	■	■	-	-	-	-	-	-	-	■	23
DNCKE	-	-	-	-	-	-	-	-	-	-	dncke
<b>Standard hole pattern, with end-position locking</b>											
DNC...-EL	-	■	-	-	-	-	-	-	-	-	31
<b>Standard hole pattern, cylinder/valve combination</b>											
DNC-V1 ... V6	■	■	■	-	■	■	-	■	-	■	38
<b>Standard hole pattern, tandem cylinder</b>											
DNCT	-	-	-	■	-	-	-	-	-	-	dnct

# Standard cylinders DNC, ISO 15552

Peripherals overview



DNC-...-S2

Mounting attachments and accessories							
	Brief description	DNC				→ Page/ Internet	
		Basic version	KP	EL	V1 ... V6		
1	Multi-position kit DPNC	For connecting two cylinders with identical piston diameters to form a multi-position cylinder	■ <sup>1)</sup>	■	■	■ <sup>1)</sup>	47
2	Foot mounting HNC/CRHNC	For bearing or end caps	■	■	■	■	48
3	Flange mounting FNC/CRFNG	– For bearing or end caps – Cannot be used on the bearing cap in combination with bellows kit DADB	■	■	■	■	49
4	Trunnion flange ZNCF/CRZNG	– For bearing or end caps – Cannot be used on the bearing cap in combination with bellows kit DADB	■	■	■	■	50
5	Trunnion support LNZG/CRLNZG	–	■	■	■	■	52
6	Swivel flange SNC	For end caps	■ <sup>1)</sup>	■ <sup>1)</sup>	■	■ <sup>1)</sup>	53
7	Clevis foot LSNG	With spherical bearing	■ <sup>1)</sup>	■ <sup>1)</sup>	■	■ <sup>1)</sup>	56
8	Clevis foot LSNSG	Weld-on, with spherical bearing	■ <sup>1)</sup>	■ <sup>1)</sup>	■	■ <sup>1)</sup>	56

# Standard cylinders DNC, ISO 15552

Peripherals overview

FESTO

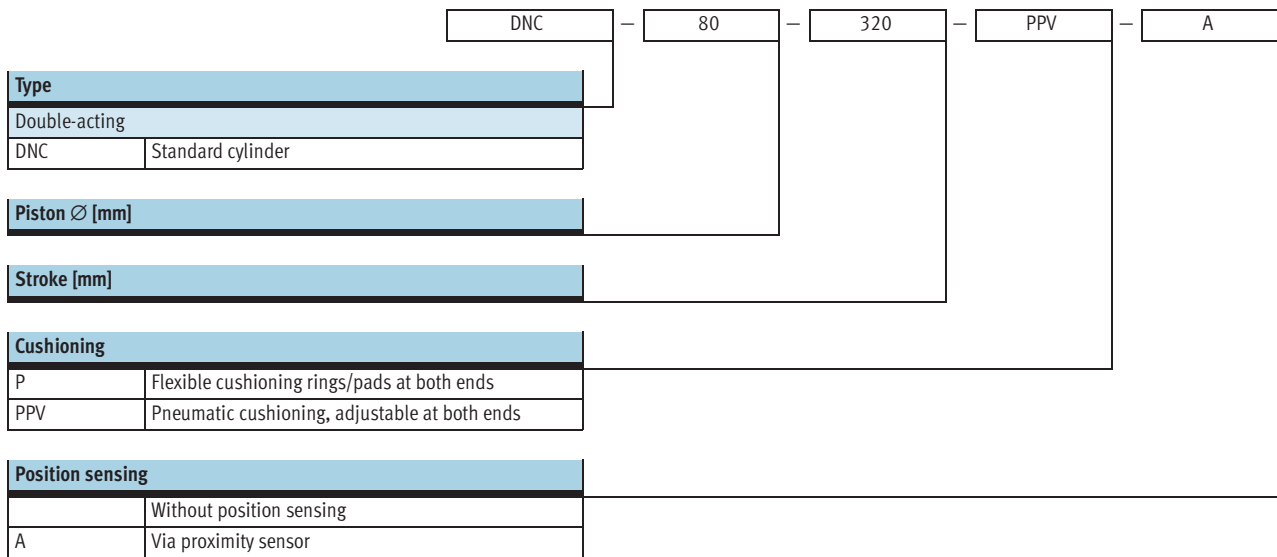
Mounting attachments and accessories							
	Brief description	DNC				→ Page/ Internet	
		Basic version	KP	EL	V1 ... V6		
9	Swivel flange SNCS	With spherical bearing for end caps	■ <sup>1)</sup>	■ <sup>1)</sup>	■	■ <sup>1)</sup>	55
10	Clevis foot LBG	–	■ <sup>1)</sup>	■	■	■ <sup>1)</sup>	56
11	Swivel flange SNCL	For end caps	■ <sup>1)</sup>	■ <sup>1)</sup>	■	■ <sup>1)</sup>	55
12	Swivel flange SNCB/SNCB-...-R3	For end caps	■ <sup>1)</sup>	■ <sup>1)</sup>	■	■ <sup>1)</sup>	54
13	Clevis foot LNG/CRLNG	–	■ <sup>1)</sup>	■ <sup>1)</sup>	■	■ <sup>1)</sup>	56
14	Clevis foot LSN	With spherical bearing	■ <sup>1)</sup>	■ <sup>1)</sup>	■	■ <sup>1)</sup>	56
15	Trunnion mounting kit ZNCM	For mounting anywhere along the cylinder profile barrel	■	■	■	■	51
16	Rod eye SGS/CRSGS	With spherical bearing	■	■	■	■	57
17	Right-angle clevis foot LQG	–	■	■	■	■	56
18	Rod clevis SGA	With male thread	■	■	■	■	57
19	Coupling piece KSG	To compensate for radial deviations	■	■	■	■	57
	Coupling piece KSZ	For cylinders with a non-rotating piston rod to compensate for radial deviations	■	■	■	■	57
20	Rod clevis SG/CRSG	Permits a swivelling movement of the cylinder in one plane	■	■	■	■	57
21	Self-aligning rod coupler FK	For compensating radial and angular deviations	■	■	■	■	57
22	Adapter AD	For fitting a suction cup on a hollow cylinder piston rod	■	–	–	■	57
23	Guide unit FENG	For protecting standard cylinders against rotation at high torque loads	■	■ ∅ 50 and above	–	–	62
24	Mounting kit SMB-8-FENG	For attaching proximity sensor SMT-8 to cylinders in combination with guide unit FENG	■ <sup>2)</sup>	■ ∅ 50 and above	■	–	62
25	Slot cover ABP-5-S	For protecting the sensor cables and keeping dirt out of the sensor slots	■	■	■	■	63
26	Proximity sensor SME/SMT-8	Can be integrated in the cylinder profile barrel	■	■	■	■	63
27	One-way flow control valve GRLA	For regulating speed	■	■	■	■	64
28	Push-in fitting QS	For connecting compressed air tubing with standard outside diameter	■	■	■	■	quick star
29	Bellows kit DADB	– Protects the cylinder (piston rod, seal and bearings) against a wide range of media and thus prevents premature wear – The kit can only be used in combination with an extended piston rod (K8)	■	–	■	■	58

1) Not with variant S2 or S20

2) For piston ∅ 32, 40 mm only with variant R3

# Standard cylinders DNC, ISO 15552

Type codes



**Note**

The standard cylinder DNC can be ordered using either a fixed part number and type designation or via the modular product system. The type code listed above only

applies to the DNC standard cylinder with fixed part number and type designation. Variants can only be ordered using the modular product system.

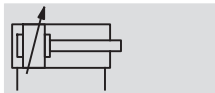
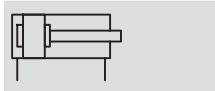
# Standard cylinders DNC, ISO 15552

Technical data

Function

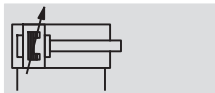
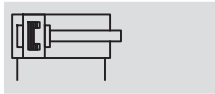
**DNC-...**

Without position sensing



**DNC-...-A-...**

With position sensing



⌀ - Diameter  
32 ... 125 mm

- | - Stroke length  
10 ... 2,000 mm

www.festo.com/en/  
Spare\_parts\_service

Wearing parts kits  
→ 22



- Standards-based cylinders to ISO 15552 (corresponds to the withdrawn standards ISO 6431, DIN ISO 6431, VDMA 24 562, NF E 49 003.1 and UNI 10290)



DIN



General technical data							
Piston Ø	32	40	50	63	80	100	125
Pneumatic connection	G $\frac{1}{8}$	G $\frac{1}{4}$	G $\frac{1}{4}$	G $\frac{3}{8}$	G $\frac{3}{8}$	G $\frac{1}{2}$	G $\frac{1}{2}$
Piston rod thread	M10x1.25	M12x1.25	M16x1.5	M16x1.5	M20x1.5	M20x1.5	M27x2
	K3	M6	M8	M10	M10	M12	M16
	K5	M10	M12	M16	M16	M20	M27
Constructional design	Piston						
	Piston rod						
	Profile barrel						
Max. torsional backlash of piston rod [°]	Q ±0.65	±0.6	±0.45	±0.45	±0.45	±0.45	-
Cushioning	Flexible cushioning rings/pads at both ends						
	Pneumatic cushioning, adjustable at both ends						
Cushioning length PPV [mm]	20	20	22	22	32	32	42
Position sensing	Via proximity sensor						
Type of mounting	Via female thread						
	Via accessories						
Mounting position	Any						

Note: This product conforms with the ISO 1179-1 standard and the ISO 228-1 standard.

# Standard cylinders DNC, ISO 15552

Technical data

Operating and environmental conditions								
Piston Ø	32	40	50	63	80	100	125	
Operating medium	Filtered compressed air, lubricated or unlubricated							
Operating pressure [bar]		0.6 ... 12					0.6 ... 10	
	R8	1.5 ... 12					1.5 ... 10	
	S11	After 10 strokes						
			0.16 ... 12		0.1 ... 12		0.06 ... 12	
		After 24 hours						
	0.3 ... 12		0.2 ... 12		0.1 ... 12			
TT	1 ... 12					-		
Ambient temperature <sup>1)</sup> [°C]		-20 ... +80						
	S6	0 ... 120						
	TT	-40 ... +80					-	
Corrosion resistance class	2							
CRC <sup>2)</sup>	R3	3						
Certification	Germanischer Lloyd							
ATEX	Specified types → <a href="http://www.festo.com">www.festo.com</a>							

- Note operating range of proximity sensors
- Corrosion resistance class 2 as per Festo standard 940 070  
Components subject to moderate corrosion stress. Externally visible parts with primarily decorative surface requirements which are in direct contact with a normal industrial environment or media such as coolants or lubricating agents.  
Corrosion resistance class 3 as per Festo standard 940 070  
Components requiring higher corrosion resistance. External visible parts in direct contact with industrial atmospheres or media such as solvents and cleaning agents, with a predominantly functional requirement for the surface.

Force [N] and impact energy [J]								
Piston Ø	32	40	50	63	80	100	125	
Theoretical force at 6 bar, advancing		483	754	1,178	1,870	3,016	4,712	7,363
	S2/S20	415	633	990	1,682	2,721	4,418	6,881
Theoretical force at 6 bar, retracting		415	633	990	1,682	2,721	4,418	6,881
	S2/S20	415	633	990	1,682	2,721	4,418	6,881
Max. impact energy at the end positions <sup>1)</sup>		0.1	0.2	0.2	0.5	0.9	1.2	5

- The permissible impact energy is reduced by approx. 10% for variants K10 and S20

Permissible impact velocity:

$$v_{perm.} = \sqrt{\frac{2 \times E_{perm.}}{m_{dead} + m_{load}}}$$

Maximum permissible load:

$$m_{load} = \frac{2 \times E_{perm.}}{v^2} - m_{dead}$$

$v_{perm.}$  Permissible impact velocity  
 $E_{perm.}$  Max. impact energy  
 $m_{intrinsic}$  Moving load (drive)  
 $m_{Load}$  Moving effective load

**Note**  
 This data represents the maximum values that can be achieved. The maximum permissible impact energy must be observed.



# Standard cylinders DNC, ISO 15552

Technical data

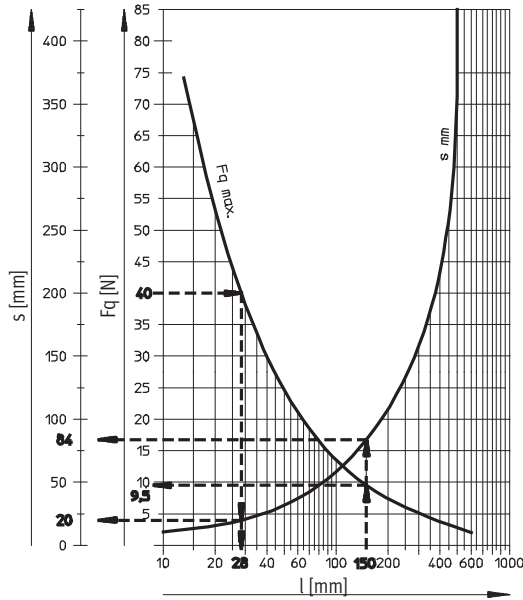
FESTO

## Lateral force $F_q$ as a function of stroke length $l$ and lever arm $s$

Q – Square piston rod

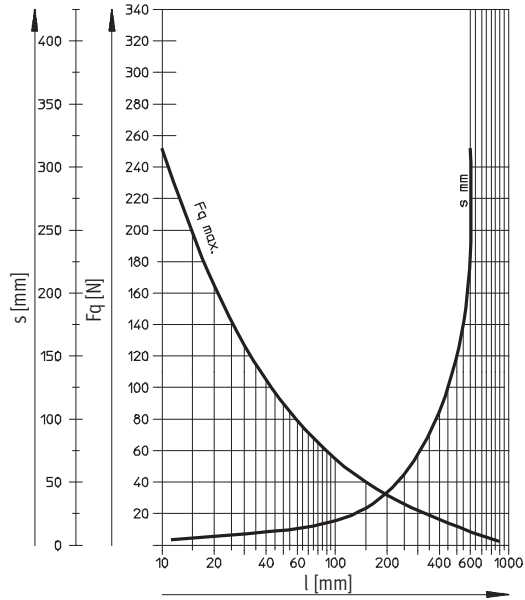
Ø 32

Max. torque = 800 Nmm / Max. stroke = 300 mm



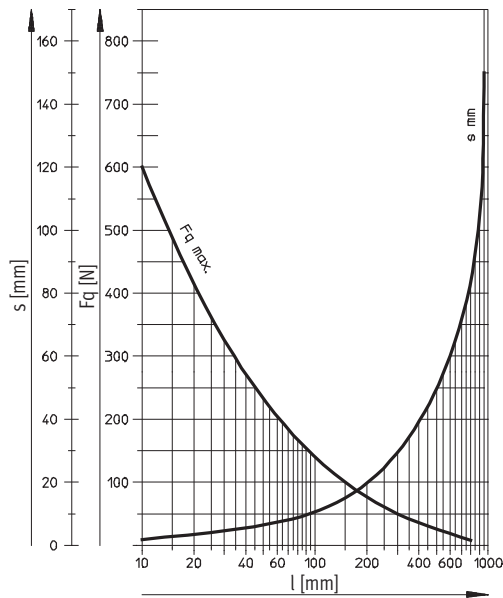
Ø 40

Max. torque = 1,100 Nmm / Max. stroke = 400 mm



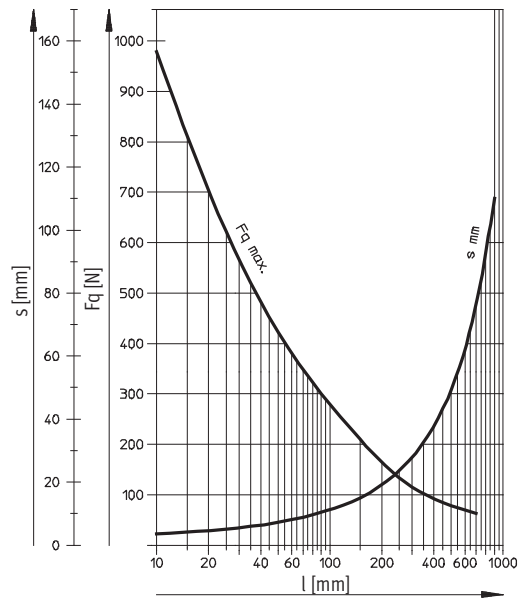
Ø 50/63

Max. torque = 1,500 Nmm / Max. stroke = 500 mm



Ø 80/100

Max. torque = 3,000 Nmm / Max. stroke = 600 mm



## Examples for piston Ø 32 mm

Example 1:

Stroke length  $l$  = 150 mm

Result: permissible

Lateral force  $F_q$  = 9.5 N

Lever arm  $s$  = 84 mm

Example 2:

Lateral force  $F_q$  = 40 N

Result: permissible

Stroke length  $l$  = 28 mm

Lever arm  $s$  = 20 mm

Example 3:

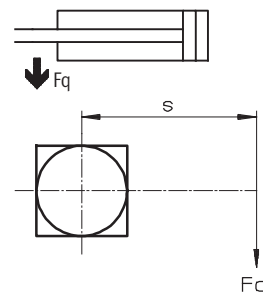
Stroke length  $l$  = 150 mm

Lever arm  $s$  = 20 mm

$$F_q = \frac{\text{Max. torque } 800 \text{ Nmm}}{\text{Lever arm } 100 \text{ mm}} = 8 \text{ N}$$

Result: permissible

$$F_q = 8 \text{ N} < F_{q\text{max}} = 9.5 \text{ N}$$



# Standard cylinders DNC, ISO 15552

Technical data

Weight [g]							
Piston $\varnothing$	32	40	50	63	80	100	125
<b>Basic version</b>							
Product weight with 0 mm stroke	517	800	1,260	1,709	2,790	4,653	6,771
Additional weight per 10 mm stroke	30	45	64	73	106	115	168
Moving load with 0 mm stroke	162	307	538	663	1,131	1,544	2,809
Additional load per 10 mm stroke	9	16	25	25	38	38	63
<b>Q – Square piston rod</b>							
Product weight with 0 mm stroke	504	738	1,187	1,632	2,652	4,508	–
Additional weight per 10 mm stroke	29	41	60	68	99	108	–
Moving load with 0 mm stroke	149	244	465	587	994	1,399	–
Additional load per 10 mm stroke	8	11	20	20	31	31	–
<b>S2 – Through piston rod</b>							
Product weight with 0 mm stroke	576	895	1,390	1,917	3,114	5,297	7,529
Additional weight per 10 mm stroke	39	61	89	98	144	153	231
Moving load with 0 mm stroke	170	330	560	711	1,200	1,660	2,925
Additional load per 10 mm stroke	18	32	50	50	76	76	126
<b>K10 – Smooth anodised piston rod</b>							
Product weight with 0 mm stroke	443	655	1,001	1,437	2,302	4,138	5,719
Additional weight per 10 mm stroke	24	35	47	57	81	90	127
Moving load with 0 mm stroke	88	162	279	391	643	1,029	1,757
Additional load per 10 mm stroke	3	6	8	9	13	13	22
<b>S2-K10 – Through, smooth anodised piston rod</b>							
Product weight with 0 mm stroke	514	766	1,181	1,676	2,701	4,821	6,674
Additional weight per 10 mm stroke	27	40	56	65	94	103	148
Moving load with 0 mm stroke	108	201	351	470	787	1,184	2,070
Additional load per 10 mm stroke	6	11	17	17	26	26	43
<b>TT – Low temperature</b>							
Product weight with 0 mm stroke	520	876	1,279	2,112	2,972	5,039	–
Additional weight per 10 mm stroke	31	46	65	73	108	116	–
Moving load with 0 mm stroke	108	204	363	460	802	1,045	–
Additional load per 10 mm stroke	9	16	25	25	39	39	–
<b>TT-S2 – Low temperature with through piston rod</b>							
Product weight with 0 mm stroke	606	1,020	1,546	2,401	3,453	5,617	–
Additional weight per 10 mm stroke	40	62	89	98	147	154	–
Moving load with 0 mm stroke	169	326	573	687	1,199	1,473	–
Additional load per 10 mm stroke	18	32	49	49	77	77	–

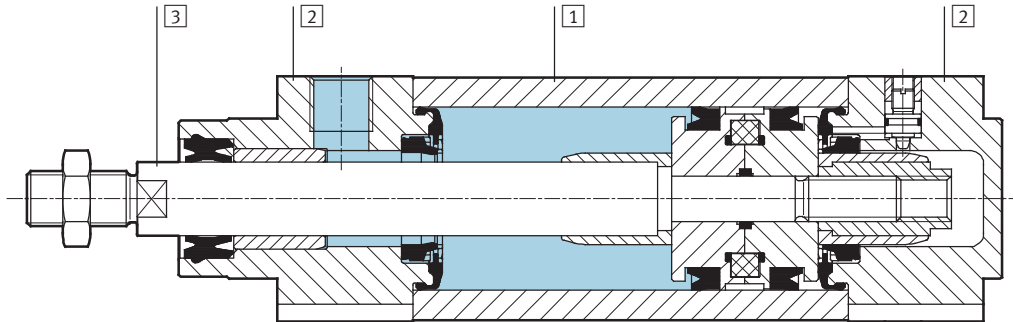
# Standard cylinders DNC, ISO 15552

Technical data

FESTO

## Materials

Sectional view



Standard cylinder	Basic version	K10	R3
1 Profile barrel	Wrought aluminium alloy, smooth anodised	Wrought aluminium alloy, smooth anodised	
2 Bearing and end caps	Die-cast aluminium		
3 Piston rod	High-alloy steel	Wrought aluminium alloy, anodised	High-alloy stainless steel
- Seals	Polyurethane, nitrile rubber		

Standard cylinder	R8	S6	S10	S11	TT
1 Profile barrel	Wrought aluminium alloy, smooth anodised				
2 Bearing and end caps	Die-cast aluminium				Coated aluminium
3 Piston rod	Tempered steel, hard-chromium plated	High-alloy steel			
- Seals	Polyurethane, nitrile rubber	Fluoro rubber			Polyurethane

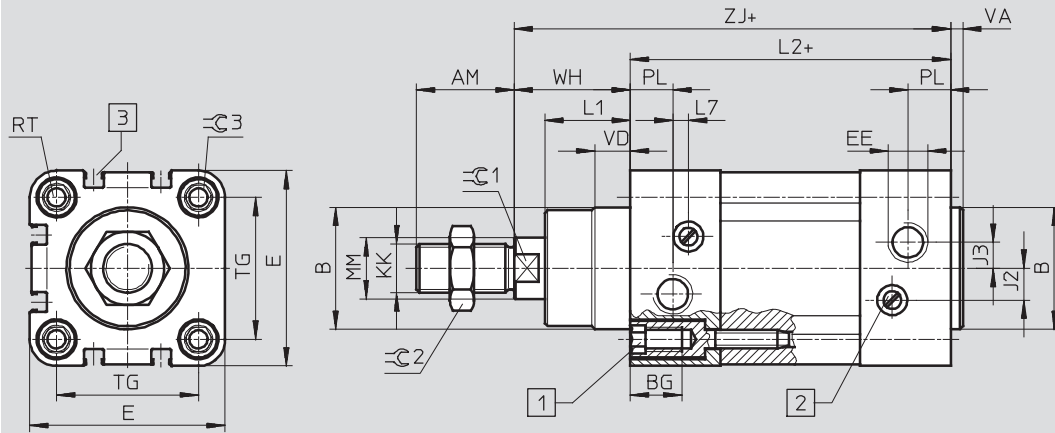
# Standard cylinders DNC, ISO 15552

Technical data



## Dimensions – Basic version

Download CAD Data → [www.festo.com/us/cad](http://www.festo.com/us/cad)



- 1 Socket head screw with female thread for mounting attachments
  - 2 Regulating screw for adjustable end-position cushioning
  - 3 Slot for proximity sensor SME/SMT-8
- + = plus stroke length

∅ [mm]	AM	B ∅ d11	BG	E	EE	J2		J3	KK	L1	L2
							TT				
32	22	30	16	45	G $\frac{1}{8}$	6		5.2	M10x1.25	18	94
40	24	35	16	54	G $\frac{1}{4}$	8		6	M12x1.25	21.5	105
50	32	40	17	64	G $\frac{1}{4}$	10.4	11	8.5	M16x1.5	28	106
63	32	45	17	75	G $\frac{3}{8}$	12.4		10	M16x1.5	28.5	121
80	40	45	17	93	G $\frac{3}{8}$	12.5		8	M20x1.5	34.7	128
100	40	55	17	110	G $\frac{1}{2}$	12		10	M20x1.5	38.2	138
125	54	60	22	134	G $\frac{1}{2}$	13		8	M27x2	46	160

∅ [mm]	L7	MM ∅	PL	RT	TG	VA	VD	WH	ZJ	⌀C1	⌀C2	⌀C3
40	3.6	16	14	M6	38	4	10.5	30	135	13	18	6
50	5.1	20	14	M8	46.5	4	11.5	37	143	17	24	8
63	6.6	20	17	M8	56.5	4	15	37	158	17	24	8
80	10.5	25	16.4	M10	72	4	15.7	46	174	22	30	6
100	8	25	18.8	M10	89	4	19.2	51	189	22	30	6
125	14	32	18	M12	110	6	20.5	65	225	27	36	8

Note: This product conforms with the ISO 1179-1 standard and the ISO 228-1 standard.

# Section 6.0

---

## *Product Catalog Information*

**Customer:**

Huber Technology

**Job Name:**

Wichita, KS

Strainpress Control Panel

**Arranged By:**

EleMech, Inc.  
2275 White Oak Circle  
Aurora, IL, 60502

**Project Engineer:**

Matt Martone

**Date:**

06/12/19

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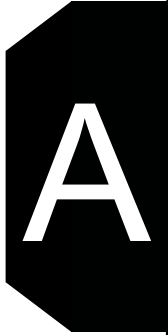


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OIU Screen Prints - B

Electrical Drawings - C

Bill of Materials - D

Catalog Cuts - E



Rev: 0

Date: 6/12/2019

Section: A

Section Name: Table of Contents

By: Matt Martone

Job Number: HBR7752

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Section 6 Page 2

# OIU Screen Prints

**B**



Rev: 0

Date: 6/12/2019

Section:

**B**

Section Name:

**OIU Screen Prints**

By: JATT MARTON

Job Number:

**HBR7752**

Page #

**1/1**

Section 6 Page 3

INLET PRESSURE : .0 PSI

DISCHARGE PRESSURE : .0 PSI

DIFFERENTIAL PRESSURE : .0 PSI

STRAINPRESS POWER : .0 %

STRAINPRESS RUNTIME : .0 HRS

F1 - ALARMS



F2 - MAIN



F4 - SETPOINTS

PERMISSIVE SIGNAL NOT PRESENT EL

HIGH MOISTURE FAULT

LOW AIR SUPPLY PRESSURE FAULT

INSPECTION HATCH NOT ENGAGED

STRAINPRESS POWER : .0 %

STRAINPRESS RUNTIME : .0 HRS

F1 - ALARMS



F2 - MAIN



F4 - SETPOINTS

PRESSURE  
SETPOINTS

STRAINPRESS

POWER  
SETPOINTS

F1 - ALARMS



F2 - MAIN



F4 - SETPOINTS

# START DIFFERENTIAL PRESSURE



PSI



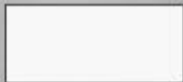
**F1 - BACK**

**F2 - MAIN**

**F3 - SETPOINTS**

**F4 - NEXT**

# START INLET PRESSURE



PSI



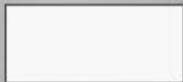
**F1 - BACK**

**F2 - MAIN**

**F3 - SETPOINTS**

**F4 - NEXT**

# HIGH INLET PRESSURE



PSI

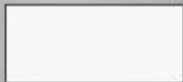


**F1 - BACK**

**F2 - MAIN**

**F3 - SETPOINTS**

**F4 - NEXT**



PSI

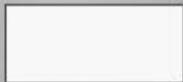


F1 - BACK

F2 - MAIN

F3 - SETPOINTS

F4 - NEXT



PSI

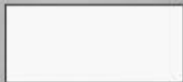


F1 - BACK

F2 - MAIN

F3 - SETPOINTS

F4 - NEXT



PSI

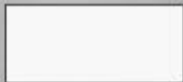


F1 - BACK

F2 - MAIN

F3 - SETPOINTS

F4 - NEXT



PSI

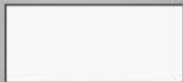


F1 - BACK

F2 - MAIN

F3 - SETPOINTS

F4 - NEXT



%



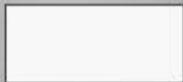
**F1 - BACK**

**F2 - MAIN**

**F3 - SETPOINTS**

**F4 - NEXT**

# CYLINDER MAXIMUM CONTROL PRESSURE



%

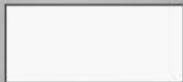


F1 - BACK

F2 - MAIN

F3 - SETPOINTS

F4 - NEXT



%



**F1 - BACK**

**F2 - MAIN**

**F3 - SETPOINTS**

**F4 - NEXT**



%



**F1 - BACK**

**F2 - MAIN**

**F3 - SETPOINTS**

**F4 - NEXT**

# STRAINPRESS OVER-TORQUE FAULT SETPOINT



%

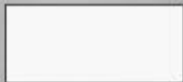


F1 - BACK

F2 - MAIN

F3 - SETPOINTS

F4 - NEXT



Seconds

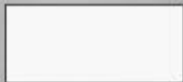


**F1 - BACK**

**F2 - MAIN**

**F3 - SETPOINTS**

**F4 - NEXT**



Seconds



F1 - BACK

F2 - MAIN

F3 - SETPOINTS

F4 - NEXT



Seconds

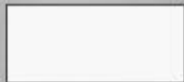


**F1 - BACK**

**F2 - MAIN**

**F3 - SETPOINTS**

**F4 - NEXT**



Counts



**F1 - BACK**



**F2 - MAIN**



**F3 - SETPOINTS**



**F4 - NEXT**





Seconds



**F1 - BACK**

**F2 - MAIN**

**F3 - SETPOINTS**

**F4 - NEXT**



Seconds

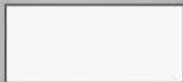


**F1 - BACK**

**F2 - MAIN**

**F3 - SETPOINTS**

**F4 - NEXT**



Seconds



**F1 - BACK**

**F2 - MAIN**

**F3 - SETPOINTS**

**F4 - NEXT**



Seconds

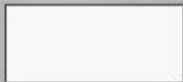


**F1 - BACK**

**F2 - MAIN**

**F3 - SETPOINTS**

**F4 - NEXT**



Seconds



F1 - BACK

F2 - MAIN

F3 - SETPOINTS

F4 - NEXT



Alarm Message

Occurrence Time

Occurrence Date

Alarm Message	Occurrence Time	Occurrence Date



F1 - ALARMS



F2 - MAIN



F4 - SETPOINTS

# Electrical Drawings



Rev: 0

Date: 6/12/2019

Section:

C

Section Name:

Electrical Drawings

By: JATT MARTON

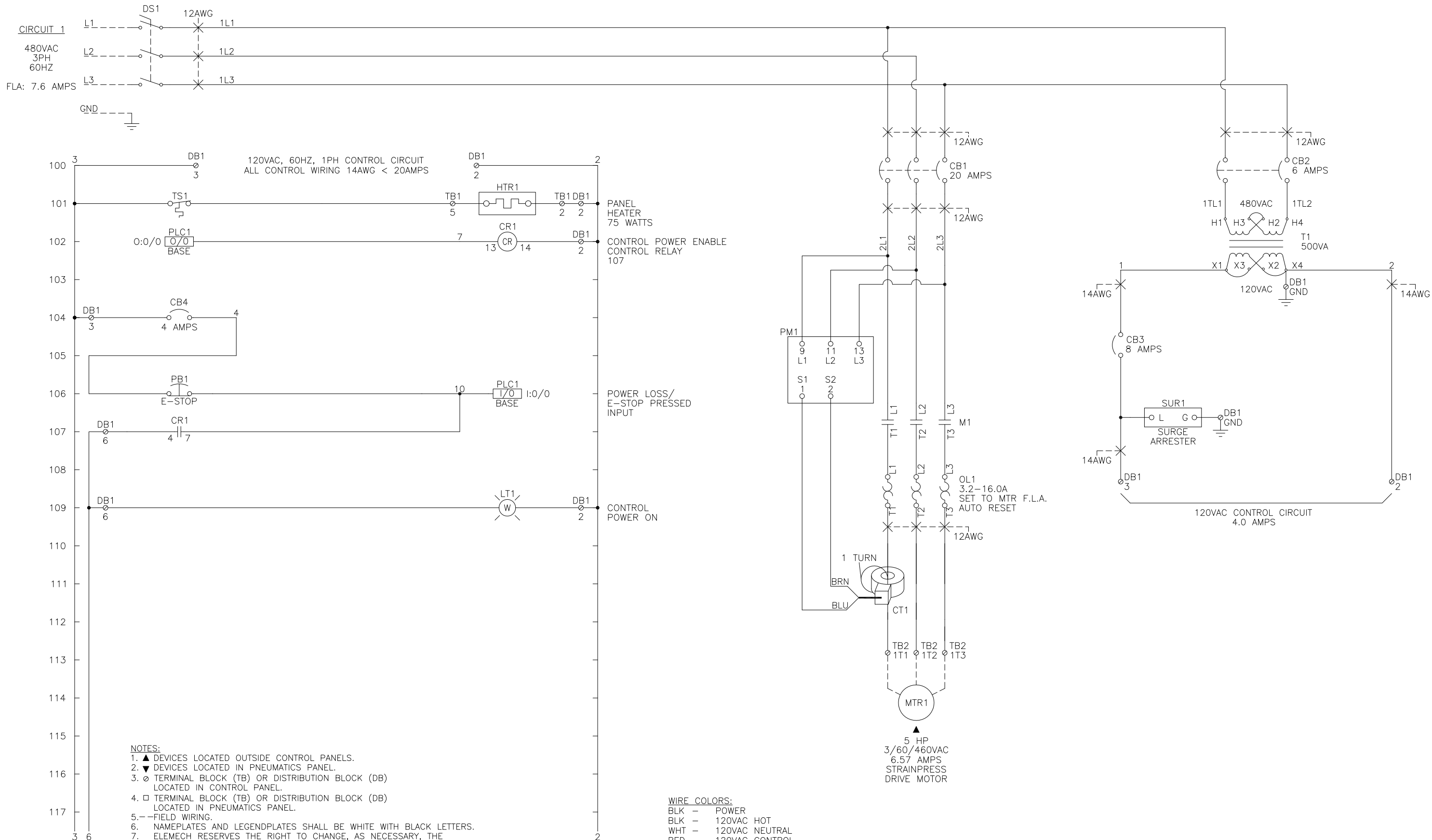
Job Number:

HBR7752

Page #

1/1

Section 6 Page 29



- NOTES:**
- ▲ DEVICES LOCATED OUTSIDE CONTROL PANELS.
  - ▼ DEVICES LOCATED IN PNEUMATICS PANEL.
  - ⊙ TERMINAL BLOCK (TB) OR DISTRIBUTION BLOCK (DB) LOCATED IN CONTROL PANEL.
  - TERMINAL BLOCK (TB) OR DISTRIBUTION BLOCK (DB) LOCATED IN PNEUMATICS PANEL.
  - FIELD WIRING.
  - NAMEPLATES AND LEGENDPLATES SHALL BE WHITE WITH BLACK LETTERS.
  - ELEMECH RESERVES THE RIGHT TO CHANGE, AS NECESSARY, THE SPACING, ORIENTATION, AND PHYSICAL LOCATION OF DEVICES IN ORDER TO OPTIMIZE THE DESIGN.
  - LOCAL MOTOR DISCONNECT SWITCHES SHALL BE PROVIDED BY OTHERS IF REQUIRED BY LOCAL REGULATIONS.
  - JUNCTION BOXES ARE NOT SHOWN AND SHALL BE PROVIDED BY OTHERS AS NECESSARY.

- WIRE COLORS:**
- BLK - POWER
  - BLK - 120VAC HOT
  - WHT - 120VAC NEUTRAL
  - RED - 120VAC CONTROL
  - YEL - REMOTE
  - GRN - GROUND
  - BLU - DC POSITIVE/CONTROL
  - WHT/BLU - DC NEUTRAL

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					CHECKED	CCC
					APPROVED	
DATE	REVISION	NO.	BY	CK	APP	DATE
						05/23/19

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STRAINPRESS CONTROL PANEL

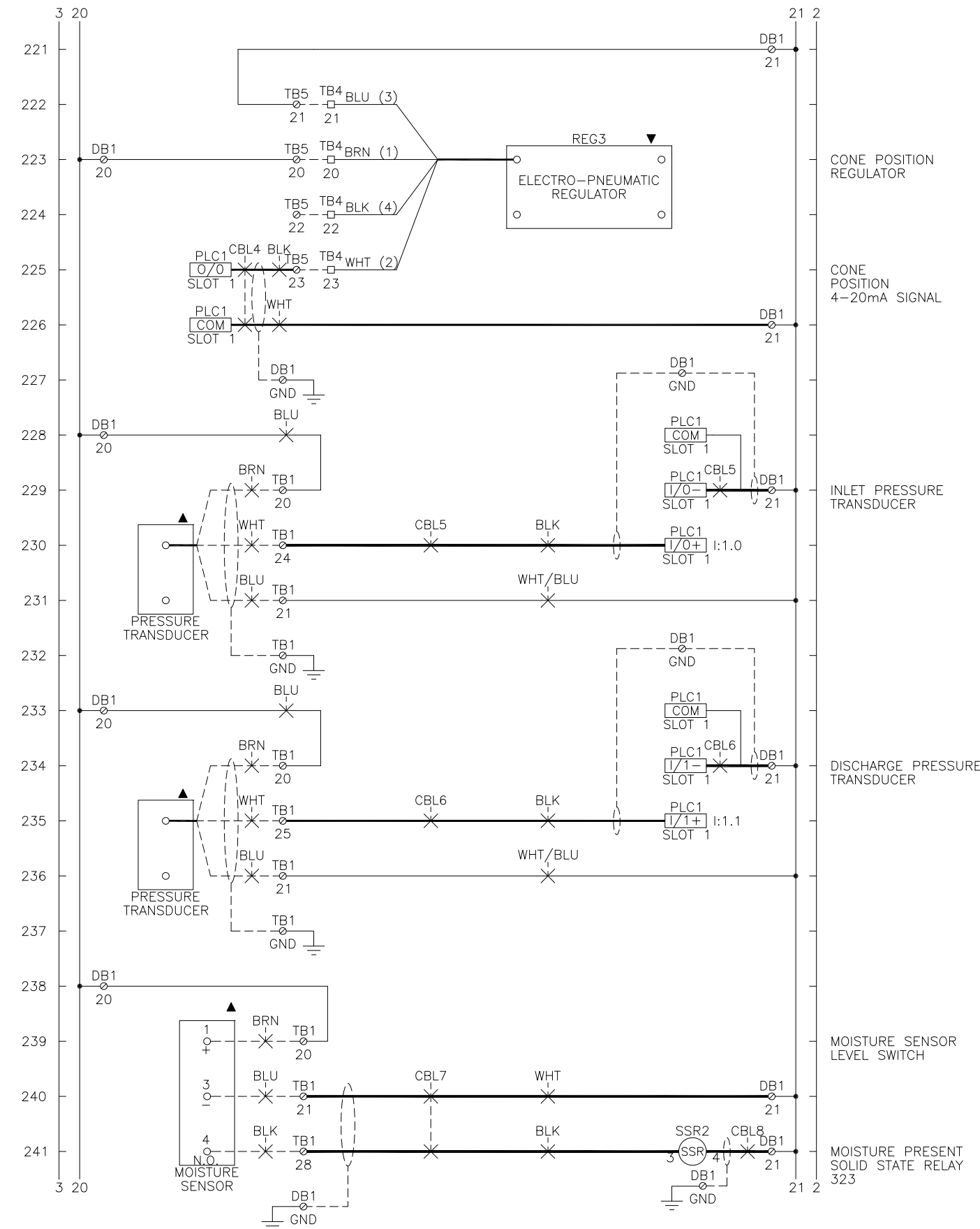
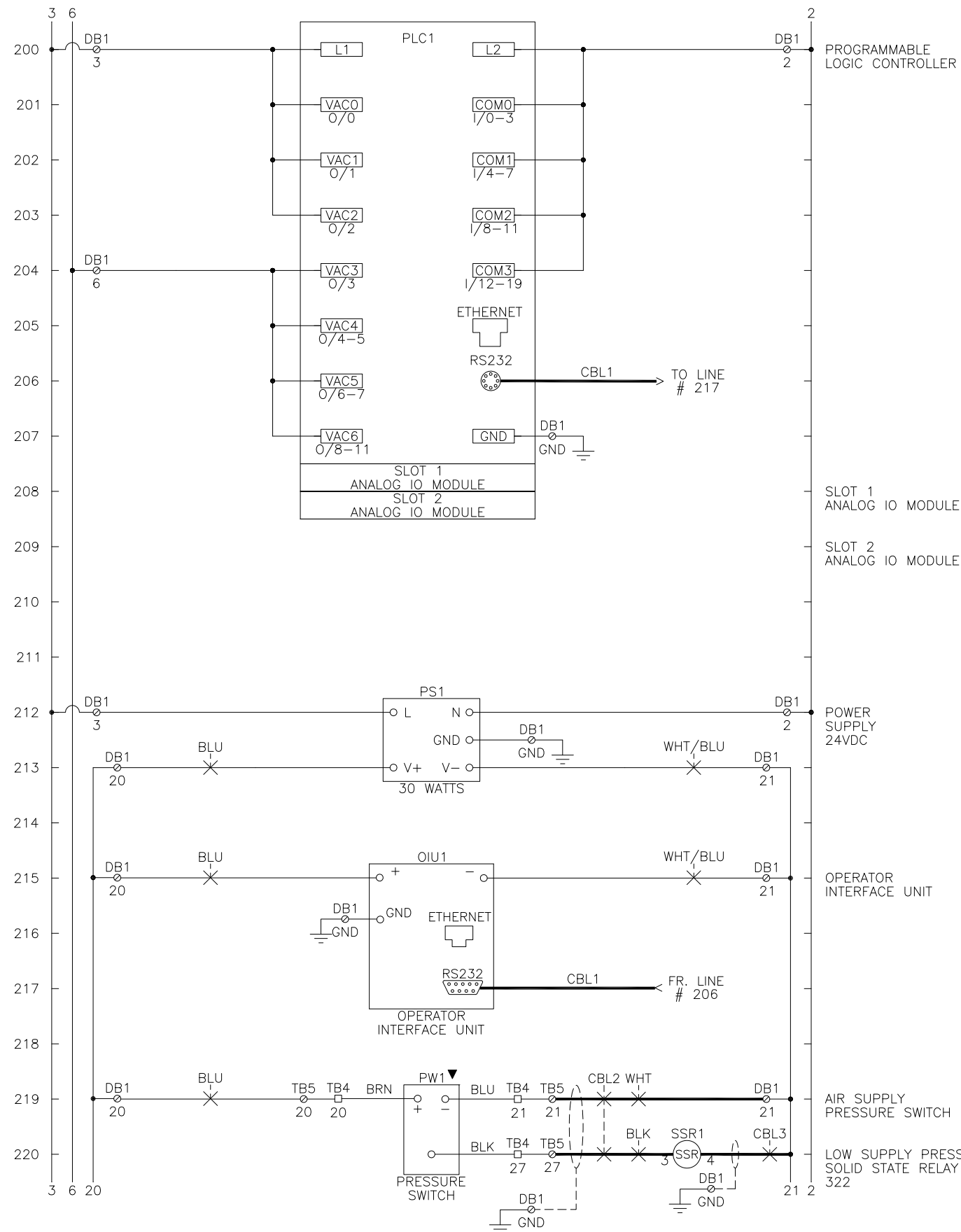
WICHITA, KS

SCALE: NONE

PROJECT NUMBER: 73004414

DRAWING NO: HBR7752A1

SHEET 1 OF 9



06/06/19	AS BUILT	A	AJ	CCC	DESIGNED	AJ
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STRAINPRESS CONTROL PANEL

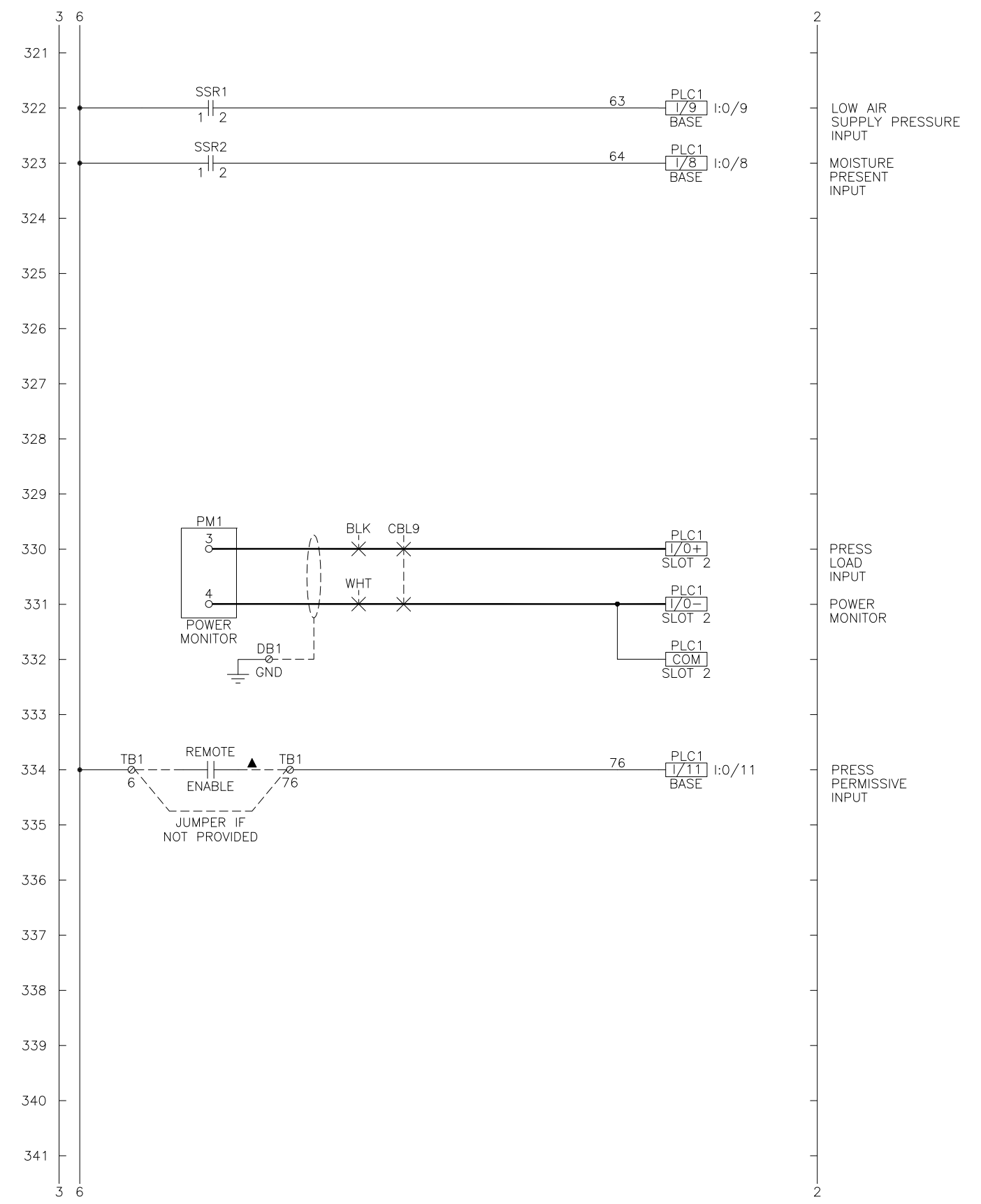
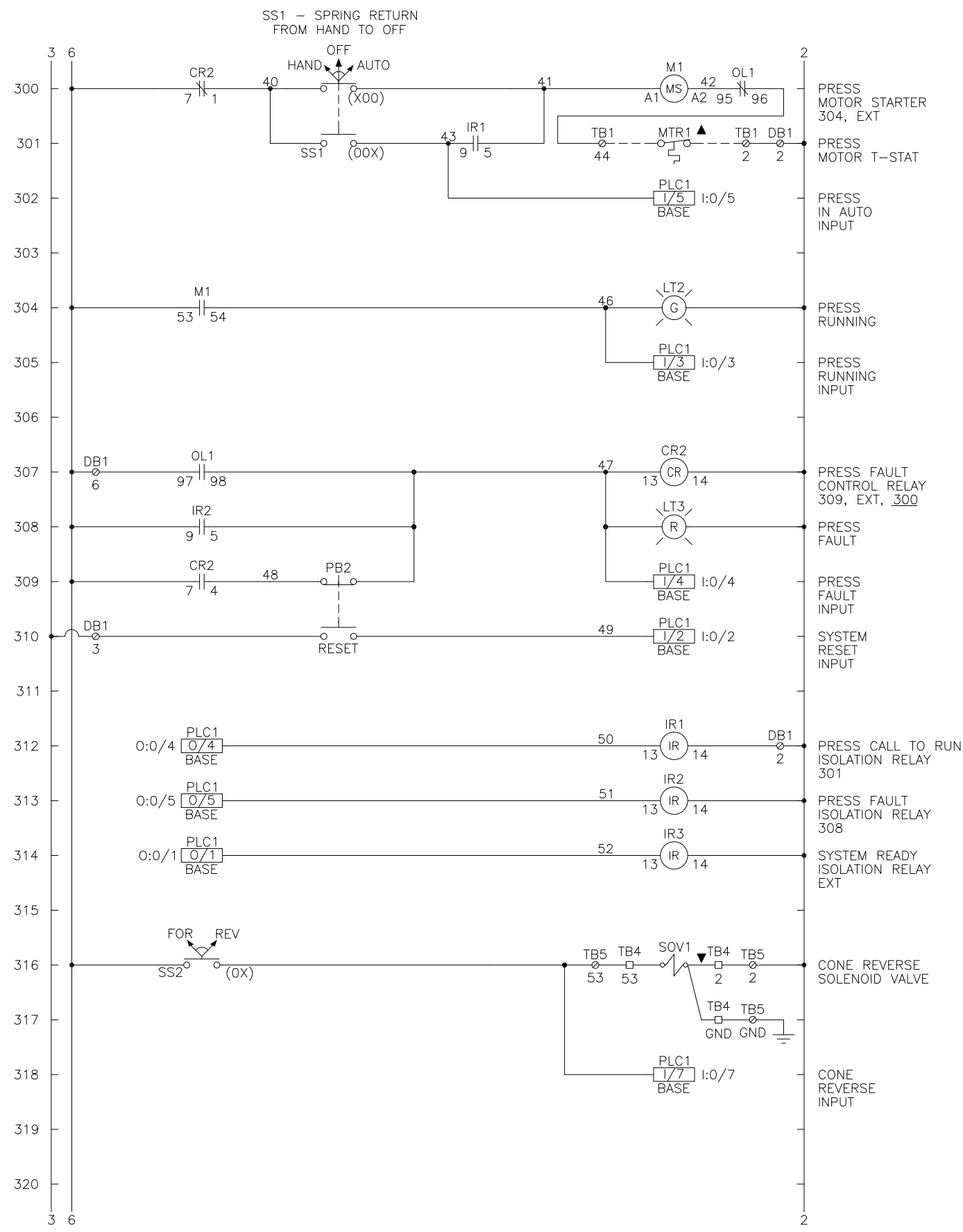
WICHITA, KS

SCALE: NONE

PROJECT NUMBER: 73004414

DRAWING NO: HBR7752A2

SHEET 2 OF 9



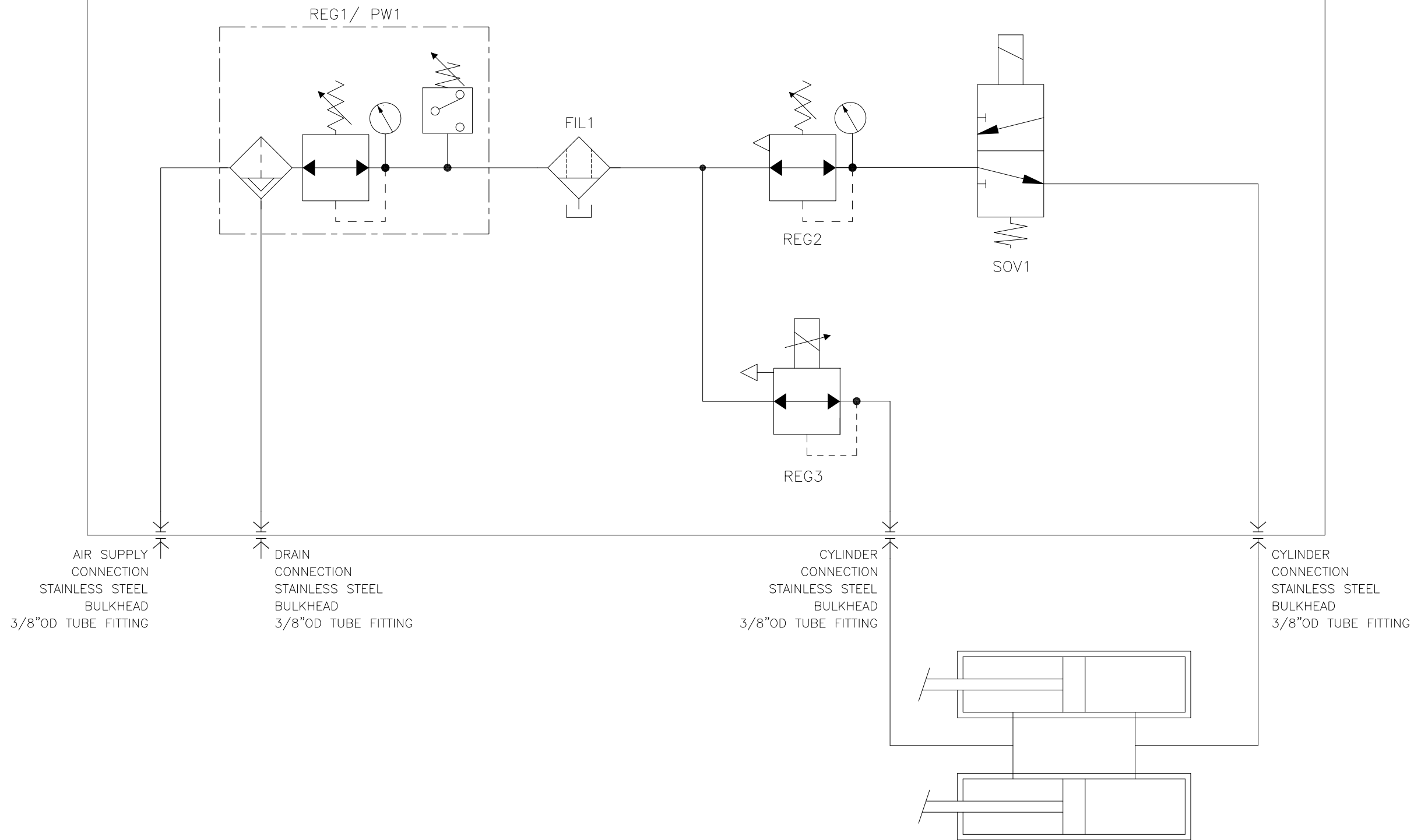
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					DETAILED	
					CHECKED	CCC
					APPROVED	
DATE	REVISION	NO.	BY	CK	APP	DATE
						05/23/19

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STRAINPRESS CONTROL PANEL	
WICHITA, KS	SCALE: NONE
PROJECT NUMBER: 73004414	DRAWING NO: HBR7752A3
	SHEET 3 OF 9

PNEUMATIC CONTROL PANEL

NOTE: ALL AIR LINES WILL BE 3/8" BLUE POLYURETHANE TUBING.



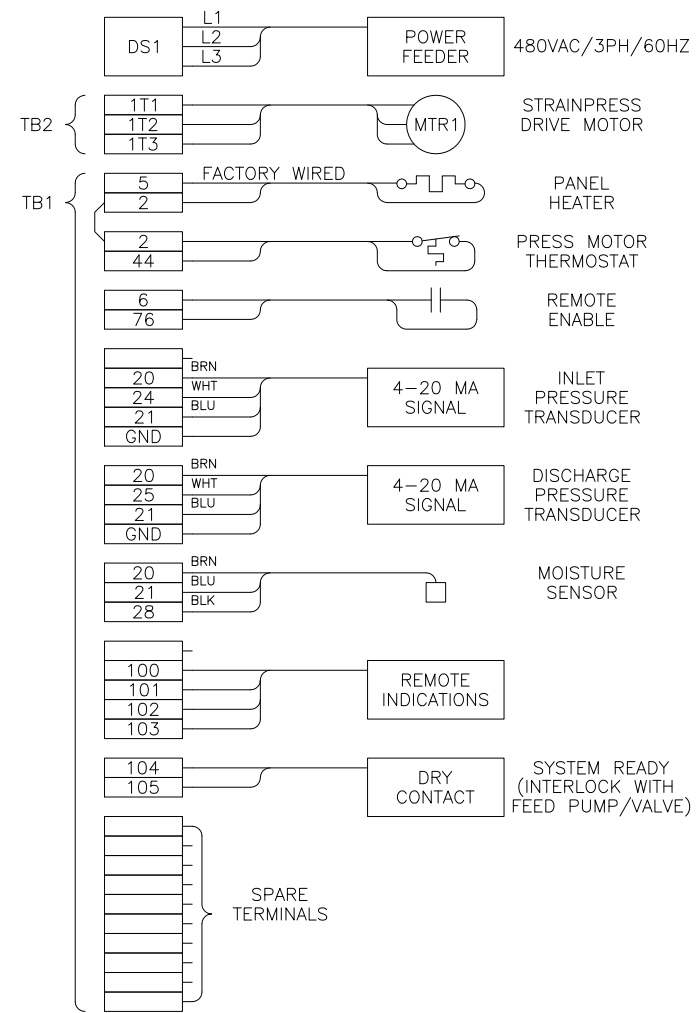
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						DETAILED	
						CHECKED	CCC
						APPROVED	
DATE	REVISION		NO.	BY	CK	APP DATE	05/23/19

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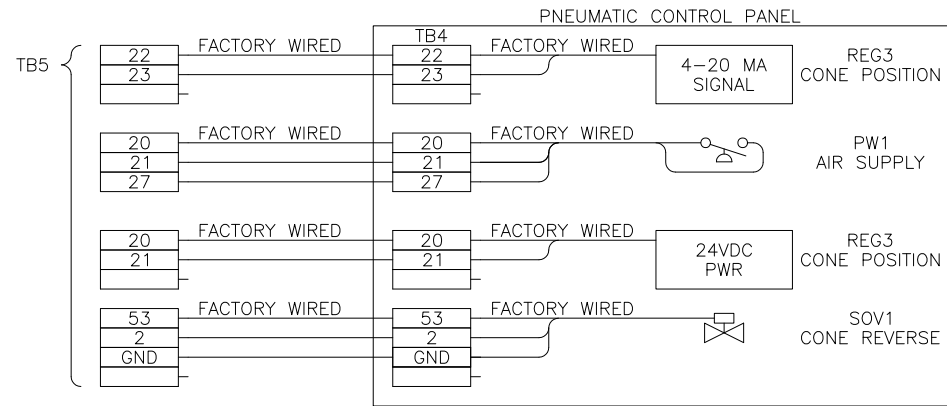
STRAINPRESS CONTROL PANEL	
WICHITA, KS	SCALE: NONE
PROJECT NUMBER: 73004414	DRAWING NO: HBR7752A4 SHEET 4 OF 9

FIELD WIRING DIAGRAM

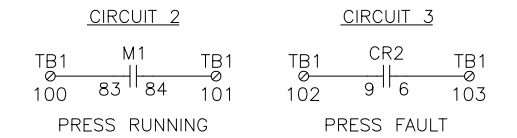
**WARNING:**  
 DAMAGE RESULTING FROM INSTALLATION OF TOP ENTRY CONDUIT WILL VOID WARRANTY.  
 - USE PROPER FITTINGS, MYERS TYPE 4 OR EQUAL  
 - PROTECT INTERIOR DEVICES FROM INSTALLATION DEBRIS  
 - CONDUIT MUST BE SEALED WATERTIGHT TO PREVENT WATER ENTRY



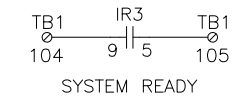
FIELD WIRING DIAGRAM



DRY CONTACT OUTPUTS



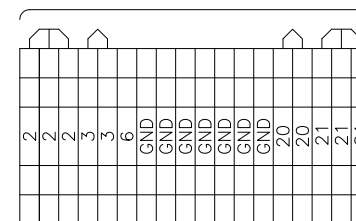
CIRCUIT 4



MAX. CONTROLLED LOAD: 10A @ 120VAC

NOTE: BRANCH CIRCUIT PROTECTION PROVIDED BY OTHERS PER N.E.C.

DB1 DETAIL



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						05/23/19

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STRAINPRESS  
 CONTROL PANEL

WICHITA, KS SCALE:  
 NONE

PROJECT NUMBER: 73004414 DRAWING NO: HBR7752A5  
 SHEET 5 OF 9

## DEVICE SETTINGS

### PLC - I/O

ALLEN-BRADLEY MICROLOGIX 1400																			
IN																			
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
OUT																			
0	1	2	3	4	5														
6	7	8	9	10	11														

POWER  
 RUN  
 FAULT  
 FORCE  
 COM0  
 DCOMM

#### PLC INPUTS

I/0	POWER LOSS/E-STOP
I/1	SPARE
I/2	SYSTEM RESET
I/3	PRESS RUNNING
I/4	PRESS FAULT
I/5	PRESS IN AUTO
I/6	SPARE
I/7	CONE REVERSE
I/8	MOISTURE PRESENT
I/9	LOW AIR SUPPLY PRESSURE
I/10	SPARE
I/11	PRESS PERMISSIVE
I/12	SPARE
I/13	SPARE
I/14	SPARE
I/15	SPARE
I/16	SPARE
I/17	SPARE
I/18	SPARE
I/19	SPARE

#### PLC OUTPUTS

O/0	CONTROL POWER ENABLE
O/1	SYSTEM READY
O/2	SPARE
O/3	SPARE
O/4	PRESS CALL TO RUN
O/5	PRESS FAULT
O/6	SPARE
O/7	SPARE
O/8	SPARE
O/9	SPARE
O/10	SPARE
O/11	SPARE

#### PLC STATUS BITS

S:1/8 - FAULT OVERRIDE AT POWERUP = 1

#### PLC ANALOG INPUTS - SLOT NO.1

IN0	INLET PRESSURE
IN1	DISCHARGE PRESSURE

#### PLC ANALOG OUTPUTS - SLOT NO.1

OUT0	CONE POSITION
OUT1	SPARE

#### PLC ANALOG INPUTS - SLOT NO.2

IN0	PRESS LOAD
IN1	SPARE

#### PLC ANALOG OUTPUTS - SLOT NO.2

OUT0	SPARE
OUT1	SPARE

### PLC1 - SETPOINTS

REGISTER NUMBER	DESCRIPTION	FACTORY SETTING	RANGE
F8:50	START DIFFERENTIAL PRESSURE	7 PSI	0-20 PSI
F8:51	START INLET PRESSURE	20 PSI	0-35 PSI
F8:52	HIGH INLET PRESSURE	35 PSI	0-43 PSI
F8:53	INLET PRESSURE 4mA SCALING	-7 PSI	-7-200 PSI
F8:54	INLET PRESSURE 20mA SCALING	200 PSI	-7-200 PSI
F8:55	DISCHARGE PRESSURE 4mA SCALING	-7 PSI	-7-200 PSI
F8:56	DISCHARGE PRESSURE 20mA SCALING	200 PSI	-7-200 PSI
N7:0	MAINTAINED HIGH INLET PRESSURE FAULT TIME	30 SEC.	1-300 SEC.
N7:1	HIGH INLET PRESSURE RECOVERY TIME	30 SEC.	1-300 SEC.
N7:2	HIGH INLET PRESSURE FAULT COUNT RESET TIME	300 SEC.	1-300 SEC.
N7:3	HIGH INLET PRESSURE ATTEMPTS TO CLEAR FAULT	3 COUNTS	1-10 COUNTS
N7:4	STRAINPRESS OFF DELAY TIME	20 SEC.	1-300 SEC.
N7:5	STRAINPRESS OVER-TORQUE DELAY TIME	1 SEC.	1-30 SEC.
N7:6	HIGH MOISTURE FAULT DELAY TIME	60 SEC.	1-300 SEC.
N7:7	LOW AIR SUPPLY PRESSURE DELAY TIME	120 SEC.	1-300 SEC.
N7:10	DISCHARGE PRESSURE GREATER THAN INLET DELAY TIME	15 SEC.	0-999 SEC.
F8:57	CYLINDER MIN. CONTROL PRESSURE	0%	0-100%
F8:58	CYLINDER MAX CONTROL PRESSURE	100%	0-100%
F8:59	STRAINPRESS MIN. POWER	20%	0-100%
F8:60	STRAINPRESS MAX POWER	80%	0-100%
F8:61	STRAINPRESS OVER-TORQUE FAULT	80%	0-100%

#### NOTES:

- THE ABOVE IS A PARTIAL LISTING OF SETPOINTS. ONLY THE SETPOINTS THAT ARE SHOWN ABOVE SHALL BE ALTERED IN THE FIELD.

## DEVICE SETTINGS

### PLC1 - COMMUNICATIONS SETUP

PARAMETER	VALUE	PARAMETER	VALUE
DRIVER	DF1 FULL DUPLEX	IP ADDRESS	10.0.0.1
BAUD RATE	9600	SUBNET MASK	255.255.255.0
PARITY	NONE	GATEWAY ADDRESS	0.0.0.0
STOP BITS	1		
ERROR DETECTION	CRC		

### QIU1 - COMMUNICATIONS SETUP

PARAMETER	VALUE
DRIVER	DF1 FULL DUPLEX
BAUD RATE	9600
PARITY/STOP BITS	NONE/1
ERROR DETECTION	CRC
HANDSHAKING	OFF

### PM1 - SETTINGS

WINDOW NUMBER	FUNCTION DESCRIPTION	DEFAULT	FACTORY SETTING
04	PARAMETER LOCK	0	0
05	MONITOR TYPE	=O.L.U.L.	OVERLOAD
11	MAIN ALARM	100%	
12	PRE-ALARM	100%	
21	MAIN ALARM MARGIN	16%	
22	PRE-ALARM MARGIN	8%	
31	START-UP DELAY	2 SEC.	
32	RESPONSE DELAY	0.5 SEC.	
33	HYSTERESIS	0%	
41	MOTOR RATED POWER	2.9 HP	5.0 HP
42	MOTOR RATER CURRENT	5.6 AMP	6.5 AMPS
61	MAIN ALARM LATCHED	OFF	
62	ALARM AT ZERO CURRENT	OFF	
63	MAIN ALARM (NO/NC)	NC	NO
64	PRE-ALARM (NO/NC)	NO	
65	ADVANCE RELAY OPERATION	0	
81	REMOTE DIGITAL INPUT	RES	
91	ANALOG OUTPUT	0.20	4.20 (ON)
92	ANALOG OUTPUT LOW	0%	
93	ANALOG OUTPUT HIGH	100%	

#### NOTES:

- FACTORY SETTING '\*' NOTES PARAMTERS SET IN THE FIELD.
- RELAYS CHANGE TO PROGRAMMED STATE ON POWER-UP.
- THE ABOVE IS A PARTIAL PARAMETER LIST AND THEIR SETTINGS. FOR A COMPLETE LIST REFER TO THE OWNERS MANUAL.
- O.L. = OVERLOAD, U.L. = UNDERLOAD

### PW1 - SETTINGS

PARAMETER	DESCRIPTION	DEFAULT	FACTORY SETTING
P-	PRESSURE SETTING	50 PSI	75 PSI

#### SETPOINT CHANGE INSTRUCTIONS:

- PRESS THE "S" KEY. THE DISPLAY SHOULD FLASH "P-".
- USE THE UP AND DOWN ARROW KEYS TO ADJUST THE PRESSURE SETPOINT.
- PRESS THE "S" KEY TO SAVE SETTING.

### REG3 - SETPOINTS

PARAMETER	DESCRIPTION	DEFAULT	FACTORY SETTING
F_1	MIN. PRESSURE	0 PSI	0 PSI
F_2	MAX. PRESSURE	100 PSI	80 PSI

#### SETPOINT CHANGE INSTRUCTIONS:

- PRESS AND HOLD THE "V" KEY. THE DISPLAY SHOULD FLASH "Loc".
- PRESS THE "S" KEY. THE DISPLAY SHOULD READ "unL".
- PRESS THE "S" KEY TO CYCLE BETWEEN THE SETPOINTS.
- USE THE UP AND DOWN ARROW KEYS TO ADJUST A SETPOINT.
- PRESS THE "S" KEY TO SAVE SETTING.
- PRESS AND HOLD THE "A" KEY. THE DISPLAY SHOULD FLASH "unL".
- PRESS THE "S" KEY. THE DISPLAY SHOULD READ "Loc".

### IS1 - SETTINGS

HEATER ON/OFF	60 °F
---------------	-------

## DEVICE SETTINGS

### PLC1 - SCADA COMMUNICATIONS

REGISTER NUMBER	DESCRIPTION	NORMAL STATE	ACTIVE STATE	DATA TYPE	FUNCTION
N25:0	PLC1 BASE DISCRETE INPUTS	0	1	BIT	READ
N25:2	PLC1 BASE DISCRETE OUTPUTS	0	1	BIT	READ
F28:0	PRESS INLET PRESSURE(PSI)	-	-	REAL	READ
F28:1	PRESS DISCHARGE PRESSURE(PSI)	-	-	REAL	READ
F28:2	PRESS LOAD(%)	-	-	REAL	READ

#### NOTES:

- THE ABOVE IS A LISTING OF BITS BEING MESSAGED FROM THE MAIN PANEL TO THE SCADA SYSTEM.

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						05/23/19

# HUBER

## TECHNOLOGY

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STRAINPRESS CONTROL PANEL

WICHITA, KS

SCALE: NONE

PROJECT NUMBER:  
73004414

DRAWING NO:  
HBR7752A6

SHEET 6 OF 9

SEQUENCE OF OPERATION

CONTROL POWER ON-DELAY:

EACH TIME THE CONTROL PANEL POWER SUPPLY IS CYCLED, THE PLC WILL ALLOW ALL SOLID STATE DEVICES TO FULLY ENERGIZE BEFORE ENABLING THE CONTROL POWER CIRCUIT.

SYSTEM READY INTERLOCK:

THE SYSTEM READY INTERLOCK CONTROL RELAY WILL BE ENERGIZED WHEN THE FOLLOWING CONDITIONS ARE SATISFIED. THE SYSTEM READY CONTROL RELAY NEEDS TO BE INTERLOCKED WITH THE SLUDGE FEED PUMP CALL TO RUN SIGNAL.

1. STRAINPRESS SELECTOR IS IN THE AUTO POSITION.
2. STRAINPRESS MOTOR STARTER THERMAL OVERLOAD IS NOT TRIPPED.
3. STRAINPRESS NOT IN OVERTORQUE CONDITION.
4. SLUDGE INLET PRESSURE IS BELOW THE HIGH PRESSURE SET-POINT.
5. SCREENINGS DISCHARGE MOISTURE FAULT IS NOT ACTIVATED.
6. PNEUMATIC SYSTEM AIR SUPPLY IS HEALTHY.
7. ALL EMERGENCY STOPS ARE IN OPERABLE POSITIONS.
8. THE REMOTE ENABLE SIGNAL HAS BEEN RECEIVED.

STRAINPRESS MODES OF OPERATION:

HAND: WHEN THE STRAINPRESS HAND-OFF-AUTO SELECTOR IS IN THE HAND POSITION, THE STRAINPRESS WILL RUN CONTINUOUSLY. THE STRAINPRESS SELECTOR WILL SPRING RETURN FROM HAND TO OFF.

AUTO: WHEN STRAINPRESS SELECTOR IS IN THE AUTO POSITION AND THE SYSTEM READY INTERLOCK IS ENERGIZED, THE STRAINPRESS WILL START TO RUN DUE TO THE FOLLOWING CONDITIONS.

1. THE DIFFERENCE BETWEEN THE SLUDGE INLET AND DISCHARGE PRESSURE HAS REACHED THE START DIFFERENTIAL PRESSURE SET-POINT.
2. THE SLUDGE INLET PRESSURE HAS REACHED THE START INLET PRESSURE SET-POINT.

ONCE A START CONDITION IS RECEIVED, THE STRAINPRESS WILL START TO RUN CONTINUOUSLY. ONCE THE ABOVE PRESSURE CONDITIONS ARE REMOVED, THE STRAINPRESS WILL CONTINUE TO RUN FOR A TIME SET IN THE STRAINPRESS OFF-DELAY TIMER.

EMERGENCY STOP:

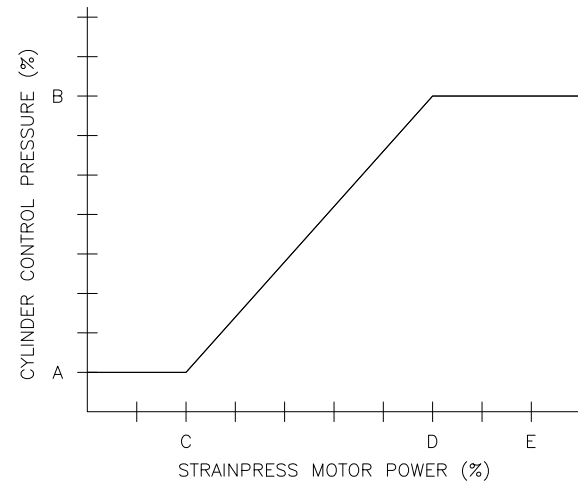
THE STRAINPRESS WILL STOP IMMEDIATELY AND THE SYSTEM READY INTERLOCK WILL BE REMOVED IF ANY OF THE E-STOP PUSHBUTTONS ARE PRESSED. IN ORDER TO RESUME OPERATION, ALL E-STOPS MUST BE RESET AND THE SYSTEM RESET PUSHBUTTON MUST BE PRESSED.

SEQUENCE OF OPERATION

PNEUMATIC CYLINDER AIR PRESSURE REGULATOR:

WHEN THE STRAINPRESS STARTS TO RUN, THE STRAINPRESS POWER MONITOR WILL PROVIDE A 4-20ma SIGNAL PROPORTIONAL TO MOTOR LOAD FROM 0-100% MOTOR NAMEPLATE POWER. THIS ANALOG SIGNAL WILL BE USED BY THE ELECTRO-PNEUMATIC REGULATOR TO ADJUST THE AMOUNT OF AIR PRESSURE SUPPLIED TO THE CONTROL SIDE OF THE PNEUMATIC CYLINDERS. THE AIR PRESSURE SUPPLIED TO THE CYLINDERS DURING NORMAL OPERATION WILL BE AS DETAILED BELOW. AS THE MOTOR POWER FLUCTUATES BETWEEN, THE MINIMUM AND MAXIMUM POWER SET-POINTS, THE CYLINDER CONTROL PRESSURE WILL INCREASE AND DECREASE BETWEEN THE MINIMUM AND MAXIMUM CONTROL PRESSURE SET-POINTS.

CYLINDER CONTROL PRESSURE VS. MOTOR POWER



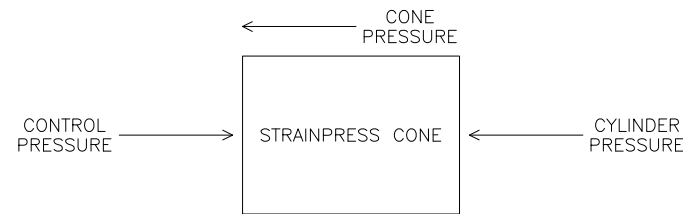
MOTOR POWER / CONTROL PRESSURE SCALING SET-POINTS:

- A. CYLINDER MINIMUM CONTROL PRESSURE
- B. CYLINDER MAXIMUM CONTROL PRESSURE
- C. STRAINPRESS MINIMUM POWER
- D. STRAINPRESS MAXIMUM POWER
- E. STRAINPRESS HIGH POWER FAULT

PNEUMATIC CYLINDER REVERSE MODE:

WHEN THE PRESS CONE SELECTOR IS IN THE REVERSE POSITION, THE CONE REVERSE SOLENOID VALVE WILL BE ENERGIZED AND THE CONTROL PRESSURE WILL BE SET TO 100%.

CONE PRESSURE DIAGRAM



NOTE: CONE PRESSURE = CYLINDER PRESSURE - CONTROL PRESSURE

SEQUENCE OF OPERATION

FAULTS:

STRAINPRESS MOTOR OVERLOAD - WHEN THE STRAINPRESS MOTOR OVERLOAD IS SENSED, THE STRAINPRESS WILL STOP IMMEDIATELY, THE STRAINPRESS READY INTERLOCK WILL BE REMOVED AND THE STRAINPRESS FAULT LIGHT WILL BE ENERGIZED.

STRAINPRESS MOTOR OVER-TORQUE - WHEN THE STRAINPRESS OVER-TORQUE IS SENSED, THE STRAINPRESS WILL STOP IMMEDIATELY, THE STRAINPRESS READY INTERLOCK WILL BE REMOVED AND THE STRAINPRESS FAULT LIGHT WILL BE ENERGIZED.

SLUDGE INLET HIGH PRESSURE ALARM - WHEN HIGH PRESSURE IS SENSED AT THE SLUDGE INLET, THE STRAINPRESS READY INTERLOCK WILL BE REMOVED. THE ALARM CONDITION WILL RESET AND THE SYSTEM WILL RESUME NORMAL OPERATION ONCE NORMAL PRESSURE HOLDS FOR THE TIME SET IN THE HIGH INLET PRESSURE RECOVERY TIMER.

SLUDGE INLET HIGH PRESSURE SHUTDOWN - WHEN HIGH PRESSURE IS SENSED AT THE SLUDGE INLET AND IS MAINTAINED FOR THE TIME SET IN THE MAINTAINED HIGH INLET PRESSURE FAULT TIME, THE STRAINPRESS WILL STOP IMMEDIATELY, THE STRAINPRESS READY INTERLOCK WILL BE REMOVED AND THE STRAINPRESS FAULT LIGHT WILL BE ENERGIZED.

WHEN HIGH PRESSURE IS SENSED AT THE SLUDGE INLET THE NUMBER OF TIMES SET IN THE HIGH INLET PRESSURE ATTEMPTS TO CLEAR FAULT WITHIN THE TIME SET IN THE HIGH INLET PRESSURE FAULT COUNT RESET TIMER, THE STRAINPRESS WILL STOP IMMEDIATELY, THE STRAINPRESS READY INTERLOCK WILL BE REMOVED AND THE STRAINPRESS FAULT LIGHT WILL BE ENERGIZED.

AIR SUPPLY LOW PRESSURE - WHEN LOW AIR PRESSURE IS SENSED IN THE PNEUMATIC CONTROL SYSTEM FOR THE TIME SET IN THE LOW AIR SUPPLY PRESSURE DELAY TIME, THE STRAINPRESS WILL STOP IMMEDIATELY, THE STRAINPRESS READY INTERLOCK WILL BE REMOVED. AIR SUPPLY LOW PRESSURE WILL NOT PREVENT HAND OPERATION.

SCREENINGS DISCHARGE HIGH MOISTURE - WHEN MOISTURE IS SENSED IN THE SCREENINGS DISCHARGE CHAMBER AND MAINTAINED FOR THE TIME SET IN THE HIGH MOISTURE FAULT DELAY, THE STRAINPRESS WILL STOP IMMEDIATELY AND THE STRAINPRESS READY INTERLOCK WILL BE REMOVED. HIGH MOISTURE WILL NOT PREVENT HAND OPERATION.

ALL OF THE ABOVE FAULTS CAN BE RESET BY PRESSING THE SYSTEM RESET PUSHBUTTON.

OIU - INFORMATION:

1. THE OIU WILL DISPLAY THE ELAPSED MOTOR RUN TIMES.
2. ALL ADJUSTABLE SET-POINTS MAY BE ACCESSED AND ADJUSTED THROUGH THE OIU.
3. ALL PRESENT FAULTS WILL BE DISPLAYED ON THE OIU.
4. THE HISTORY OF ALL PAST FAULTS CAN BE ACCESSED THROUGH THE OIU.
5. STRAINPRESS MOTOR LOAD WILL BE DISPLAYED ON THE OIU.
6. SLUDGE INLET PRESSURE WILL BE DISPLAYED ON THE OIU.
7. SLUDGE DISCHARGE PRESSURE WILL BE DISPLAYED ON THE OIU.
8. SLUDGE DISCHARGE PRESSURE GREATER THAN INLET PRESSURE WARNING WILL BE DISPLAYED ON THE OIU.

06/06/19	AS BUILT		A	AJ	CCC	DESIGNED	AJ
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						CHECKED	CCC
						APPROVED	
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							05/23/19

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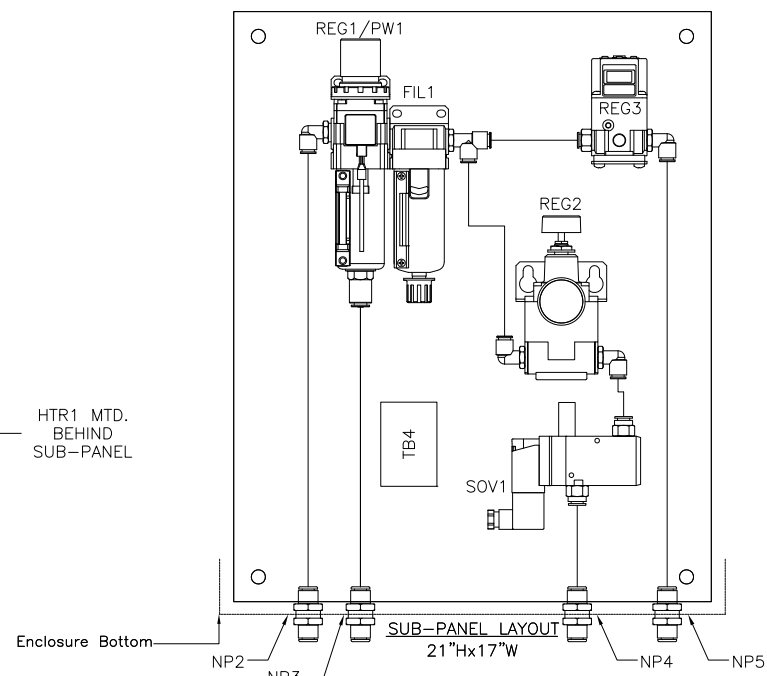
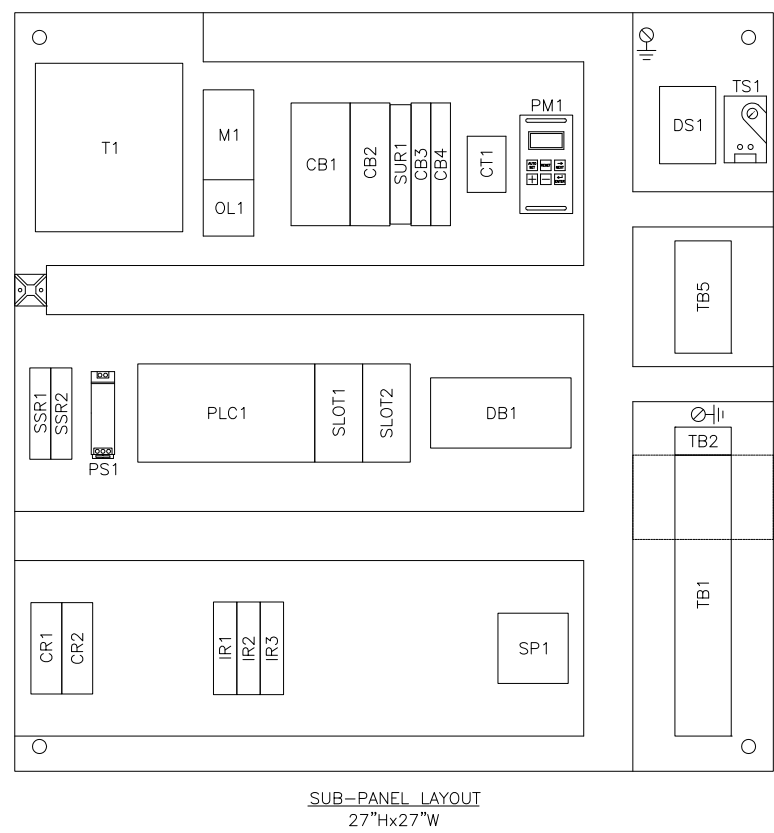
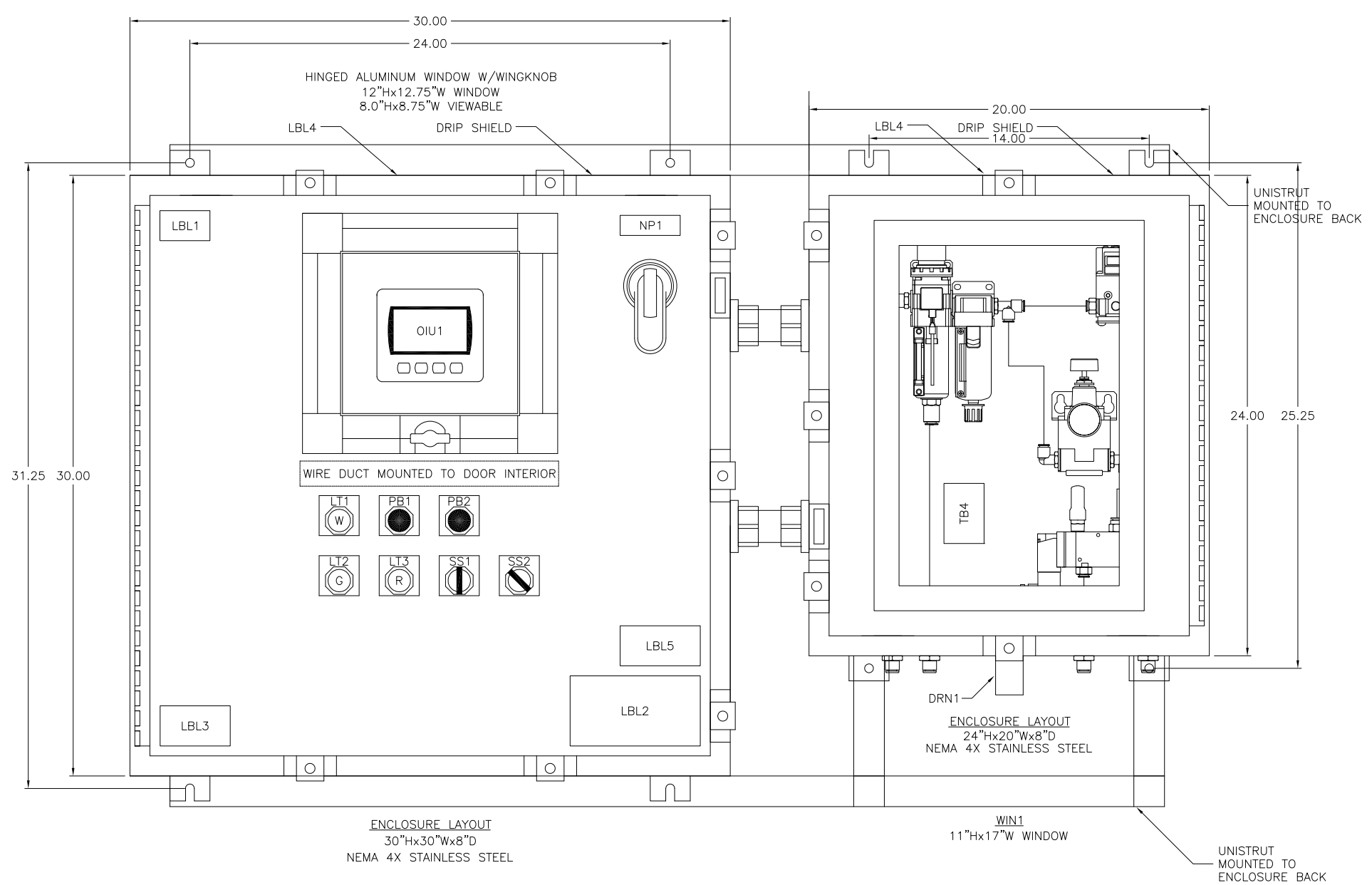
STRAINPRESS  
CONTROL PANEL

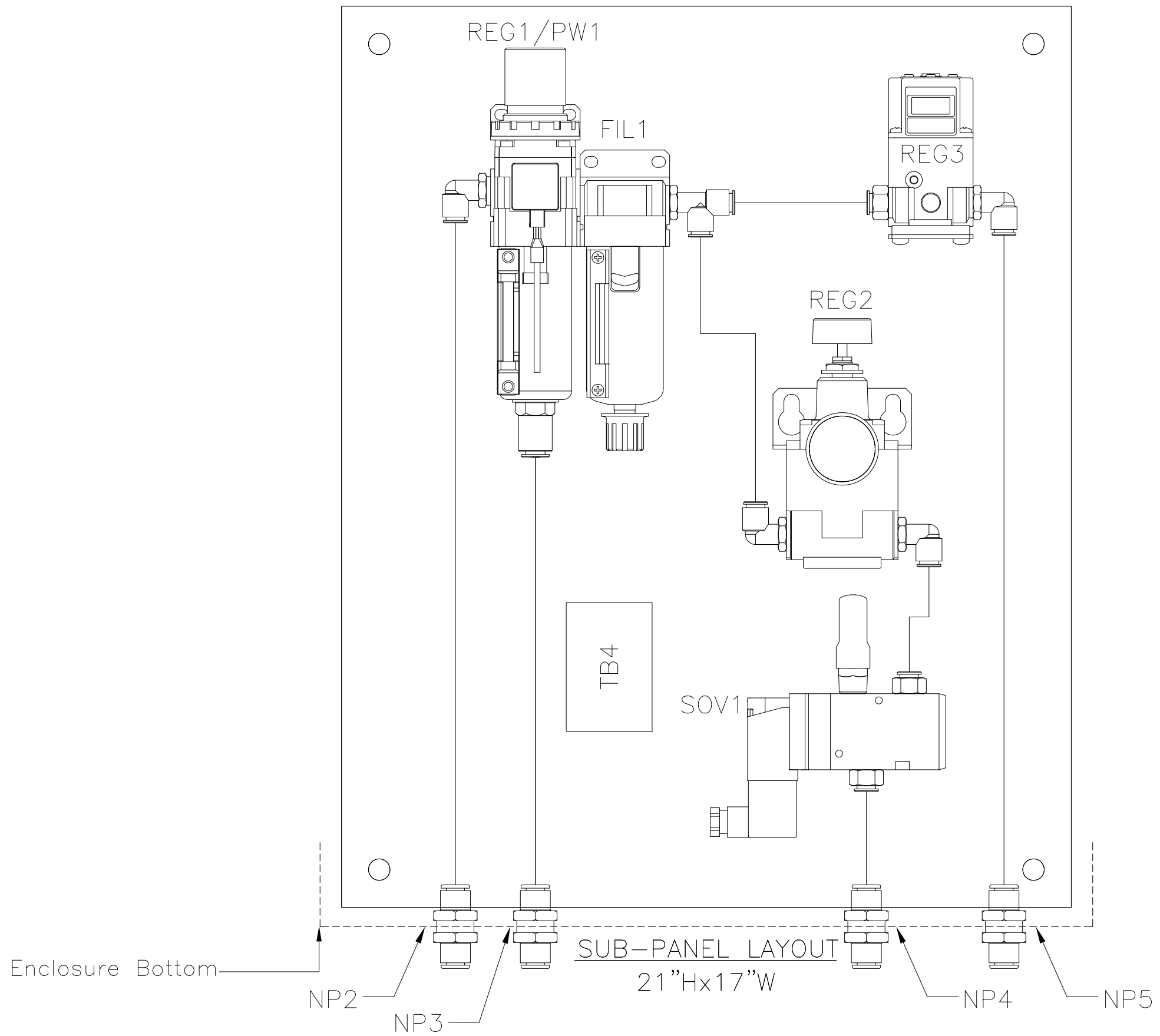
WICHITA, KS

SCALE:  
NONE

PROJECT NUMBER:  
73004414

DRAWING NO:  
HBR7752A7  
SHEET 7 OF 9





NAMEPLATES:  
 NP2 - AIR SUPPLY CONNECTION  
 NP3 - DRAIN CONNECTION  
 NP4 - CYLINDER CONNECTION  
 NP5 - CONTROL CONNECTION

06/06/19	AS BUILT	A	AJ	CCC	DESIGNED	AJ
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STRAINPRESS CONTROL PANEL		SCALE: NONE
WICHITA, KS		
PROJECT NUMBER: 73004414	DRAWING NO: HBR7752A9 SHEET 9 OF 9	

# Bill of Materials



Rev: 0

Date: 6/12/2019

Section:

D

Section Name:

Bill of Materials

By: JATT MARTON

Job Number:

HBR7752

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Item	Component	Description	Manufacturer Part Number	QTY	Device
<b>Strainpress Control Panel (Quantity: 1)</b>					
1	00-000-000	Wire, Hardware, Wire labels, etc.	EleMech: Miscellaneous	1	
2	10-069-000	Wireway Duct Cover, 1.5"W, 6 Ft. Section, w/Panduit F Series	Panduit: C1.5WH6	8	
3	10-069-001	Wireway Duct Cover, 1"W, 6 Ft. Section, w/Panduit F Series	Panduit: C1WH6	3	
4	10-069-005	Wireway Duct, 1.5"Wx3"H, 6 Foot Section	Panduit: F1.5X3WH6	8	
5	10-069-007	Wireway Duct, 1"Wx3"H, 6 Foot Section	Panduit: F1X3WH6	3	
6	15-213-001	Unistrut, 10' Stick, Galvin. Steel, 1 5/8" Sq, Slotted	B-Line: B22SGALV10	2	
7	15-213-002	Unistrut, Spring Nut, 3/8 x 16, For Channels 1-3/8" - 1-5/8"	B-Line: N228	12	
8	15-213-005	Unistrut, Two Hole Flat Plate, Zinc Plated	B-Line: B129-ZN	2	
9	25-000-A001	Legendplate Assembly, Yellow E-Stop, Standard Encl.	EleMech: 25-000-A001 Assembly	1	
10	25-000-A002	Legendplate Assembly, White, Black Text, Standard Encl.	EleMech: 25-000-A002 Assembly	6	
11	25-000-A019	Nameplate Assembly, White: Power Supply - 3/60/480VAC	EleMech: 25-000-A019 Assembly	1	
12	42-063-007	Terminal Block, Din Rail, 35MM Wide, 15 High, 2 Meters Long	lboco: Omega 3 AF	1	
13	51-000-062	Wire, MTW Type, 600V, 105°C, CSA/UL1015, Tinned Copper	EleMech: 51-000-062	1	
14	52-000-000	Label, Underwriters Laboratories 508A, w/Decal Set	EleMech: 508A	1	
15	03-058-156	Circuit Breaker, 3 Pole, 480VAC, 20A, 10kA, UL489, Type D	Square D: M9F43320	1	CB1
16	03-058-121	Circuit Breaker, 1 Pole, 240VAC, 4A, 14kA, UL489, Type C	Square D: M9F42104	1	CB4
17	57-005-000	Cable, Comm., PC DB9 to PLC 8 Pin Mini-Din, 6.5 Ft.	Allen-Bradley: 1761-CBL-PM02	1	CBL1
18	06-058-011	Control Relay, 3PDT,120VAC, 11Pin Spade, Indicator, Operator	Square D: RXM3AB2F7	2	CR1,2
19	06-058-012	Control Relay, Bus Jumper, 2-Pole, w/Telemec. RXM Relay	Square D: RXZ S2	1	CR1,2
20	38-058-003	Socket, 11 Pin Spade, Din, Screw Term., 3Tier, 250V w/3-Pole	Square D: RXZE2S111M	2	CR1,2
21	34-024-000	PM, Current Xfmr, 1PH, 0.4-10A, Din Rail, CTM10, w/EL-FI	Emotron: 01-2471-10	1	CT1
22	07-063-000	Distribution Block, End Cover, 4 Pole, 300V,10A, w/WK4E\U\VB	Wieland: 07.311.4053.1	2	DB1
23	07-063-001	Distribution Block, Jumper, 4 Pole, 300V,10A, w/WK4E\U\VB	Wieland: Z7.210.3427	3	DB1
24	07-063-002	Distribution Block, Single Pole, 10A, 300V, WK4E\U\VB	Wieland: 57.404.6955.1	11	DB1
25	09-001-A010	Disconnect Assembly, Non-Fused, 60 Amp, NEMA 4X, 8-10" Depth	ABB: OT63F3 Assembly	1	DS1
26	11-000-340	Enclosure Drip Shield, Stainless Steel, Per Inch	EleMech: 11-000-340	30	EN1
27	11-000-A042	Wind Kit, Alum/Hinge, Wing Knob w/out Frame, 12.75"H x 12"W	EleMech: 11-000-A042	1	EN1
28	11-035-035	Enclosure, NEMA 4X, 304SS, 30"Hx30"Wx8"D, C. Hinge	Hoffman: A-30H3008SSLP	1	EN1
29	11-035-135	Sub-Panel, Painted Steel, w/30"Hx30"W C. Hinge Encl	Hoffman: A-30P30	1	EN1

Item	Component	Description	Manufacturer Part Number	QTY	Device
30	53-017-002	Conduit, Hub, 1 1/2", NEMA 4X, (Non-Standard)	Crouse Hines: ST-5	4	EN1,2
31	53-054-013	Conduit, Nipple, 1 1/2xCLS", 304SS, (Non-Standard)	RJ Keck: SS4N112CL	2	EN1,2
32	15-011-000	Ground Lug, 14AWG - 4AWG	Blackburn: L70	2	GND
33	17-451-000	Heater, Silicone, Flat, 120VAC, 75 Watts, w/12" Lead, UL/CSA	Tempco: SHS80707	1	HTR1
34	52-137-003	Label, Caution: Heater Element, 1.5"Wx0.75"H, White/Red	Nameplate Tech: 52-137-003	1	HTR1
35	06-058-024	Control Relay, SPDT,120VAC, 5Pin Spade, Operator, 15A	Square D: RPM12F7	3	IR1-3
36	06-058-027	Control Relay Retension Clip, w/Telemec. RPM 1-Pole Relay	Square D: RPZR235	3	IR1-3
37	38-058-009	Socket, 5 Pin Spade, Din Mount, Screw Term., w/ RPM 1-Pole	Square D: RPZF1	3	IR1-3
38	52-137-002	Label, Multiple Supply Sources, Warning, 2.5"Wx1.5"H, Yellow	Nameplate Tech: 52-137-002	1	LBL1
39	52-137-000	Label, High Voltage, Danger, 2.25"Wx4.0"H, White/Black/Red	Nameplate Tech: 52-137-000	1	LBL2
40	32-005-046	Lens, Pilot Light, White, NEMA 4X, Standard, w/A-B 800H	Allen-Bradley: 800T-N26W	1	LT1
41	32-005-048	Pilot light, NEMA 4X, 120VAC, Transformer, No Lens	Allen-Bradley: 800H-PR16	3	LT1-3
42	32-005-044	Lens, Pilot Light, Green, NEMA 4X, Standard, w/A-B 800H	Allen-Bradley: 800T-N26G	1	LT2
43	32-005-045	Lens, Pilot Light, Red, NEMA 4X, Standard, w/A-B 800H	Allen-Bradley: 800T-N26R	1	LT3
44	22-005-003	Contact, 3PH, Non-Rev., 23 Amp, 1NO Aux., 120VAC Coil	Allen-Bradley: 100-C23D10	1	M1
45	22-005-011	Aux. Contact, Top mounted, 4NO, w/A-B 100C/104C	Allen-Bradley: 100-FA40	1	M1
46	25-000-A010	Nameplate Assembly, White, Black Text, 1"Hx3"W	EleMech: 25-000-A010 Assembly	1	NP1
47	26-005-075	OIU, PV800, 4", NEMA 4X, 24VDC, Color, Touch, Ethernet	Allen-Bradley: 2711R-T4T	1	OIU1
48	HBR-164-P009	Program, OIU, Panelview 800 4", Standard	EleMech: HBR-164-P009	1	OIU1
49	28-005-038	Overload Relay, 3PH, Adj Class, 3.2-16A, w/100-C09...C23	Allen-Bradley: 193-EEDB	1	OL1
50	29-005-117	Pushbutton, E-Stop, NEMA 4X, Oper+1NC, Twist Rel. Red Head	Allen-Bradley: 800H-TFRXT6D2	1	PB1
51	02-005-004	Contact Block, 1NC, w/A-B 800 Series	Allen-Bradley: 800T-XD2	1	PB2
52	29-005-002	Pushbutton, NEMA 4X, Oper+1NO, Flush Head, Black	Allen-Bradley: 800H-AR2D1	1	PB2
53	33-005-048	MicroLogix 1100/1200/1400, Combo Analog 2-Input/2-Output	Allen-Bradley: 1762-IF2OF2	2	PLC1
54	33-005-154	MicroLogix 1400, 20-120V In, 12-Rly Out, 2-232, Eth, 120VAC	Allen-Bradley: 1766-L32AWA	1	PLC1
55	HBR-164-P001	Program, PLC, MicroLogix 1400, Standard	EleMech: HBR-164-P001	1	PLC1
56	34-024-009	PM, EL-FI M20 3PH, 380-500VAC, 2)SPST Out, 4/20mA Out	Emotron: 01-2520-40	1	PM1
57	37-323-009	Power Supply, 30W, 85-264VAC IN, 24VDC OUT, NEC Class 2	Delta: DRS-24V30W1NZ	1	PS1
58	13-000-A000	Spare Parts Box Assembly, Din Rail Mount	EleMech: 13-000-A000 Assembly	1	SP1
59	39-005-010	Selector Switch, Nema 4X, 3 Pos. Spring Fr. Left, 1NO-1NC	Allen-Bradley: 800H-JR4A	1	SS1

Item	Component	Description	Manufacturer Part Number	QTY	Device
60	39-005-001	Selector Switch, NEMA 4X, 2 Pos. Maintained, 1NO-1NC	Allen-Bradley: 800H-HR2A	1	SS2
61	06-109-000	Control Relay, Solid State, 4-32VDC IN, 12-280VAC Out SPST	Crouzet: 84 130 108	2	SSR1,2
62	40-012-010	Surge Suppressor, 1 Pole, 120VAC, 200kA SCCR, DIN, Notes	Bussman: BSPMA1120S2GR	1	SUR1
63	41-018-A070	Control Transformer Assembly, 480-120VAC, 500VA, w/C-Breaker	Cutler-Hammer: C0500E2A Assembly	1	T1,CB2,3
64	42-063-000	Terminal Block, Labels, Custom Printed, w/WK4/U	Wieland: 04.242.6353-CUSTOM	122	TB,DB
65	42-063-001	Terminal Block, End Plate, Gray, w/WK4/U	Wieland: 07.311.0155.0	4	TB,DB
66	42-063-003	Terminal Block, Single Pole Gray, 30A, 600V, 6MM Wide, WK4/U	Wieland: 57.504.0055.0	48	TB,DB
67	42-063-004	Terminal Block, Ground, 30A, 600V, 6MM Wide, w/WK4/U	Wieland: 57.504.9055.0	8	TB,DB
68	42-063-009	Terminal Block, End Clamp, w/WKN10/U	Wieland: Z5.522.8553	7	TB,DB
69	42-063-015	Terminal Block, Jumper, w/WK4/U, 02 pole, Insulated	Wieland: Z7.281.1227	1	TB1
70	42-063-008	Terminal Block, Labels, Blank, w/WK4/U-(600 tags per box)	Wieland: Z4.242.6353	30	TB1,5
71	46-034-000	Thermostat, for heater control, N.C.contact, 6 amp,30-140 F.	Stego: 01140.9-00	1	TS1
<b>Strainpress Pneumatic Control Panel (Quantity: 1)</b>					
72	94-255-009	Tubing, 3/8"OD, Polyurethane, Blue, 100 Foot Roll	SMC USA: TIUB11BU-33	1	
73	11-008-A000	Enclosure Drain Breather, 1/2"NPT, Assembly	Appleton: ECDB50B Assembly	1	DRN1
74	11-000-340	Enclosure Drip Shield, Stainless Steel, Per Inch	EleMech: 11-000-340	20	EN2
75	11-035-023	Enclosure, NEMA 4X, 304SS, 24"Hx20"Wx8"D, C. Hinge	Hoffman: A-24H2008SSLP	1	EN2
76	11-035-132	Sub-Panel, Painted Steel, w/24"Hx20"W C. Hinge Encl	Hoffman: A-24P20	1	EN2
77	11-035-211	Wind Kit, Nema 4,4X,12 & 13, Stainless Steel 17x11	Hoffman: A-PWK1711NFSS	1	EN2
78	94-255-003	Mist Separator, 0-145PSI, 3/8"NPT, w/ Metal Bowl	SMC USA: AFM30-N03B8Z-A	1	FIL1
79	94-255-005	Fitting, Male Connector, Straight, 3/8"OD Tube x 3/8"MNPT	SMC USA: KQ2H11-36AS	3	FIT
80	94-255-006	Fitting, Male Elbow, 3/8"OD Tube x 3/8"MNPT	SMC USA: KQ2L11-36AS	4	FIT
81	94-255-008	Fitting, Bulkhead, Union, SS, w/ 3/8"OD Tube x 3/8"OD Tube	SMC USA: KQG2E11-00	4	FIT
82	94-255-020	Fitting, Male Run Tee, 3/8"OD x 3/8" OD x 3/8" NPT	SMC USA: KQ2Y11-36AS	1	FIT
83	25-000-A010	Nameplate Assembly, White, Black Text, 1"Hx3"W	EleMech: 25-000-A010 Assembly	4	NP2-5
84	94-255-004	Regulator, 0-120PSI, 3/8"NPT, w/ Filter and pressure switch	SMC USA: AW30-NO3BDE3-8Z	1	REG1
85	94-255-021	Regulator, 30 Series Spacer	SMC USA: Y300	1	REG1
86	94-255-002	Regulator, 0-115PSI, 3/8"NPT, w/ Gauge	SMC USA: IR3020-N03BG	1	REG2
87	94-255-019	Regulator, Electro-Pneumatic, 130psi, 4-20mA, 4wire, 24VDC	SMC USA: ITV2050-02N3CL4-Q	1	REG3
88	74-255-005	Solenoid Valve, 3 port 2 Pos., 3/8" NPTF, 120VAC, N.O.	SMC USA: VP542K-3DZ1-03TB	1	SOV1

Item	Component	Description	Manufacturer Part Number	QTY	Device
89	74-255-007	Solenoid Valve, Muffler, 3/8" NPT Port, 30 dB Reduction	SMC USA: AN30-NO3	1	SOV1
90	42-063-000	Terminal Block, Labels, Custom Printed, w/WK4/U	Wieland: 04.242.6353-CUSTOM	20	TB4
91	42-063-001	Terminal Block, End Plate, Gray, w/WK4/U	Wieland: 07.311.0155.0	1	TB4
92	42-063-003	Terminal Block, Single Pole Gray, 30A, 600V, 6MM Wide, WK4/U	Wieland: 57.504.0055.0	12	TB4
93	42-063-004	Terminal Block, Ground, 30A, 600V, 6MM Wide, w/WK4/U	Wieland: 57.504.9055.0	1	TB4
94	42-063-008	Terminal Block, Labels, Blank, w/WK4/U-(600 tags per box)	Wieland: Z4.242.6353	6	TB4
95	42-063-009	Terminal Block, End Clamp, w/WKN10/U	Wieland: Z5.522.8553	2	TB4
<b>Spare Parts / Ship Loose (Total Quantity Provided)</b>					
96	61-000-012	Labor, Engineering, Submittal, Schematics, BOM	EleMech: 61-000-012	1	ENG



# Catalog Cuts

**5SJ4 1 10 - 7 HG41**  
 a b c d e

**SIEMENS**

a Frame Style	
Code	Description
5SJ4	Standard Frame

b Poles	
Code	Description
1	1-Pole
2	2-Pole
3	3-Pole

c Rated Current	
Code	Rated Current ( $I_n$ )
14	0.3
05	0.5
01	1
15	1.6
02	2
03	3
04	4
11	5
06	6
08	8
10	10
13	13
18	15
16	16
20	20
25	25
30	30
32	32
35	35
40	40
45	45
50	50
60	60
63	63

d Trip Curve (Characteristic)			
Code	Trip Curve	Magnetic Trip Point	Thermal Trip Point
6	B	3 to 5 $I_n$	1.13 to 1.45 Breaker Rating
7	C	5 to 10 $I_n$	
8	D	10 to 20 $I_n$	

e Version	
Code	Description
HG40	240 VAC, Same Polarity
HG41	240 VAC
HG42	480Y/277 VAC

**Certifications:**  
 CE  
 UL Listed and Certified to Canadian Standards  
 HACR Rated

5SJ4 ... HG41

5SJ4 ... HG40

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	Date: MM/DD/YYYY	Job Number: ELE5000	Page # 1/1
Manuf.: PNo: SIEMENS: 5SJ4102-7HG40	By: Engineer Initials		

03-056-035  
 EleMech Part Number Refer to Bill of Materials for more information

03-056-\*\*\*  
 A '\*\*\*' Suffix indicates this information is for multiple devices.

Refer to Electrical Drawings

Manufacturer: Model Number

Reference Job #

- **Base and covers sold separately**
- Non-slip cover design incorporates integral high friction lining to inhibit cover movement
- Cover flush with base provides greater wire capacity and improves aesthetics
- Easy cover removal makes changes to wiring quick and easy
- Available in various colors



10-069-000

▪ Part Number	C1.5WH6
▪ RoHS Compliancy Status	Compliant
▪ Part Description	Covers duct to protect wires, improve aesthetics and provides greater wire capacity. Base and covers sold separately.
▪ Product Type	Type C Cover for Flush Cover Wiring Duct
▪ Material	Lead-Free PVC
▪ Color	White
▪ Length (ft.)	6
▪ Length (m)	1.82
▪ CE Compliant	Yes
▪ Pricing Description	Duct Cover, PVC, 1.5"W X 6', White



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Manuf.: . PNo: Panduit: C1.5WH6



- **Base and covers sold separately**
- Non-slip cover design incorporates integral high friction lining to inhibit cover movement
- Cover flush with base provides greater wire capacity and improves aesthetics
- Easy cover removal makes changes to wiring quick and easy
- Available in various colors



10-069-001

▪ Part Number	C1WH6
▪ RoHS Compliancy Status	Compliant
▪ Part Description	Covers duct to protect wires, improve aesthetics and provides greater wire capacity. Base and covers sold separately.
▪ Product Type	Type C Cover for Flush Cover Wiring Duct
▪ Material	Lead-Free PVC
▪ Color	White
▪ Length (ft.)	6
▪ Length (m)	1.82
▪ CE Compliant	Yes
▪ Pricing Description	Duct Cover, PVC, 1"W X 6', White

## Panduit Wiring Duct Approvals and Compliances

 630-499-7080 · www.elemechinc.com	Rev: 0	Device Tag:	
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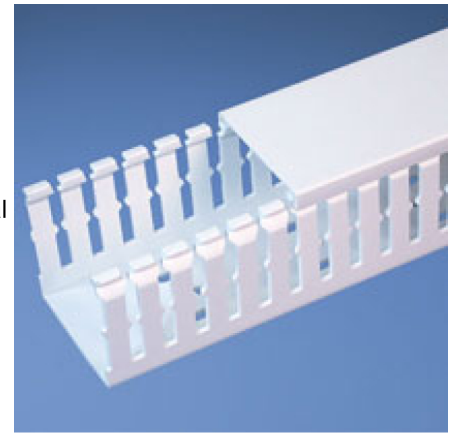
# F1.5X3WH6



**PANDUIT**

**Specifications**

- Made of lead-free PVC
- UL Recognized continuous use temperature: 122°F (50°C)
- UL94 Flammability Rating of V-0
- Conforms with NFPA 79-2002 section 14.3.1 requirement for flame retardant material
- Available in Light Gray and White
- Provided with mounting holes



10-069-005

▪ Part Number	F1.5X3WH6
▪ RoHS Compliancy Status	Compliant
▪ Part Description	Narrow finger, slotted wiring duct.
▪ Material	Lead-Free PVC
▪ Color	White
▪ CSA Certified	Yes
▪ Length (ft.)	6
▪ CE Compliant	Yes
▪ CE Marking	Yes
▪ Duct Size W x H (In.)	1.75 x 3.12
▪ Duct Size W x H (mm)	44.5 x 79.2
▪ Mounting Method	Standard Mounting Holes
▪ Pricing Description	Slotted Duct,PVC,1.5"X3"X6',White



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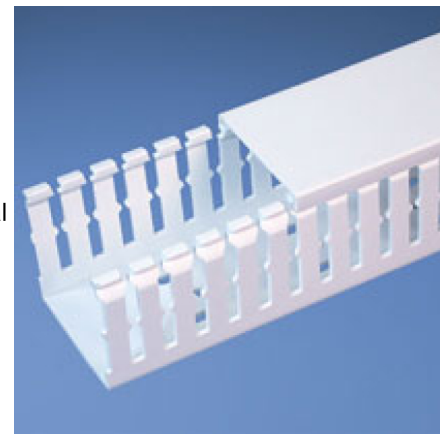
# F1X3WH6



**PANDUIT**

### Specifications

- Made of lead-free PVC
- UL Recognized continuous use temperature: 122°F (50°C)
- UL94 Flammability Rating of V-0
- Conforms with NFPA 79-2002 section 14.3.1 requirement for flame retardant material
- Available in Light Gray and White
- Provided with mounting holes



10-069-007

▪ Part Number	F1X3WH6
▪ RoHS Compliancy Status	Compliant
▪ Part Description	Narrow finger, slotted wiring duct.
▪ Material	Lead-Free PVC
▪ Color	White
▪ CSA Certified	Yes
▪ Length (ft.)	6
▪ CE Compliant	Yes
▪ CE Marking	Yes
▪ Duct Size W x H (In.)	1.26 x 3.12
▪ Duct Size W x H (mm)	32.0 x 79.2
▪ Mounting Method	Standard Mounting Holes
▪ Pricing Description	Slotted Duct,PVC,1"X3"X6',White

## Panduit Wiring Duct Approvals and Compliances



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Manuf.: . PNo:

Panduit: F1X3WH6

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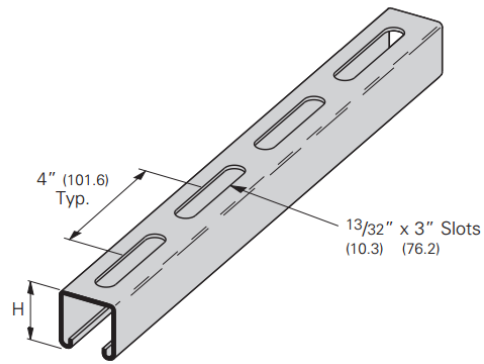
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**B11S thru B56S  
S Type Channel**

• For beam loads use 90% of Channel Loading Chart

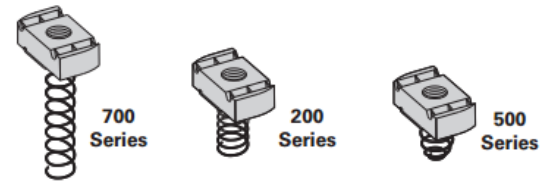


Part No.	Thickness	Height H		Weight	
		In.	mm	Lbs./Ft.	kg/m
B11S	12 Ga. (2.6)	3 1/4"	(82.5)	2.94	(4.37)
B12S	12 Ga. (2.6)	2 7/16"	(61.9)	2.36	(3.51)
B22S	12 Ga. (2.6)	1 5/8"	(41.3)	1.79	(2.66)
B24S	14 Ga. (1.9)	1 5/8"	(41.3)	1.32	(1.96)
B26S	16 Ga. (1.5)	1 5/8"	(41.3)	1.06	(1.58)
B32S	12 Ga. (2.6)	1 3/8"	(34.9)	1.59	(2.36)
B42S	12 Ga. (2.6)	1"	(25.4)	1.33	(1.98)
B52S	12 Ga. (2.6)	1 3/16"	(20.6)	1.16	(1.72)
B54S	14 Ga. (1.9)	1 3/16"	(20.6)	.89	(1.32)
B56S	16 Ga. (1.5)	1 3/16"	(20.6)	.79	(1.17)



**Spring Nut**

Part No.	Thread Size	Fits Channel Sizes
N721	#8-32	B11 & B12
N221	#8-32	B22, B24, B26, B32
N521	#8-32	B42, B52, B54, B56
N727	#10-32	B11 & B12
N227	#10-32	B22, B24, B26, B32
N527	#10-32	B42, B52, B54, B56
N722	#10-24	B11 & B12
N222	#10-24	B22, B24, B26, B32
N522	#10-24	B42, B52, B54, B56
N724	1/4-20	B11 & B12
N224	1/4-20	B22, B24, B26, B32
N524	1/4-20	B42, B52, B54, B56
N723	5/16-18	B11 & B12
N223	5/16-18	B22, B24, B26, B32
N523	5/16-18	B42, B52, B54, B56
N728	3/8-16	B11 & B12
N228	3/8-16	B22, B24, B26, B32
N528	3/8-16	B42, B52, B54, B56
N726	7/16-14	B11 & B12
N226	7/16-14	B22, B24, B26, B32
N526	7/16-14	B42, B52, B54, B56
N725	1/2-13	B11 & B12
N225	1/2-13	B22, B24, B26, B32
N525	1/2-13	B42, B52, B54, B56
N755	5/8-11	B11 & B12
N255	5/8-11	B22, B24, B26, B32
N555	5/8-11	B42, B52, B54, B56
N775	3/4-10	B11 & B12
N275	3/4-10	B22, B24, B26, B32
N575	3/4-10	B42, B52, B54, B56
N778	7/8-9	B11 & B12
N278	7/8-9	B22, B24, B26, B32



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Manuf.: . PNo:

B-Line: B22SGALV10

# Flat Plate Fittings

B-Line  
by **FAT-N**

15-213-005

## B129

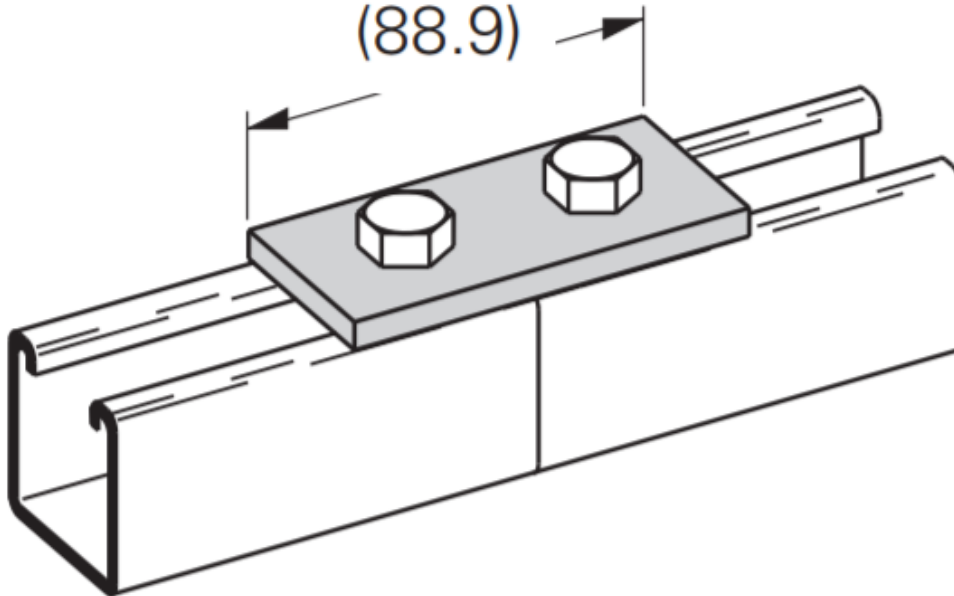
### Two Hole Splice Plate

- Standard finishes: ZN, GRN
- Wt./C 37 Lbs. (16.8 kg)

**PA** ZN  
GRN



3 1/2"  
(88.9)



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Rev:  
0

Date:  
6/12/2019

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ATT MARTON

Device Tag:

Job Number:  
HBR7752

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**1/1**  
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Manuf.: PNo:

B-Line: B129-ZN

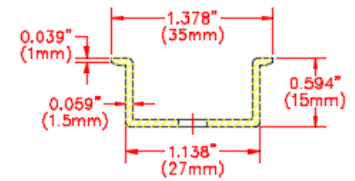
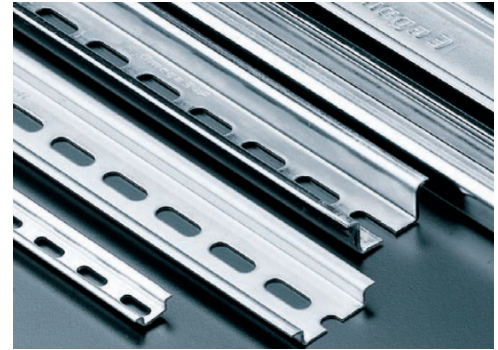
# DIN RAILS



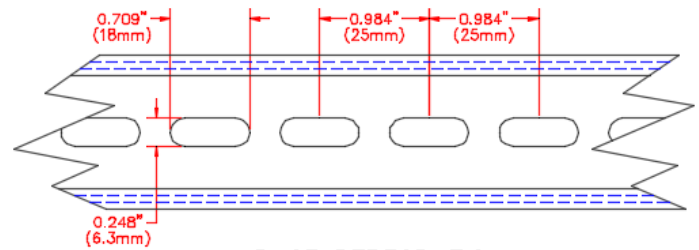
42-063-007

Catalog Number	Lengths per Pack
G1	12
G1F	12
G1F1	24
OMEGA 2F	20
OMEGA 2F1	40*
OMEGA 3	20
OMEGA 3F	20
OMEGA 3F1	40*
OMEGA 3FD	20
OMEGA 3A	10
OMEGA 3AF	10
OMEGA 3AF1	20*
OMEGA 3AFD	10
OMEGA 3B	10
OMEGA 3B1	10*
OMEGA 75	2

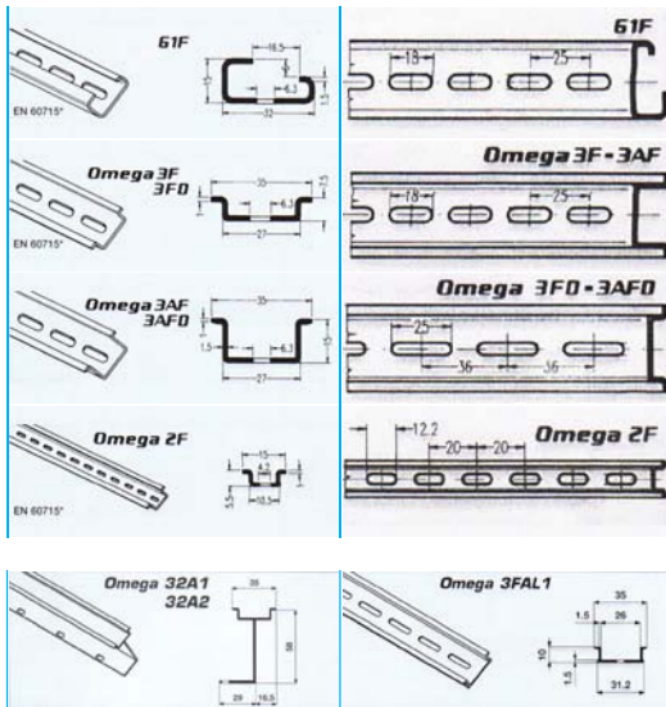
Treated with galvanic zinc plating and passivation (gal Zn 8c according to Din 50960)  
 Minimum thickness 6 microns  
 Standard length: 2 meters (6'6¾")



FRONT SECTION



BASE PERFORATION



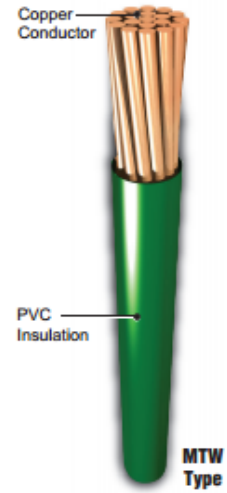
Manuf.: . PNo: Iboco: Omega 3 AF

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 By: ATT MARTON

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 Job Number: HBR7752  
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# Wire – MTW Type

- CONDUCTORS:**
  - 22 AWG - 8AWG Stranded Tinned Copper per ASTM B-33
  - 22 AWG - 10 AWG Solid Tinned Copper per ASTM M-33
- INSULATION:**
  - Color-Coded Polyvinyl Chloride (PVC)
- TEMPERATURE RANGE/  
VOLTAGE RATING:**
  - UL 1011/1015/1028/BC-5W2: 105°C/600V
  - UL MTW: 90°C/600V
  - CSA AWM I A/B & TEW: 105°C/600V
- FLAME COMPLIANCES:**
  - UL VW-1
  - CSA FT-1
- INDUSTRY APPROVALS:**
  - UL Standard 758 - Styles 1011/1015/1028/1032/1230/1231/1335/1344
  - UL Standard 1063 - MTW
  - UL Standard 1426 - BC-5W2: 16 AWG - 8 AWG
  - CSA AWM I A/B & TEW
  - UL THHW
  - UL CT Tray Rated
  - SAE J378
- STANDARD COLORS:**
  - Black, Orange, Blue, Violet, White, Yellow, Brown, Green/Yellow, Red, Green, Gray
- OPTIONS:**
  - Stripes available upon request (minimums may apply)
  - Other copper constructions available upon request (minimums may apply)



51-000-062

Catalog Number	Description
F22027	22 AWG (7/.0096) TC AWM 1015
F20037	20 AWG (10/30) TC AWM 1015
F18054	18 AWG (16/30) TC AWM 1015
F16032	16 AWG (26/30) TC AWM 1015
F14037	14 AWG (41/30) TC AWM 1015
F12024	12 AWG (65/30) TC AWM 1015
F10012	10 AWG (105/30) TC AWM 1015
F08010	8 AWG (7X19/29) TC AWM 1028

**TEW/MTW Wire (Tinned Copper) Applications:**

► This tinned copper hook up wire may be used for wiring of machine tools, appliances, and control cabinets.



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Device Tag:

Manuf.: . PNo:

EleMech: 51-000-062

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# Multi 9



## UL 489 / CSA C22.2 No 5 / IEC/EN 60947-2 / GB 14048-2

C60BP are multi-standard miniature circuit breakers and branch circuit protection as defined by UL 489. It combines following functions:

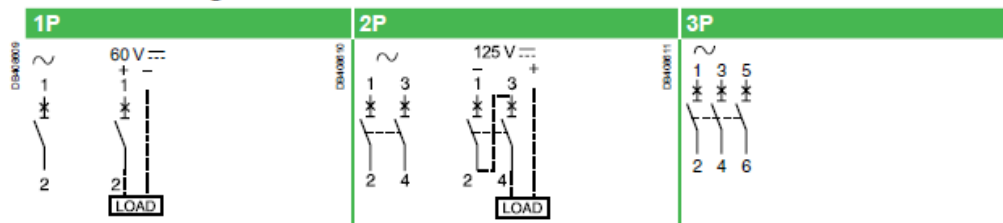
- circuit protection against short-circuit currents
- circuit protection against overload currents
- tripping and fault indication by the addition of auxiliaries.



Number of 18 mm (0.71 in.) poles	Rating (A) 25°C/77°F	Breaking capacity (kA rms) AIR				Icu IEC 60947-2			
		UL 489 / CSA C22.2 No 5				IEC 60947-2			
1P	Voltage (Ue)	277 V ~	240 V ~	120 V ~	60 V ∴	440 V ~	415 V ~	240 V ~	60 V ∴
		0.5 to 35	10	14	14	10	-	3	10
2P	Voltage (Ue)	480Y/277 V ~		240 V ~	125 V ∴	440 V ~	415 V ~	240 V ~	125 V ∴
		1 to 25	10	14	10	6	10	20	-
3P		1 to 35	10	14	-	6	10	20	-
2P/3P		40 to 63	-	10	-	6	10	20	-



### Electrical diagrams



### Catalogue numbers

Tunnel terminal connection											
Type	UL489 and CSA voltages	1P			2P			3P			
Auxiliaries		Remote indication and tripping, see page 43									
Rating (In)		Curve			Width in 9 mm modules	Curve		Width in 9 mm modules	Curve		Width in 9 mm modules
		Z	C	D (=K)		C	D (=K)		C	D (=K)	
<b>C60BP</b>											
0.5	480Y/277 V and 240 V	M9F44170	M9F42170	M9F43170	2	-	-	4	-	-	6
1		M9F44101	M9F42101	M9F43101		M9F42201	M9F43201		M9F42301	M9F43301	
2		M9F44102	M9F42102	M9F43102		M9F42202	M9F43202		M9F42302	M9F43302	
3		M9F44103	M9F42103	M9F43103		M9F42203	M9F43203		M9F42303	M9F43303	
4		M9F44104	M9F42104	M9F43104		M9F42204	M9F43204		M9F42304	M9F43304	
5		M9F44105	M9F42105	M9F43105		M9F42205	M9F43205		M9F42305	M9F43305	
6		M9F44106	M9F42106	M9F43106		M9F42206	M9F43206		M9F42306	M9F43306	
8		M9F44108	M9F42108	M9F43108		M9F42208	M9F43208		M9F42308	M9F43308	
10		M9F44110	M9F42110	M9F43110		M9F42210	M9F43210		M9F42310	M9F43310	
15		M9F44115	M9F42115	M9F43115		M9F42215	M9F43215		M9F42315	M9F43315	
20		M9F44120	M9F42120	M9F43120		M9F42220	M9F43220		M9F42320	M9F43320	
25		M9F44125	M9F42125	M9F43125		M9F42225	M9F43225		M9F42325	M9F43325	
30		M9F44130	M9F42130	M9F43130		M9F42230	M9F43230		M9F42330	M9F43330	
35		M9F44135	M9F42135	M9F43135		M9F42235	M9F43235		M9F42335	M9F43335	
40		240 V only	M9F44140	M9F42140	M9F43140	2	M9F42240	M9F43240	4	M9F42340	M9F43340
45	M9F44145		M9F42145	M9F43145		M9F42245	M9F43245		M9F42345	M9F43345	
50	M9F44150		M9F42150	M9F43150		M9F42250	M9F43250		M9F42350	M9F43350	
63	M9F44163		M9F42163	M9F43163		M9F42263	M9F43263		M9F42363	M9F43363	



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Device Tag:

CB4

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Manuf.: PNO:

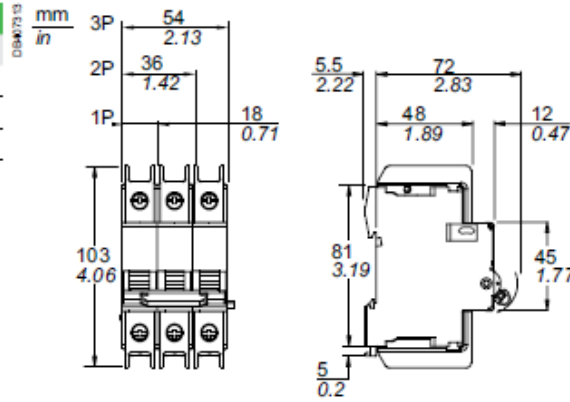
Square D: M9F42104

03-058-121

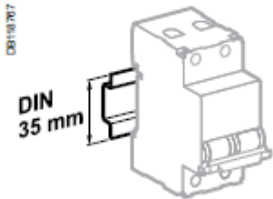
**Weight (g / oz)**

Circuit-breaker	
Type	C60BP
1P	130 g / 4.58 oz
2P	260 g / 9.17 oz
3P	390 g / 13.76 oz

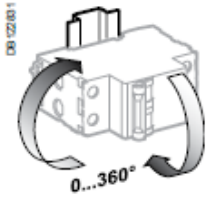
**Dimensions (mm / inches)**



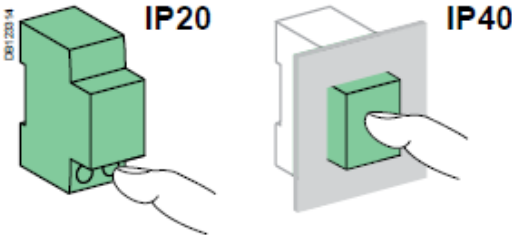
C60BP Tunnel terminal



Clip on DIN rail 35 mm.



Indifferent position of installation.



**Technical data**

Main characteristics			
Insulation voltage (Ui)		500 V	
Service breaking capacity (Ics)	In alternating current	75 % of Icu	
	In direct current	100 % of Icu	
Pollution degree		3	
Rated impulse withstand voltage (Uimp)		6 kV	
Thermal tripping	Reference temperature	25°C / 77°F	
Magnetic tripping	Z curve	In alternating current	3 In ± 20 %
		In direct current	4.2 In ± 20 %
	C curve	In alternating current	8.5 In ± 20 %
		In direct current	12 In ± 20 %
	D curve (=K curve)	In alternating current	12 In ± 20 %
		In direct current	17 In ± 20 %
Additional characteristics			
Degree of protection (IEC 60529)	Device only	IP20	
	Device in modular enclosure	IP40	
Endurance (O-C)	Electrical	10,000 cycles	
	Mechanical	20,000 cycles	
Operating temperature		-30°C to +70°C / -22°F to 158°F	
Storage temperature		-40°C to +80°C / -40°F to 176°F	
Tropicalization (IEC 60068-1)		Treatment 2 (relative humidity 95 % at 55°C / 131°F)	
Dissipated power		See page 68	



RXM●AB2F7

### RXM Miniature Relays (page 4)

- 2 pole relays; 12 A, 1/2 hp (IEC rating = 12 A)
- 3 pole relays; 10 A, 1/3 hp (IEC rating = 10 A)
- 4 pole relays; 8 A, 1/3 hp (IEC rating = 6 A)
- 4 pole relays; 3 A (low level), 1/16 hp (IEC rating = 3 A)

- Mechanical "relay status" indicator on all relays
- Pilot light option available
- Manual operator optional for all relays
- Built-in marking area

### Insulation characteristics

Rated insulation voltage (Ui)	250 V (IEC), 300 V (UL, CSA)	
Rated impulse withstand voltage (Uimp)	3.6 kV (1.2/50 μs)	
Dielectric strength (rms voltage)	Between coil and contact	2,500 Vac
	Between poles	2,500 Vac
	Between contacts	1,500 Vac

### Contact characteristics

Relay type		RXM2AB●●●	RXM3AB●●●	RXM4AB●●●
Number and type of contacts (see page 12)		DPDT	3PDT	4PDT
Contact materials		AgNi		
Conventional thermal current (Ith)	For ambient temperature ≤ 131 °F (55 °C)	12 A	10 A	6 A
	Conforming to IEC in utilization category AC-1	N.O. 6 A	10 A 5 A	6 A 3 A
Rated operational current	Conforming to UL Resistive @277 Vac, hp @ 120 Vac	12 A, 1/2 hp	10 A, 1/3 hp	8 A, 1/3 hp
Maximum operating rate In operating cycles/hour	No load	18,000		
	Under load	1,200		
Switching voltage	Maximum	250 Vac/Vdc		
	Minimum	10 mA on 17 V		
Switching capacity	Maximum	3,000 VA	2,500 VA	1,500 VA
Utilization coefficient		20%		
Mechanical durability in millions of operating cycles		10		
Electrical durability in millions of operating cycles	Resistive load	0.1		

### Coil characteristics

Average consumption	AC	1.2 VA									
	DC	0.9 W									
Drop-out voltage threshold	AC	≥ 0.15 Uc									
	DC	≥ 0.1 Uc									
Operating time (response time)	Between coil energization and making of the N.O. contact	AC	20 ms								
		DC	20 ms								
	Between coil de-energization and making of the N.C. contact	AC	20 ms								
		DC	20 ms								
Coil voltage Uc		12 V	24 V	48 V	110 V	120 V	125 V	220 V	230 V	240 V	
Relay coil voltage codes		JD	BD	ED	FD	—	GD	MD	—	—	
DC	Average resistance at 68 °F (20 °C) ± 10%	160 Ω	650 Ω	2,600 Ω	11,000 Ω	—	11,000 Ω	14,000 Ω	—	—	
	Operating voltage limits	Min.	9.6 V	19.2 V	38.4 V	88 V	—	100 V	176 V	—	—
		Max.	13.2 V	26.4 V	52.8 V	121 V	—	138 V	242 V	—	—
Relay coil voltage codes		—	B7	E7	—	F7	—	M7	P7	U7	
AC	Average resistance at 68 °F (20 °C) ± 15%	—	180 Ω	770 Ω	—	4,430 Ω	—	15,000 Ω	15,000 Ω	15,500 Ω	
	Operating voltage limits	Min.	—	19.2 V	38.4 V	—	96 V	—	176 V	184 V	192 V
		Max.	—	26.4 V	52.8 V	—	132 V	—	242 V	253 V	264 V

### Environment

Dielectric strength	2000 V AC (between poles) 2000 V AC (between coil and contact) 1300 V AC (between contacts)
Product certifications	CSA GOST Lloyds UL
Standards	EN/IEC 61810-1 UL 508 CSA C22.2 No 14



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By: ATT MARTON

Device Tag:

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Manuf.: PNo:

Square D: RXM3AB2F7

Miniature relays with lockable test button, without LED

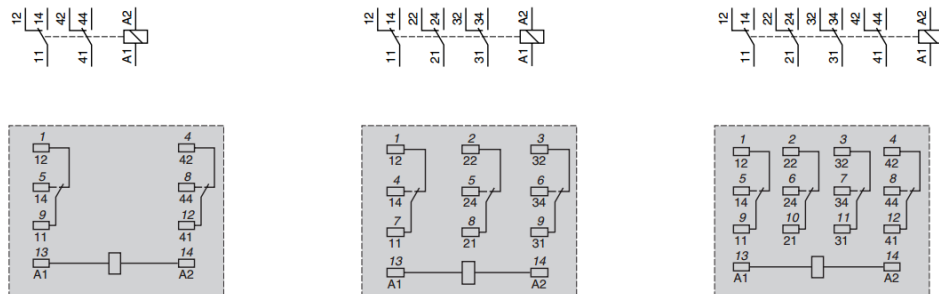
Coil Voltage	Number and type of contacts - Thermal current (Ith)								
	DPDT - 12 A			3PDT - 10 A			4PDT - 6 A		
	Catalog Number	Weight		Catalog Number	Weight		Catalog Number	Weight	
		lb.	kg		lb.	kg		lb.	kg
12 Vdc	RXM2AB1JD	0.082	0.037	RXM3AB1JD	0.084	0.038	RXM4AB1JD	0.080	0.036
24 Vdc	RXM2AB1BD	0.082	0.037	RXM3AB1BD	0.084	0.038	RXM4AB1BD	0.080	0.036
48 Vdc	RXM2AB1ED	0.082	0.037	RXM3AB1ED	0.084	0.038	RXM4AB1ED	0.080	0.036
110 Vdc	RXM2AB1FD	0.082	0.037	RXM3AB1FD	0.084	0.038	RXM4AB1FD	0.080	0.036
220 Vdc	—	—	—	—	—	—	RXM4AB1MD	0.080	0.036
24 Vac	RXM2AB1B7	0.082	0.037	RXM3AB1B7	0.084	0.038	RXM4AB1B7	0.080	0.036
48 Vac	RXM2AB1E7	0.082	0.037	RXM3AB1E7	0.084	0.038	RXM4AB1E7	0.080	0.036
120 Vac	RXM2AB1F7	0.082	0.037	RXM3AB1F7	0.084	0.038	RXM4AB1F7	0.080	0.036
230 Vac	RXM2AB1P7	0.082	0.037	RXM3AB1P7	0.084	0.038	RXM4AB1P7	0.080	0.036
240 Vac	—	—	—	—	—	—	RXM4AB1U7	0.080	0.036

Miniature relays with lockable test button, with LED

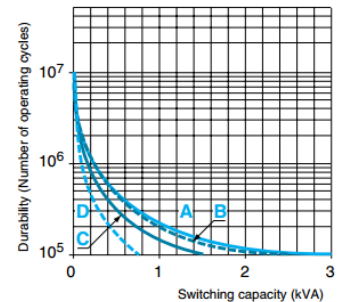
12 Vdc	RXM2AB2JD	0.082	0.037	RXM3AB2JD	0.084	0.038	RXM4AB2JD	0.080	0.036
24 Vdc	RXM2AB2BD	0.082	0.037	RXM3AB2BD	0.084	0.038	RXM4AB2BD	0.080	0.036
48 Vdc	RXM2AB2ED	0.082	0.037	RXM3AB2ED	0.084	0.038	RXM4AB2ED	0.080	0.036
110 Vdc	RXM2AB2FD	0.082	0.037	RXM3AB2FD	0.084	0.038	RXM4AB2FD	0.080	0.036
125 Vdc	—	—	—	—	—	—	RXM4AB2GD	0.080	0.036
24 Vac	RXM2AB2B7	0.082	0.037	RXM3AB2B7	0.084	0.038	RXM4AB2B7	0.080	0.036
48 Vac	RXM2AB2E7	0.082	0.037	RXM3AB2E7	0.084	0.038	RXM4AB2E7	0.080	0.036
120 Vac	RXM2AB2F7	0.082	0.037	RXM3AB2F7	0.084	0.038	RXM4AB2F7	0.080	0.036
230 Vac	RXM2AB2P7	0.082	0.037	RXM3AB2P7	0.084	0.038	RXM4AB2P7	0.080	0.036

Miniature relays

RXM2●●●●● RXM3●●●●● RXM4●●●●●



Resistive load AC



RXM ●●●●●

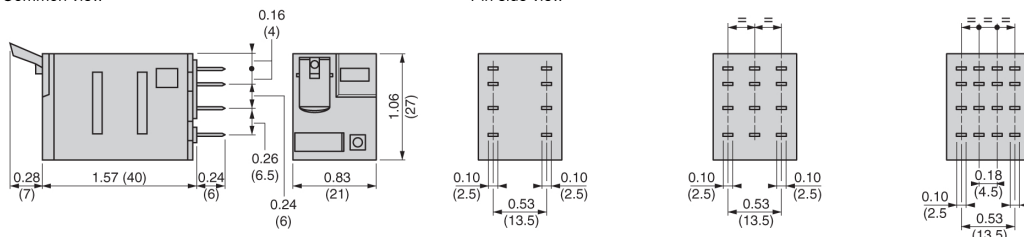
Common view

RXM 2

Pin side view

RXM 3

RXM 4



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Square D: RXM3AB2F7

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# RXZS2

bus jumper for Zelio Relay RXZ sockets with separate contacts



06-058-012

## Main

Commercial Status	Commercialised
Range of product	Zelio Relay
Accessory / separate part type	Jumper
Accessory / separate part designation	Bus jumper
Sale per indivisible quantity	10

## Complementary

Product compatibility	Socket RXZ
Accessory / separate part destination	All RXZ sockets with separate contacts
[Ith] conventional free air thermal current	5 A
Product weight	0.005 kg

## Ordering and shipping details

Category	21128 - ZELIO ICE CUBE RELAY ACCESSORIES
Discount Schedule	CP2
GTIN	00785901924098
Nbr. of units in pkg.	10
Package weight(Lbs)	0.01
Stock Code	Stock - Normally stocked in distribution facility
Returnability	Y
Country of origin	CN



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Device Tag:

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Manuf.: . PNo:

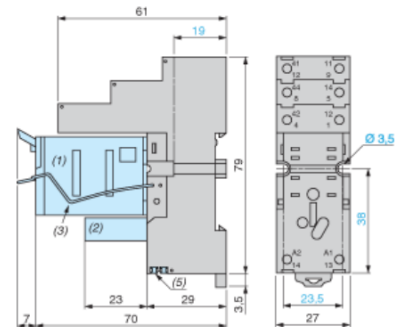
Square D: RXZ S2

RXZE2S108M



Complementary	
[Ith] conventional free air thermal current	12 A 5 A with bus jumper
[Ue] rated operational voltage	< 250 V
Tightening torque	<= 1 N.m (M3 screw(s))
Fixing mode	By screw mounting on panel Clip-on mounting on 35 mm symmetrical DIN rail
Marking	CE
Width	27 mm
Product weight	0.058 kg 0.07 kg

Environment	
Standards	IEC 61984
Product certifications	CSA UL
Ambient air temperature for storage	-40...85 °C
Ambient air temperature for operation	-40...55 °C
IP degree of protection	IP20 conforming to EN/IEC 60529
Dielectric strength	2500 V
RoHS EUR status	Compliant
RoHS EUR conformity date	0801



- 1 Relay
- 2 Protection Module
- 3 Carriage Stirrup
- 5 2 Links connection

Approvals for Sockets:



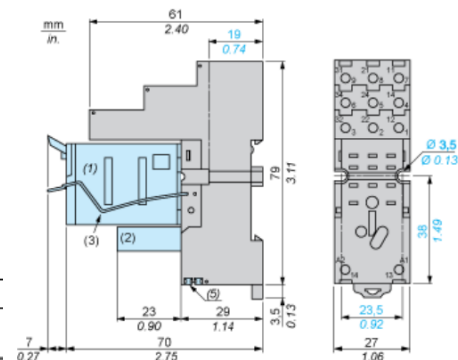
RXZE2S111M



Complementary	
[Ith] conventional free air thermal current	10 A 5 A with bus jumper
[Ue] rated operational voltage	< 250 V
Tightening torque	<= 1 N.m (M3 screw(s))
Fixing mode	By screw mounting on panel Clip-on mounting on 35 mm symmetrical DIN rail
Marking	CE
Width	27 mm
Product weight	0.066 kg

Environment	
Standards	IEC 61984
Product certifications	CSA UL
Ambient air temperature for storage	-40...85 °C
Ambient air temperature for operation	-40...55 °C
IP degree of protection	IP20 conforming to EN/IEC 60529
Dielectric strength	2500 V
RoHS EUR status	Compliant
RoHS EUR conformity date	0801

Dimensions



- (1) Relays
- (2) Protection module
- (3) Maintaining clamp
- (4) 2 elongated holes  $\varnothing 3.5$  mm x 6.5 mm /  $\varnothing 0.13$  in. x 0.25 in.
- (5) 2 bus jumpers

Approvals for Sockets:

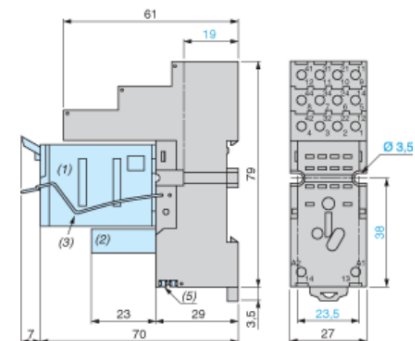


RXZE2S114M



Complementary	
[Ith] conventional free air thermal current	10 A 5 A with bus jumper
[Ue] rated operational voltage	< 250 V
Tightening torque	<= 1 N.m (M3 screw(s))
Fixing mode	By screw mounting on panel Clip-on mounting on 35 mm symmetrical DIN rail
Marking	CE
Width	27 mm
Product weight	0.058 kg 0.07 kg

Environment	
Standards	IEC 61984
Product certifications	CSA UL
Ambient air temperature for storage	-40...85 °C
Ambient air temperature for operation	-40...55 °C
IP degree of protection	IP20 conforming to EN/IEC 60529
Dielectric strength	2500 V
RoHS EUR status	Compliant
RoHS EUR conformity date	0801



- 1 Relay
- 2 Protection Module
- 3 Carriage Stirrup
- 5 2 Links connection

Approvals for Sockets:



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Device Tag:

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Manuf.: . PNO:

Square D: RXZE2S111M

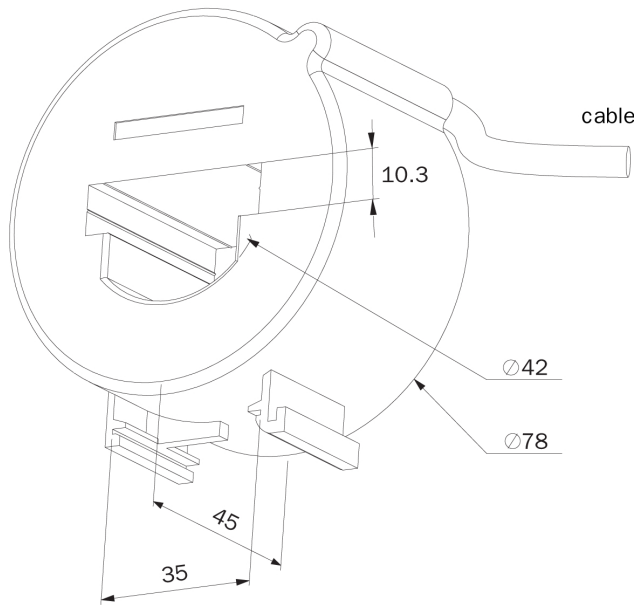
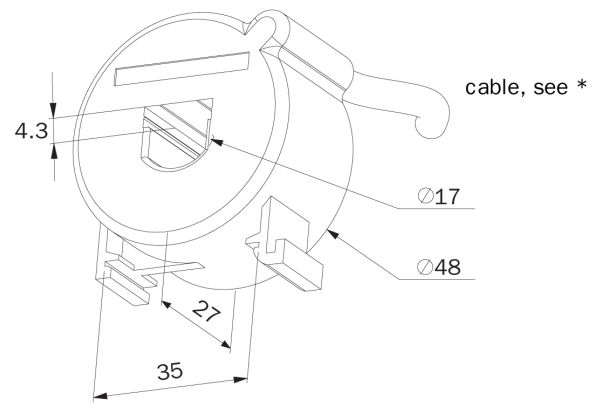
# EL-FI CTM

## Current Transformer Monitor

(FOR MOUNTING ON STANDARD DIN-RAIL 35MM)



Fig.	Type	I prim	I sec.	Part number	Suitable to;
1	CTM010	10A	0.055A	01-2471-10	M10, M20, DCM
1	CTM025	25A	0.055A	01-2471-20	M10, M20, DCM
1	CTM050	50A	0.055A	01-2471-30	M10, M20, DCM
2	CTM100	100A	0.055A	01-2471-40	M10, M20, DCM



Rev: 0	Device Tag: CT1	
Date: 6/12/2019		
By: ATT MARTON	Job Number: HBR7752	Page # 1/1

Manuf.: . PNo: Emotron: 01-2471-10

**General Data**

Part No: 07.311.4053.1

Description: End Cover – Black

Type of end plate – Yes

Snap in - Yes

Inflammability Class of insulation material acc. With UL94 – V0



07-063-000



Rev: 0

Date: 6/12/2019

Device Tag:

DB1

Manuf.: . PNo:

Wieland: 07.311.4053.1

By: ATT MARTON

Job Number: HBR7752

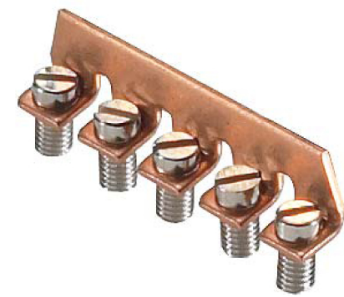
Page # 1/1  
Section 6 Page 60

# Cross connectors, (jumper bars) uninsulated



07-063-001

Type	Part no.	Std. pack
<b>WKM 4/15</b>	<b>6 mm spacing</b>	<b>Screw: M 3</b>
2pole 9215 - 2	Z7.210.3227.0	50
3pole 9215 - 3	Z7.210.3327.0	50
4pole 9215 - 4	Z7.210.3427.0	50
5pole 9215 - 5	Z7.210.3527.0	50
6pole 9215 - 6	Z7.210.3627.0	50
70pole 9215 M-70	Z7.210.3027.0	10



### General

Colour	Other
Type	Cross connector
Modular spacing	6 mm
Number of bridged clamps	4
Mounting method	Screwable
Insulated	No

### Accessories

Type	Cross connector
Mounting method	Screwable
Insulated	No
Colour	Other
Number of bridged clamps	4
Modular spacing	6 mm

 630-499-7080 · www.elemechinc.com	Rev: 0	Device Tag: <b>DB1</b>	
	Date: 6/12/2019		
Manuf.: . PNo: Wieland: Z7.210.3427	By: ATT MARTON	Job Number: HBR7752	Page # 1/1 Section 6 Page 61





**SwitchLine**  
 Non-fusible disconnect switches  
 Compact, Heavy duty  
 16A – 2000A, 600V



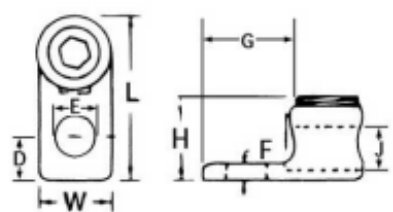
09-001-A010

Catalog number	3 pole	OT16F3	OT25F3	OT40F3	OT63F3	OT80F3	OT30F3	OT60F3	OT100F3	
<b>General purpose amp rating</b>	<b>A</b>	<b>20</b>	<b>30</b>	<b>40</b>	<b>60</b>	<b>80</b>	<b>30</b>	<b>60</b>	<b>100</b>	
Catalog reference	Page #	1.10	1.10	1.10	1.10	1.10	1.11	1.11	1.11	
Approvals <sup>①</sup>										
	2 pole	—	—	—	—	—	—	—	—	
	3 pole	CSA C22.2 No.14	CSA C22.2 No.14	CSA C22.2 No.14	CSA C22.2 No.14	CSA C22.2 No.14	CSA C22.2 No.4	CSA C22.2 No.4	CSA C22.2 No.4	
	4 pole	CSA C22.2 No.14	CSA C22.2 No.14	CSA C22.2 No.14	CSA C22.2 No.14	CSA C22.2 No.14	CSA C22.2 No.4	CSA C22.2 No.4	CSA C22.2 No.4	
<b>Technical ratings</b>										
<b>CSA,UL<sup>②</sup></b>										
Max operating voltage	V	600	600	600	600	600	600VAC / 250VDC	600VAC / 250VDC	600VAC / 250VDC	
Max horsepower rating										
Three phase										
	208V HP	3	7.5	10	15	20	10	20	25	
	240V HP	5	7.5	10	15	20	10	20	30	
	480V HP	10	15	20	30	40	20	40	50	
	600V HP	10	20	25	30	40	30	40	50	
Single phase										
	120V HP	1	1.5	2	2	2	2	3	5	
	240V HP	2	3	5	7.5	10	5	7.5	15	
<b>Technical ratings</b>										
<b>IEC<sup>③</sup></b>										
Rated insulation and operational voltage. AC20 and DC20 <sup>④</sup>	V	750	750	750	750	750	750	750	750	
Rated thermal current, I <sub>th</sub>										
AC 20/DC 20 open	A	25	32	40	63	80	40	63	115	
AC 20/DC 20 enclosed	A	25	32	40	63	80	40	63	115	
AC 21A ≤ 500V	A	16	25	40	63	80	40	63	100	
690V	A	16	25	40	63	80	40	63	100	
Rated operational power AC23										
400/415V	kW	7.5	9	11	22	37	15	18.5	37	
690V	kW	7.5	9	11	15	18.5	15	15	37	
<b>Physical characteristics</b>										
Weight <sup>⑤</sup> 3 pole	Kg	0.11	0.11	0.11	0.27	0.27	0.36	0.36	0.36	
Dimension 3 pole										
	H mm	68	68	68	91	91	100	100	100	
	W mm	35	35	35	53	53	70	70	70	
	D mm	56	56	56	72	72	75	75	75	
<b>Accessories</b>										
Terminal lug kit		Integral	Integral	Integral	Integral	Integral	Integral	Integral	Integral	
Terminal shroud		•	•	•	•	•	•	•	•	
Auxiliary contact		•	•	•	•	•	•	•	•	
Handle CSA/UL/NEMA type										
Type 1, 3R, 12		•	•	•	•	•	•	•	•	
Type 1, 3R, 4, 4X, 12		•	•	•	•	•	•	•	•	
Handle type										
Selector		•	•	•	•	•	•	•	•	
Pistol		•	•	•	•	•	•	•	•	
Conversion kits										
6 pole		•	•	•	•	•	•	•	•	
Transfer		•	•	•	•	•	•	•	•	
Bypass		•	•	•	•	•	•	•	•	
Mechanical interlock		•	•	•	•	•	•	•	•	
Electrical interlock		—	—	—	—	—	—	—	—	

CSA approved, UL listed, IEC rated, CE marked

① CSA 22.2 No.4 (UL98) —CSA File #LR58077, UL File # E101914, CSA 22.2 No. 14 (UL508) —CSA File #LR58247, UL File # E63822

 630-499-7080 · www.elemechinc.com	Rev: 0	Device Tag: DS1	
	Date: 6/12/2019		
Manuf.: PNO: ABB: OT63F3 Assembly	By: ATT MARTON	Job Number: HBR7752	Page # 1/1 Section 6 Page 63



**Copper Connectors**  
**T&B Catalog Number:**

**UPC Number:** L70  
 78378613002  
**Status:** Active  
**Description:**

Type L - Copper Single Conductor, One-Hole Mount for Conductor Range 14 Sol.-4 Str.

**Features**

Cold forged from pure electrolytic copper with 99 percent conductivity.

**General**

Style	Type L - Copper Single Conductor, One-Hole Mount
Material	Copper
Wire Range	14 Sol.-4 Str.

**Dimension Information**

Length (inches)	1 1/8
Width (inches)	17/32
Height (inches)	35/64
D (inches)	9/32
E (inches)	9/32
F (inches)	3/32
G (inches)	21/32
J (inches)	9/32

**Packaging**

T&B Inner Pack	100
Package in Units	1000
T&B Sold in UOM	Each
T&B Weight Per UOM	3.32 lbs. per 100

**Notes**

Available with screwdriver slot head screws only.  
 UL 486A tested.

**Certifications**

RoHS Compliance	Yes
-----------------	-----

**Certifications**



File Nbr:  
 E9809

For further technical assistance, please contact us...

Thomas & Betts - USA  
 8155 T&B Blvd.  
 Memphis, TN 38125  
 www.tnb.com

T&B Technical Support  
 MS 3B-50  
 8155 T&B Blvd.  
 Memphis, TN 38125

Hours: 7AM - 6PM CDT  
 Monday-Friday  
 Phone: (888) 862-3289  
 Fax: (901) 252-1321  
 Email: techsupport@tnb.com

 630-499-7080 · www.elemechinc.com	Rev: 0	Device Tag: <b>GND</b>	
	Date: 6/12/2019		
Manuf.: . PNo: <b>Blackburn: L70</b>	By: ATT MARTON	Job Number: HBR7752	Page # <b>1/1</b> Section 6 Page 64

# Flexible Heaters

## Flexible Heater Installation Methods

### Flexible Heater Pressure Sensitive Adhesive (PSA)

#### PSA

For ease of attachment specify PSA. Installation is simple: just peel off the protective liner and apply. It will adhere to most clean smooth surfaces. Care must be taken when installing to attain a smooth, consistent, uniform bond to achieve maximum results.

#### Maximum Temperature:

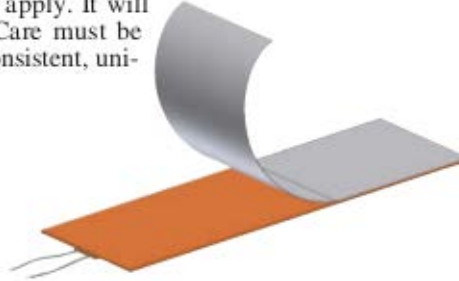
Continuous – 300°F (149°C)  
Intermittent – 500°F (260°C)

#### Recommended Watt Density:

Under 5 W/in<sup>2</sup> (0.78 W/cm<sup>2</sup>)

#### PSA Plus

A layer of aluminum foil is vulcanized to the back of the heater for added heat dissipation prior to the application of PSA.



17-451-000

UL Recognized: U.S. & Canada E65652

CSA Certified: 043099

Tempco PN: **SHS80707**  
SILICONE RUBBER HEATER  
3.000" W x 5.000" L  
12" Teflon® leads in location A  
Wire construction  
Pressure sensitive adhesive  
75 watts, 120 volts



Tempco PN: **SHS80708**  
SILICONE RUBBER HEATER  
4.500" W x 6.500" L  
12" Teflon® leads in location A  
Wire construction  
Pressure sensitive adhesive  
150 watts, 120 volts



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Rev: 0

Date: 6/12/2019

By: ATT MARTON

Device Tag:

HTR1

Job Number: HBR7752

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Section 6 Page 65

Manuf.: . PNo: Tempco: SHS80707

# Zelio® Plug-In Relays

## RPM power relays



Telemecanique

06-058-024

### General characteristics

<b>Conforming to standards</b>			IEC/EN 61810-1 (iss. 2), UL 508, CSA C22-2 n° 14
<b>Product certifications</b>			cULus File E164862 CCN NLDX, NLDX7; cURus File E164862 CCN NLDX2, NLDX8; CSA; CE; RoHS compliant
<b>Ambient air temperature</b> around the device	Storage	°C (F)	- 40... + 85 (-40... +185)
	Operation	°C (F)	- 40... + 55 (-40... +131)
<b>Vibration resistance</b> conforming to IEC/EN 60068-2-6	In operation		3 gn (10...150 Hz± 1 mm / 5g/5 cycles)
	Not operating		5 gn (10...150 Hz± 1 mm / 5g/5 cycles)
<b>Degree of protection</b>	Conforming to IEC/EN 60529		IP 40
<b>Shock resistance</b> conforming to IEC/EN 60068-2-27	Opening		15 gn
	Closing		15 gn
<b>Protection category</b>			RT I
<b>Mounting position</b>			Any

### Insulation characteristics

<b>Rated insulation voltage (Ui)</b>	Conforming to IEC/EN 60947	V	250 (IEC), 300 (UL, CSA)
<b>Rated impulse withstand voltage (Uimp)</b>		kV	4 (1.2/50 μs)
<b>Dielectric strength</b> (rms voltage)	Between coil and contact	~ V	1550
	Between poles	~ V	1550
	Between contacts	~ V	1500

### Contact characteristics

Relay type			RPM1●●●	RPM2●●●	RPM3●●●	RPM4●●●
<b>Number and type of contacts</b>			1 C/O	2 C/O	3 C/O	4 C/O
<b>Contact materials</b>			AgNi			
<b>Conventional thermal current (Ith)</b>	For ambient temperature ≤ 55 °C	A	15			
<b>Rated operational current</b> in utilization categories AC-1 and DC-1	Conforming to IEC	NO	A	15		
		NC	A	7.5		
	Conforming to UL		A	15		
<b>Switching current</b>	Minimum		mA	10		
<b>Switching voltage</b>	Maximum		V	~/∞ 250 (IEC)		
	Minimum		V	17		
<b>Nominal load (resistive)</b>			A	15 / 250 ~ V		
			A	15 / 28 ∞ V		
<b>Switching capacity</b>	Maximum	~	VA	3750		
		∞	W	420		
	Minimum		mW	170		
<b>Maximum operating rate</b> In operating cycles/hour	No-load			18 000		
	Under load			1200		
<b>Utilization coefficient</b>				20 %		
<b>Mechanical durability</b>	In millions of operating cycles			10		
<b>Electrical durability</b> In millions of operating cycles	Resistive load			0.1		0.06
	Inductive load			See curves below		

**Electrical durability of contacts**  
Resistive load ~      Reduction coefficient for inductive load ~ (depending on power factor cos φ)      Maximum switching capacity on resistive load ∞



Rev: 0

Date: 6/12/2019

By: ATT MARTON

Device Tag:

IR1-3

Job Number: HBR7752

Page # 1/2

Manuf.: PNO:

Square D: RPM12F7

### Power relays without LED (sold in lots of 10)

Control circuit voltage	Number and type of contacts - Thermal current (Ith)							
	1 C/O - 15 A		2 C/O - 15 A		3 C/O - 15 A		4 C/O - 15 A	
	Catalog number	Weight	Catalog number	Weight	Catalog number	Weight	Catalog number	Weight
V		kg		kg		kg		kg
~ 12	RPM11JD	0.026	RPM21JD	0.036	RPM31JD	0.054	RPM41JD	0.071
~ 24	RPM11BD	0.026	RPM21BD	0.036	RPM31BD	0.054	RPM41BD	0.071
~ 48	RPM11ED	0.026	RPM21ED	0.036	RPM31ED	0.054	RPM41ED	0.071
~ 110	RPM11FD	0.026	RPM21FD	0.036	RPM31FD	0.054	RPM41FD	0.071
~ 24	RPM11B7	0.026	RPM21B7	0.036	RPM31B7	0.054	RPM41B7	0.071
~ 48	RPM11E7	0.026	RPM21E7	0.036	RPM31E7	0.054	RPM41E7	0.071
~ 120	RPM11F7	0.026	RPM21F7	0.036	RPM31F7	0.054	RPM41F7	0.071
~ 230	RPM11P7	0.026	RPM21P7	0.036	RPM31P7	0.054	RPM41P7	0.071

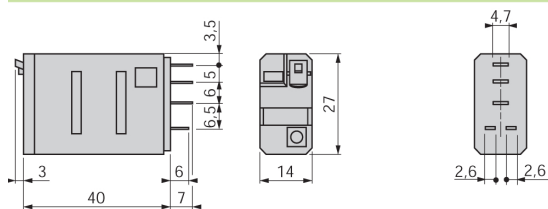
### Power relays with LED (sold in lots of 10)

~ 12	RPM12JD	0.026	RPM22JD	0.036	RPM32JD	0.054	RPM42JD	0.071
~ 24	RPM12BD	0.026	RPM22BD	0.036	RPM32BD	0.054	RPM42BD	0.071
~ 48	RPM12ED	0.026	RPM22ED	0.036	RPM32ED	0.054	RPM42ED	0.071
~ 110	RPM12FD	0.026	RPM22FD	0.036	RPM32FD	0.054	RPM42FD	0.071
~ 24	RPM12B7	0.026	RPM22B7	0.036	RPM32B7	0.054	RPM42B7	0.071
~ 48	RPM12E7	0.026	RPM22E7	0.036	RPM32E7	0.054	RPM42E7	0.071
~ 120	RPM12F7	0.026	RPM22F7	0.036	RPM32F7	0.054	RPM42F7	0.071
~ 230	RPM12P7	0.026	RPM22P7	0.036	RPM32P7	0.054	RPM42P7	0.071

### Dimensions (mm):

#### Power relays

#### RPM 1

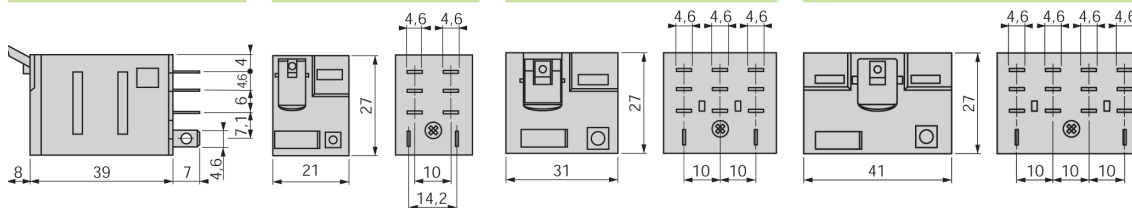


#### Common side view

#### RPM2

#### RPM 3

#### RPM 4



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Date: 6/12/2019

By: ATT MARTON

Device Tag:

IR1-3

Job Number:

HBR7752

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Manuf.: PNo:

Square D: RPM12F7



# 30.5 mm Push Buttons Pilot Lights



# Allen-Bradley

800 T - P T 16 G  
a b c d e f g

**a**

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

**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

## Specifications\*

Electrical Ratings	
Contact ratings	Refer to the contact ratings tables on page 10-4.
Dielectric strength	2200V for one minute, 1300V for one minute (Logic Reed)
Electrical design life cycles	1 000 000 at max. rated load, 200 000 at max. rated load (Logic Reed)
Mechanical Ratings	
Vibration	10...2000 Hz, 1.52 mm displacement (peak-to-peak) max./ 10 G max. (except Logic Reed)
Shock	1/2 cycle sine wave for 11 ms ≥ 25 G (contact fragility) and no damage at 100 G
Degree of protection	Type 1/4/12/13 (800T); Type 1/4/4X/12/13 (800H); EN/IEC 60529 IP66/65
Mechanical design life cycles	
Push buttons	(Momentary, non-illuminated) 10 000 000 min. (Momentary, illuminated) 250 000 min. (Push-pull/twist-to-release) 250 000 min.
Selector switches	(Non-illuminated) 1 000 000 min. (Illuminated, key-operated) 200 000 min.
Potentiometers	25 000 min.
All other devices	200 000 min.
Contact operation	Shallow, mini, and low-voltage contact blocks: Slow, double make and break Logic Reed and sealed switch contact blocks: Single break magnetic
Wire gauge/Terminal screw torque	#18...14 AWG (#18...10 Max Duty) / 6...8 lb•in
Typical operating forces	
Operators without contact blocks	Flush, extended button, standard mushroom, jumbo plastic mushroom: 2 lbs max. Jumbo and extended aluminum mushroom head: 3.95 lbs max. Maintained selector switch: 3.6 in•lb max.
Spring return selector switches	3.6 in•lb to stop, 0.2 in•lb to return
Illuminated push buttons and push-to-test pilot lights	5 lb max.
2-position push-pull	8.0 lb max. push or pull
3-position push-pull	8 lb max. push to in position or pull to center position (15 lb max. pull to out position)
Twist-to-release or push-pull	9 lbs max. push or pull 30 in•oz max. twist, 6 in•oz minimum return
Potentiometer	Rotational torque 3...12 in•oz; stopping torque 12 in•lb (minimum)
Contact blocks	Standard 1 lb Logic Reed 1 lb max. Sealed switch 3 lb max. at 0.205 in. plunger travel Stackable sealed switch 1 lb max. MaxDuty 1.4 lb max. PenTUFF 1.4 lb max. Self Monitoring 1.6 lb
Environment	
Temperature range	Operating -40...+131 °F (-40...+55 °C) Storage -40...+185 °F (-40...+85 °C)
<b>Note:</b> Operating temperatures below freezing are based on the absence of moisture and liquids. Consult your local Rockwell Automation sales office or Allen-Bradley distributor for use in lower temperature applications.	
Humidity	50...95% RH from 77...140 °F (25...60 °C) per Procedure IV of MIL-STD-810C, Method 507.1 cycling test



Rev: 0

Date: 6/12/2019

By: ATT MARTON

Device Tag:

LT1-3

Job Number: HBR7752

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Manuf.: . PNo: Allen-Bradley: 800H-PR16

32-005-048

# Replacement Color Caps

30.5 mm Accessories

**Allen-Bradley**



32-005-044

Color	800T/H Pilot Light Color Caps		
	Standard*	Push-to-Test*	18 mm
	Cat. No.	Cat. No.	Cat. No.
Amber	800T-N26A	800T-N42	800T-N122A
Blue	800T-N26B	800T-N43	800T-N122B
Clear	800T-N26C	800T-N45	800T-N122C
Green	800T-N26G	800T-N41	800T-N122G
Red	800T-N26R	800T-N40	800T-N122R
White	800T-N26W	800T-N44	800T-N122W



Rev: 0

Date: 6/12/2019

By: ATT MARTON

Device Tag:

LT2

Job Number: HBR7752

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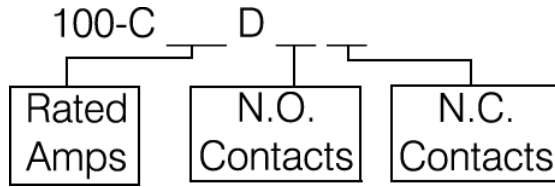
Manuf.: PNo:

Allen-Bradley: 800T-N26G

# Bulletin 100-C Contactors



22-005-003



V	120
Hz	D
60Hz	



Ie		Ratings for Switching AC Motors - AC-2, AC-3, AC-4										Aux. Contacts		Cat. No.	*
[A]		kW (50 Hz)					HP (60 Hz)					N.O.	N.C.		
AC-3	AC-1	230V	380V 415V 400V	500V	690V	1Ø		3Ø							
460V	40°C						115V	230V	200V	230V	460V	575V	N.O.	N.C.	
9	25	3	4	4	4	1/3	1	2	2	5	7-1/2	1	0	100-C09Ø10	
												0	1	100-C09Ø01	
12	25	4	5.5	5.5	5.5	1/2	2	3	3	7-1/2	10	1	0	100-C12Ø10	
												0	1	100-C12Ø01	
16	32	5.5	7.5	7.5	7.5	1	3	5	5	10	10	1	0	100-C16Ø10	
												0	1	100-C16Ø01	
23	32	7.5	11	11	10	2	3	5	7-1/2	15	15	1	0	100-C23Ø10	
												0	1	100-C23Ø01	
30	45	10	15	15	15	2	5	7-1/2	10	20	20	0	0	100-C30Ø00	
												1	0	100-C30Ø10	
												0	1	100-C30Ø01	
37	50	11	18.5	18.5	18.5	3	5	10	10	25	25	0	0	100-C37Ø00	
												1	0	100-C37Ø10	
												0	1	100-C37Ø01	
43	63	13	22	22	22	3	7-1/2	10	15	30	30	0	0	100-C43Ø00	
												1	0	100-C43Ø10	
												0	1	100-C43Ø01	
60	90	18.5	30	30	30	5	10	15	20	40	40	0	0	100-C60Ø00	
												1	0	100-C60Ø10	
												0	1	100-C60Ø01	
72	90	22	37	37	37	5	15	20	25	50	50	0	0	100-C72Ø00	
												1	0	100-C72Ø10	
												0	1	100-C72Ø01	
85	100	25	45	45	45	7-1/2	15	25	30	60	60	0	0	100-C85Ø00	
												1	0	100-C85Ø10	
												0	1	100-C85Ø01	

⊗ Coil Voltage Code and Terminal Position

The Cat. No. as listed is incomplete. Select a coil voltage code from the table below to complete the Cat. No. Example: 120V, 60Hz: Cat. No. 100-C09Ø10 becomes Cat. No.100-C09D10.

[V]	12	24	32	36	42	48	100	110	120	127	200	200-220	208-240	220-230	230-240	240	277	347	380	380-400	400	400-415	440	480	500	550	600
50 Hz	R	K	V	W	X	Y	KP	—	D	P	S	KG	L	—	F	—	VA	T	—	N	—	G	B	—	M	C	—
60 Hz	Q	J	—	V	—	X	—	KP	—	D	—	—	KG	H	L	—	—	A	T	I	E	—	N	B	—	—	C
50/60 Hz	—	KJ	—	—	—	KY	KP	—	KD	—	—	KG	KL†	—	—	KL†	KF	—	—	—	—	KN	—	KB	—	—	—

† Not available on 100/104-C90 or -C97 contactors.

DC Voltages [V]		9	12	24	36	48	48-72	60	64	72	80	110	110-125	115	125	220	220-250	230	250
100-C09...C43	Standard	ZR	ZQ	ZJ	ZW	ZY	—	ZZ	ZB	ZG	ZE	ZD	—	ZP	ZS	ZA	—	ZF	ZT
	with Integrated Diode	—	—	DJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Electronic with Integrated Diode	—	EQ	EJ	—	—	EY	—	—	—	—	—	ED	—	—	—	—	EA	—
100-C60...C97	with Integrated Diode	DR	DQ	DJ	DW	DY	—	DZ	DB	DG	DE	DD	—	DP	DS	DA	—	DF	DT



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By: ATT MARTON

Device Tag:

M1

Job Number: HBR7752

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Manuf.: . PNO: Allen-Bradley: 100-C23D10

# Auxiliary Contacts

Allen-Bradley



## Auxiliary Contact Blocks for Front Mounting ①



- 2- and 4-pole
  - Quick and easy mounting without tools
  - Electronic-compatible contacts down to 17V, 5 mA
  - Mutual positive guidance to the main contactor poles (except for L types)
  - Models with equal function with several terminal numbering choices
- L = Late break / Early make



## Auxiliary contact blocks for front installation ③

- 2 and 4 poles
- Quick and easy mounting without tools
- Contacts compatible with electronics
- Mutual positive guidance with the main contactor poles (except for L types)
- Models with equal function with several terminal numbering choices

L = late break / early make

 N.O.	 N.C.	Connection Diagrams	For Use With	Cat. No.
0	2		100-C all C30×00...C85×00	100-FA02 100-FB02
1	1		100-C all C30×00...C85×00 C09×10...C23×10	100-FA11 100-FB11 100-FC11
2	0		100-C all C30×00...C85×00	100-FA20 100-FB20
1L	1L		100-C all C30×00...C85×00	100-FAL11 100-FBL11
0	4		100-C all	100-FA04
1	3		100-C all	100-FA13
2	2		100-C all C30×00...C85×00 C09×10...C23×10	100-FA22 100-FB22 100-FC22
3	1		100-C all C09×10...C23×10	100-FA31 100-FC31
4	0		100-C all	100-FA40
1+1L	1+1L		100-C all	100-FAL22

22-005-011



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Device Tag:

M1

Job Number: HBR7752

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Manuf.: PNO:



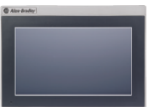

Allen-Bradley: 100-FA40

# PanelView™ 800



# Allen-Bradley

26-005-075

Feature	4 in.	7 in.	10 in.
			
<b>Catalog Number</b>	<b>2711R-T4T</b>	<b>2711R-T7T</b>	<b>2711R-T10T</b>
Resolution	480 x 272 WQVGA	800 x 480 WVGA	800 x 600 SVGA
Display Type	TFT touch screen, wide LCD		
Display Hour	40,000 hours		
Colors	65K colors		
Backlight	LED		
Power Supply	24V DC		
Processor, CPU Speed	800 MHz		
Operator Input	Resistive touch and tactile function keys	Resistive touch	
Internal Storage	128 MB	256 MB	
RAM	128 MB DDR	256 MB DDR	
Operation System	Microsoft Windows CE 6.0		
Real-time Clock With Battery	Yes		
Operating Temperature	0°...50°C		
RS232/RS422/485 (isolated)	Separate RS232 and RS422/RS485 connectors		
Ethernet 10/100 Mbps	1		
USB Host (USB 2.0)	Yes		
microSD™ Slot	Yes		
Product Dimension (mm) (Height x Width x Depth)	116 X 138 X 43	144 X 197 X 54	225 X 287 X 55
Panel Cutout (mm) (Height x Width)	99 X 119	125 X 179	206 X 269
Weight	0.35 kg (0.76 lb)	0.68 kg (1.48 lb)	1.57 kg (3.41 lb)
Front Bezel Protection	IP65, NEMA 4X, 12, 13		
Certifications	cULus listed; Class 1 Div 2, Groups A,B,C,D, T4A, CE, RCM, KC, RoHS		



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Manuf.: PNO:

Allen-Bradley: 2711R-T4T

By:

ATT MARTON

# E1 Plus Solid-State Overload Relays

Allen-Bradley




## Bulletin 193-EE – Three-Phase Devices

- Selectable Trip Class (10, 15, 20, 30)
- Selectable Auto/Manual-Auto Reset
- Screw-Type Control Terminals

Mounts to Contactor	Adjustment Range (A)	Cat. No. ①
100-C09...100-C23	0.1...0.5	193-EEAB
	0.2...1.0	193-EEBB
	1.0...5.0	193-EECB
	3.2...16	193-EEDB
	5.4...27	193-EEEB
100-C30...100-C43	5.4...27	193-EEED
	9...45	193-EEFD
100-C60...100-C85	18...90	193-EEGE

## Specifications

Cat. No.		193-ED1_B, 193-EE_B, and 592-EE_T
<b>Main Circuits</b>		
Rated Insulation Voltage $U_i$		690V AC
Rated Impulse Strength $U_{imp}$		6 kV AC
Rated Operating Voltage $U_e$		690V AC (IEC) / 600V AC (CSA/UL)
Terminal Cross-Sections:		
Terminal Type		
Terminal Screw		M5
Flexible-Stranded with Ferrule	Single Conductor Torque	2.5...16 mm <sup>2</sup> 2.5 N-m
	Two Conductor Torque	2.5...10 mm <sup>2</sup> ① 3.4 N-m
Coarse-Stranded / Solid	Single Conductor Torque	2.5...25 mm <sup>2</sup> 2.5 N-m
	Two Conductor Torque	6...16 mm <sup>2</sup> ① 3.4 N-m
Stranded / Solid	Single Conductor Torque	14...6 AWG 22 lb-in
	Two Conductor Torque	14...6 AWG ① 30 lb-in
Poizdrive Screwdriver Size		2
Slotted Screwdriver (mm)		1 x 6
Hexagon Socket Size (mm)		—
<b>Control Circuits</b>		
Rated Insulation Voltage $U_i$		690V AC
Rated Impulse Strength $U_{imp}$		6 kV AC
Rated Operating Voltage $U_e$		690V AC (IEC) / 600V AC (CSA/UL)
Rating Designation		B600
Rated Operating Current $I_e$		N.O. / N.C.
AC-15	12...120V	3 / 2
	220...240V	1.5 / 1.5
	380...480V	0.75 / 0.75
	500...600V	0.6 / 0.6
DC-13, at L/R ≤ 15 ms	24V	1.1 / 1.1
	110V	0.4 / 0.4
	220V	0.2 / 0.2
	440V	0.08 / 0.08
Thermal Current $I_{the}$		5 A
Contact Reliability		17V, 5 mA
Screw Terminal Cross-Sections:		
Terminal Screw		M3
Flexible-Stranded with Ferrule	Single Conductor Torque	0.5...2.5 mm <sup>2</sup> 0.55 N-m
	Two Conductor Torque	0.25...1.5 mm <sup>2</sup> 0.55 N-m
Coarse-Stranded / Solid	Single Conductor Torque	0.5...4 mm <sup>2</sup> 0.55 N-m
	Two Conductor Torque	0.2...2.5 mm <sup>2</sup> 0.55 N-m
Stranded / Solid	Single Conductor Torque	24...10 AWG 5 lb-in
	Two Conductor Torque	24...12 AWG 5 lb-in
Screwdriver (mm)		#1 Pozidrive / 0.6 x 3.5 slotted
<b>Cage Clamp Cross-Sections:</b>		
Flexible-Stranded with Ferrule		0.25...1 mm <sup>2</sup>
Coarse-Stranded / Solid		0.2...1.5 mm <sup>2</sup>
Stranded / Solid		24...14 AWG

## Environmental Ratings

Ambient Temperature	Storage	-40...85°C (-40...185°F)
	Operating	-20...60°C (-4...140°F)
Humidity	Operating	5...95%, non-condensing per IEC 68-2-3 and IEC 68-2-31
	Damp Heat	
Vibration (per IEC 68-2-6)		3 G
Shock (per IEC 68-2-27)		30 G
Maximum Altitude		2000 m
Pollution Environment		Pollution Degree 3
Degree of Protection		IP20

## Protection

Type of Relay	Ambient Compensated, Time Delay, Phase	
Nature of Relay	Solid-State	
Trip Rating	120% FLA	
Trip Class	Type ED	10
	Type EE	10, 15, 20, 30
Reset Mode	Type ED	Manual
	Type EE	Automatic or Manual

## Electromagnetic Compatibility

Electrostatic Discharge Immunity	Test Level	8 kV Air Discharge 6 kV Contact Discharge
	Performance Level	1 ① ②
RF Immunity	Test Level	10 V/m
	Performance Level	1 ① ②
Electrical Fast Transient/Burst Immunity	Test Level	4 kV
	Performance Level	1 ① ②
Surge Immunity	Test Level	2 kV (L-E) 1 kV (L-L)
	Performance Level	1 ① ②

## Standards Compliance

IEC/EN 60947-4-1  
IEC/EN 60947-5-1  
CSA 22.2 No. 14  
UL 508

## Certifications

CE  
cULus Listed  
C-Tick  
CCC



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Manuf.: PNO:

Allen-Bradley: 193-EEDB

Rev:

0

Date:

6/12/2019

By:

ATT MARTON

Device Tag:

OL1

Job Number:

HBR7752

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28-005-038

# 30.5 mm Push Buttons Emergency Stop Operators



## 2-Position Red Trigger Action Twist-to-Release, Non-Illuminated

- Tamper resistant – front-of-panel mounting and non-removable operator head
- Compliant with global E-stop standards, including EN ISO 13850 and EN 60947-5-5



Cat. No. 800T-TFXJET6



Cat. No. 800T-TFXLET6



Cat. No. 800T-TFXK6



Cat. No. 800H-TFRXT6

Contact Type	Operator Position		Type 4/13			Type 4/4X/13
	Out	In	45 mm Plastic	63 mm Metal	Key Release	45 mm Plastic
No contacts	—	—	Cat. No.* <b>‡</b>	Cat. No.* <b>§</b>	Cat. No.* <b>‡</b>	Cat. No.* <b>‡</b>
1 N.C.	X	O	800T-TFXT6D2	800T-TFXLT6D2	800T-TFXK6D2	800H-TFRXT6D2
1 N.O. - 1 N.C.	O	X	800T-TFXT6A	800T-TFXLT6A	800T-TFXK6A	800H-TFRXT6A
1 S.M.C.B.➤	X	O	800TC-TFXT6D4S	800TC-TFXLT6D4S	800TC-TFXK6D4S	800HC-TFRXT6D4S

### Standards Compliance

UL 508

CCC

### Certifications

UL Listed

(File No. E14840, E10314  
Guide No. NKCR, NOIV)

CSA Certified

(File No. LR1234, LR11924)

CSA C22.2, No. 14

EN/IEC: 60947-5-1

\* For finger-safe contact block terminals, add a **C** to the cat. no. Example: Cat. No. 800TC-TFXT6 or 800HC-TFRXT6.

‡ To order a device with a jumbo (60 mm) plastic head add the letter **J** after **X**. Example: Cat. No. 800T-TFXJT6A or 800H-TFRXT6A.

§ To order a jumbo head device with "E-STOP" printed on the cap add the letters **JE** after **X**. Example: Cat. No. 800T-TFXJET6 or 800H-TFRXJET6.

➤ To order a device with "E-STOP" engraved on the cap add the letter **E** after **L**. Example: Cat. No. 800TC-TFXLET6D4S.

‡ Provided with two DO18 keys.

➤ Self-monitoring contact block.



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

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

Head Type‡		
800T Type 4/13	Description	800H Type 4/4X/13
Code		Code
FX	Standard (45 mm) mushroom head	FRX
FXJ	Jumbo (60 mm) mushroom head	FRXJ
FXJE	Jumbo (60 mm) mushroom head with "E-STOP"	FRXJE
FXK	45 mm mushroom head key release	—
FXL	63 mm anodized aluminum head	—
FXLE	63 mm anodized aluminum head with "E-STOP"	—

Release Function	
Code	Color
Blank	Key release‡
T	Twice release

**Note:** X = Closed/O = Open

‡ Configurable only with **FXK** head type.

Contact Block(s)			
Code	Operator Position		Description
	Out	In	
Blank	—	—	No contacts on operator
<b>Standard</b>			
D1	O	X	1 N.O.
D2	X	O	1 N.C.
D4	X	O	1 N.C.L.B.
A	O	X	1 N.O. - 1 N.C.
A1	O	X	1 N.O. - 1 N.C.L.B.
A5	X	O	2 N.C.L.B.
<b>PenTUFF (Low Voltage)</b>			
D1V	O	X	1 N.O.
D2V	X	O	1 N.C.
D4V	X	O	1 N.C.L.B.
AV	O	X	1 N.O. - 1 N.C.
<b>Class 1, Div. 2/Zone 2</b>			
<b>Logic Reed</b>			
D1R	O	X	1 N.O.
D2R	X	O	1 N.C.
AR	O	X	1 N.O. - 1 N.C.
<b>Sealed Switch</b>			
D1P	O	X	1 N.O.
D2P	X	O	1 N.C.
AP	O	X	1 N.O.
	X	O	1 N.C.
<b>Stackable Sealed Switch</b>			
D1Y	O	X	1 N.O.
D2Y	X	O	1 N.C.
AY	O	X	1 N.O. - 1 N.C.



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Device Tag:

PB1

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Manuf.: PNO:

Allen-Bradley: 800H-TFRXT6D2

29-005-117

# Accessories

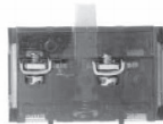
## 30.5 mm Push Buttons



# Allen-Bradley



Shallow Block



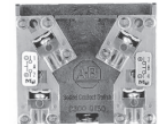
PenTUFF™ (Low Voltage)  
Contact Block



Logic Reed Block



Sealed Switch Block



Stackable Sealed  
Switch Block

Contact Type	Shallow Block*§		PenTUFF (Low Voltage) Block*§		Logic Reed Block‡		Sealed Switch Block‡		Stackable Sealed Switch Block‡	
	Cat. No.	Code	Cat. No.	Code	Cat. No.	Code	Cat. No.	Code	Cat. No.	Code
1 N.O.	800T-XD1	D	800T-XD1V	H	800T-XD1R	V	800T-XD1P	R	800T-XD1Y	5
1 N.C.	800T-XD2	E	800T-XD2V	U	800T-XD2R	W	800T-XD2P	S	800T-XD2Y	6
1 N.O.E.M.	800T-XD3	G	800T-XD3V	I	—	—	—	—	—	—
1 N.C.L.B.	800T-XD4	J	800T-XD4V	Q	—	—	—	—	—	—
1 N.O. - N.C.	800T-XA	A	800T-XAV	F	800T-XAR	T	800T-XAP	P	800T-XAY	7
2 N.O.	800T-XA2§	M	—	—	800T-XA2R§	Y	—	—	800T-XA2Y	8
2 N.C.	800T-XA4	N	—	—	800T-XA4R	Z	—	—	800T-XA4Y	9
1 N.C.L.B. - 1 N.O.	800T-XA1	B	—	—	—	—	—	—	—	—
1 N.C.L.B. - 1 N.C.	800T-XA7	C	—	—	—	—	—	—	—	—

**Note:** Modular suffix codes can be used when specifying selector switches with multiple contact blocks.

### PenTUFF™ (Low Voltage) Contact Ratings

Minimum DC: 5V, 1 mA  
 Maximum thermal continuous current  $I_{th}$  2.5 A AC/1.0 A DC. Bulletin 800T units with 800T-XAV contacts have ratings as follows:

Max. Opertnl. Volts $U_e$	Utilization Category		Rated Operational Currents		
	IEC	NEMA	Volts $U_e$	Make	Break
AC 300	AC-15	C300	120...300 0...120	1800VA 15 A	180VA 1.5 A
DC 150	DC-13	R150	24...150 0...24	28VA 1.0 A	

### Stackable Sealed Switch Contact Ratings

Minimum: 5V, 10 mA (digital); 24V, 1 mA (analog)  
 Maximum continuous current  $I_{th}$  2.5 A. Bulletin 800T units have control circuit ratings with sealed switch contact blocks as follows:

Max. Opertnl. Volts $U_e$	Utilization Category		Rated Operational Currents		
	IEC	NEMA	Volts $U_e$	Make	Break
AC 300	AC-15	C300	120...300 0...120	1800VA 15 A	180VA 1.5 A
DC 150	DC-13	Q150	24...150 0...24	69VA 2.5 A	

### MaxDuty Contact Rating

Maximum thermal continuous current  $I_{th}$  24 A.  
 Pilot Duty — 120V AC, 12 A; 24V DC, 10 A  
 Motor Ratings — 120V AC, 1.5 Hp; 240V AC, 3 Hp; 24V DC, 10 A FLA/60 A LRA

### Logic Reed Contact Ratings

Minimum — DC: 5V, 1 mA  
 Maximum — DC: 30V, 0.06 A, AC: 150V, 0.15 A  
 Should only be used with resistive loads.

### Product Certifications

Certifications	UR/UL, CSA, CCC, CE
Standards Compliance — CE Marked	NEMA ICS-5; UL 508, EN ISO 13850, EN 60947-1, EN 60947-5-1, EN 60947-5-5



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Date: 6/12/2019

By: ATT MARTON

Device Tag:

PB2

Job Number: HBR7752

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Manuf.: PNo: Allen-Bradley: 800T-XD2

02-005-004

# 30.5 mm Push Buttons



# Allen-Bradley

29-005-002

800 T - A 1 A

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

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

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

Operator Type		
800T Type 4/13	Description	800H Type 4/4X/13
Code		Code
A	Flush head	AR
B	Extended head	BR
D	Mushroom head	DR
DX	Mushroom head less color cap	DRX
—	Bootless guarded head	GR
—	Booted head	R*

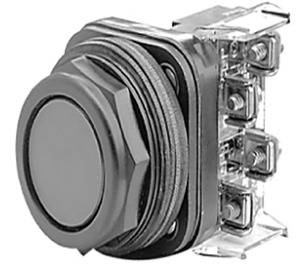
Color Cap	
Code	Description
Blank	Used only when ordering Operator Type DX/DRX
1	Green
2	Black
3	Orange*

Color Cap	
Code	Description
4	Grey*
5	White*
6	Red
7	Blue
9	Yellow

Special Mushroom Head	
Code	Description
J§	Jumbo mushroom head — plastic
L§	Jumbo mushroom head — metal

**Note:** Special mushroom head options only apply to mushroom head operator type code D/DR (Table c).

Contact Block(s)	
Code	Description
Blank	No contacts
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	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.



### Certifications

UL Listed  
 (File No. E14840, E10314  
 Guide No. NKCR, NOIV)  
 CSA Certified  
 (File No. LR1234, LR11924)  
 CSA C22.2, No. 14

### Specifications\*

Electrical Ratings	
Contact ratings	Refer to the contact ratings tables on page 10-4.
Dielectric strength	2200V for one minute, 1300V for one minute (Logic Reed)
Electrical design life cycles	1 000 000 at max. rated load, 200 000 at max. rated load (Logic Reed)
Mechanical Ratings	
Vibration	10...2000 Hz, 1.52 mm displacement (peak-to-peak) max / 10 G max. (except Logic Reed)
Shock	1/2 cycle sine wave for 11 ms ≥ 25 G (contact fragility) and no damage at 100 G
Degree of protection	Type 1/4/12/13 (800T); Type 1/4/4X/12/13 (800H); EN/IEC 60529 IP66/65
Mechanical design life cycles	
Push buttons	(Momentary, non-illuminated) 10 000 000 min. (Momentary, illuminated) 250 000 min. (Push-pull/twist-to-release) 250 000 min.
Selector switches	(Non-illuminated) 1 000 000 min. (Illuminated, key-operated) 200 000 min.
Potentiometers	25 000 min.
All other devices	200 000 min.
Contact operation	Shallow, mini, and low-voltage contact blocks: Slow, double make and break Logic Reed and sealed switch contact blocks: Single break magnetic
Wire gauge/Terminal screw torque	#18...14 AWG (#18...10 Max Duty) / 6...8 lb•in
Typical operating forces	
Operators without contact blocks	Flush, extended button, standard mushroom, jumbo plastic mushroom: 2 lbs max. Jumbo and extended aluminum mushroom head: 3.95 lbs max. Maintained selector switch: 3.6 in•lb max.
Spring return selector switches	3.6 in•lb to stop, 0.2 in•lb to return
Illuminated push buttons and push-to-test pilot lights	5 lb max.
2-position push-pull	8.0 lb max. push or pull
3-position push-pull	8 lb max. push to in position or pull to center position (15 lb max. pull to out position)
Twist-to-release or push-pull	9 lbs max. push or pull 30 in•oz max. twist, 6 in•oz minimum return
Potentiometer	Rotational torque 3...12 in•oz; stopping torque 12 in•lb (minimum)
Contact blocks	Standard 1 lb Logic Reed 1 lb max. Sealed switch 3 lb max. at 0.205 in. plunger travel Stackable sealed switch 1 lb max. MaxDuty 1.4 lb max. PenTUFF 1.4 lb max. Self Monitoring 1.6 lb
Environment	
Temperature range	Operating -40...+131 °F (-40...+55 °C) Storage -40...+185 °F (-40...+85 °C)
<b>Note:</b> Operating temperatures below freezing are based on the absence of moisture and liquids. Consult your local Rockwell Automation sales office or Allen-Bradley distributor for use in lower temperature applications.	
Humidity	50...95% RH from 77...140 °F (25...60 °C) per Procedure IV of MIL-STD-810C, Method 507.1 cycling test



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Manuf.: PNO: Allen-Bradley: 800H-AR2D1

# MicroLogix™ Analog Input/Output Module

(Catalog Number 1762-IF2OF2)

**Allen-Bradley**



33-005-048

## General Specifications

Specification	Value
Dimensions	90 mm (height) x 87 mm (depth) x 40 mm (width) height including mounting tabs is 110 mm  3.54 in. (height) x 3.43 in. (depth) x 1.58 in. (width) height including mounting tabs is 4.33 in.
Approximate Shipping Weight (with carton)	240g (0.53 lbs.)
Storage Temperature	-40°C to +85°C (-40°F to +185°F)
Operating Temperature	0°C to +55°C (-32°F to +131°F)
Operating Humidity	5% to 95% non-condensing
Operating Altitude	2000 meters (6561 feet)
Vibration	Operating: 10 to 500 Hz, 5G, 0.030 in. max. peak-to-peak
Shock	Operating: 30G
Bus Current Draw (max.)	40 mA at 5V dc 105 mA at 24V dc
Analog Normal Operating Range	Voltage: 0 to 10V dc Current: 4 to 20 mA
Full Scale <sup>(1)</sup> Analog Ranges	Voltage: 0 to 10.5V dc Current: 0 to 21 mA
Resolution	12 bits (unipolar)
Repeatability <sup>(2)</sup>	±0.1%
Input and Output Group to System Isolation	30V ac/30V dc rated working voltage <sup>(3)</sup> (N.E.C. Class 2 required) (IEC Class 2 reinforced insulation)  type test: 500V ac or 707V dc for 1 minute
Module Power LED	On: indicates power is applied.
Recommended Cable	Belden™ 8761 (shielded)



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Allen-Bradley: 1762-IF2OF2

## Input Specifications

Specification	Value
Number of Inputs	2 differential (unipolar)
A/D Converter Type	Successive approximation
Common Mode Voltage Range <sup>(1)</sup>	±27 V
Common Mode Rejection <sup>(2)</sup>	> 55 dB at 50 and 60 Hz
Non-linearity (in percent full scale)	±0.1%
Typical Overall Accuracy <sup>(3)</sup>	±0.5% full scale at 0 to 55°C ±0.3% full scale at 25°C
Input Impedance	Voltage Terminal: 200KΩ Current Terminal: 250Ω
Current Input Protection	±32 mA
Voltage Input Protection	±30 V
Channel Diagnostics	Over or under range or open circuit condition by bit reporting for analog inputs.

## Output Specifications

Specification	Value
Number of Outputs	2 single-ended (unipolar)
D/A Converter Type	Resistor string
Resistive Load on Current Output	0 to 500 Ω (includes wire resistance)
Load Range on Voltage Output	> 1KΩ
Reactive Load, Current Output	< 0.1 mH
Reactive Load, Voltage Output	< 1 μF
Typical Overall Accuracy <sup>(1)</sup>	±1% full scale at 0 to 55°C ±0.5% full scale at 25°C
Output Ripple range 0 to 500 Hz (referred to output range)	< ±0.1%
Non-linearity (in percent full scale)	< ±0.5%
Open and Short-Circuit Protection	Continuous
Output Protection	±32 mA



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Manuf.: PNo:

Allen-Bradley: 1762-IF2OF2

# MicroLogix™ 1400 / 1766

Allen-Bradley

## Small Programmable Logic Controller



33-005-154

### Overview

The new Allen-Bradley® MicroLogix™ 1400 from Rockwell Automation complements the existing MicroLogix family of small programmable logic controllers. MicroLogix 1400 combines the features you demand from MicroLogix 1100, such as EtherNet/IP, online editing, and a built-in LCD, plus provides you with enhanced features, such as: higher I/O count, faster High Speed Counter/PTO and enhanced network capabilities

Take advantage of the built-in LCD with back lighting to set the Ethernet network configuration, display floating point values on a user configurable display, display OEM logos at startup and read or write any binary, integer and long file elements in the data table. Controllers without embedded analog come with 32 digital I/O count, while analog versions have 32 digital I/O and 6 analog I/O. All versions can be expanded using up to seven 1762 I/O modules - the same I/O modules that MicroLogix 1100 and 1200 utilize.



Three embedded communication ports provide you with superior communications capabilities. MicroLogix 1400 offers an isolated RS232C/RS485 combination port; a non-isolated RS232C port; and an RJ-45 port for 10/100 Mbps EtherNet/IP peer-to-peer messaging.

Similar to the rest of the MicroLogix family, MicroLogix 1400 is programmed with RSLogix 500 programming software (Version 8.1 and above) as well as new RSLogix Micro programming software.



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MicroLogix	1766-L32BWA	1766-L32AWA	1766-L32BXB	1766-L32BWAA	1766-L32AWAA	1766-L32BXBA
Input Power	120/240 VAC		24 VDC	120/240 VAC		24 VDC
Memory	non-volatile battery backed RAM					
User Program / User Data Space	10 K / 10K configurable					
Data Logging / Recipe Storage	128 K (without Recipe) / up to 64 K (after subtracting Data Logging)					
Battery Back-up	Yes					
Back-up Memory Module	Yes					
Digital Inputs	(12) Fast 24VDC (8) Normal 24VDC	(20) 120VAC	(12) Fast 24VDC (8) Normal 24VDC	(12) Fast 24VDC (8) Normal 24VDC	(20) 120VAC	(12) Fast 24VDC (8) Normal 24VDC
Digital Outputs	(12) Relay	(12) Relay	(6) Relay (3) Fast DC (3) Normal DC	(12) Relay	(12) Relay	(6) Relay (3) Fast DC (3) Normal DC
Analog Inputs / Outputs	None			(4) Voltage Inputs / (2) Voltage Outputs		
Serial Ports	(1)RS232C/RS485*, (1)RS232C**					
Serial Protocols	DF1 Full Duplex, DF1 Half Duplex Master/Slave, DF1 Radio Modem, DH-485, Modbus RTU Master/Slave, ASCII, DNP 3 Slave					
Ethernet Ports	(1) 10/100 EtherNet/IP port					
Ethernet Protocols	EtherNet/IP messaging only					
Trim Potentiometers	2 Digital					
High-Speed Inputs	Up to 6 channels @ 100 kHz	N/A	Up to 6 channels @ 100 kHz	Up to 6 channels @ 100 kHz	N/A	Up to 6 channels @ 100 kHz
Real Time Clock	Yes, embedded					
PID	Yes (limited by loop and stack memory)					
PWM /PTO	N/A		3 channel PTO (100kHz)\PWM (40kHz)	N/A		3 channel PTO (100kHz)\PWM (40kHz)
Dual Axis Servo control	N/A		Through embedded PTO	N/A		Through embedded PTO
Embedded LCD	Yes					
Floating Point Math	Yes					
Online Editing	Yes					
Operating Temperature	-20° C to +60° C					
Storage Temperature	-40° C (or -30° C) to +85° C					

\* RS232C/RS485\* and RS232C\*\* are optional accessories. \*\* RS232C\*\* is not available on the 1766-L32BWA.

 <b>630-499-7080 · www.elemechinc.com</b>	Rev: 0	Device Tag:  <h2 style="margin: 0;">PLC1</h2>	
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# Emotron M20 Shaft Power Monitor

**emotron**

34-024-009

Article number	Designation
01-2520-20	Emotron M20 1x100-240/3x100-240 VAC
01-2520-40	Emotron M20 3x380-500 VAC
01-2520-50	Emotron M20 3x525-690 VAC



Dimensions (WxHxD)	45x90x115 mm (1.77" x 3.54" x 4.53") 
Mounting	35 mm DIN rail 46277
Weight	0.30 kg (10.5 oz)
Supply voltage (±10%)	1x100-240 VAC, 3x100-240 VAC, 3x380-500 VAC 3x525-690 VAC
Frequency	50 or 60 Hz
Current input	Current transformer; CTM 010, 025, 050 and 100. Input 0-55 mA. (>100 A extra transformer needed)
Power consumption	Max. 6 VA
Start-up delay	1-999 s
Hysteresis	0-50% of rated motor power
Response delay max	0.1-500 s
Response delay min	0.1-500 s
Relay output	5 A/240 VAC Resistive, 1.5 A/240 VAC Pilot duty/AC12
Analogue output	Max. load 500 ohm
Digital input	Max. 240 VAC or 48 VDC. High: ≥24 VAC/DC, Low: <1 VAC/DC. Reset >50 ms
Fuse	Max. 10 A
Terminal wire size	Use 75 °C copper (CU) wire only. 0.2-4.0 mm <sup>2</sup> single core (AWG12). 0.2-2.5 mm <sup>2</sup> flexible core (AWG14), stripped length 8 mm (0.32")
Terminal tightening torque	0.56-0.79 Nm (5-7 lb-in)
Accuracy	±2%, ±1 unit cos phi>0.5; excl. current transformer; +20 °C (+68 °F)
Repeatability	±1 unit 24h; +20 °C (+68 °F)
Temperature tolerance	Max. 0.1%/ °C
Operating temperature	-20 to +50 °C (-4 °F to +122 °F)
Storage temperature	-30 to +80 °C (-22 °F to +176 °F)
Protection class	IP20
Approved to	CE (up to 690VAC), UL and cUL (up to 600 VAC)



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Emotron: 01-2520-40		Section 6 Page 82	

# Sync DIN Rail Power Supply

## 24V 30W 1 Phase (NEC Class 2) / DRS-24V30W1NZ



**Model Number:** DRS-24V30W1NZ  
**Unit Weight:** 0.11 kg (0.24 lb)  
**Dimensions (L x W x D):** 75 x 21 x 89.5 mm  
 (2.95 x 0.83 x 3.52 inch)



37-323-009

### Safety Standards



CB Certified for worldwide use

### Sync DIN Rail Power Supply

Model Number	Input Voltage Range	Rated Output Voltage	Rated Output Current
DRS-24V30W1NZ	85-264Vac (120-375Vdc)	24Vdc	1.25A

### Model Numbering

DR	S –	24V	30W	1	N	Z
DIN Rail	Product Series S – Sync Series	Output Voltage	Output Power	Single Phase	NEC Class 2	Without DC OK Relay Contact

### Specifications

#### Input Ratings / Characteristics

Nominal Input Voltage	100-240Vac
Input Voltage Range	85-264Vac
Nominal Input Frequency	50-60Hz
Input Frequency Range	47-63Hz
DC Input Voltage Range*	120-375Vdc
Input Current	< 0.55A @ 115Vac, < 0.35A @ 230Vac
Efficiency at 100% Load	> 87.5% @ 115Vac, > 88.0% @ 230Vac
Max Power Dissipation	0% load < 0.5W @ 115Vac & 230Vac 100% load < 4.5W @ 115Vac & 230Vac
Max Inrush Current (Cold Start)	< 20A @ 115Vac, < 40A @ 230Vac
Leakage Current (Neutral to PE terminal)	< 0.5mA @ 264Vac

\*Fulfills test conditions for DC input. Safety approval for DC input can be obtained upon request.



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Manuf.: PNo:

Delta: DRS-24V30W1NZ

## Output Ratings / Characteristics\*\*

Nominal Output Voltage	24Vdc
Factory Set Point Tolerance	24Vdc ± 2%
Output Voltage Adjustment Range	24-28Vdc
Output Current	1.25A (30W max.)
Output Power	30W
Line Regulation	< 0.5% (@ 85-264Vac, 100% load)
Load Regulation	< 1.0% (@ 85-264Vac, 0-100% load)
PARD*** (20MHz)	< 75mVpp @ > 0°C to 70°C < 150mVpp @ 0°C to -20°C
Rise Time	< 30ms @ nominal input (100% load)
Start-up Time	< 2,500ms @ 115Vac (100% load) < 1,000ms @ 230Vac (100% load)
Hold-up Time	> 20ms @ 115Vac (100% load) > 100ms @ 230Vac (100% load)
Dynamic Response (Overshoot & Undershoot O/P Voltage)	± 5% @ 85-264Vac input, 0-100% load (Slew Rate: 0.1A/μS, 50% duty cycle @ 5Hz to 1KHz)
Start-up with Capacitive Loads	3,000μF Max

\*\*For power de-rating from < -10°C to -20°C, and 55°C to 70°C, see power de-rating on page 3.

\*\*\*PARD is measured with an AC coupling mode, 5cm wires, and in parallel with 0.1μF ceramic capacitor & 47μF electrolytic capacitor.

## Mechanical

Case Cover / Chassis	Plastic	
Dimensions (L x W x D)	75 x 21 x 89.5 mm (2.95 x 0.83 x 3.52 inch)	
Unit Weight	0.11 kg (0.24 lb)	
Indicator	Green LED (DC OK)	
Cooling System	Convection	
Terminal	Input	3 Pins (Rated 300V/16A)
	Output	2 Pins (Rated 300V/16A)
Wire	Input / Output	AWG 22-12 / AWG 20-12
Mounting Rail	Standard TS35 DIN Rail in accordance with EN 60715	
Noise (1 Meter from power supply)	Sound Pressure Level (SPL) < 25dBA	

## Environment

Surrounding Air Temperature	Operating	-20°C to +70°C (Cold start at -40°C @ 40% load)
	Storage	-40°C to +85°C
Power De-rating	-10°C to -20°C de-rate power by 2% / °C > 55°C de-rate power by 3.33% / °C	
Operating Humidity	5 to 95% RH (Non-Condensing)	
Operating Altitude	0 to 2,000 Meters (6,560 ft.)	
Shock Test	Non-Operating	IEC60068-2-27, Half Sine Wave: 50G for a duration of 11ms; 3 times per direction, 9 times in total
	Operating	IEC 60068-2-27, Half Sine Wave: 10G for a duration of 11ms; 1 time in X axis
Vibration	Non-Operating	IEC 60068-2-6, Random: 5-500Hz; 2.09G <sub>rms</sub> , 20 min per axis for all X, Y, Z directions
	Operating	IEC 60068-2-6, Sine Wave: 10-500Hz; 2G peak; displacement of 0.35mm; 1 octave per min; 60 min per axis for all X, Y, Z directions
Pollution Degree	2	



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Manuf.: PNo:

Delta: DRS-24V30W1NZ

### Protections

Overvoltage	< 34.8V, SELV Output, Latch Mode
Overload / Overcurrent	105~160% of rated load current, Hiccup Mode, Non-Latching (Auto-Recovery)
Over Temperature	< 75°C Surrounding Air Temperature @ 100% load, Latch Mode
Short Circuit	Hiccup Mode, Non-Latching (Auto-recovery when the fault is removed)
Internal Fuse	T3.15A
Degree of Protection	IP20
Protection Against Shock	Class I with PE* connection

\*PE: Primary Earth

### Reliability Data

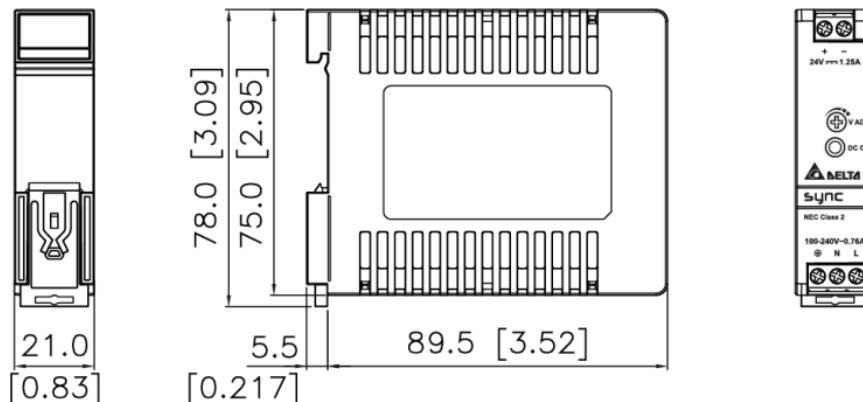
MTBF	Telcordia SR-332	> 700,000 hrs	I/P: 115Vac & 230Vac, O/P: 100% load, Ta: 25°C
	MIL-HDBK-217F	260,000 hrs	I/P: 115Vac & 230Vac, O/P: 100% load, Ta: 25°C
Expected Cap Life Time	10 years (115ac & 230Vac, 50% load @ 40°C)		

### Safety Standards / Directives

Safety Entry Low Voltage		SELV (EN 60950)
Electrical Safety	TUV Bauart	EN 60950-1
	UL/cUL recognized	UL 60950-1, CSA C22.2 No. 60950-1 (File No. E191395)
	CB Scheme	IEC 60950-1, Limited Power Source (LPS)
Industrial Control Equipment	UL/cUL listed	UL 508 and CSA C22.2 No. 107.1-01 (File No. E315335)
Class 2 Power Supply	UL/cUL recognized	UL 60950-1, CSA C22.2 No. 60950-1 (File No. E191395)
CE		In conformance with EMC Directive 2004/108/EC and Low Voltage Directive 2006/95/EC
Material and Parts		RoHS Directive 2011/65/EU Compliant
Galvanic Isolation	Input to Output	3.0KVac
	Input to Ground	3.0KVac
	Output to Ground	0.5KVac

### Dimensions

L x W x D: 75 x 21 x 89.5 mm [2.95 x 0.83 x 3.52 inch]



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Manuf.: PNo:

Delta: DRS-24V30W1NZ

# 30.5 mm Push Buttons Selector Switches

800 T - HA 2 A

a b c d e



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

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

Knob Insert Colors		
800T Type 4/13	Description	800H Type 4/4X/13
Code		Code
H	White	HR
HX	Packet of colored inserts*	HRX

Metal Wing Lever Colors§		
Code	Color	Code
HA	Red	—
HG	Grey	—

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

Contact Block(s)			
Code	Contact Configuration	Description	
		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

## Specifications\*

Electrical Ratings	
Contact ratings	Refer to the contact ratings tables on page 10-4.
Dielectric strength	2200V for one minute, 1300V for one minute (Logic Reed)
Electrical design life cycles	1 000 000 at max. rated load, 200 000 at max. rated load (Logic Reed)
Mechanical Ratings	
Vibration	10...2000 Hz, 1.52 mm displacement (peak-to-peak) max./10 G max. (except Logic Reed)
Shock	1/2 cycle sine wave for 11 ms ≥ 25 G (contact fragility) and no damage at 100 G
Degree of protection	Type 1/4/12/13 (800T); Type 1/4/4X/12/13 (800H); EN/IEC 60529 IP66/65
Mechanical design life cycles	
Push buttons	(Momentary, non-illuminated) 10 000 000 min. (Momentary, illuminated) 250 000 min. (Push-pull/twist-to-release) 250 000 min.
Selector switches	(Non-illuminated) 1 000 000 min. (Illuminated, key-operated) 200 000 min.
Potentiometers	25 000 min.
All other devices	200 000 min.
Contact operation	Shallow, mini, and low-voltage contact blocks: Slow, double make and break Logic Reed and sealed switch contact blocks: Single break magnetic
Wire gauge/Terminal screw torque	#18...14 AWG (#18...10 Max Duty) / 6...8 lb•in
Typical operating forces	
Operators without contact blocks	Flush, extended button, standard mushroom, jumbo plastic mushroom: 2 lbs max. Jumbo and extended aluminum mushroom head: 3.95 lbs max. Maintained selector switch: 3.6 in•lb max.
Spring return selector switches	3.6 in•lb to stop, 0.2 in•lb to return
Illuminated push buttons and push-to-test pilot lights	5 lb max.
2-position push-pull	8.0 lb max. push or pull
3-position push-pull	8 lb max. push to in position or pull to center position (15 lb max. pull to out position)
Twist-to-release or push-pull	9 lbs max. push or pull 30 in•oz max. twist, 6 in•oz minimum return
Potentiometer	Rotational torque 3...12 in•oz; stopping torque 12 in•lb (minimum)
Contact blocks	Standard 1 lb Logic Reed 1 lb max. Sealed switch 3 lb max. at 0.205 in. plunger travel Stackable sealed switch 1 lb max. MaxDuty 1.4 lb max. PenTUFF 1.4 lb max. Self Monitoring 1.6 lb
Environment	
Temperature range	Operating -40...+131 °F (-40...+55 °C) Storage -40...+185 °F (-40...+85 °C)
<b>Note:</b> Operating temperatures below freezing are based on the absence of moisture and liquids. Consult your local Rockwell Automation sales office or Allen-Bradley distributor for use in lower temperature applications.	
Humidity	50...95% RH from 77...140 °F (25...60 °C) per Procedure IV of MIL-STD-810C, Method 507.1 cycling test

**Certifications**  
UL Listed  
(File No. E14840, E10314  
Guide No. NKKCR, NOIV)  
CSA Certified  
(File No. LR1234, LR11924)  
CSA C22.2, No. 14



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Manuf.: PNO:  
Allen-Bradley: 800H-HR2A

- Complete, compact units
- DIN rail and panel mounting
- Rating: 5 A ~ or 3 A ≐
- Output voltage 12-280 V ~ or 5-48 V ≐
- Input voltage 4-32 V ≐ regulated
- Input to output insulation voltage: 4 kV
- LED display of input status
- Replaceable protection fuse
- UL - cUL approval and CE marking



**Output specifications**

	Triac	Transistor
Voltage range (Vrms max)	12-280 ~	5-48 ≐
Peak voltage (t=1 min.) (V peak)	600 ~	60 ≐
Maximum off-state leakage (at Vmax and T = 25 °C)	2 mArms	10 µA
Maximum current (Arms)	5	3
Minimum current (mArms)	50	10
Max. 1-cycle surge T=25°C (V peak)	100	5
On-state voltage drop at Imax and T=25°C (V peak)	1.6	1.6
I²t (t = 10 ms) (A²s)	600	-
Static (off-state) dv/dt (V/µs)	200	n/a
Rth junction/ambient air	20.3° C/W	22.6° C/W

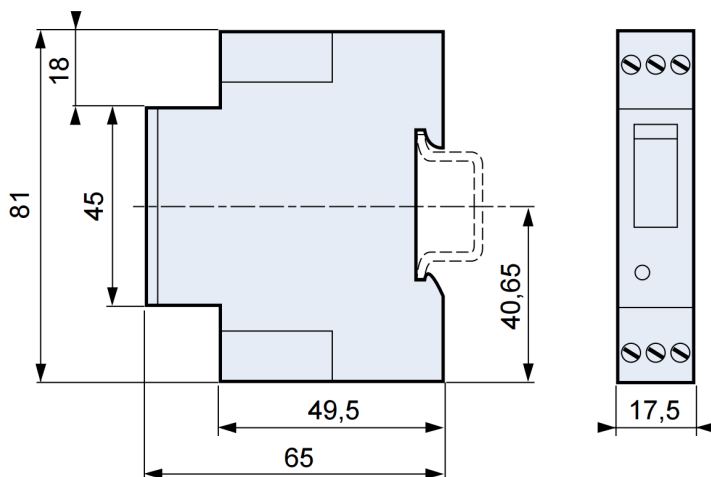
**Input specifications**

	4-32 ≐	4-32 ≐
Input voltage (V)	4-32 ≐	4-32 ≐
Drop-out voltage	1V ≐	1V ≐
Maximum current (at Vmax)	22	16
Nominal input resistance	Regulated input	
Response time (close)	< 10 ms	50 µs
Response time (open)	< 10 ms	50 µs

**Characteristics**

Operating temperature (° C)	-30 to +80
Storage temperature (° C)	-40 to +100
Input to output insulation voltage (Vrms)	4000
Input/output capacitance (pF)	8
Replaceable protection fuse	Yes Yes
LED display of input status of input status	Yes Yes
Capacity of input and output terminals	with ferrule : 2 x 1.5 mm² without ferrule : 2 x 2.5 mm² 1 x 4 mm²

**Dimensions**



**Part numbers**

**Zero voltage switching (output ~)**

Rating	Output	Input	Part Number
3 A	5-48 V ≐	4-32 V ≐	84 130 104
5 A	12-280 V ~	4-32 V ≐	84 130 105

**Instantaneous switching**

Rating	Output	Input	Part Number
5 A	12-280 V ~	4-32 V ≐	84 130 108



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Manuf.: . PNo:

Crouzet: 84 130 108

06-109-000

# Surge Protection Made Simple™ for UL Applications

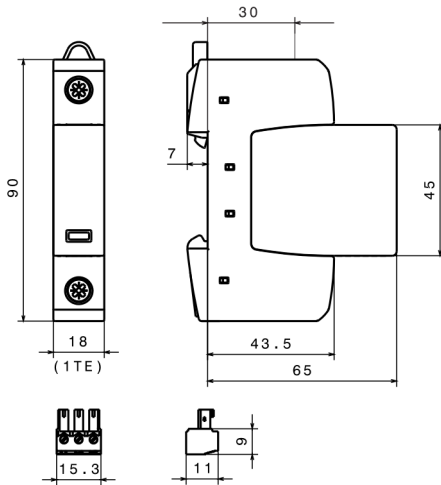
Single Pole BSP UL Series for 120, 240 and 347Vac

Single-Phase 2 Wire Systems



40-012-010

Dimensions - mm



BSPM1120S2G  
BSPM1240S2G  
BSPM1347S2G

Nominal system voltage	120Vac	240, 277 or 240 and 277Vac	347Vac
Max. Continuous Operating Voltage AC (MCOV) (V <sub>c</sub> )	275Vac	385Vac	600Vac
Catalog numbers (base = modules)	W/O remote signaling BSPM1120S2G	BSPM1240S2G	BSPM1347S2G
	W/ remote signaling BSPM1120S2GR	BSPM1240S2GR	BSPM1347S2GR
Replacement module	MOV technology BPM275UL	BPM385UL	BPM600UL
<b>Specifications</b>			
Rated voltage	120-127Vac	240-277Vac	347Vac
Voltage Protection Rating VPR	1kV	1.5kV	2kV
SCCR	200kA	200kA	125kA
Discharge current	Nom. I <sub>n</sub> 20kA Max. I <sub>max</sub> 40kA		
Response time t <sub>A</sub>	≤25 ns		
Frequency	50/60Hz		
Number of poles	1		
Number of wires/connection points	2 Wires / 2 connection points		
Operating state/fault indication	Green (good) / Red (replace)		
Cross-sectional area	Min. 14AWG - Cu stranded, solid or fine Max. 2AWG - Cu solid or stranded / 4AWG - Cu fine		
Terminal torque	45 lb-in (5.1N•m)		
Mounting	35mm DIN-rail per EN 60715		
Enclosure material	Thermoplastic, UL 94V0		
Protection	IP20 (finger-safe)		
Location	Indoor		
Capacity	1 Mods, DIN 43880		
Application and standard	UL Type 2 Component Assembly, UL 1449, 4 <sup>th</sup> Edition		
Agency information	cURus, RoHS Compliant		
Warranty	Five years*		
<b>Remote contact signaling</b>			
Signaling Type	Changeover contact		
Switching capacity (volts/amperes)	AC 250V/0.5A DC 250V/0.1A; 125V/0.2A; 75V/0.5A		
Conductor cross-sectional area	60/75°C Max. 1.5mm <sup>2</sup> /14AWG solid/flexible		
Ordering Information	Order from catalog numbers above		

**SCCR Rated  
BSP UL Series (Type 2)**



Rev: 0

Date: 6/12/2019

By: ATT MARTON

Device Tag:

SUR1

Job Number: HBR7752

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Manuf.: . PNO:  
Bussman: BSPMA1120S2GR

# Cutler-Hammer Control Power Transformers



Cutler-Hammer  
**EATON**



41-018-A070

## Technical Data

Type	Epoxy encapsulated windings	Standards	ANSI/NEMA ST-1
Frequency	50/60 Hz	Approvals	UL 506
Insulation	Class 105, 55°C temperature rise		UL, file E46323
Terminals	Pressure plate		CSA, file LR27533

**Primary: 240 x 480, 230 x 460, 220 x 440 with Jumpers**  
**Secondary: 120/115/110 with Fuse Clips for 13/32 x 1-1/2 Fuses**

VA	Dimensions (Inches)			Weight Lbs.	Dimensions (mm)			Weight kg	Wiring Diagram ①	Style Number
	Height	Width	Depth		Height	Width	Depth			
25	2-9/16	3	2-1/2	1.7	65	76	64	.8	1	C0025E2A
50	2-9/16	3	3	2.6	65	76	76	1.2	1	C0050E2A
75	2-9/16	3	3-1/2	3.5	65	76	89	1.6	1	C0075E2A
100	2-7/8	3-3/8	3-3/8	4.2	73	86	86	1.9	1	C0100E2A
150	3-3/16	3-3/4	4	6.7	81	95	102	3.0	1	C0150E2A
200	3-13/16	4-1/2	4	8.5	97	114	102	3.9	1	C0200E2A
250	3-13/16	4-1/2	4-3/8	10.0	97	114	111	4.5	1	C0250E2A
300	3-13/16	4-1/2	4-3/4	11.3	97	114	121	5.1	1	C0300E2A
350	3-13/16	4-1/2	5-1/4	13.6	97	114	133	6.2	1	C0350E2A
500	4-3/4	5-1/4	5-1/2	19.2	121	133	140	8.7	1	C0500E2A
750	4-3/4	5-1/4	7	28.1	121	133	178	12.8	1	C0750E2A
1000	5-11/16	6-3/4	6-7/16	29.5	144	171	164	13.4	1	C1000E2A
1500	6-3/8	7-1/2	7-3/8	40.0	162	191	187	18.1	1	C1500E2A

**Primary: 240 x 480 with Jumpers**  
**Secondary: 24 with Fuse Clips for 13/32 x 1-1/2 Fuses (through 500 VA)**

VA	Dimensions (Inches)			Weight Lbs.	Dimensions (mm)			Weight kg	Wiring Diagram ①	Style Number
	Height	Width	Depth		Height	Width	Depth			
50	2-9/16	3	3	2.7	65	76	76	1.2	2	C0050E2B
75	2-9/16	3	3-1/2	3.5	65	76	89	1.6	2	C0075E2B
100	2-7/8	3-3/8	3-3/8	4.2	73	86	86	1.9	2	C0100E2B
150	3-3/16	3-3/4	4	6.7	81	95	102	3.0	2	C0150E2B
200	3-13/16	4-1/2	4	8.5	97	114	102	3.9	2	C0200E2B
250	3-13/16	4-1/2	4-3/8	10.1	97	114	111	4.6	2	C0250E2B
300	3-13/16	4-1/2	4-3/4	11.4	97	114	121	5.2	2	C0300E2B
350	3-13/16	4-1/2	5-1/4	13.4	97	114	133	6.1	2	C0350E2B
500	4-3/4	5-1/4	5-5/8	17.5	121	133	143	7.9	2	C0500E2B
750	4-3/4	5-1/4	7	28.1	121	133	178	12.8	2	C0750E2B

**Primary: 240 x 480 with Jumpers**  
**Secondary: 120 x 240 with Jumpers, Secondary Fuse Clips not Applicable**

VA	Dimensions (Inches)			Weight Lbs.	Dimensions (mm)			Weight kg	Wiring Diagram ①	Style Number
	Height	Width	Depth		Height	Width	Depth			
50	2-9/16	3	3	2.6	65	76	76	1.2	11	C0050E2CXX
75	2-9/16	3	3-1/2	3.5	65	76	89	1.6	11	C0075E2CXX
100	2-7/8	3-3/8	3-3/8	4.2	73	86	86	1.9	11	C0100E2CXX
150	3-3/16	3-3/4	4	6.7	81	95	102	3.1	11	C0150E2CXX
200	3-13/16	4-1/2	4	8.5	97	114	102	3.9	11	C0200E2CXX
250	3-13/16	4-1/2	4-3/8	10.0	97	114	111	4.6	11	C0250E2CXX
300	3-13/16	4-1/2	4-7/8	11.8	97	114	124	5.4	11	C0300E2CXX
350	3-13/16	4-1/2	5-1/4	13.6	97	114	133	6.2	11	C0350E2CXX
500	4-3/4	5-1/4	5-1/4	17.5	121	133	133	8.0	11	C0500E2CXX
750	4-3/4	5-1/4	7	26.4	121	133	178	12.0	11	C0750E2CXX



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T1,CB2,3

Manuf.: PNO:  
Cutler-Hammer: C0500E2A Assembly

By: ATT MARTON

Job Number: HBR7752

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Primary: 240 x 480, 230 x 460, 220 x 440 with Jumpers and Two-Pole Primary Fuse Block for Rejection Type Fuses  
Secondary: 120/115/110 with Fuse Clips for 13/32 x 1-1/2 Fuses

VA	Dimensions (Inches)			Weight Lbs.	Dimensions (mm)			Weight kg	Wiring Diagram ①	Style Number
	Height	Width	Depth		Height	Width	Depth			
50	3-15/16	3	3	2.8	100	76	76	1.3	1	C0050E2AFB
75	3-15/16	3	3-1/2	3.7	100	76	89	1.7	1	C0075E2AFB
100	4-1/4	3-3/8	3-3/8	4.4	108	86	86	2.0	1	C0100E2AFB
150	4-9/16	3-3/4	4	6.9	116	95	102	3.1	1	C0150E2AFB
200	5-3/16	4-1/2	4	8.7	132	114	102	3.9	1	C0200E2AFB
250	5-3/16	4-1/2	4-3/8	10.2	132	114	111	4.6	1	C0250E2AFB
300	5-3/16	4-1/2	4-3/4	11.5	132	114	121	5.2	1	C0300E2AFB
350	5-3/16	4-1/2	5-1/4	13.8	132	114	133	6.3	1	C0350E2AFB
500	6-1/8	5-1/4	5-1/2	19.4	156	133	140	8.8	1	C0500E2AFB
750	6-1/8	5-1/4	7	28.3	156	133	178	12.8	1	C0750E2AFB
1000	7-1/16	6-3/4	6-7/16	29.7	179	171	164	13.4	1	C1000E2AFB
1500	7-3/4	7-1/2	7-3/8	40.2	197	191	187	18.1	1	C1500E2AFB

Primary: 240 x 480 with Jumpers and Two-Pole Primary Fuse Block for Rejection Type Fuses  
Secondary: 24 with Fuse Clips for 13/32 x 1-1/2 Fuses

VA	Dimensions (Inches)			Weight Lbs.	Dimensions (mm)			Weight kg	Wiring Diagram ①	Style Number
	Height	Width	Depth		Height	Width	Depth			
50	3-15/16	3	3	2.8	100	76	76	1.3	2	C0050E2BFB
75	3-15/16	3	3-1/2	3.8	100	76	89	1.7	2	C0075E2BFB
100	4-1/4	3-3/8	3-3/8	4.4	108	86	86	2.1	2	C0100E2BFB
150	4-9/16	3-3/4	4	6.9	116	95	102	3.1	2	C0150E2BFB
200	5-3/16	4-1/2	4	8.7	132	114	102	3.9	2	C0200E2BFB
250	5-3/16	4-1/2	4-3/8	10.3	132	114	111	4.7	2	C0250E2BFB
300	5-3/16	4-1/2	4-3/4	11.6	132	114	121	5.3	2	C0300E2BFB
350	5-3/16	4-1/2	5-1/4	13.6	132	114	133	6.2	2	C0350E2BFB
500	6-1/8	5-1/4	5-5/8	17.7	156	133	143	8.0	2	C0500E2BFB

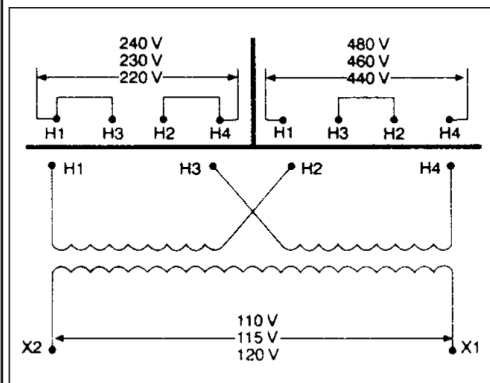


Figure 9-12. Diagram 1

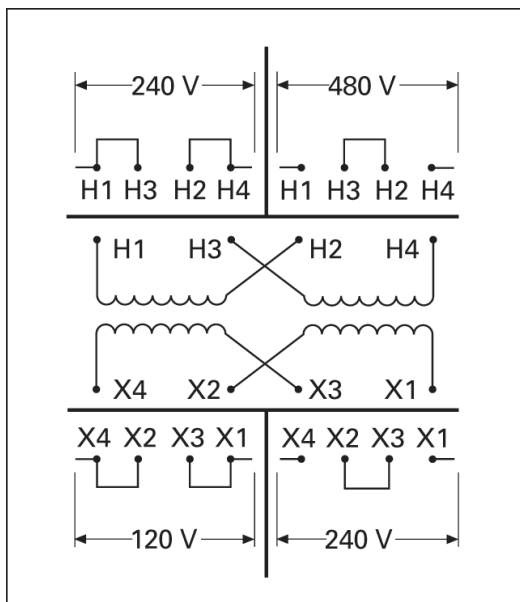


Figure 9-22. Diagram 11

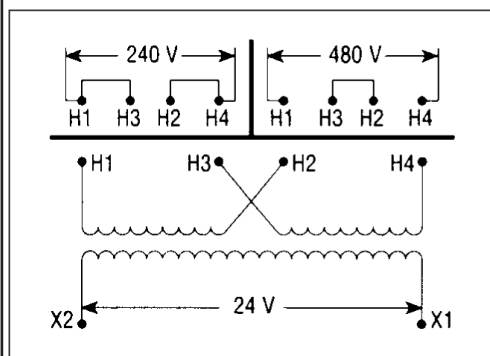


Figure 9-13. Diagram 2



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Date: 6/12/2019  
By: ATT MARTON

Device Tag: T1, CB2, 3  
Job Number: HBR7752  
Page #: 2/2

Manuf.: PNO: Cutler-Hammer: C0500E2A Assembly

Item No. Z7.281.1227.0

Insulated jumper bar IVBWK 4 - 2

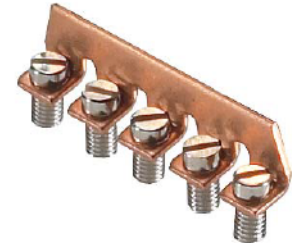
Cross connector, insulated for DIN rail terminal blocks type WK ..., 2-pole

Item No.	Z7.281.1227.0
EAN	4015573156081
order unit	10 Piece(s)

**Technical data**

**Accessories**

ArticlePrice	
Colour	Yellow
Type	Cross connector
Modular spacing	5.95 mm
Number of bridged clamps	2
Mounting method	Screwable
Insulated	Yes



Type	Part no.	Std. pack	Type	Part no.	Std. pack	Type	Part no.	Std. pack
for terminal blocks type			<b>WK 4/U</b>			<b>WK 4/3-6 SKO</b>		
<b>WK 2,5/U</b>	<b>5 mm spacing Screw: M 2.5</b>		<b>6 mm spacing Screw: M 3</b>			<b>6 mm spacing Screw: M 3</b>		
<b>WK 2,5 - 4 KOI/U</b>			<b>WK 4TKS D/U</b>			2pole 2072/2	Z7.220.0227.0	50
<b>WK 2,5 U/8113 S/H</b>			<b>WK 4 3 S 1 K/U</b>			3pole 2072/3	Z7.220.0327.0	50
<b>WKN 2,5 E/U</b>			<b>WK 4 3-6 S 1 K/U</b>			4pole 2072/4	Z7.220.0427.0	50
2pole VB WK 2,5-2	Z7.280.0227.0	10	<b>WK 4 5 S 2,8 1 K/U</b>			5pole 2072/5	Z7.220.0527.0	50
3pole VB WK 2,5-3	Z7.280.0327.0	10	<b>WK 4 3 S 1 K/IW/U</b>			6pole 2072/6	Z7.220.0627.0	50
4pole VB WK 2,5-4	Z7.280.0427.0	10	<b>WK 4 3-6 S 1 K/IW/U</b>			70pole 2072/M	Z7.210.1027.0	10
5pole VB WK 2,5-5	Z7.280.0527.0	10	<b>WK 4/U F1</b>					
6pole VB WK 2,5-6	Z7.280.0627.0	10	<b>WK 4/U F2</b>			<b>WK/5 S/U</b>	<b>6 mm spacing Screw: M 3</b>	
80pole VB WK 2,5 M-80	Z7.280.0027.0	10	2pole VB WK 4-2	Z7.281.0227.0	10	<b>WK/5-10 S/U</b>		
			3pole VB WK 4-3	Z7.281.0327.0	10	<b>WK/3-6 S/U</b>		
			4pole VB WK 4-4	Z7.281.0427.0	10	<b>WK/4 S/U</b>		
			5pole VB WK 4-5	Z7.281.0527.0	10	<b>WK/4-8 S/U</b>		
			6pole VB WK 4-6	Z7.281.0627.0	10	2pole 9703/6-2	Z7.211.0227.0	50
			70pole VB WK 4 M-70	Z7.281.0027.0	10	3pole 9703/6-3	Z7.211.0327.0	50
<b>WKM 2,5/15</b>	<b>5 mm spacing Screw: M 2.5</b>					4pole 9703/6-4	Z7.211.0427.0	50
<b>WKM 2,5 F1/15</b>			<b>WK 4/D 1/2 U</b>	<b>6 mm spacing Screw: M 3</b>		5pole 9703/6-5	Z7.211.0527.0	50
<b>WKM 2,5 F2/15</b>			<b>WK 4/D 2/2 U</b>			6pole 9703/6-6	Z7.211.0627.0	50
<b>WKM 2,5/2 S 2,8 1 K/15</b>			2pole VB WK 4 D...2	Z7.281.6227.0	10	70pole 9703/6 M-70	Z7.211.0027.0	10
<b>WKM 2,5 TP1 O/15</b>			3pole VB WK 4 D...3	Z7.281.6327.0	10			
<b>WKM 2,5 TP2 O/15</b>			4pole VB WK 4 D...4	Z7.281.6427.0	10			
2pole VB WKM 2,5/15-2	Z7.215.4227.0	50	5pole VB WK 4 D...5	Z7.281.6527.0	10			
3pole VB WKM 2,5/15-3	Z7.215.4327.0	50	6pole VB WK 4 D...6	Z7.281.6627.0	10			
4pole VB WKM 2,5/15-4	Z7.215.4427.0	50	70pole VB WK 4 D... M-70	Z7.281.6027.0	10			
5pole VB WKM 2,5/15-5	Z7.215.4527.0	50						
6pole VB WKM 2,5/15-6	Z7.215.4627.0	50	<b>WKM 4/15</b>	<b>6 mm spacing Screw: M 3</b>				
60pole VB WKM 2,5/15 M-60	Z7.215.4027.0	10	<b>WK 4/D EU</b>					
			<b>WK 4 E/U</b> for upper tier block					
<b>WK/3 S/IW/U</b>	<b>6 mm spacing Screw: M 3</b>		<b>WK 4 E/U GU ORANGE</b>					
<b>WK/3 - 6 S/IW/U</b>			<b>WK 4 E/U GO</b>					
<b>WK/4 S/IW/U</b>			<b>WK 4 E/U G2</b>					
<b>WK/4-8 S/IW/U</b>			<b>WK 4 E/U G1 ORANGE</b>					
2pole VB WK/...S/IW/U-2	Z7.281.3227.0	10	<b>WK 4 E/U G-URL</b>					
3pole VB WK/...S/IW/U-3	Z7.281.3327.0	10	<b>WK 4 E/U G-ULR</b>					
4pole VB WK/...S/IW/U-4	Z7.281.3427.0	10	<b>WK 4 E/U VB SCHWARZ</b>					
5pole VB WK/...S/IW/U-5	Z7.281.3527.0	10	2pole 9215 - 2	Z7.210.3227.0	50			
6pole VB WK/...S/IW/U-6	Z7.281.3627.0	10	3pole 9215 - 3	Z7.210.3327.0	50			
20pole VB WK/...S/IW/U-20	Z7.281.3027.0	10	4pole 9215 - 4	Z7.210.3427.0	50			
			5pole 9215 - 5	Z7.210.3527.0	50			
			6pole 9215 - 6	Z7.210.3627.0	50			
			70pole 9215 M-70	Z7.210.3027.0	10			



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Rev:

0

Date:

6/12/2019

By:

ATT MARTON

Device Tag:

TB1

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HBR7752

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Manuf.: . PNO:

Wieland: Z7.281.1227

# SMALL COMPACT THERMOSTAT





## KTO 011 / KTS 011



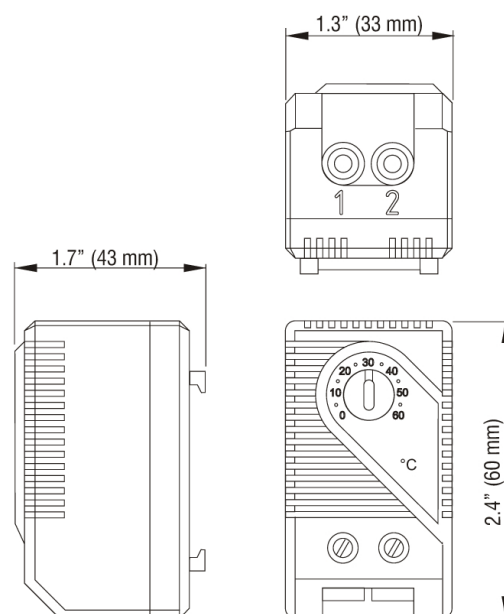
46-034-000



### Technical Data KT 011

Part No.	Contact type	Scale on housing
01140.9-00	normally closed 	30 - 140°F
01141.9-00	normally open 	30 - 140°F
01146.9-00	normally closed 	0 - 60°C
01147.9-00	normally open 	0 - 60°C

Sensor element:	Thermostatic bi-metal
Maximum tolerance:	±7.2°F (4K)
Switching difference (hysteresis):	12.6°F ± 5.4°F (7°C ± 3K)
Service life:	100,000 cycles
Switching capacity (max. load):	15A resistive/2A inductive @ 120 VAC 10A resistive/2A inductive @ 250 VAC DC 30W
EMI/EMC compliance:	EN 55014-1-2, EN 61000-3-2, EN 61000-3-3
Connections:	2-pole terminal for AWG 14 max. (2.5 mm <sup>2</sup> )
Mounting:	Clip for 35 mm DIN rail (EN 50022)
Dimensions (H x W x D):	2.4 x 1.3 x 1.7" (60 x 33 x 43 mm)
Housing:	Plastic, UL94V-0
Weight:	1.27 oz (36 g)
Protection type:	IP 20
Operating/storage temperature:	-49 to 158°F (-45 to 70°C)
Agency approvals:	UL, CSA



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0

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TS1

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Manuf.: . PNo:

Stego: 01140.9-00

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ATT MARTON

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Type	Size	Catalog Number
<b>NEMA 3R Universal Drain and Breather</b> For high performance water drainage and continuous ventilation. Stainless Steel.	1/2"	ECDB50HP
<b>NEMA 4X Drain</b> For automatic water drainage. Stainless Steel.	1/2"	DRNB4X
<b>NEMA 4X Breather</b> For continuous ventilation. Stainless Steel.	1/2"	BRTB4X
<b>Group B Universal Drain and Breather</b> Raintight. For automatic water drainage and continuous ventilation. Stainless Steel.	1/2"	ECDB50B
	3/8"	ECDB38B
<b>Groups C &amp; D Universal Drain and Breather</b> For automatic water drainage and continuous ventilation. Stainless Steel.	3/8"	ECDB38
<b>Non-Hazardous Location Drain</b> Also suitable for Class I, Div. 1 per NEC 501.4(B). Aluminum. For steel add suffix - S.	1/2"	CRN50
	3/4"	CRN75



ECDB Drain/Breathers

**DRAIN FITTINGS:**

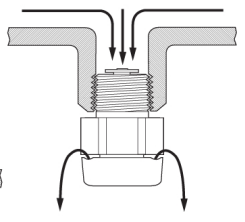
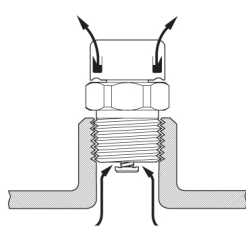
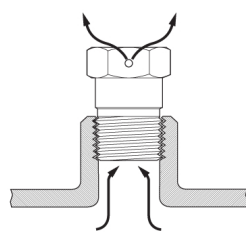
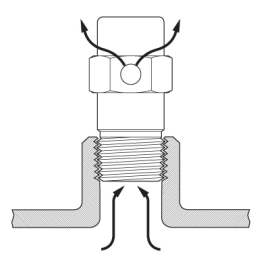
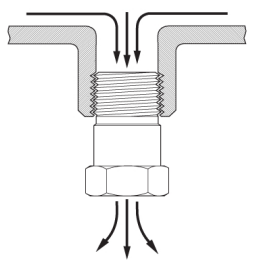
Generally installed at bottom of enclosure housing to drain moisture caused by condensation.

**BREATHER FITTINGS:**

Generally installed at top of enclosure housing to minimize condensation.

**UNIVERSAL DRAIN-BREATHER FITTINGS:**

Generally installed at top and/or bottom of enclosure housing. The features of a drain fitting and a breather fitting are combined into one fitting.



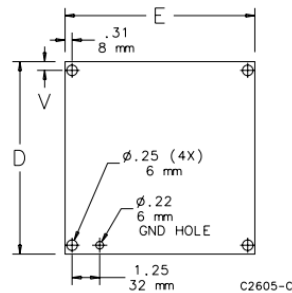
Rev: 0	Device Tag: DRN1	
Date: 6/12/2019		
By: ATT MARTON	Job Number: HBR7752	Page # 1/1
		Section 6 Page 93

Manuf.: . PNo: Appleton: ECDB50B Assembly



# SUB-PANELS FOR ENCLOSURES

<b>SUB-PANEL CATALOG NUMBER</b>	<b>SUB-PANEL DIMENSIONS (IN.)</b>
<b>A-DP<u>ESS</u></b>	<b><u>D</u> x <u>E</u></b>



**NOTE:**

- 6 indicates 316 Stainless Steel.
- AL indicates Aluminum
- G indicates Conductive Steel

Catalog Number	Material	Panel Size D x E (in.)	Panel Size D x E (mm)	Panel Gauge or Thickness	Edge Flanges	T (in.)	T (mm)	Number of Holes
A12P24	Painted steel	9.00 x 21.00	229 x 533	12 ga.	0	-	-	4
A12P24G	Conductive steel	9.00 x 21.00	229 x 533	12 ga.	0	-	-	4
A16P12	Painted steel	13.00 x 9.00	330 x 229	12 ga.	0	-	-	4
A16P12G	Conductive steel	13.00 x 9.00	330 x 229	12 ga.	0	-	-	4
A16P12SS6	Stainless Steel	13.00 x 9.00	330 x 229	12 ga.	0	-	-	4
A16P12AL	Aluminum	13.00 x 9.00	330 x 229	0.10 in./3 mm	0	-	-	4
A16P16	Painted steel	13.00 x 13.00	330 x 330	12 ga.	0	-	-	4
A16P16G	Conductive steel	13.00 x 13.00	330 x 330	12 ga.	0	-	-	4
A16P16SS6	Stainless Steel	13.00 x 13.00	330 x 330	12 ga.	0	-	-	4
A16P16AL	Aluminum	13.00 x 13.00	330 x 330	0.10 in./3 mm	0	-	-	4
A18P18	Painted steel	15.00 x 15.00	381 x 381	12 ga.	0	-	-	4
A18P18G	Conductive steel	15.00 x 15.00	381 x 381	12 ga.	0	-	-	4
A20P12	Painted steel	17.00 x 9.00	432 x 229	12 ga.	0	-	-	4
A20P12G	Conductive steel	17.00 x 9.00	432 x 229	12 ga.	0	-	-	4
A20P16	Painted steel	17.00 x 13.00	432 x 330	12 ga.	0	-	-	4
A20P16G	Conductive steel	17.00 x 13.00	432 x 330	12 ga.	0	-	-	4
A20P16SS6	Stainless Steel	17.00 x 13.00	432 x 330	12 ga.	0	-	-	4
A20P16AL	Aluminum	17.00 x 13.00	432 x 330	0.10 in./3 mm	0	-	-	4
A20P20	Painted steel	17.00 x 17.00	432 x 432	12 ga.	0	-	-	4
A20P20G	Conductive steel	17.00 x 17.00	432 x 432	12 ga.	0	-	-	4
A20P20SS6	Stainless steel	17.00 x 17.00	432 x 432	12 ga.	0	-	-	4
A20P20AL	Aluminum	17.00 x 17.00	432 x 432	0.10 in./3 mm	0	-	-	4
A24P16	Painted steel	21.00 x 13.00	533 x 330	12 ga.	0	-	-	4
A24P16G	Conductive steel	21.00 x 13.00	533 x 330	12 ga.	0	-	-	4
A24P16SS6	Stainless Steel	21.00 x 13.00	533 x 330	12 ga.	0	-	-	4
A24P20	Painted steel	21.00 x 17.00	533 x 432	12 ga.	2	0.75	19	4
A24P20G	Conductive steel	21.00 x 17.00	533 x 432	12 ga.	2	0.75	19	4
A24P20SS6	Stainless Steel	21.00 x 17.00	533 x 432	12 ga.	2	0.75	19	4
A24P20AL	Aluminum	21.00 x 17.00	533 x 432	0.10 in./3 mm	4	0.75	19	4
A24P24	Painted steel	21.00 x 21.00	533 x 533	12 ga.	2	0.75	19	4
A24P24G	Conductive steel	21.00 x 21.00	533 x 533	12 ga.	2	0.75	19	4
A24P24SS6	Stainless Steel	21.00 x 21.00	533 x 533	12 ga.	2	0.75	19	4
A24P24AL	Aluminum	21.00 x 21.00	533 x 533	0.10 in./3 mm	2	0.75	19	4
A30P16	Painted steel	27.00 x 13.00	686 x 330	12 ga.	2	0.75	19	4
A30P16G	Conductive steel	33.00 x 27.00	838 x 686	12 ga.	2	0.75	19	4
A30P20	Painted steel	27.00 x 17.00	686 x 432	12 ga.	2	0.75	19	4
A30P20G	Conductive steel	27.00 x 17.00	686 x 432	12 ga.	2	0.75	19	4
A30P20SS6	Stainless Steel	27.00 x 17.00	686 x 432	12 ga.	2	0.75	19	4
A30P24	Painted steel	27.00 x 21.00	686 x 533	12 ga.	2	0.75	19	4
A30P24G	Conductive steel	27.00 x 21.00	686 x 533	12 ga.	2	0.75	19	4
A30P24SS6	Stainless Steel	27.00 x 21.00	686 x 533	12 ga.	2	0.75	19	4
A30P24AL	Aluminum	27.00 x 21.00	686 x 533	0.10 in./3 mm	2	0.75	19	4
A30P30	Painted steel	27.00 x 27.00	686 x 686	12 ga.	4	0.75	19	4
A30P30G	Conductive steel	27.00 x 27.00	686 x 686	12 ga.	4	0.75	19	4
A30P30SS6	Stainless Steel	27.00 x 27.00	686 x 686	12 ga.	4	0.75	19	4
A36P16	Painted steel	33.00 x 13.00	838 x 330	12 ga.	2	0.75	19	4
A36P16G	Conductive steel	33.00 x 13.00	838 x 330	12 ga.	2	0.75	19	4
A36P24	Painted steel	33.00 x 21.00	838 x 533	12 ga.	2	0.75	19	6
A36P24G	Conductive steel	33.00 x 21.00	838 x 533	12 ga.	2	0.75	19	6
A36P24SS6	Stainless Steel	33.00 x 21.00	838 x 533	12 ga.	2	0.75	19	6
A36P24AL	Aluminum	33.00 x 21.00	838 x 533	0.10 in./3 mm	2	0.75	19	6
A36P30	Painted steel	33.00 x 27.00	838 x 686	12 ga.	4	0.75	19	6
A36P30G	Conductive steel	33.00 x 27.00	838 x 686	12 ga.	4	0.75	19	6
A36P30SS6	Stainless Steel	33.00 x 27.00	838 x 686	12 ga.	4	0.75	19	6
A36P30AL	Aluminum	33.00 x 27.00	838 x 686	0.10 in./3 mm	4	0.75	19	6
A36P36	Painted steel	33.00 x 33.00	838 x 838	12 ga.	4	0.75	19	8
A36P36G	Conductive steel	33.00 x 33.00	838 x 838	12 ga.	4	0.75	19	8
A36P36SS6	Stainless Steel	33.00 x 33.00	838 x 838	12 ga.	4	0.75	19	8
A40P24	Painted steel	37.00 x 21.00	940 x 533	12 ga.	4	0.75	19	6
A40P24G	Conductive steel	37.00 x 21.00	940 x 533	12 ga.	4	0.75	19	6
A40P30	Painted steel	37.00 x 29.00	940 x 737	12 ga.	4	0.75	19	4
A40P30G	Conductive steel	37.00 x 29.00	940 x 737	12 ga.	4	0.75	19	4
A42P24	Painted steel	39.00 x 21.00	991 x 533	12 ga.	2	0.75	19	6
A42P24G	Conductive steel	39.00 x 21.00	991 x 533	12 ga.	2	0.75	19	6
A42P30	Painted steel	39.00 x 27.00	991 x 686	12 ga.	4	0.75	19	6



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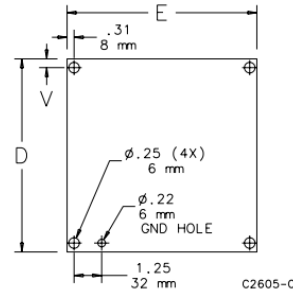
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# SUB-PANELS FOR ENCLOSURES

<b>SUB-PANEL CATALOG NUMBER</b>	<b>SUB-PANEL DIMENSIONS (IN.)</b>
<b>A-DPESS</b>	<b>D x E</b>

**NOTE:**

1. 6 indicates 316 Stainless Steel.
2. AL indicates Aluminum
3. G indicates Conductive Steel



Catalog Number	Material	Panel Size D x E (in.)	Panel Size D x E (mm)	Panel Gauge or Thickness	Edge Flanges	T (in.)	T (mm)	Number of Holes
A42P30G	Conductive steel	39.00 x 27.00	991 x 686	12 ga.	4	0.75	19	6
A42P30SS6	Stainless Steel	39.00 x 27.00	991 x 686	12 ga.	4	0.75	19	6
A42P36	Painted steel	39.00 x 33.00	991 x 838	12 ga.	4	0.75	19	8
A42P36G	Conductive steel	39.00 x 33.00	991 x 838	12 ga.	4	0.75	19	8
A42P36SS6	Stainless Steel	39.00 x 33.00	991 x 838	12 ga.	4	0.75	19	8
A42P42	Painted steel	39.00 x 39.00	991 x 991	12 ga.	4	0.75	19	8
A42P42G	Conductive steel	39.00 x 39.00	991 x 991	12 ga.	4	0.75	19	8
A48P24	Painted steel	45.00 x 21.00	1143 x 533	12 ga.	2	0.75	19	6
A48P24G	Conductive steel	45.00 x 21.00	1143 x 533	12 ga.	2	0.75	19	6
A48P30	Painted steel	45.00 x 27.00	1143 x 686	12 ga.	4	0.75	19	6
A48P30G	Conductive steel	45.00 x 27.00	1143 x 686	12 ga.	4	0.75	19	6
A48P36	Painted steel	45.00 x 33.00	1143 x 838	12 ga.	4	0.75	19	8
A48P36G	Conductive steel	45.00 x 33.00	1143 x 838	12 ga.	4	0.75	19	8
A48P36SS6	Stainless Steel	45.00 x 33.00	1143 x 838	12 ga.	4	0.75	19	8
A48P36AL	Aluminum	45.00 x 33.00	1143 x 838	0.10 in./3 mm	4	0.75	19	8
A48P42	Painted steel	45.00 x 39.00	1143 x 991	12 ga.	4	0.75	19	8
A48P42G	Conductive steel	45.00 x 39.00	1143 x 991	12 ga.	4	0.75	19	8
A48P48	Painted steel	44.00 x 44.00	1118 x 1118	11 ga.	4	0.84	21	10
A48P48G	Conductive steel	44.00 x 44.00	1118 x 1118	11 ga.	4	0.84	21	10
A54P42	Painted steel	50.00 x 38.00	1270 x 965	11 ga.	4	0.84	21	10
A54P42G	Conductive steel	50.00 x 38.00	1270 x 965	11 ga.	4	0.84	21	10
A60P24	Painted steel	57.00 x 21.00	1448 x 533	12 ga.	4	0.75	19	6
A60P24G	Conductive steel	57.00 x 21.00	1448 x 533	12 ga.	4	0.75	19	6
A60P30	Painted steel	57.00 x 27.00	1448 x 686	12 ga.	4	0.75	19	6
A60P30G	Conductive steel	57.00 x 27.00	1448 x 686	12 ga.	4	0.75	19	6
A60P36	Painted steel	57.00 x 33.00	1448 x 838	12 ga.	4	0.75	19	8
A60P36G	Conductive steel	57.00 x 33.00	1448 x 838	12 ga.	4	0.75	19	8
A60P36SS6	Stainless Steel	57.00 x 33.00	1448 x 838	12 ga.	4	0.75	19	8
A60P36AL	Aluminum	57.00 x 33.00	1448 x 838	0.10 in./3 mm	4	0.75	19	8
A60BFP42	Painted steel	56.00 x 38.00	1422 x 965	11 ga.	4	0.84	21	10
A60BFP42G	Conductive steel	56.00 x 38.00	1422 x 965	11 ga.	4	0.84	21	10
A60P48	Painted steel	56.00 x 44.00	1422 x 1118	11 ga.	4	0.84	21	10
A60P48G	Conductive steel	56.00 x 44.00	1422 x 1118	11 ga.	4	0.84	21	10
A60P60	Painted steel	56.00 x 56.00	1422 x 1422	11 ga.	4	0.84	21	10
A60P60G	Conductive steel	56.00 x 56.00	1422 x 1422	11 ga.	4	0.84	21	10
A72P36	Painted steel	69.00 x 33.00	1753 x 838	12 ga.	4	0.75	19	8
A72P36G	Conductive steel	69.00 x 33.00	1753 x 838	12 ga.	4	0.75	19	8
A72P60	Painted steel	68.00 x 56.00	1727 x 1422	11 ga.	4	0.84	21	10
A72P60G	Conductive steel	68.00 x 56.00	1727 x 1422	11 ga.	4	0.84	21	10
A72P72	Painted steel	68.00 x 68.00	1727 x 1727	11 ga.	4	0.84	21	10
A72P72G	Conductive steel	68.00 x 68.00	1727 x 1727	11 ga.	4	0.84	21	10



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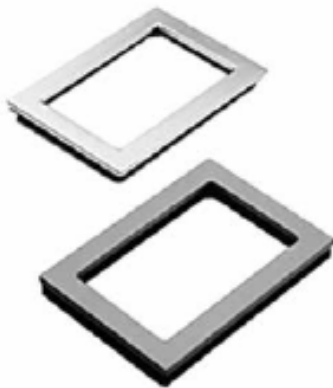
Device Tag:  
EN2  
Job Number:  
HBR7752

# STEEL AND STAINLESS STEEL WINDOW KITS



11-035-211

PAINTED STEEL WINDOW KIT CATALOG NUMBER	STAINLESS STEEL WINDOW KIT CATALOG NUMBER	WINDOW SIZE
A-PWK <u>M</u> NF	A-PWK <u>M</u> NFSS	M x N



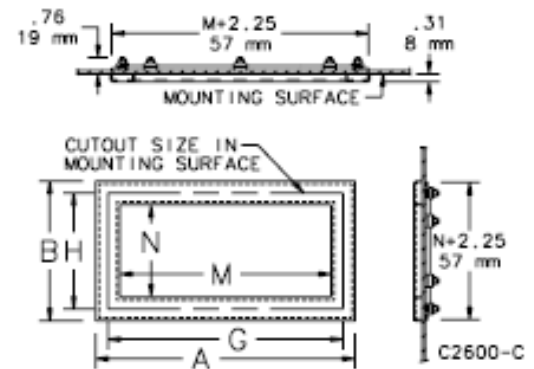
Steel Window Kits are designed to be used on Type 4 and 12 enclosures. Stainless Steel Window Kits are suitable for Type 4, 4X, 12 and 13 enclosures in indoor or outdoor applications where corrosion is a problem. These kits are easily installed by making a cutout in the enclosure and attaching the window and frame in place. Frames are made from heavy-gauge steel with an ANSI 61 gray polyester powder finish over pretreated surfaces or from heavy-gauge Type 304 stainless steel with a brushed finish. The window is .25-in. [6-mm] acrylic for steel kits or .25-in. [6-mm] polycarbonate material for stainless steel kits. Oil-resistant gasketing ensures a water-tight seal around the perimeter of the window and frame. All mounting hardware is furnished. Custom sizes, materials and finishes can be provided on special order. Consult factory for information.

**BULLETIN: A80SW, A80W**

### INDUSTRY STANDARDS

UL 508A Component Recognized; Type 4, 4X (stainless steel version only), 12, 13; File No. E61997

CSA Type 4, 4X (stainless steel version only), 12,13; File No. 42186  
 NEMA/EEMAC 4, 4X (stainless steel version only), 12, 13  
 IEC 60529, IP66



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Manuf.: PNo: Hoffman: A-PWK1711NFSS

# Mist Separator

# Series AFM20/30/40



94-255-003



**AFM 30 F 03 BD 2R**

Mist separator: AFM  
 Body size: 30  
 Thread type: F  
 Port size: 03  
 Accessory: BD  
 Option: 2R

Thread type	
Nil	Rc
N <sup>(1)</sup>	NPT
F <sup>(2)</sup>	G

Symbol	Port size	Body size		
		20	30	40
01	1/8	●	—	—
02	1/4	●	●	●
03	3/8	—	●	●
04	1/2	—	—	●
06	3/4	—	—	●

Symbol	Description	Applicable model
Nil	—	—
B <sup>(R)</sup>	With bracket	AFM20 to 40
C	Float type <sup>(*)</sup> auto-drain (N.C.)	AFM20 to 40
D	Float type <sup>(*)</sup> auto-drain (N.O.)	AFM30/40

Symbol	Description	Applicable model
2	Metal bowl	AFM20 to 40
6	Nylon bowl	AFM20 to 40
8	Metal bowl with level gauge	AFM30/40
C	With bowl guard	AFM20
J <sup>(R)</sup>	Drain guide 1/4	AFM30/40
R	Flow direction: Right → Left	AFM20 to 40
W	Drain cock with barb fitting: ø6 x ø4 nylon tubing	AFM30/40
Z <sup>(R)</sup>	Name plate and caution plate for bowl in imperial units (PSI, °F)	AFM20 to 40

## Standard Specifications

Model	AFM20	AFM30	AFM40	AFM40-06
Port size	1/8 1/4	1/4 3/8	1/4 3/8 1/2	3/4
Fluid	Air			
Proof pressure	1.5 MPa			
Maximum operating pressure	1.0 MPa			
Minimum operating pressure	0.05 MPa			
Ambient and fluid temperature	-5 to 60°C (With no freezing)			
Rated flow (l/min (ANR)) <sup>(1)</sup>	200	450	1100	1100
Nominal filtration rating	0.3 µm (95% filtered particle size)			
Outlet side oil mist concentration	Maximum 1.0 mg/m <sup>3</sup> (ANR) (approx. 0.8 ppm) <sup>(2)</sup>			
Bowl material	Polycarbonate			
Bowl guard	Option	Standard		
Drain capacity (cm <sup>3</sup> )	8	25	45	45
Weight (kg)	0.18	0.22	0.44	0.49



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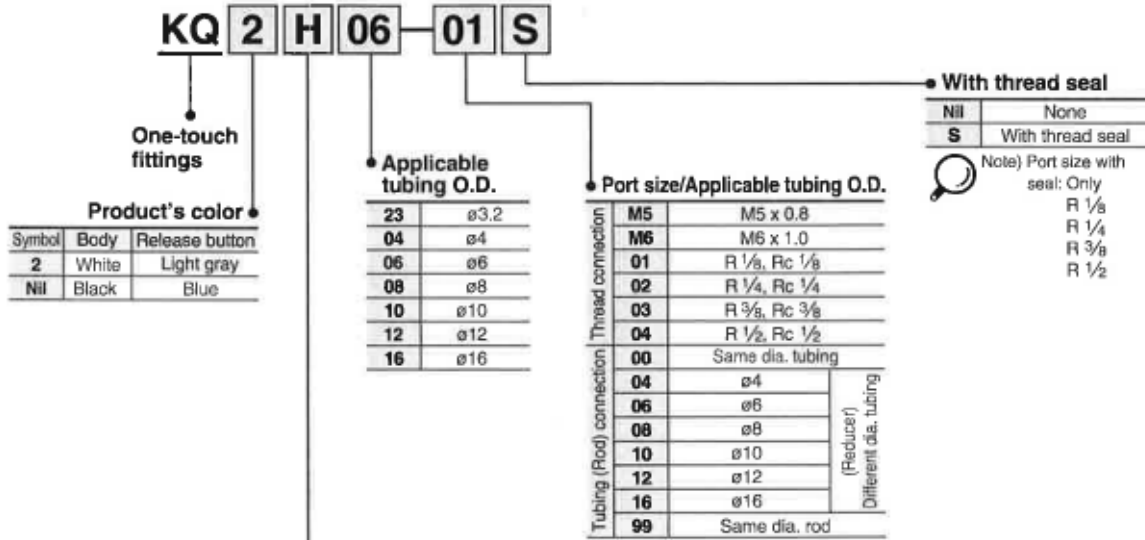
Manuf.: . PNO: SMC USA: AFM30-N03B8Z-A

# One-touch Fittings Series KQ2

Applicable Tubing: Metric Size  
Connection Thread: M, R, Rc



94-255-020



**Product's color**

Symbol	Body	Release button
2	White	Light gray
Nil	Black	Blue

**Applicable tubing O.D.**

23	ø3.2
04	ø4
06	ø6
08	ø8
10	ø10
12	ø12
16	ø16

**Port size/Applicable tubing O.D.**

Tubing (Rod) connection	Thread connection	Port size/Applicable tubing O.D.
M5		M5 x 0.8
M6		M6 x 1.0
01		R 1/8, Rc 1/8
02		R 1/4, Rc 1/4
03		R 3/8, Rc 3/8
04		R 1/2, Rc 1/2
00		Same dia. tubing
04		ø4
06		ø6
08		ø8
10		ø10
12		ø12
16		ø16
99		Same dia. rod

(Reducer)  
Different dia. tubing

**With thread seal**

Nil	None
S	With thread seal

Note) Port size with seal: Only  
R 1/8  
R 1/4  
R 3/8  
R 1/2

**Model**

H	Male connector	T	Male branch tee
	Straight union		Union tee
	Different diameter straight		Different diameter tee * Note)
S	Hex. socket head male connector	TW	Cross*
F	Female connector	TX	Different diameter cross*
	Male elbow	TY	Different diameter cross*
L	Union elbow	Y	Male run tee
	Plug-in elbow		Male delta union
	Reducer elbow	D	Delta union
LU	Male branch connector		Branch
	Branch union elbow	U	Union "Y"
K	45° male elbow		Different dia. union "Y"
V	Universal male elbow		Plug-in "Y"
VS	Hexagon socket head universal male elbow		Delta branch
VF	Universal female elbow	UD	Different dia. double union "Y"
LF	Female elbow	XD	Double plug-in "Y"
VD	Double universal male elbow	X	Different diameter plug-in "Y"
VT	Triple universal male elbow	R	Plug-in reducer
Z	Branch universal male elbow		Bulkhead union
ZF	Branch universal female elbow	E	Bulkhead connector
ZD	Double branch universal male elbow	LE	Bulkhead male elbow
ZT	Triple branch universal male elbow		
W	Extended plug-in elbow		
	Extended male elbow		

**Accessory**

Symbol	Name
	Nipple
KQ2N	Reducer nipple
	Adaptor
KQ2C	Tube cap
KQ2C	Color cap
KQ2P	Plug (White)
KQP	Plug (Blue)

Use the below part number to order the gasket for M5 and M6 threads.  
Gasket for M5 thread: M-5G2  
Gasket for M6 thread: M-6G

\* Available only for white color body.  
Note) KQT06-04, KQT08-06, KQT10-08, and KQT12-10 are available as made to order.

**Male run tee**



P. 24  
Use to branch line in the same direction from female thread and in 90° direction.

Applicable tubing O.D. (inch)	Connection thread NPT	Model	H (Width across flats)	Note) øD1	øD2	L1	L2	A *	M	Min. port size	Weight (g)
3/8	1/4	KQ2Y11-35S	17.46	17.9	17	25.5	29.5	49	21	7	29
	3/8	KQ2Y11-36S					31.5	51			38
	1/2	KQ2Y11-37S	22.23				35.5	53			64



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Device Tag:

FIT

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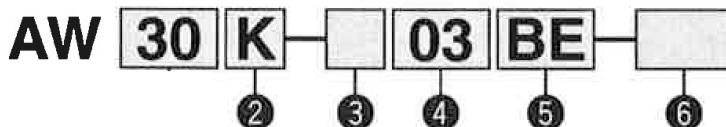
Manuf.: PNO:

SMC USA: KQ2Y11-36AS

# Modular Type Filter Regulators



94-255-004



2	With backflow mechanism	Nil	Without backflow mechanism	
		K <sup>Note 1)</sup>	With backflow mechanism	
+				
3	Thread type	Nil	Rc	
		N <sup>Note 2)</sup>	NPT	
		F <sup>Note 3)</sup>	G	
+				
4	Port size	02	1/4	
		03	3/8	
+				
5 Option	a	Mounting	Nil	Without mounting option
			B <sup>Note 5)</sup>	With bracket
			H	With set nut (for panel fitting)
	+			
	b	Float type auto drain	Nil	Without auto drain
			C	Float type auto drain (N.C.)
			D	Float type auto drain (N.O.)
	+			
	c	Pressure gauge	Nil	Without pressure gauge
			E	Square embedded type pressure gauge (with limit indicator)
			G	Round type pressure switch (without limit indicator)
				Round type pressure switch (with limit indicator)
Digital pressure switch		E1 <sup>Note 6)</sup>	Output: NPN output / Electrical entry: Wiring bottom entry	
	E2 <sup>Note 6)</sup>	Output: NPN output / Electrical entry: Wiring top entry		
	E3 <sup>Note 6)</sup>	Output: PNP output / Electrical entry: Wiring bottom entry		
	E4 <sup>Note 6)</sup>	Output: PNP output / Electrical entry: Wiring top entry		
+				
6 Semi-standard	d	Set pressure	Nil	0.05 to 0.85 MPa set
			1 <sup>Note 7)</sup>	0.02 to 0.2 MPa set
+				
e	Bowl	Nil	Polycarbonate bowl	
		2	Metal bowl	
		6	Nylon bowl	
		8	Metal bowl with level gauge	
6 Semi-standard	f	Drain port <sup>Note 8)</sup>	Nil	With drain cock
			J <sup>Note 9)</sup>	Drain guide 1/8
				Drain guide 1/4
			W <sup>Note 10)</sup>	Drain cock with barb fitting: For $\varnothing 6 \times \varnothing 4$ nylon tube
	+			
	g	Exhaust mechanism	Nil	Relieving type
			N	Non-relieving type
	+			
	h	Flow direction	Nil	Flow direction: Left to right
			R	Flow direction: Right to left
	+			
	i	Pressure unit	Nil	Name plate, caution plate for bowl, and pressure gauge in imperial units: MPa
Z <sup>Note 11)</sup>			Name plate, caution plate for bowl, and pressure gauge in imperial units (PSI, F)	
ZA <sup>Note 12)</sup>			Digital pressure switch: With unit switching function	



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Device Tag: REG1  
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Manuf.: PNO: SMC USA: AW30-NO3BDE3-8Z

# Standard Specifications

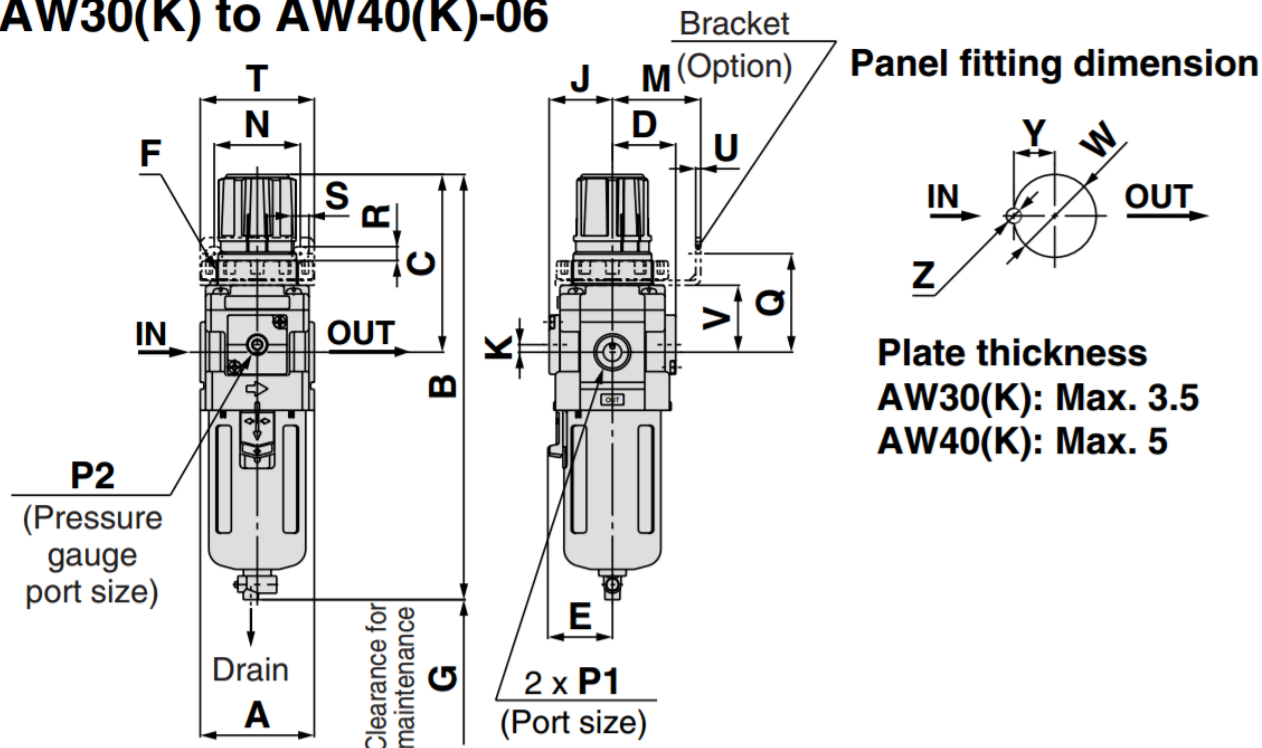


94-255-004

Model	<b>AW30(K)</b>
Port size	1/4, 3/8
Pressure gauge port size <sup>Note 1)</sup>	1/8
Fluid	Air
Ambient and fluid temperature <sup>Note 3)</sup>	-5 to 60°C
Proof pressure	1.5 MPa
Maximum operating pressure	1.0 MPa
Set pressure range	0.05 to 0.85 MPa
Relief pressure	Set pressure + 0.05 MPa
Nominal filtration rating	5 m
Drain capacity (cm <sup>3</sup> )	25
Bowl material	Polycarbonate
Bowl guard	Standard
Construction	Relieving type
Weight (kg)	0.40

Model	Standard specifications											Optional specifications					
	P1	P2	A	B (Note)	C	D	E	F	G	J	K	Square type pressure gauge H	Digital pressure gauge J	Round type pressure gauge H	J		
AW30(K)	1/4, 3/8	1/8	53	201	86	29.5	30	M38 x 1.5	55	29.5	3.5	□28	30.5	□27.8	41	ø37.5	66

## AW30(K) to AW40(K)-06



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Manuf.: PNo: SMC USA: AW30-NO3BDE3-8Z

# Spacer Attachment



Y300	-	A
------	---	---

94-255-021

SMC'S new AC-A series of modular type F.R.L. unit is available in five sizes and is interchangeable with the existing modular AC line. The pressure drop across the regulator has been reduced creating a more efficient unit with a maximum set pressure of 100 psi. The element and bowl on the AW and AF series is now one-piece, making element replacement easier. Required maintenance space has been reduced by as much as 46% on the AF series, depending on the body size. Bowls on the size 30 and 40 are now covered with a transparent bowl guard, completely protecting them from the environment, and making the interior contents visible from 360 degrees. The base color of the new AC-A series is urban white, maintaining a clean, modern look.

- Compact spacer reduces assembly space
- Easy maintenance
- Attaches FRL's with tightening of screws
- O-ring prevents leakage



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Device Tag:

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Manuf.: PNo: SMC USA: Y300

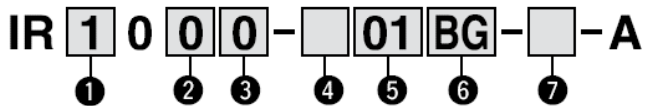
# Precision Regulator



# Series IR1000/2000/3000

94-255-002

## How to Order



- Option/Semi-standard: Select one each for a to f.
- Option/Semi-standard symbol: When more than one specification is required, indicate in alphanumeric order.

	Symbol	Description	1				
			Body size				
			1	2	3		
2	Set pressure range	0	0.73 to 29 psi (0.005 to 0.2 MPa)	●	●	—	
		1	1.5 to 29 psi (0.01 to 0.2 MPa)	—	—	●	
		2	1.5 to 58 psi (0.01 to 0.4 MPa)	●	●	●	
		2	1.5 to 116 psi (0.01 to 0.8 MPa)	●	●	●	
+							
3	Exhaust direction	0	Bottom exhaust	●	●	●	
		1	Front exhaust	—	—	●	
		2	Rear exhaust	—	—	●	
+							
4	Pipe thread type	Nil	Rc	●	●	●	
		N	NPT	●	●	●	
		F	G	●	●	●	
+							
5	Port size	01	1/8	●	—	—	
		02	1/4	—	●	●	
		03	3/8	—	—	●	
		04	1/2	—	—	●	
+							
6	a	Mounting	Nil	Without mounting option	●	●	●
			B <sup>Note 2)</sup>	With bracket	●	●	●
			H	With hexagon panel nut (for panel mount)	●	●	●
	+						
	b	Pressure gauge	Nil	Without pressure gauge	●	●	●
			G	Round type pressure gauge	●	●	●
	c	With digital pressure switch	EA	NPN open collector 1 output	●	●	●
			EB	PNP open collector 1 output	●	●	●
			EC	NPN open collector 1 output + Analog voltage output	●	●	●
			ED	NPN open collector 1 output + Analog current output	●	●	●
+							
7	d	Flow direction	Nil	Flow direction: Left to right	●	●	●
			R	Flow direction: Right to left	●	●	●
	+						
e	Knob	Nil	Upward	●	●	●	
		V	Downward	●	●	●	
+							
f	Pressure unit <sup>Note 3)</sup>	Nil	Name plate and pressure gauge in imperial units: MPa	●	●	●	
		Z	Name plate and pressure gauge in imperial units: psi	●	●	●	
		ZA	Digital pressure switch: With unit conversion function	●	●	●	

	Pipe thread type	Name plate in imperial units	Pressure gauge in imperial units		Sales <sup>Note 6)</sup>
			G	EA, EB, EC, ED	
Nil	Rc	MPa	MPa	Fixed SI unit	Japan, Overseas
	NPT				
	G				
Z <sup>Note 4)</sup>	Rc	psi	psi	With unit conversion function (Initial value psi)	Only overseas
	NPT				
	G				
ZA <sup>Note 5)</sup>	Rc	MPa	—	With unit conversion function	Only overseas
	NPT				
	G				

 630-499-7080 · www.elemechinc.com	Rev: 0	Device Tag: REG2	
	Date: 6/12/2019		
Manuf.: PNo: SMC USA: IR3020-N03BG	By: ATT MARTON	Job Number: HBR7752	Page # 1/2

## Standard Specifications

(Knob)

Model	Basic type (Knob)		
	IR10□0-A	IR20□0-A	IR30□0-A
Fluid	Air		
Proof pressure	218 psi [1.5 MPa]		
Max. supply pressure	145 psi [1.0 MPa]		
Min. supply pressure <sup>Note 1)</sup>	Set pressure + 7.3 psi [0.05 MPa]		Set pressure + 15 psi [0.1 MPa]
Set pressure range psi [MPa]	IR1000-A: 0.73 to 29 [0.005 to 0.2]	IR2000-A: 0.73 to 29 [0.005 to 0.2]	IR3000-A: 1.5 to 29 [0.01 to 0.2]
	IR1010-A: 1.5 to 58 [0.01 to 0.4]	IR2010-A: 1.5 to 58 [0.01 to 0.4]	IR3010-A: 1.5 to 58 [0.01 to 0.4]
	IR1020-A: 1.5 to 116 [0.01 to 0.8]	IR2020-A: 1.5 to 116 [0.01 to 0.8]	IR3020-A: 1.5 to 116 [0.01 to 0.8]
Sensitivity	Within 0.2% of full span		
Repeatability <sup>Note 2)</sup>	Within ±0.5% of full span		
Air consumption <sup>Note 3)</sup>	0.04 scfm [1 L/min (ANR)] or less		
Port size	1/8	1/4	1/4, 3/8, 1/2
Pressure gauge port	1/8 (2 locations)		
Ambient and fluid temperature <sup>Note 4)</sup>	23 to 140°F [-5 to 60°C] (No freezing)		
Weight (kg) <sup>Note 5)</sup>	0.13	0.23	0.47

Note 1) When there is no flow rate on the outlet.

Note 2) Other characteristics such as aging deterioration and temperature characteristics are not included.

Note 3) Measuring conditions: supply pressure 145 psi [1.0 MPa], set pressure 29 psi [0.2 MPa]

Note 4) 23 to 140°F [-5 to 60°C] for the products with the digital pressure switch

Note 5) Without accessories

## Accessories (Option)/Part No.

Description	IR10□0-A	IR20□0-A	IR30□0-A
Bracket assembly <sup>Note 1)</sup>	IR10P-501AS	IR20P-501AS	IR30P-501AS
Hexagon panel nut	IR10P-600S	IR20P-600S	IR20P-600S
Round type pressure gauge <sup>Note 2)</sup>	0.2 MPa setting	G33-2-□01	G43-2-□01
	0.4 MPa setting	G33-4-□01	G43-4-□01
	0.8 MPa setting	G33-10-□01	G43-10-□01
Digital pressure switch <sup>Note 3)</sup>	NPN 1 output	ISE30A-□01-N-ML	
	PNP 1 output	ISE30A-□01-P-ML	
	NPN 1 output/ Voltage output	ISE30A-□01-C-ML	
	NPN 1 output/ Current output	ISE30A-□01-D-ML	

Note 1) This is an assembly of the bracket and resin panel nut.

Note 2) □ in part numbers for a round type pressure gauge indicates a type of connection thread. No indication is necessary for R; however, indicate N for NPT.

A 1.0 MPa pressure gauge is fitted for 0.8 MPa setting.

Please contact SMC regarding the supply of pressure gauge with psi unit specifications.

 Note 3) □ in part numbers for a digital pressure switch indicates a type of connection thread. No indication is necessary for R; however, indicate N for NPT. For details on handling digital pressure switch and specifications, refer to the **WEB catalog** or the Best Pneumatics No. 6.

Please contact SMC regarding the supply of digital pressure switch with unit conversion function.

## Modular Products and Accessories

Applicable products and accessories	Applicable size		
	Series IR1000-A	Series IR2000-A	Series IR3000-A
Filter	AF20-A	AF30-A	AF40-A
Spacer	Y200-A	Y300-A	Y400-A
Spacer with bracket	Y200T-A	Y300T-A	Y400T-A

 Refer to the **WEB catalog** for details of the modular applicable products and accessories. The former modular and mounting brackets can be used.

# Electro-Pneumatic Regulator

## Series ITV1000/2000/3000



ITV2000

94-255-019

ITV 3 0 1 0 - 0 1 [ ] 2 [ ] S [ ] - [ ]

**Model**

1	1000 type
2	2000 type
3	3000 type

**Pressure range**

1	0.1 MPa
3	0.5 MPa
5	0.9 MPa

**Power supply voltage**

0	24 VDC
1	12 to 15 VDC

Note) Communication models (CC, DE, PR, RC), 16 points preset input and 10 bit digital input are available only for 24 VDC.

**Input signal/**

**Communication model**

0	Current type 4 to 20 mA DC (Sink type)
1	Current type 0 to 20 mA DC (Sink type)
2	Voltage type 0 to 5 VDC
3	Voltage type 0 to 10 VDC
40	4 points preset input
52	16 points preset input (Switch output/NPN output)
53	16 points preset input (Switch output/PNP output)
60	10 bit digital input
CC	CC-Link
DE	DeviceNet™
PR	PROFIBUS DP
RC	RS-232C communication

**Monitor output**

1	Analog output 1 to 5 VDC
2	Switch output/NPN output
3	Switch output/PNP output
4	Analog output 4 to 20 mA DC (Sink type)
Nil	None

**Thread type**

Nil	Rc
N	NPT
T	NPTF
F	G

**Made to Order Specifications**  
Refer to pages 816, 832, and 833 for details.

**Pressure display unit**

Nil	MPa
2 <sup>Note)</sup>	kgf/cm <sup>2</sup>
3	bar
4 <sup>Note)</sup>	psi
5	kPa

Note) Under Japan's new Measurement Act, this is only for overseas sales (SI units are to be used inside Japan). For the communication models, CC, DE, PR and RC, only "Nil" is available as it does not have a pressure display.

**Cable connector type**

S	Straight type 3 m
L	Right angle type 3 m
N	Without cable connector

Note) Even when a cable connector is selected, communication cable is not included in the communication models, CC, DE and PR. Please order it separately. Refer to the below.  
For 10 bit digital input, right angle type cannot be selected.

**Bracket \***

Nil	Without bracket
B	Flat bracket
C	L-bracket

\* Bracket is included.

**Port size**

1	1/8 (1000 type)
2	1/4 (1000, 2000, 3000 type)
3	3/8 (2000, 3000 type)
4	1/2 (3000 type)

For communication cables, use the parts listed below (refer to M8/M12 connector in Best Pneumatics No.1 for details) or order the product certified for the respective protocol (with M12 connector) separately.

Application	Communication cable part number	Note
CC-Link compatibility	PCA-1567720 (Socket type)	Dedicated Bus adapter supplied with the product.
	PCA-1567717 (Plug type)	
DeviceNet™ compatibility	PCA-1557633 (Socket type)	T-branch connector not supplied.
	PCA-1557646 (Plug type)	
PROFIBUS DP compatibility	PCA-1557688 (Socket type)	T-branch connector not supplied.
	PCA-1557691 (Plug type)	



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Manuf.: PNo: SMC USA: ITV2050-02N3CL4-Q

Model	ITV101 <input type="checkbox"/> <small>Note 8)</small>	ITV103 <input type="checkbox"/> <small>Note 8)</small>	ITV105 <input type="checkbox"/> <small>Note 8)</small>
	ITV201 <input type="checkbox"/>	ITV203 <input type="checkbox"/>	ITV205 <input type="checkbox"/>
	ITV301 <input type="checkbox"/>	ITV303 <input type="checkbox"/>	ITV305 <input type="checkbox"/>
<b>Minimum supply pressure</b>	Set pressure +0.1 MPa		
<b>Maximum supply pressure</b>	0.2 MPa	1.0 MPa	
<b>Set pressure range</b> <small>Note 1)</small>	0.005 to 0.1 MPa	0.005 to 0.5 MPa	0.005 to 0.9 MPa
<b>Power supply</b>	<b>Voltage</b>	24 VDC $\pm$ 10%, 12 to 15 VDC	
	<b>Current consumption</b>	Power supply voltage 24 VDC type: 0.12 A or less <small>Note 9)</small> Power supply voltage 12 to 15 VDC type: 0.18 A or less	
<b>Input signal</b> <small>Note 9)</small>	<b>Current type</b> <small>Note 2)</small>	4 to 20 mA DC, 0 to 20 mA DC (Sink type)	
	<b>Voltage type</b>	0 to 5 VDC, 0 to 10 VDC	
	<b>Preset input</b>	4 points (Negative common), 16 points (No common polarity)	
<b>Input impedance</b>	<b>Digital input</b>	10 bit (Parallel)	
	<b>Current type</b>	250 $\Omega$ or less <small>Note 6)</small>	
	<b>Voltage type</b>	Approx. 6.5 k $\Omega$	
	<b>Preset input</b>	Power supply voltage 24 VDC type: Approx. 4.7 k $\Omega$ Power supply voltage 12 VDC type: Approx. 2.0 k $\Omega$	
<b>Output signal (monitor output)</b> <small>Note 3)</small>	<b>Analog output</b>	1 to 5 VDC (Output impedance: Approx. 1 k $\Omega$ ) 4 to 20 mA DC (Sink type) (Output impedance: 250 $\Omega$ or less) Output accuracy $\pm$ 6% F.S. or less	
	<b>Switch output</b>	NPN open collector output: Max. 30 V, 80 mA PNP open collector output: Max. 80 mA	
<b>Linearity</b>	$\pm$ 1% F.S. or less		
<b>Hysteresis</b>	0.5% F.S. or less		
<b>Repeatability</b>	$\pm$ 0.5% F.S. or less		
<b>Sensitivity</b>	0.2% F.S. or less		
<b>Temperature characteristics</b>	$\pm$ 0.12% F.S./ $^{\circ}$ C or less		
<b>Output pressure display</b> <small>Note 4)</small>	<b>Accuracy</b>	$\pm$ 2% F.S. $\pm$ 1 digit or less	
	<b>Minimum unit</b>	MPa: 0.001, kgf/cm <sup>2</sup> : 0.01, bar: 0.01, psi: 0.1 <small>Note 5)</small> , kPa: 1	
<b>Ambient and fluid temperature</b>	0 to 50 $^{\circ}$ C (No condensation)		
<b>Enclosure</b>	IP65		
<b>Weight</b> <small>Note 10)</small>	ITV10 <input type="checkbox"/> <input type="checkbox"/>	Approx. 250 g (without options)	
	ITV20 <input type="checkbox"/> <input type="checkbox"/>	Approx. 350 g (without options)	
	ITV30 <input type="checkbox"/> <input type="checkbox"/>	Approx. 645 g (without options)	

Note 1) Please refer to Figure 1 for the relationship between set pressure and input. Because the maximum set pressure differs for each pressure display, refer to page 853.

Note 2) 2-wire type 4 to 20 mA DC is not available. Power supply voltage (24 VDC or 12 to 15 VDC) is required.

Note 3) Select either analog output or switch output.

Further, when switch output is selected, select either NPN output or PNP output.

When measuring ITV analog output from 1 to 5 VDC, if the load impedance is less than 100 k $\Omega$ , the analog output monitor accuracy of within  $\pm$ 6% (full span) may not be available. The product with the accuracy of within  $\pm$ 6% is supplied upon your request. Output pressure remains unaffected.

Note 4) Adjustment of numerical values such as the zero/span adjustment or preset input type is set based on the minimum units for output pressure display (e.g. 0.001 to 0.500 MPa). Note that the unit cannot be changed.

Note 5) The minimum unit for 0.9 MPa (130 psi) types is 1 psi.

Note 6) Value for the state with no over current circuit included. If an allowance is provided for an over current circuit, the input impedance varies depending on the input current. This is 350  $\Omega$  or less for an input current of 20 mA DC.

Note 7) The above characteristics are confined to the static state. When air is consumed on the output side, the pressure may fluctuate.

Note 8) The ITV1000 series is a Grease-free specification (Wetted parts).

Note 9) Refer to the table below for communication specifications.

Note 10) Add 50 g for digital input type, 70 g for 16 points preset input type respectively.



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# Rubber Seal 3 Port/Pilot Poppet Type Body Ported/Single Unit

VP 3 4 2 [ ] - 5 G [ ] [ ] 1-01 [ ] A

**Series**

3	VP300
5	VP500
7	VP700

**Pressure specification**

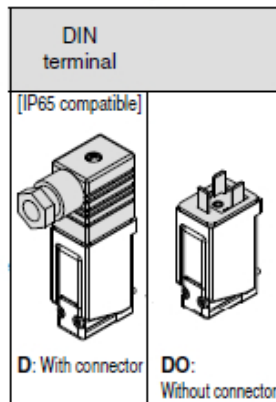
Nil	Standard (0.7 MPa)
K	High-pressure type (1.0 MPa)

**Rated voltage**
**DC**

5	24 VDC
6	12 VDC

**AC (50/60 Hz)**

1	100 VAC
2	200 VAC
3	110 VAC [115 VAC]
4	220 VAC [230 VAC]
7	240 VAC
B	24 VAC

**Electrical entry**

**Thread type**

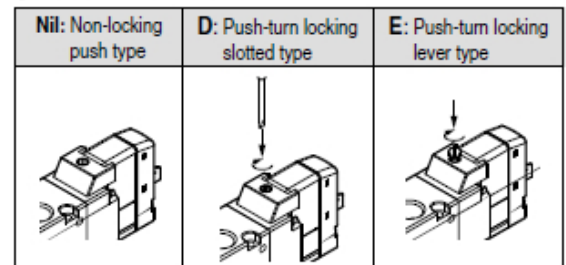
Nil	Rc
F	G
N	NPT
T	NPTF

**Type of actuation**

A	N.C. (Normally closed)
B	N.O. (Normally open)

**Port size**

Symbol	Port size	VP300	VP500	VP700
01	1/8	○	—	—
02	1/4	○	○	—
03	3/8	—	○	○
04	1/2	—	—	○

**Manual override**

**Light/surge voltage suppressor**

		DC	AC
Nil	Without light/surge voltage suppressor	○	○
S	With surge voltage suppressor	○	○ <sup>(Not)</sup>
Z	With light/surge voltage suppressor	○	○
R	With surge voltage suppressor (Non-polar)	○	—
U	With light/surge voltage suppressor (Non-polar)	○	—

# Specifications



74-255-005

Fluid	Air	
Type of actuation	N.C. or N.O. (Convertible)	
Internal pilot Operating pressure range (MPa)	Standard	0.2 to 0.7
	High-pressure type	0.2 to 1.0
External pilot Operating pressure range (MPa)	Standard	-100 kPa to 0.7
	High-pressure type	-100 kPa to 1.0
	Pilot pressure range	Same as operating pressure (Min. 0.2 MPa)
Ambient and fluid temperature (°C)	-10 to 50 (No freezing)	
Max. operating frequency (Hz)	5	
Manual override	Non-locking push type Push-turn locking slotted type Push-turn locking lever type	
Pilot exhaust type	Individual exhaust	
Lubrication	Not required	
Mounting orientation	Unrestricted	
Impact/Vibration resistance (m/s <sup>2</sup> ) <small>Note</small>	300/50	
Enclosure	Dust-tight (IP65 for D, Y, T)	

## Solenoid Specifications

Electrical entry	Grommet (G), (H) L-type plug connector (L) M-type plug connector (M)		DIN terminal (D) DIN (EN175301-803) terminal (Y) Conduit terminal (T)	
	G, H, L, M		D, Y, T	
Coil rated voltage (V)	DC	24, 12		
	AC (50/60 Hz)	24, 100, 110, 200, 220, 240		
Allowable voltage fluctuation		±10% of rated voltage*		
Power consumption (W)	DC	Standard	1.5 (With light: 1.55)	1.5 (With light: 1.75)
		With power saving circuit	0.55 (With light only)	0.75 (With light only)
Apparent power (VA)*	AC	24 V	1.5 (With light: 1.55)	1.5 (With light: 1.75)
		100 V	1.55 (With light: 1.65)	1.55 (With light: 1.7)
		110 V		
		[115 V]		
		200 V		
		220 V		
[230 V]				
240 V				



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SOV1

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Manuf.: PNo:

SMC USA: VP542K-3DZ1-03TB

# Silencer

## Compact Resin Type/Male Thread

# Series AN05 to 40



74-255-007



### Specifications

Fluid	Compressed air
Max. operating pressure <sup>Note 1)</sup>	145psi (1.0 MPa)
Noise reduction	30 dB(A) <sup>Note 2)</sup>
Ambient and fluid temperature	41 to 140°F (5 to 60°C) <sup>Note 3)</sup>

Note 1) It indicates the inlet pressure for solenoid valve.

Note 2) The value may vary, depending on the pneumatic circuit or pressure that is exhausted from the solenoid valve.

Note 3) The product can be used in temperatures 14 to 140°F (-10 to 60°C) if there is no risk of water droplets forming and freezing.



**AN 20 - 02**

Body size

Symbol
05
10
15
20
30
40

Thread type

	M thread
Nil	R
N	NPT

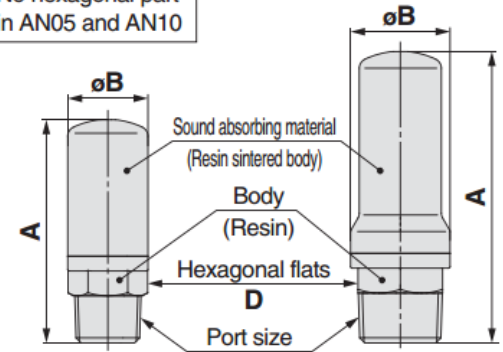
Thread connection port size

Symbol	Port size	Applicable model
M5	M5 x 0.8	AN05
01	1/8	AN10
02	1/4	AN15/20
03	3/8	AN30
04	1/2	AN40

AN05/10/20

AN15/30/40

No hexagonal part in AN05 and AN10



### Specifications

Fluid	Compressed air
Max. operating pressure <sup>Note 1)</sup>	145psi (1.0 MPa)
Noise reduction	30 dB(A) <sup>Note 2)</sup>
Ambient and fluid temperature	41 to 140°F (5 to 60°C) <sup>Note 3)</sup>

Note 1) It indicates the inlet pressure for solenoid valve.

Note 2) The value may vary, depending on the pneumatic circuit or pressure that is exhausted from the solenoid valve.

Note 3) The product can be used in temperatures 14 to 140°F (-10 to 60°C) if there is no risk of water droplets forming and freezing.

Refer to page 5 for Precautions on these products.

### Performance

Model	Effective area mm <sup>2</sup>	Sonic conductance C [dm <sup>3</sup> /(s·bar)]	Recommended flow m <sup>3</sup> /min(ANR)	Weight g
AN05-M5	5	1	0.4 or less	0.5
AN10-01	10	2	0.8 or less	1
AN15-02	15	3	1.0 or less	2.5
AN20-02	35	7	3.0 or less	4
AN30-03	60	12	5.0 or less	5.5
AN40-04	90	18	8.0 or less	8.5

Note) Recommended flow rate is the flow at 72.5psi (0.5 MPa) in the inlet pressure.

### Dimensions

Model	Port size R, NPT	A	B	D
AN05-M5	M5 x 0.8	15	6.5	-
AN10-01	1/8	23	11	-
AN15-02	1/4	32	16	14
AN20-02	1/4	45	16.5	14
AN30-03	3/8	58.5	20	17
AN40-04	1/2	68	24	21



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Device Tag:

SOV1

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Manuf.: . PNo: SMC USA: AN30-NO3



**2,5 mm<sup>2</sup>/5 mm Width**

**4 mm<sup>2</sup>/6 mm Width**

**10 mm<sup>2</sup>/10 mm Width**

**16 mm<sup>2</sup>/12 mm Width**

**35 mm<sup>2</sup>/16 mm Width**

Type	Part no.	Std. pack	Type	Part no.	Std. pack	Type	Part no.	Std. pack
<b>Marking strips, unmarked</b>			<b>Marking strips, unmarked</b>			<b>10 mm<sup>2</sup>/10 mm Width</b>		
9705 A/5/10	04.242.5053.0	25	9705 A/6/10	04.242.6053.0	25	<b>marked for 5 blocks (every 2nd tag) *</b>		
<b>Marking strips, marked</b>			<b>Marking strips, marked</b>			<b>16 mm<sup>2</sup>/12 mm Width</b>		
9705 A/5/9 B 1 - 9	04.842.4953.0	25	9705 A/6/9 B 1 - 9	04.842.5953.0	25	9705 A/5/10/5 B 04.842.5553.0 25		
9705 A/5/10 B*	04.842.5053.0	25	9705 A/6/10 B*	04.842.6053.0	25			
9705 A/5/10 B 1 - 10	04.845.0153.0	25	9705 A/6/10 B 1 - 10	04.846.0153.0	25			
11 - 20	04.845.0253.0	25	11 - 20	04.846.0253.0	25			
21 - 30	04.845.0353.0	25	21 - 30	04.846.0353.0	25			
31 - 40	04.845.0453.0	25	31 - 40	04.846.0453.0	25			
41 - 50	04.845.0553.0	25	41 - 50	04.846.0553.0	25			
51 - 60	04.845.0653.0	25	51 - 60	04.846.0653.0	25	<b>marked for 5 blocks (every 2nd tag) *</b>		
61 - 70	04.845.0753.0	25	61 - 70	04.846.0753.0	25	9705 A/6/10/5 B 04.842.6553.0 25		
71 - 80	04.845.0853.0	25	71 - 80	04.846.0853.0	25			
81 - 90	04.845.0953.0	25	81 - 90	04.846.0953.0	25			
91 - 100	04.845.1053.0	25	91 - 100	04.846.1053.0	25			
						<b>35 mm<sup>2</sup>/16 mm Width</b>		
⊕ (10 x)	04.855.0053.0	25	⊕ (10 x)	04.856.0053.0	25	<b>marked for 5 blocks (every 2nd tag) *</b>		
⊖ (10 x)	04.855.0153.0	25	⊖ (10 x)	04.856.0153.0	25	9705 A/8/10/5 B 04.842.8553.0 25		
+	04.855.0253.0	25	+	04.856.0253.0	25			
-	04.855.0353.0	25	-	04.856.0353.0	25			
L1 (10 x)	04.855.0453.0	25	L1 (10 x)	04.856.0453.0	25			
L2 (10 x)	04.855.0553.0	25	L2 (10 x)	04.856.0553.0	25			
L3 (10 x)	04.855.0653.0	25	L3 (10 x)	04.856.0653.0	25			
PE (10 x)	04.855.0753.0	25	PE (10 x)	04.856.0753.0	25			
SL (10 x)	04.855.3153.0	25	SL (10 x)	04.856.3153.0	25			
N (10 x)	04.855.3253.0	25	N (10 x)	04.856.3253.0	25			
F1 (10 x)	04.855.0953.0	25	F1 (10 x)	04.856.0953.0	25			
F2 (10 x)	04.855.1053.0	25	F2 (10 x)	04.856.1053.0	25			
L1, L2, L3, N, PE (2 x)	04.855.0853.0	25	L1, L2, L3, N, PE (2 x)	04.856.0853.0	25			
with enlarged marking area			with enlarged marking area					
9705 AL/5/10	04.242.5153.0	25	9705 AL/6/10	04.242.6353.0	25			
*Custom marking upon request			*Custom marking upon request			* indicate required marking with part no.		

42-063-000

<p>630-499-7080 · www.elemechinc.com</p>	Rev: 0	Device Tag: TB4	
	Date: 6/12/2019		
Manuf.: PNo: Wieland: 04.242.6353-CUSTOM	By: ATT MARTON	Job Number: HBR7752	Page # 1/1
			Section 6 Page 110



# Datasheet

Art.No. 07.311.0155.0

End plate AP 2,5 -4 /V0

End plate for DIN rail terminal blocks type WK ..., color gray

Art.No.	07.311.0155.0
EAN	4015573392663
Order unit	10 pieces

## Approvals

## Technical data

### General

Colour	Grey
Type of end plate	Yes
Type of partition	No
Thickness	1.5 mm
Snap in	Yes
Inflammability class of insulation material acc. with UL94	V0

### Accessories

Type of end plate	Yes
Type of partition	No
Colour	Grey
Thickness	1.5 mm
Snap in	Yes
Inflammability class of insulation material acc. with UL94	V0



Rev: 0

Date: 6/12/2019

By: ATT MARTON

Device Tag:

TB4

Job Number: HBR7752

Page # 1/1  
Section 6 Page 111

Manuf.: . PNO: Wieland: 07.311.0155.0

# Feed-through blocks with screw connection

## selosIOS



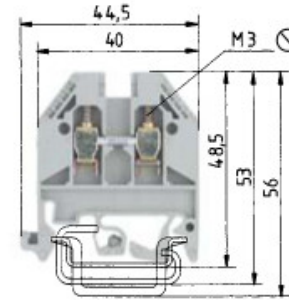
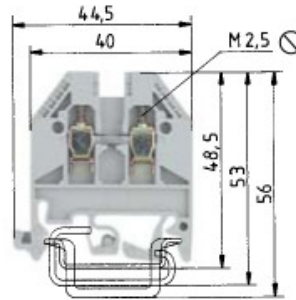
42-063-003

UL wire connection versions

<sup>4)</sup> or 2x no. 14 sol/str AWG  
or 2x no. 16 sol/str AWG  
or 2x no. 18 sol/str AWG  
or 3x no. 20 sol/str AWG or 3x no. 22 sol/str AWG

<sup>5)</sup> or 2x no. 12 sol/str AWG  
or 2x no. 16 sol/str AWG  
or 3x no. 18 sol/str AWG or 3x no. 22 sol/str AWG

<sup>6)</sup> or 2x no. 12 sol/str AWG  
or 2x no. 14 sol/str AWG  
or 3x no. 16 sol/str AWG



0344 Ex II 2GD IM2  
Ex e I/II  
EN 60947-7-1:2002  
UL ratings  
CSA ratings  
KEMA 02 ATEX 2114 U<sup>1)</sup> EN 60079-0/EN 60079-7  
Width  
Approvals

Field/factory wiring

Wire strip length

### WK 2,5/U

fine-stranded solid V A  
0.5-2.5 mm<sup>2</sup> 0.5-4 mm<sup>2</sup> 800V/8 kV/3 24  
No. 22-12 AWG 600V 20/30  
No. 24-12 AWG 600V 25  
0.5-2.5 mm<sup>2</sup> 0.5-4 mm<sup>2</sup> 690V 23  
5 mm 9 mm



### WK 4/U

fine-stranded solid V A  
0.5-4 mm<sup>2</sup> 0.5-6 mm<sup>2</sup> 800V/8 kV/3 32  
No. 22-10 AWG<sup>4)</sup> 600V 30/35  
No. 20-10 AWG 600V 40  
0.5-4 mm<sup>2</sup> 0.5-6 mm<sup>2</sup> 690V 14/27<sup>6)</sup>  
6 mm 9 mm



	Type	Part No.	Std. Pack	Type	Part No.	Std. Pack	
<b>Feed-through block</b>	gray	WK 2,5/U	57.503.0055.0	100	WK 4/U	57.504.0055.0	100
<b>Feed-through block Ex i</b>	blue	WK 2,5/U BLAU	57.503.0055.6	100	WK 4/U BLAU	57.504.0055.6	100
<b>Accessories</b>							
1. Mounting rail TS 35, DIN rail 7.5 mm high	L = 2 m	35 x 27 x 7,5 EN 60715	98.300.0000.0	1	35 x 27 x 7,5 EN 60715	98.300.0000.0	1
Mounting rail TS 35, DIN rail, 15 mm high	L = 2 m	35 x 24 x 15 EN 60715	98.360.0000.0	1	35 x 24 x 15 EN 60715	98.360.0000.0	1
Mounting rail TS 32, G rail <sup>2)</sup>	L = 2 m	9006 EN 60715 G-32	98.190.0000.0	1	9006 EN 60715 G-32	98.190.0000.0	1
2. End clamp with U-foot <sup>2)</sup>	10mm wide	WE 1/U	25.523.5753.0	100	WE 1/U	25.523.5753.0	100
End clamp TS 35, with screw	8mm wide	9708/2 S35	25.522.8553.0	100	9708/2 S35	25.522.8553.0	100
End clamp TS 35, without screw	8mm wide	WEF 1/35	25.523.9353.0	100	WEF 1/35	25.523.9353.0	100
3. End plate	gray	AP 2,5 - 4	07.311.0155.0	10	AP 2,5 - 4	07.311.0155.0	10
	blue	AP 2,5 - 4 BLAU	07.311.0155.6	10	AP 2,5 - 4 BLAU	07.311.0155.6	10
4. Partition	gray	TW 2,5 - 4	07.311.1155.0	10	TW 2,5 - 4	07.311.1155.0	10
	blue	TW 2,5 - 4 BLAU	07.311.1155.6	10	TW 2,5 - 4 BLAU	07.311.1155.6	10
5. Cross connector with screws	2 pole	IVB WK 2,5 - 2	Z7.280.2227.0	10	IVB WK 4 - 2	Z7.281.1227.0	10
insulated	3 pole	IVB WK 2,5 - 3	Z7.280.2327.0	10	IVB WK 4 - 3	Z7.281.1327.0	10
	up to 12 pole	IVB WK 2,5 - 12	Z7.280.3227.0	10	IVB WK 4 - 12	Z7.281.2227.0	10
6. Partition plate with marking facility		TS 2,5 GELB	07.311.2053.8	10	TS 4 GELB	07.311.2153.8	10
7. Single cover with marking facility		AD VB 2,5 GELB	04.326.2053.8	10	AD VB 4 GELB	04.326.2153.8	10
8. Cover with warning symbol over 4 blocks		AD VB 5/4 GELB	04.343.4756.8	10	AD VB 6/4 GELB	04.343.4856.8	10
For more accessories see pages 60-77							
For marking systems see pages 70-75							
<sup>4)</sup> For maintaining the proper isolation distances, the open side of a feed-through terminal block as well as both sides of a jumper are to be enclosed by partitions. <sup>1)</sup> Please note the mounting instructions on the cover page. <sup>2)</sup> Do not use in Ex environments. <sup>3)</sup> With/without jumper							



Rev: 0

Date: 6/12/2019

By: ATT MARTON

Device Tag:

TB4

Job Number: HBR7752

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Manuf.: . PNo:

Wieland: 57.504.0055.0

Earth terminal WK 4 SL/ U /V0

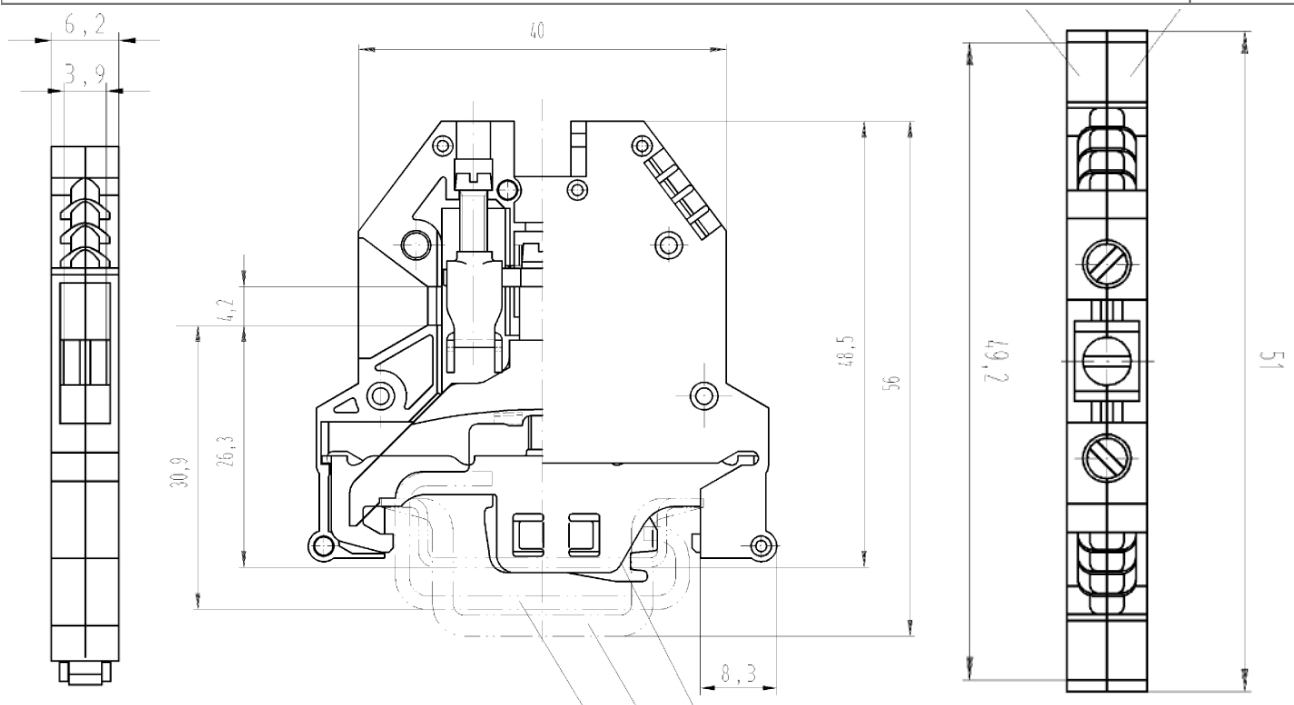
Ground DIN rail terminal block with screw connection for mounting on TS 35 and TS 32, nominal cross section 4 mm<sup>2</sup>, width 6 mm, color green/yellow



42-063-004



Rated impulse voltage	8 kV
Pollution degree	3
Closing plate required	No
Length	51 mm
Type of insulation material	Thermoplastic
Cross section UL	22-10 AWG
Cross section CSA	20-10 AWG
Maximum cross section fine stranded	4 mm <sup>2</sup>
Wire strip length	9 mm
Torque conductor mounting	0.5 Nm
Torque rail mounting	0,5



Rev: 0

Date: 6/12/2019

By: ATT MARTON

Device Tag:

TB4

Job Number: HBR7752

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Section 6 Page 113

Manuf.: . PNo:

Wieland: 57.504.9055.0

Item No. Z5.522.8553.0  
 End bracket 9708 / 2 S 35  
 End clamp for mounting rail TS 35



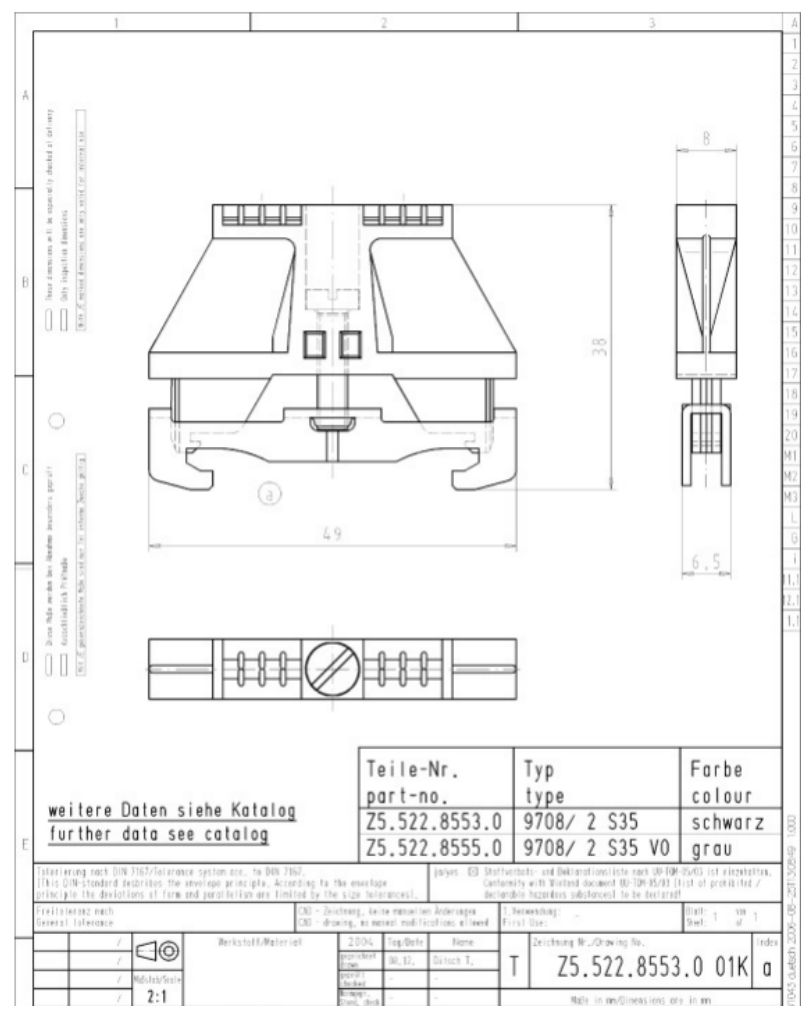
42-063-009



Item No.	Z5.522.8553.0
EAN	4015573141766
order unit	100 Piece(s)

Technical data

Accessories	
ArticlePrice	udp_no_price
Colour	Black
Inflammability class of insulation material acc. with UL94	V2
Width/grid dimension	8 mm
Latching	Screwable
Length	49 mm
Material	Metal
Mounting method	DIN rail (top hat rail) 35/7.5 mm



Rev:	0	Device Tag:	
Date:	6/12/2019	TB4	
By:	ATT MARTON	Job Number:	HBR7752
		Page #	1/1

Manuf.: . PNO:  
 Wieland: Z5.522.8553

# Section 7.0

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**LIST OF SPARE PARTS SUPPLIED  
BY HUBER WITH EQUIPMENT**

**Wichita, KS**

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**No spare parts have been included in this order.**

Spare parts can be ordered from:

Joshua Dobbs  
Director of Service – North America  
9375 NorthCross Center Court, Suite A  
Huntersville, NC 28078  
Tel: 704-949-1004  
Fax: 704-896-2830  
E-Mail: [parts@hhusa.net](mailto:parts@hhusa.net)

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## LIST OF SPECIAL TOOLS

Wichita, KS

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The Huber screw shaft tensioning tool set will be sent to site. More information on this tool set may be found on page 40 of the operational manual.

## STORAGE PROCEDURE

### Wichita, KS

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#### **Mechanical Equipment Storage:**

When selecting the location for storage, take care that the components cannot be damaged due to vehicles or careless working. The components may not become dirty due to splashes of concrete or mortar. There should be no spark fountains from angle grinders etc. Exposed electrical components of the equipment (sensors and motors) must be wrapped with a waterproof bag. The equipment may not be stored externally near the coast. The storage location must be vibration free. Do not store organic dissolvents at the location of storage. Avoid ultraviolet radiation as well as ambient air containing ozone, hydrogen sulfide, and chloride. If equipment is stored for longer than 6 months, the gearbox oil should be drained and refilled with new oil. Please contact Huber on the project specific external storage strategy for approval.

#### **Control Panel Storage:**

When selecting the storage place take care that the components cannot be damaged due to vehicles or careless working. The components may not become dirty due to splashes of concrete or mortar. There are no spark fountains from angle grinders etc. The control panel must be stored internally in a climate controlled environment within a non-classified environment. The storage temperature shall not drop below 35°F and shall not exceed 95°F. Specific external storage strategies are allowed upon prior written permission by Huber. In these cases, please provide detailed storage plan, in writing, so that a component by component evaluation can be completed for the control system.

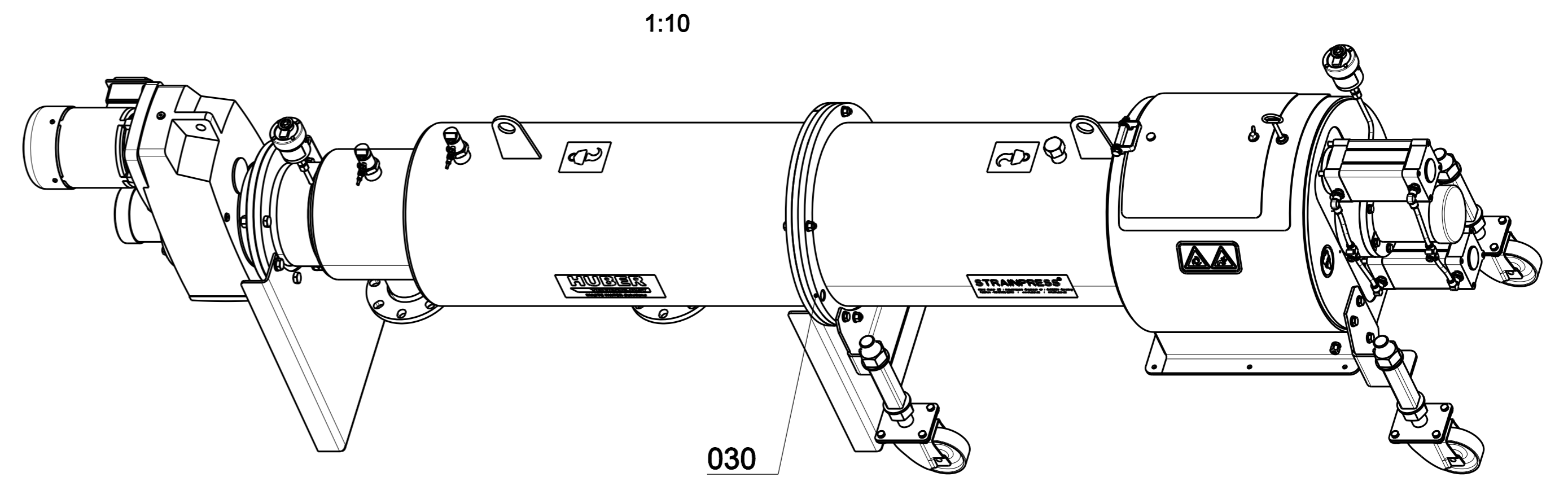
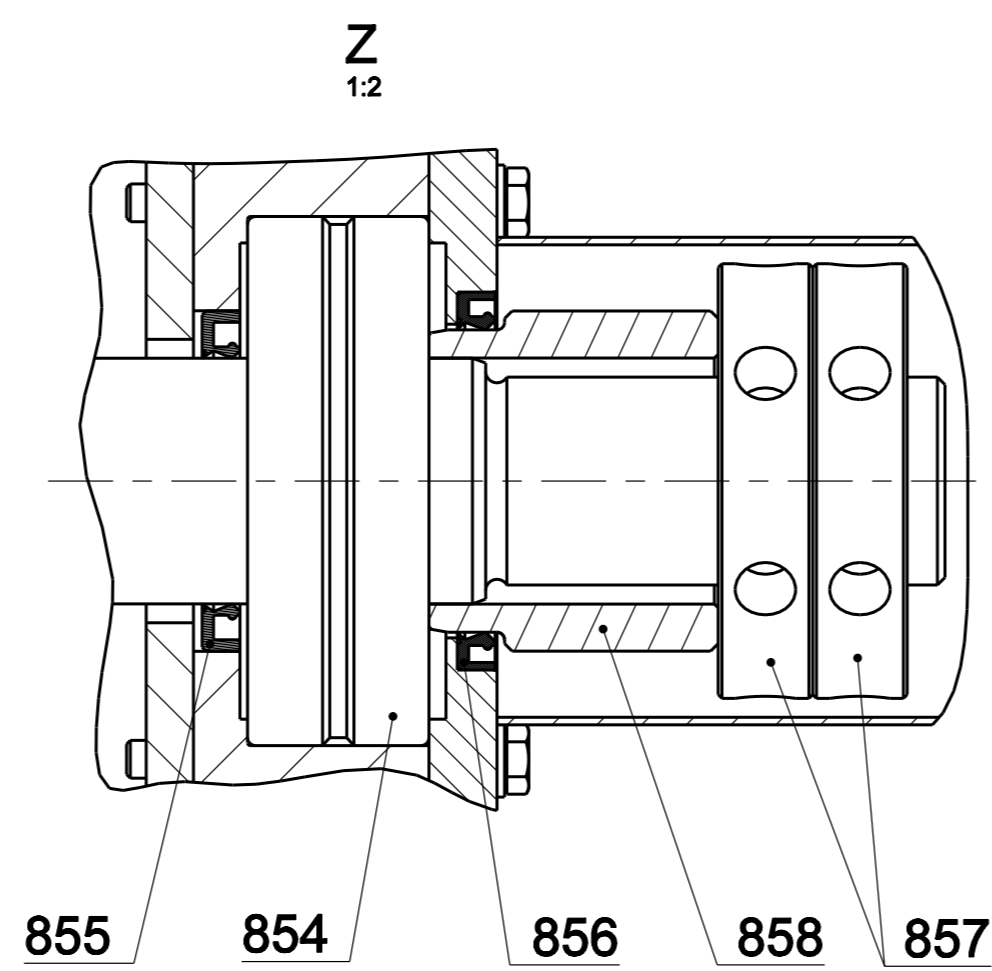
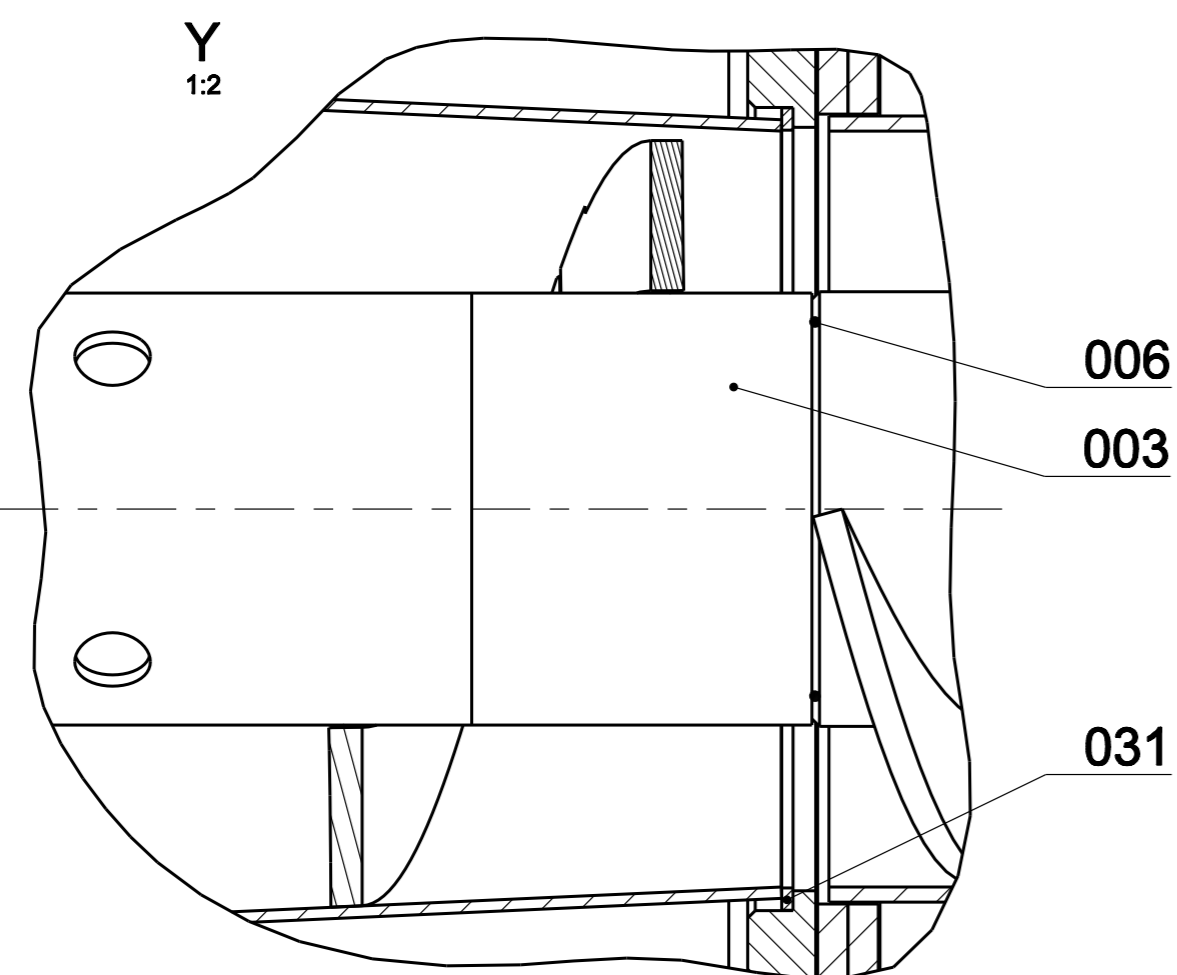
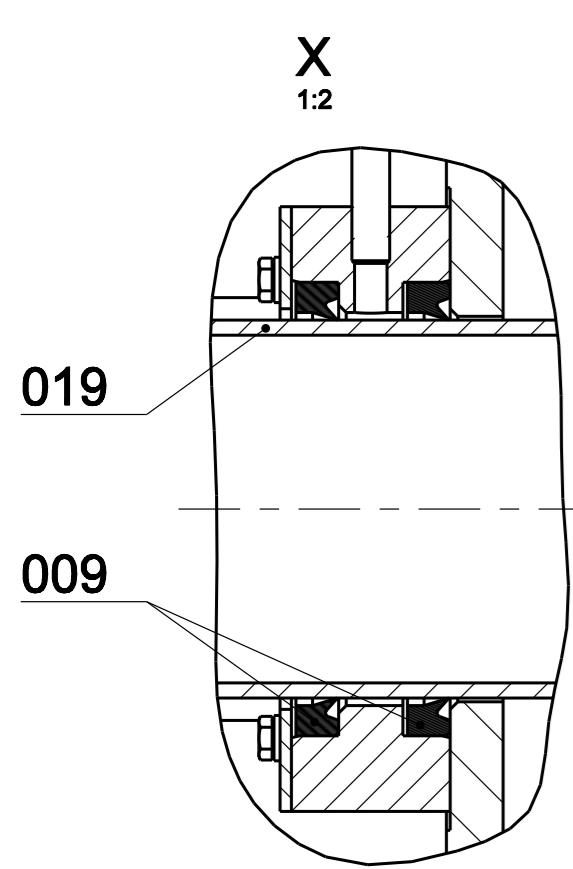
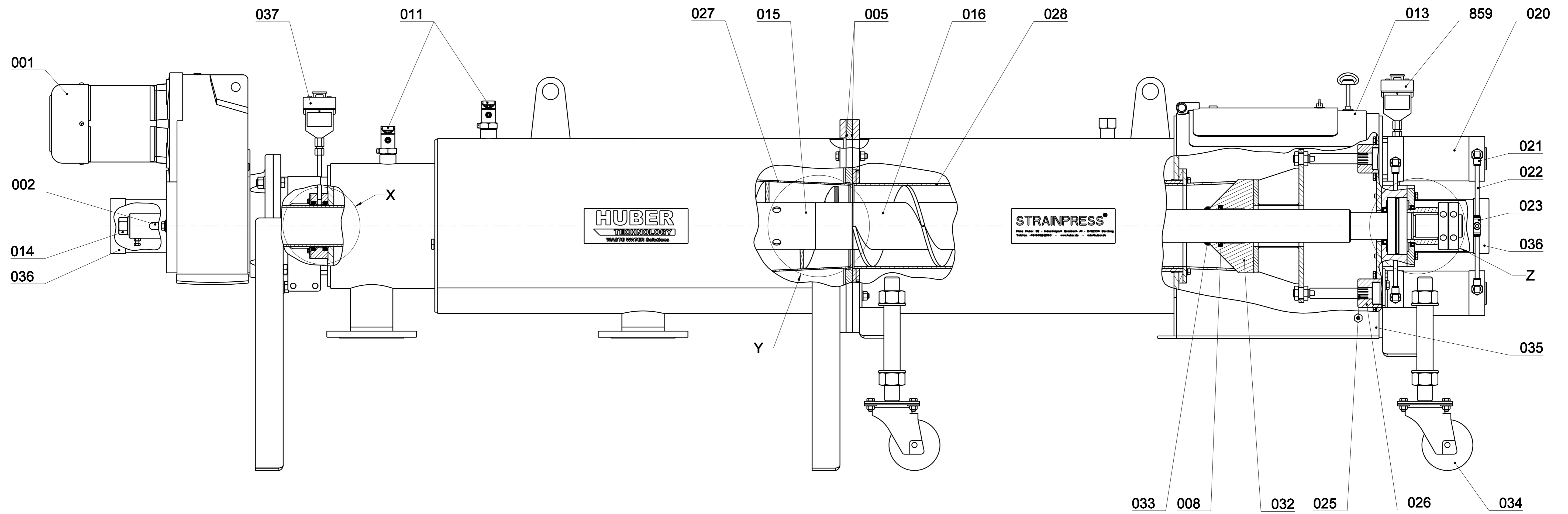
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## NUMBER OF DAYS AND TRIPS FOR START-UP

Wichita, KS

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A Huber service technician has been allocated for a total of four (4) days of eight (8) hours for manufacturer's installation inspection, equipment start-up, and operator training for the wastewater screening equipment. These days shall not exceed two (2) total trips. Additional services are available upon request on a per diem rate.



Pos. / Item	Menge / Quantity	Bezeichnung / Specification	Werkstoff / Lieferant / Material / Supplier	Bemerkung / Anmerkungen
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Technische Änderungen vorbehalten / Subject to change			ISO 2768-mK	D-92334 Berching / Tel.: +49-8462-201-0
		Datum/Date	Name	
		Bear./Rev.	14.11.2003	ak
		Gepr./Appr.	II	II
		Tag	Norm.	
Revi-Aenderung / Revision Modified		Tag / Date	Name	Projektbezeichnung / Project Name
		Standard / Item Code	Family	Project / Project
				Art.-Code / Item Code
				Blatt / Sheet
				1/1

**HUBER TECHNOLOGY**

SP4 L3738 Strainpress Grobstoffabsch.  
SP4 Strainpress - sludge cleaner

011\_000062

## spare and wear parts

## Strainpress® sludge cleaner SP4

Wearing parts are parts that are subject to increased wear due to their specific function. Such wear depends to a great extent on:

- Application conditions (such as an increased grit rate, or abrasive materials)
- Running hours
- Maintenance

Ersatzteil / spare part: s  
Verschleißteil / wear part: w


Empfohlene 2 Jahre / recommended 2 years	Empfohlene 5 Jahre / recommended 5 years	Pos item	Benennung / description	Standzeit / operating time (Std / hours)
		001	geared engine	s
		002	adjusting spring	s
		003	adjusting spring	s
X	X	005	o-ring	s
X	X	006	o-ring	s
X	X	008	oil-seal	w 4000 - 8000
X	X	009	oil-seal	w 4000 - 8000
		011	pressure sensor	s
		013	sealing	s
		014	pull rod	s
X	X	015	worm shaft screen zone	w 4000 - 8000
	X	016	worm shaft compacting zone	w 6000 - 10000
		019	bush	w
		020	pneumatic cylinder	s
		021	L-plug connection	s
		022	hose	s
		023	T-plug connection	s
X		025	journal-bearing bushing	s 4000 - 8000
		026	adapter	s
X		027	screen screenzone	w 8000 - 12000
		028	screen presszone	w 10000 - 15000
		030	locking bolt	s
X	X	031	intermediate ring	w 4000 - 8000
X		032	pressure cone	w 4000 - 8000
X		033	cone guard ring	w 4000 - 8000
		034	st. st. castor	s
X		035	sluge probe	s 10000 - 15000
		036	valve-protecting cap	s
X	X	037	electronically monitored greasing	s 1,5 Jahre / years
		854	self aligning roller bearing	s
X	X	855	oil-seal	w 6000 - 10000

Empfohlene 2 Jahre / recommended 2 years	Empfohlene 5 Jahre / recommended 5 years	Pos item	Benennung / description		Standzeit / operating time (Std / hours)	
X	X	856		oil-seal	w	6000 - 10000
		857		shaft nut	s	
		858		sleeve	s	
X	X	859		electronically monitored greasing	s	0,5 Jahre / years

# Section 8.0

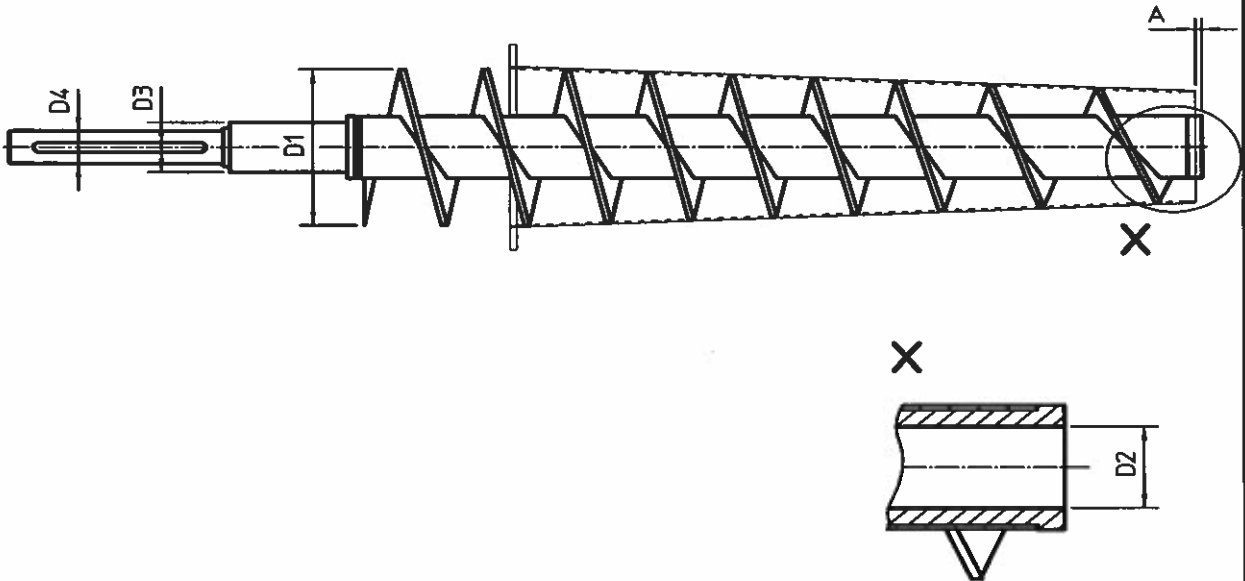
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FINAL TEST REPORT			
HUBER Sludgecleaner STRAINPRESS® 290			
project name:	wichita, KS	project number:	73003912
article no. stored machine:	10209320	article number:	10209320
order no. serial production:	S-101123081-6	order number:	- 1
serial no. (DOP-ID):	51228	explosion-proof:	no <input checked="" type="checkbox"/> yes
perforation conical basket:	5 mm	perforation cylindr. basket:	2 mm
serial no. conical basket:		serial no. cylindr. basket:	
no. conical screw shaft:		no. cylindrical screw shaft:	
drive motor:	nord Drivesystems		
gear type:	NORD	gear number:	5382AF-N180TC
motor type:	WEG	motor number:	00518XT3ER184TC WEG
voltage:	460 V	power:	5 HP <del>KVA</del>
frequency:	60 Hz	driving speed:	min <sup>-1</sup>
		test duration:	1 Std. hour
current input drive motor			
current input NOMINAL VALUE		max. allowed (=0,66 x I nom)	
6.57	A	8.2125	A
current input ACTUAL VALUE			
04.18	A		
general tests:		yes	no
bearings and lubrication lines completely filled with grease		<input checked="" type="checkbox"/>	
purchased parts checked on damage, especially paint damage, and repaired if necessary		<input checked="" type="checkbox"/>	
a sticker "providing service hollnes" (art.no.703653) for german and austrian orders attached		<input checked="" type="checkbox"/>	
data specified on the identification plate of ex-protected equipment are according to ATEX standards (CE Ex II 2 G c T3/voltage/hertz/ampere)		<input checked="" type="checkbox"/>	
arrow for direction of rotation put on and transport direction checked		<input checked="" type="checkbox"/>	
visual inspection carried out		<input checked="" type="checkbox"/>	



**TEST REPORT MECHANCS**  
**HUBER Sludgecleaner STRAINPRESS® 290**

Project:	wichita, KS
Project-no:	73004414
Project-ref-no:	13006062
Stand.-Art.-Code:	10209320
Serial-No.:	S-101123081-6



	Nominal	Actual
A	9 <sup>+1</sup> / <sub>-3</sub>	12 mm
D1	288 <sup>0</sup> / <sub>-0.3</sub>	288
D2	75 <sup>+0,076</sup> / <sub>+0,030</sub>	75
D3	92 <sup>0</sup> / <sub>-0.035</sub>	92
D4	60 <sup>-0.05</sup> / <sub>-0.1</sub>	59.96

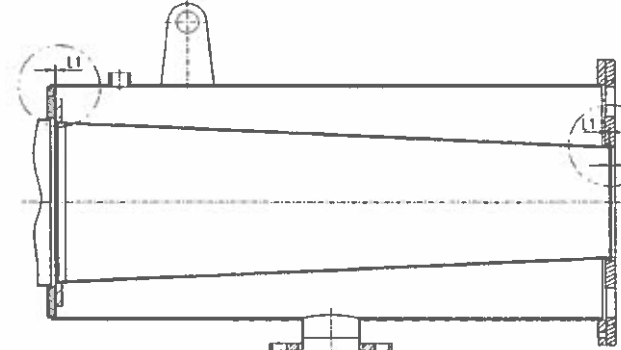
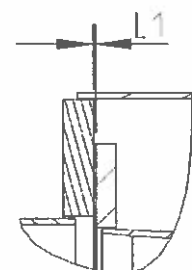
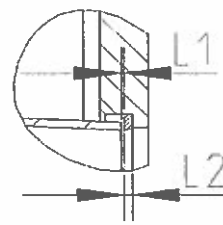
Tolerance on existing pattern seive matched (14 mm from edge pattern cone)



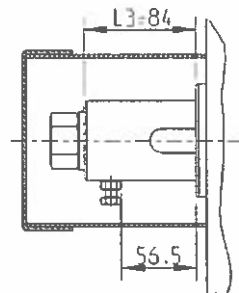
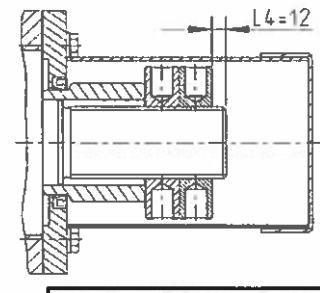
Valid from	Released	Name	Inspector
		date	date name
		05-21-14	Ever Hernandez

**FINAL TEST REPORT**  
**HUBER Sludgecleaner STRAINPRESS® 290**

project name:	wichita, KS	project number:	73004414
article no. stored machine:	10209320	article number:	10209320
order no. serial production:	S-101123081-6	order number:	1
serial no. (DOP-ID):	51228	explosion-proof:	no <input type="checkbox"/> yes <input checked="" type="checkbox"/>

		NOMINAL	ACTUAL
clearance of conic. screen basket	L1 [mm]	0,5 - 1,5	1,2
thickness of adapter ring	L2 [mm]	3	3

**Procedure:** Install the screw shaft, tighten it, measure and enter dimensions "L3" and "L4". **IMPORTANT:** Then turn the two shaft nuts back approx. 5 mm and relief the shaft!

		NOMINAL	ACTUAL	ACTUAL (after relief)	
shaft overlap	L3 [mm]	84 +10/-5	85	+5 =	90
shaft overlap	L4 [mm]	12 +5/-10	59	-5 =	54

<b>particular comments:</b>		
<b>inspector</b>	<b>date</b>	<b>Name</b>
	05-21-19	Ever Hernandez

JOB NAME: <i>Wichita, KS</i>	CHECKED BY: <i>Jim P</i>
JOB NUMBER: <i>HBR27752</i>	DATE: <i>5/28/19</i>
REF. JOB: <i>73004414</i>	

**LAYOUT**

- |  |   |
|--|---|
| <input checked="" type="checkbox"/> ALL PARTS CHECKED TO B.O.M.+S.O.                                   | <input type="checkbox"/> PRINT POCKET INSTALLED   |
| <input checked="" type="checkbox"/> B.O.M. AND STOCK REQUEST UPDATED                                   | <input type="checkbox"/> DOOR BUNDLE SECURED STUDS - GLUE   |
| <input checked="" type="checkbox"/> SPARE PARTS BOXED SEPERATE   | <input type="checkbox"/> LEGEND PLATES CORRECT + INSTALLED  |
| <input checked="" type="checkbox"/> SERIAL NUM. RECORDED   | <input type="checkbox"/> SCREWS SILICONED   |
| <input checked="" type="checkbox"/> CORRECT ENCLOSURE SIZE, GUAGE, AND FREE OF DEFECTS,DENTS,SCRATCHES | <input type="checkbox"/> NAMEPLATES CORRECT + INSTALLED   |
| <input type="checkbox"/> FLAWS CLEARED OR REJECTED BY ENG.   | <input type="checkbox"/> DECALS CORRECT + INSTALLED   |
| <input type="checkbox"/> JOB CHECKED FOR SPECIAL INST.   | <input checked="" type="checkbox"/> HEATER INSTALLED ON SUB-PAN OR WELDED TO DOOR CLEAR OF DEVICES    |
| <input type="checkbox"/> DWGS+NOTES REVIEWED BEFOR LAYOUT  | <input type="checkbox"/> PANEL VACUMMED CLEAN IN + OUT  |
| <input type="checkbox"/> ENCL. LAYOUT RECHKD BEFOR DRILLING  | <input checked="" type="checkbox"/> MISSING PARTS LOGGED ON SHORTAGE LIST AND REPORTED TO ENGINEERING |
| <input checked="" type="checkbox"/> TRANSFORMER IN UPPER LEFT CORNER                                   | <input checked="" type="checkbox"/> EXTRA PARTS GIVEN TO ENGINEERING                                  |
| <input checked="" type="checkbox"/> TRNSFMR JMPRS INST FOR VOLTAGE                                     | <input type="checkbox"/>  |
| <input checked="" type="checkbox"/> DEVICES INSTALLED CORRECT AND TIGHT                                | <input type="checkbox"/>  |
| <input type="checkbox"/> CONTACT BLOCK COVERS INSTALLED  | <input type="checkbox"/>  |
| <input checked="" type="checkbox"/> ALL DEVICES W/CORRECT AMP VALUE                                    | <input type="checkbox"/>  |
| <input checked="" type="checkbox"/> BOTH GND LUGS INSTALLED  | <input type="checkbox"/>  |

**WIRING**

- |  |  |
|--|--|
| <input checked="" type="checkbox"/> DWG NOTES REVIEWED BEFORE WIRING                                 | <input checked="" type="checkbox"/> ALL WIRING LABELED BOTH ENDS     |
| <input checked="" type="checkbox"/> ALL DEVICES MOUNTED PROPERLY                                     | <input checked="" type="checkbox"/> ALL WIRING NEATLY BUNDLED        |
| <input checked="" type="checkbox"/> ALL DUCT COVERS CUT  | <input checked="" type="checkbox"/> DOOR BUNDLE SECURED              |
| <input checked="" type="checkbox"/> ALL NAMEPLATES, LEGENDPLATES AND DEVICE LABELS CORRECT AND LEVEL | <input checked="" type="checkbox"/> ALL "AS BUILTS" APPROVED         |
| <input checked="" type="checkbox"/> TERM BLOCK LABELS INSTALLED                                      | <input checked="" type="checkbox"/> ALL LOCAL CONTROL STATIONS WIRED |
| <input checked="" type="checkbox"/> CHECK SIZING OF ALL CB, MCP, VFD                                 | <input checked="" type="checkbox"/> ALL TERMINALS ARE TIGHT          |
| <input checked="" type="checkbox"/> TRANSFORMER JMPRS INSTALLED FOR CORRECT VOLTAGES                 | <input checked="" type="checkbox"/> WIRING DOES NOT PULL OUT         |
| <input checked="" type="checkbox"/> GROUND LUGS INSTALLED  | <input checked="" type="checkbox"/> PANEL CLEAN AND FREE OF SMEARS   |
| <input checked="" type="checkbox"/> WIRING COLOR CODE FOLLOWED                                       | <input checked="" type="checkbox"/> ALL FUSES INSTALLED CORRECTLY    |
| <input checked="" type="checkbox"/> ALL TERM BLOCK JMPRS INSTALLED                                   | <input checked="" type="checkbox"/> CHECK ALL SPARES PRESENT         |
| <input checked="" type="checkbox"/> ALL SWITCHES WIRED CORRECTLY                                     | <input checked="" type="checkbox"/> CONFIRM WIRE COLOR ON LEGEND     |
| <input checked="" type="checkbox"/> ALL CONTACT BLOCK COVERS REPLACED                                | <input checked="" type="checkbox"/> CHECK ALL SPARES PRESENT         |
|  | <input type="checkbox"/> WIRE FERRULS HAVE BEEN PROVIDED             |
|  | <input type="checkbox"/> HEAT SHRINK LABLES INSTALLED                |

ASSEMBLY NOTES: \_\_\_\_\_

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JOB NAME: <del>XXXXXXXXXX</del> Wichita, KS	CHECKED BY: Justin
JOB NUMBER: HBR7752	DATE: 6/14/19
REF. JOB: 73004414	

### PRE-TESTING CHECKLIST

- VERIFY PANEL LABEL ON SALES ORDER
- CHECK SALES ORDER FOR REQUIRED LINE ITEMS + SPARE PARTS AND VERIFY QUANTITY
- IDENTIFY ALL SHORTAGES AND REPORT TO ENGINEERING
- ALL DEVICES TYPE, COLOR, AND LOCATION, INSIDE AND OUT CORRECT
- NAMEPLATES CORRECT AND LEVEL
- LABELS CORRECT AND LEVEL
- ALL DEVICES INSTALLED CORRECTLY, WITH NO LOOSE COMPONENTS
- ALL JOB FOLDERS, PANEL TAGS PER JOB#
- RECORD SERIAL NUM. CRITICAL DEVICES: PLC, VFD, LEVEL CONTROLLER, ETC.
- ENCLOSURE SIZE + TYPE CORRECT
- DWGS AND DWG NOTES ACCUR + COMPLT
- OPERATION OF DISCONNECT
- TRANSFORMER SIZE AND VOLTAGE
- OVERLOAD RELAY OR MSP TRIP RANGE
- CURRENT MON. CORRECT NUM. TURNS
- CONNECT BACKUP BATTERIES/UPS

- FUSES CORRECT SIZE AND TYPE
- ALL TERMINALS TIGHTENED IN AND OUT
- CONNECTION NEAT NO STRAND
- WIRING DOES NOT PULL OUT
- ALL WIRING STRAIGHT AND NEAT
- ALL DIP SWITCHES SET
- TIMERS SET
- PARAMETERS SET IN ALL LEVEL CONTROLLERS (IF R'QD)
- TEST ALL LOCAL CONTROL STATIONS
- ALL HIGH VOLTAGE CONNECTIONS TIGHTENED TO 20 INLBS
- CLEAN PANEL VAC/ WIPE DOWN IN+OUT
- SHIPPING ARRANGEMENTS CONFIRMED
- SHIPPING CRATE SIZE
- PNEUMATIC TUBING SIZE/RATING CORRECT PER MANUFACTURER
- PNEUMATIC VALVE, ROTOMETER, GAUGE INSTALLED PER MANUFACTURER
- PLC/OIU VOLTAGE
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### TESTING CHECKLIST

- VFDs POWER MON. CORRECT SIZE AND VOLTAGE AND CORRECTLY WIRED
- HEATER OR AC INSTALLED AND TSTAT SET (IF R'QD)
- COPIES PARAMETER SHEETS IN FOLDER
- COPIES OF FIELD SET UP IN FOLDER
- TEST PANEL HAND OPERATION
- LOAD PLC TEST OPERATION/LOAD MEM.
- CHECK SEQUENCE OF OPERATION TO SEQUENCE DESCRIBED ON DRAWING
- STORE PROGRAM TO JOB DISK /SERVER
- HIGH POT TEST (IF R'QD)
- PLC ERROR BIT SETTINGS
- PLC MEMORY MODULE NON-VOLATILE MEMORY, EEPROM
- CLEAR OIU FAULTS
- SET PLC HOUR METERS TO ZERO
- SIMULATE A BLACKOUT CONDITION BY CYCLING POWER AT THE SOURCE
- TEST PNEUMATIC SYSTEM
- "AS BUILTS" MARKED CLEARLY

- CORRECTED DWGS. CAREFULLY CHECKED TO SHOP DWGS. FOR ACCURACY
- CLEAN PANEL VAC/ WIPE DOWN IN+OUT
- ALL PARTS TO BE SHIPPED CLEARLY MARKED ON DATA SHEET
- VERIFY PANEL LABEL ON SALES ORDER
- U.L. DECAL SET (IF R'QD)
- UL DECAL INSTALLED PRIOR TO MOVING PANEL TO SHIPPING (IF R'QD)
- CSA DECAL INSTALLED PRIOR TO MOVING PANEL TO SHIPPING (IF R'QD)
- UL/CSA DECAL NUMBER: B 24777447
- GROUND LUG W/DECAL
- SHIPPING ARRANGEMENTS CONFIRMED
- SHIPPING CRATE TAGGED W/I.D.
- ENABLE VNC SERVER
- PDF AND FILE SCREEN PRINTS TO SERVER
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**VOLTAGE MEASUREMENTS:**

CONTROL CIRCUIT VOLTAGE: 129

SUPPLY VOLTAGE:

L1-L2	491
L1-L3	492
L2-L3	492

L1-GND	284
L2-GND	284
L3-GND	285

MOTOR VOLTAGE:

MOTOR	MOTOR NO.1	MOTOR NO.2	MOTOR NO.3	MOTOR NO.4
1T1-1T2	497			
1T1-1T3	497			
1T2-1T3	497			

MOTOR VOLTAGE:

MOTOR	MOTOR NO.5	MOTOR NO.6	MOTOR NO.7	MOTOR NO.8
1T1-1T2				
1T1-1T3				
1T2-1T3				

MOTOR VOLTAGE:

MOTOR	MOTOR NO.9	MOTOR NO.10	MOTOR NO.11	MOTOR NO.12
1T1-1T2				
1T1-1T3				
1T2-1T3				

MOTOR VOLTAGE:

MOTOR	MOTOR NO.13	MOTOR NO.14	MOTOR NO.15	MOTOR NO.16
1T1-1T2				
1T1-1T3				
1T2-1T3				

TESTING NOTES:

PLC = 69989673

OIU = 21070GIL1AR

# Section 9.0

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# Certificate

Standard **ISO 9001:2015**

Certificate Registr. No. **01 100 1700023**

Certificate Holder: **Huber SE**  
Industriepark Erasbach A1  
92334 Berching  
Germany

Scope: Development, manufacture and sales of machine equipment and plant for water, wastewater, sludge for municipalities and industries

Proof has been furnished by means of an audit that the requirements of ISO 9001:2015 are met.

Validity: The certificate is valid from 2017-08-13 until 2020-08-12.  
First certification 2017

2017-07-20



TÜV Rheinland Cert GmbH  
Am Grauen Stein · 51105 Köln

# C E R T I F I C A T E

**ISO 14001:2015**

for

**HUBER SE**

at the site

**92334 Berching, Industriepark Erasbach A1**

The DAU-accredited environmental verifier hereby certifies that the named organization has implemented an Environmental Management System.


**Scope: Development, production and sales of machines and plants for water/waste water and sludge treatment**

With an audit it has been assessed that the requirements of ISO 14001:2015 are fulfilled.

**Nürnberg, 8 May 2018**

The follow-up certificate No. UGA 247-2018 is valid until 29 May 2021.

  
**Dipl.-Phys. Reinhard Mirz**  
Umweltgutachter  
DE-V-0260

  
**Dr. Reiner Beer**  
Umweltgutachterorganisation,  
DE-V-0279

# Section 10.0

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## Warranty

### Wichita, KS

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#### Warranty

HUBER Technology, Inc. a member of the HUBER Group warrants all screens, conveyance equipment, and parts manufactured by it to be free from defects in workmanship or materials for a period of one (1) years from the date of start-up, provided that in no event shall this warranty extend more than eighteen (18) months from date of delivery from the factory of Huber SE, Germany. If, during said warranty period, any screens, conveyance equipment or parts manufactured by said companies prove to be defective in workmanship or material under normal use and service, and if such equipment or parts are found to be defective by an authorized representative or a factory member of the Huber Group, they will be replaced or repaired free of charge.

The Huber Group or its affiliates assumes no liability for the consequential damages of any kind and the purchaser by acceptance of delivery assumes all liability for the consequences of the use or misuse of the Huber Group products by the purchaser, his employees or others. The Huber Group or affiliates will not be held responsible for travel expenses, rented equipment, outside contractor's fees, or unauthorized repair service or parts.

The warranty shall not apply to any product or part of product which has been subjected to misuse, accident, negligence or used in a manner contrary to The Huber Group or affiliates printed instructions or damage due to a defective power supply, improper electrical protection or faulty installation or repair. Wear caused due to corrosive fluids is not covered in this warranty.

The HUBER Technology sole warranty and in lieu of all other warranties, expressed or implied, which are hear by excluded including in particular all warranties of merchantability or fitness for a particular purpose.

HUBER Technology neither assumes, nor authorizes any person or company to assume for it, any other obligation in connection with the sale of its equipment with the exception of a valid Huber Group guarantee or extended warranty, if applicable. Any other enlargement or modification of this warranty by a representative or other selling agent shall be his exclusive responsibility.