

Equipment Manual

G.C. Evans Model P-1048SD

Pasteurizer

Serial Number 08200741

End User



7520 Georgetown Road
Park 100, Bldg 131, Suite B
Indianapolis, IN 46268

Manufacturer



GC Evans Sales & Mfg. Co., Inc.
14000 Dineen Drive
Little Rock, AR 72206
Ph: (501) 664-5095



G.C. EVANS SALES AND MANUFACTURING CO., INC.
14000 DINEEN DRIVE LITTLE ROCK, AR 72206 (501) 664-5095

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G.C. Evans Sales & Mfg Co Inc.

Section 1

Preventative Maintenance Schedule

**Model P-1048SD
Pasteurizer**

MASTER SCHEDULE:										Pasteurizer											
										STATUS: A		PREP BY:		APPR BY:		DEPT:		P-1048SD Pasteurizer			
ST	ON/OF	FQ	F	A	D	SH	S	P	SK	TSK#	TASK DESCRIPTION				TIME	QTY	U / M	MATERIAL DESCRIPTION		COST	CY

Water Delivery System

Q					01				00		Inspect all pumps for leaky seals. Water on floor from motor to pump head indicates worn or damaged seals. Refer to Section 4-I-A for pump identification.	0.10			Pump Seal & Volute Gasket Replacement Part Number See Spare Parts List		
A					01				00		Inspect pump impellers for wear as defined by a loss of pressure greater than 7 psi from factory setting identified on supplied pressure gauge, loss of water coverage within the warmer, or possible loud noises coming from the pump head. Any of the above may warrant an impeller change. Refer to Section 5-I Recommended Spare Parts list for specific impellers and part numbers.	3.00			Replacement Part Number See spare parts list		
A					01				00		Inspect spray nozzle pattern for inconsistencies. Consistency is strictly based on available water coverage of product. Lack of coverage warrants nozzle replacement.	0.05			Replacement Part Number Main Spray Nozzle - D3/4H-PVDF7010		
Q					04				00		Inspect system fill valve actuator for proper voltage and operational control.	0.15					
Q					04				00		Inspect level sensor for proper operation in conjunction with above	0.30					
Q					01				00		Check all water fittings for leaks & proper mounting.	0.10					
Q					04				00		Check all automatic heat/control butterfly valves for proper operation.	0.15					

MASTER SCHEDULE:		Pasteurizer														
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Plate & Frame

A					04				00		Inspect plates of heat exchanger for excessive scaling or pitting. Inspection will be necessary if obtaining temperature set points becomes difficult or requires an exorbitant amount of time.	2.00				
Q					04				00		Inspect pneumatic control valve for stroke and general valve operation.	0.15				

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Pasteurizer Conveyor Components

B						01				00	Lubricate Main Shaft Bearings Lubricate bearing while shaft is rotating. The grease should be pumped in slowly until a bead forms around the seals. If relubrication is done while machine is idle, refer to Table 7 of Section 4-III-A Form PS-7040-0021.	0.15			NLG1 Grade 2 Consistency Replacement Part Number Infeed Bearings - RPB207-C2CR Discharge Bearings - RPB408-C4CR		
A						04				00	Check & adjust set screws on all main bearings for proper tension and mounting tightness. Refer to Table 3 of Section 4-III-A Form PS-7040-0021.	0.30					
Q						04				00	Inspect DTS chain on infeed & discharge conveyor. Any broken or damaged pieces will need to be replaced.	0.30					
S						04				00	Check belt tension and remove excess slack of Main Mat-Top. Any amount of excess slack that can be removed should be removed. Initial removal should be done at one and six month intervals after initial start up. After 6 months, belt should be checked once annually.	1.00					
A						04				00	Check Main Mat Gearbox oil level & fill as needed. Level determined by height of breather plug. Fill until oil seeps out of plug location.	0.15			Mobil Gear 629 or Equivalent		
P						04				00	Oil Change required after 10000 hours or 2 years. Additional oil types can be found in the Lubrication Schedule for Nord Gear units found in Section 4-III-B.	1.00					
A						04				00	Check Load & Discharge Conveyor Gearbox oil levels & fill as needed. Level determined by height of breather plug. Fill until oil seeps out of plug location.	1.00			Mobil Gear 629 or Equivalent		
P						04				00	Oil Change required after 10000 hours or 2 years. Additional oil types can be found in the Lubrication Schedule for Nord Gear units found in Section 4-III-C Insert.	1.00					
A						04				00	Check Dynamic Transfer Belt Gearbox oil level & fill as needed. Level determined by height of breather plug. Fill until oil seeps out of plug location.	1.00			Mobil Gear 636 or Equivalent		
P						04				00	Oil Change required after 10000 hours or 2 years. Additional oil types can be found in the Lubrication Schedule for Nord Gear units found in Section 4-III-C.	1.00					

MASTER SCHEDULE:										Pasteurizer											
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Fans

Q					4				0		Lubricate discharge fan bearings. Use only 1 or 2 shots of grease with a hand gun. Maximum hand gun rating 40 psi. Refer to Section 4-IV-A Cincinnati Fan Catalog PMA-900 page 4.	0.15			Mobil Oil - Mobilux EP #2 or Equivalent Lithium based NLGI #2		
A					04				00		Check discharge blower hose clamps for tightness to ensure hoses will not detach during operation.	0.15					

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Sanitation

W					01				04		Stationary filters prior to pumps should be inspected for cleanliness & clean as necessary	0.15					
W					04				04		Remove any large debris from main reservoir.	0.15					
3					04				04		Drain Pasteurizer and replace with fresh water. (Frequency may vary from location to location depending on plant conditions.)	0.10					
Q					04				00		Insure all access panels, guards, and covers are in proper Conditions	0.10					
Q					04				04		Inspect & repair utility connection leaks (air/water/steam).	0.15					

MASTER SCHEDULE:										Pasteurizer													
STATUS: A										PREP BY: APPR BY: DEPT: P-1048SD Pasteurizer													
ST	ON/OF	FQ	F	A	D	SH	S	P	SK	TSK#	TASK DESCRIPTION							TIME	QTY	U / M	MATERIAL DESCRIPTION	COST	CY

Electrical

Q					01				06		Check & confirm proper pressure on all pumps				0.10					
A					04				06		Ohm all motors for proper amperage				3.00			Fluke meter or equivalent		
A					04				06		Clean Main Control Panel & J-Boxes				0.30					
A					04				06		Test E-Stops				0.10					
A					04				06		Test All local motor disconnects				0.10					
A					04				06		Inspect all conduit, fittings, sealtite for loose or damaged areas				0.30					
A					04				06		Clean all motor housings & shrouds				0.30					
A					04				06		Inspect wiring for insulation & loose connections				0.10					
A					04				06		Inspect all indicator lights				0.10					

MASTER SCHEDULE:

Pasteurizer

STATUS: A

PREP BY:

APPR BY:

DEPT:

P-1048SD Pasteurizer

ST ON/OF FQ F A D SH S P SK TSK# TASK DESCRIPTION

TIME QTY U / M MATERIAL DESCRIPTION

COST CY

MASTER SCHEDULE: 42313

P-1048SD Pasteruizer

SKILL:

TASK / YR:

TIME / YR:

COST / YR:

FREQUENCY CODES		SHIFT CODES		SKILL CODES	
CODE	DESCRIPTION	CODE	DESCRIPTION	CODE	DESCRIPTION
1	Sun	01	OPERATING	00	MECHANICAL WORK
2	TTh	02	OP'ING - MFR BASED	01	OPERATOR WORK
3	WMF	03	NON-OP - MFR BASED	04	SANITATION
4	TThSat	04	NON-OPERATING	06	TECHNICIAN WORK
5	SunMWF	99	PREVIOUSLY DELETED	09	SUPERVISOR
6	SunTThSat	Z9	SAMESAS / CONVERSION	12	CONTRACTOR
7	SunMTWThFSat	ZZ	CONVERSION	99	PREVIOUSLY DELETED
8	MTWThFSat			Z9	SAMESAS / CONVERSION
9	MTWThF			Z9	CONVERSION
A	Annual				
B	Bi-Monthly				
C	Bi-Weekly				
D	Every 3 Weeks				
E	Every 4 Weeks				
F	Every 5 Weeks				
G	8 Times a Year				
H	Every 6 Weeks				
I	Every 7 Weeks				
J	Every 8 Weeks				
K	3 Times a Year				
L	Only Odd Years				
M	Monthly				
N	Only Even Years				
O	Semi-Monthly				
P	Predictive				
Q	Quarterly				
R	Every 10 Weeks				
S	Semi-Annual				
T	Every 12 Weeks				
W	Weekly				



G.C. Evans Sales & Mfg Co Inc.

Section 2

Operation & Maintenance

Model P-1048SD
Pasteurizer



G.C. EVANS SALES AND MANUFACTURING CO., INC.
14000 DINEEN DRIVE LITTLE ROCK, AR 72206 (501) 664-5095

OPERATIONS & MAINTENANCE INSTRUCTIONS **G.C. EVANS MODEL P-1048SD PASTEURIZER & COMPONENTS**

I. MAINTENANCE OF THE P-1048SD PASTEURIZER

A. MAIN BELT

- The main belt is mfg. by Rexnord. Proper belt alignment and tracking was checked by GC Evans Personnel at our facility. Alignment should be checked daily for the first month of operation. After the first month, a bi-annual check will suffice. When examining this main belt, carefully inspect it for damaged modules and exposed hinge pins by observing the belt on each side through a complete revolution. If damaged modules are found or pins are telescoped beyond the twistlock edge, replace the modules and secure the pins immediately. Specific questions pertaining to belt design can be obtained from the Rexnord product literature enclosed in this manual.
- ***The main belt will “grow” with use. This is normal and attributed to break-in stretch and elongation due to wear from constant tension and load. It will be necessary to remove this slack by splicing out a full width section of belt. Contact the manufacturer for instructions on how to shorten this belt.***
- The Pasteurizer will be operated at a speed, which is a part of each products recipe and **CANNOT BE ADJUSTED**.

B. “SELF-CLEARING” INFEED & DISCHARGE CONVEYOR SYSTEMS

- The infeed conveyor system should be operated at a speed that does not cause excessive pressure on Pasteurizer’s main belt or excess side pressure on the conveyor. The transfer belt operates off a slower drive that is set to provide the most stable transfer point possible. Transfer belts were set and approved prior to the departure from our facility and rechecked onsite.
- The discharge conveyor system should be designed to function at a rate that allows the Pasteurizer to operate at a constant speed without activating the “shut-down” limit switch located on the discharge conveyor guide rail. Removal or tampering with the “SHUT DOWN” limit switch will result in CATASTROPHIC FAILURE. The transfer belt has its own drive, which operates in conjunction with the Pasteurizers main belt.

- Inspect the transfers daily for proper alignment and edge damage of the Pasteurizer belt of transfer belt. Replace damage modules immediately.

C. PUMPS

- The main pumps are intended to supply water to the spray nozzles for processing the containers. The pump flows are balanced by design. All pumps should be inspected monthly. Seals should be replaced as necessary. Check pump motor oil levels and add as required by motor mfg. For specific questions pertaining to the pumps, consult the enclosed pump literature located in the product enclosure section of the manual for this specific item.
- The heat exchanger pumps are modulated to maintain a predetermined pressure and flow as needed by the system. The desired flow will be obtained by programming in the pasteurizer, or an alarm will sound.

D. BEARINGS & CHAIN

- The P-1048SD Pasteurizer has a total of FOUR (4) bearings that require grease lubrication. The Zirts are located at all four corners of the pasteurizer. The zirts are located on the mounting tubes between the upper and lower bearings. ***This Pasteurizer is equipped with center-mount split-poly bearings on all four main shafts to prevent excessive shaft deflection. These are lube free bearings and require no lubrication.*** Specific lubrication tables are in the product enclosure section of the manual for this specific item.
CAUTION: Worn, damaged, frozen, or improperly lubricated bearings will cause damage to itself and other components. Replace them immediately.

E. GEARBOXES

- All gearboxes should be inspected and lubricated in accordance with the company's maintenance program or as indicated in the literature for the gearboxes located in the product enclosure section of the manual for this specific item.

F. TEMPERING LOOP

- I/P TRANSDUCER should be checked periodically for calibration. Check the I/P literature located in the product enclosure section of the manual for this specific item pertaining to calibration instructions.
- Plate & Frame Heat Exchangers: Exchangers may need to be flushed periodically for debris removal depending on chemicals used and debris present in tank. Consult the Operating instruction enclosure for the heat exchanger located in the product enclosure section of the manual for this specific item.

G. CLEANING

- The Pasteurizer's reservoir tank should be drained and thoroughly hosed out and cleaned weekly.
- **The stainless-steel filter screens, located in each side tank, should be cleaned daily when the Pasteurizer is in daily use. (NOTE: FAILURE TO CLEAN FILTERS WILL RESULT IN MAJOR PUMP FAILURE AS A RESULT OF PUMP CAVITATION ON THE IMPELLERS)**
- Corrosion inhibitors and cleaning chemicals should be added to the water in the reservoir tank, in compliance with the instructions of the chemical supplier. Be sure the chemicals are not over concentrated.
- The "self-clearing" infeed and discharge conveyor systems should be cleaned weekly, or in accordance with plant cleaning procedures. The belts should be removed periodically for thorough cleaning of the substructure.
- The structural framework of the Pasteurizer should be thoroughly hosed down twice monthly.

CAUTION: All electrical wiring, controls, etc. should be adequately protected during clean up.

H. GENERAL

- This Pasteurizer and its components include many moving parts. Properly operated and maintained, this tunnel is designed for years of trouble-free performance.
- Worn or damaged parts should be replaced immediately.

- All components of the conveyor systems (belts, carry-ways, rollers, etc.) should be examined periodically for wear, proper alignment, and damage.
- All wearstrips, gaskets, seals, etc. should be inspected monthly, and replaced as necessary. These components are designed to prevent damage and excessive wear to other parts of the Pasteurizer.
- After any work or replacement parts are installed, the entire Pasteurizer should be checked thoroughly to determine operation is normal.

I. SPARE PARTS

- See enclosed list

J. SERVICE

- Contact the Manufacturer for question regarding service and repairs (other than normal maintenance).
- A service crew is available to work on G.C. Evans Equipment for a nominal fee. Service work must be scheduled with the Manufacturer.
- Many service parts are available in stock from G.C. Evans Sales & Manufacturing Company. Other parts can be fabricated by us or ordered from our suppliers.

K. DISCLAIMER

- A. The preceding information is written to generally outline the operation and maintenance recommended for Evans Pasteurizers. We are pleased to discuss and answer any questions you may have. Our number is (501) 664-5095.

BELT SLACK REMOVAL

Belt slack removal should be done at the discharge end of the machine.

- Remove the guide rails from the “inside” of the tunnel on both sides of the DRIVE END.
- Looking at the sides of the machine on the Drive end, there should be a coupling with a plug. Remove the plug from the coupling on both sides of the machine. You should be able to see the sides of the mat through these openings.
- Remove the fan guard from the main drive. With your fingers rotate the motor fan blade to make the belt travel toward the infeed or discharge end. Do this to ensure that a Belt Lace is lined up directly with the hole.
- Cut two 2 x 4 boards 12” long”. Lay one each on the edge of the belt on each side about 4” back from the coupling opening toward the infeed/idle end. C clamp each board to deck of the machine to ensure the Main Mat cannot move. We would recommend (2) clamps on each board on each side.
- Once clamped, you can pull the lace/pin from the belt out of the coupling on the side. Once the pin/lace is removed, the mat is now open.
- Using the motor fan blade, rotate such that the belt is drawn from the discharge end to the infeed end. Continue to do this until you have enough force to move the C clamps. Continue to rotate the fan and at the same time have someone on each side on the machine to pull the belt toward the infeed end in.
- You will then need to pull the lace out of the slack portion, remove the slack, and then put the lace back in the belt thus splicing the two sections together.
- Remove clamps and boards, install guide rails, plate and fan cover.

Tools needed:

4-C clamps

Socket to remove Fan Motor Cover on Gearbox motor

2 wood blocks as described

Needle nose pliers to grab the lace

Wood Screw to screw into the side of the lace to pull



G.C. Evans Sales & Mfg Co Inc.

Section 3

Electrical Schematics

Model P-1048SD
Pasteurizer

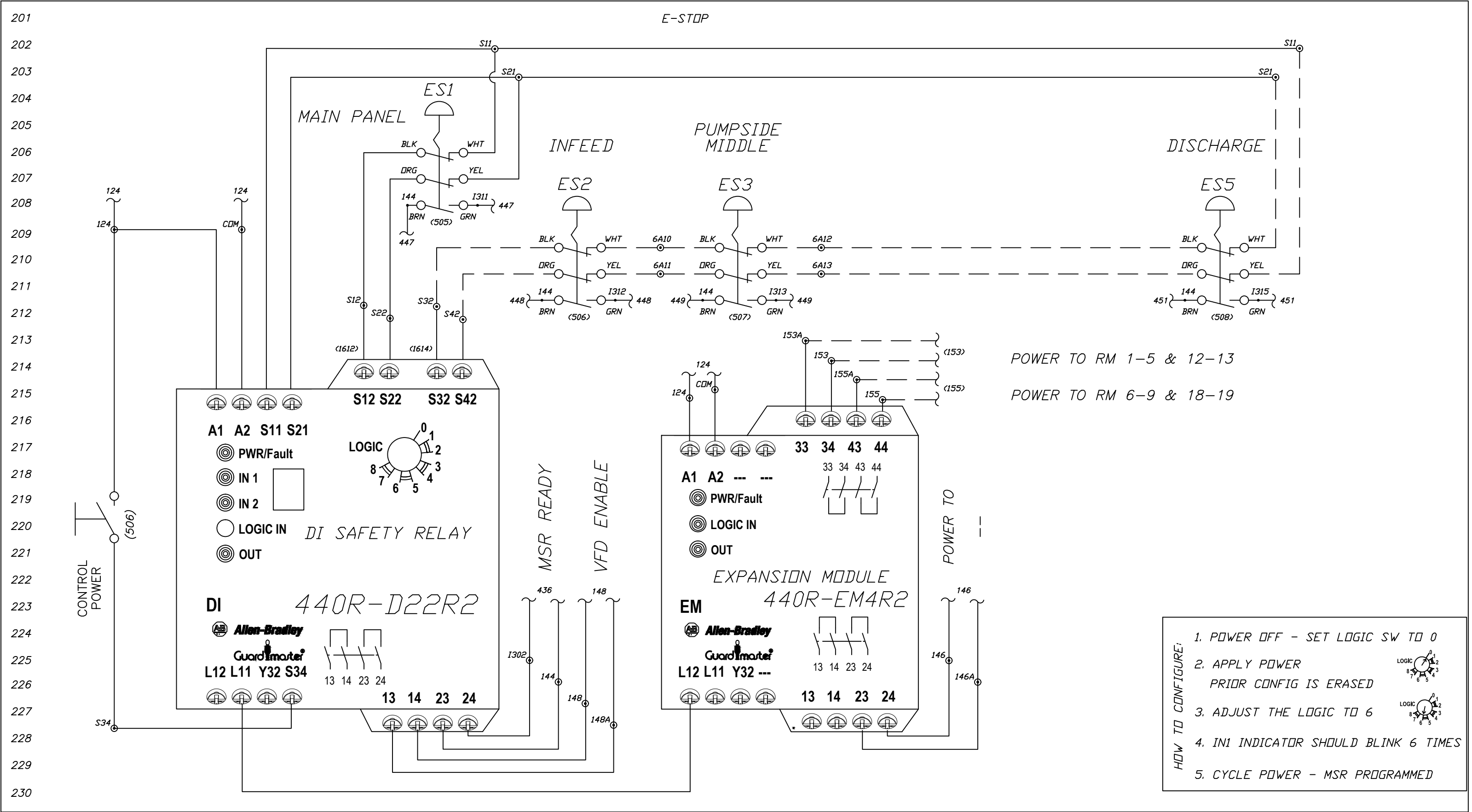


G.C. Evans Sales & Mfg Co Inc.

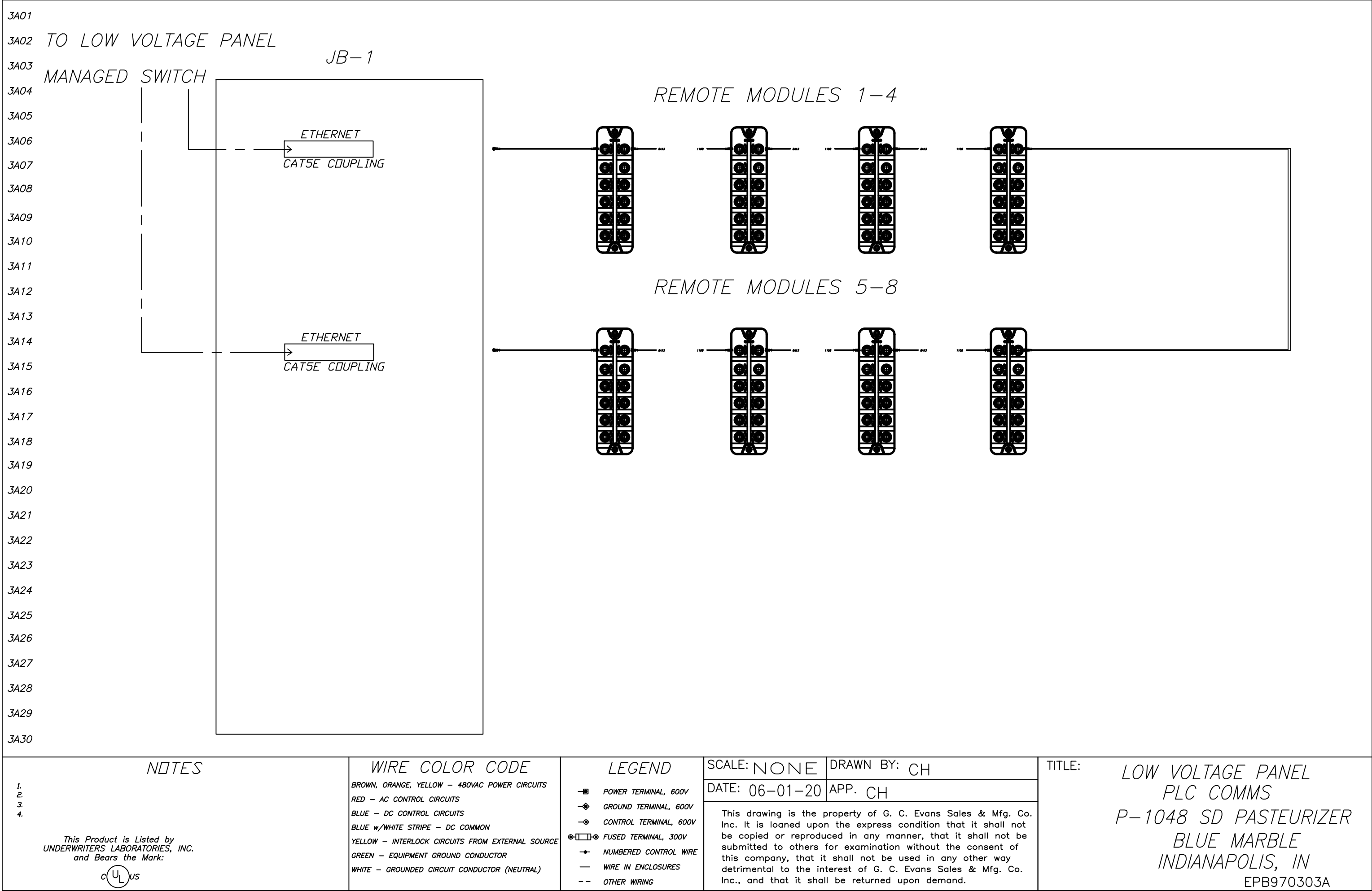
Section 3-I

Low Voltage Panel

Model P-1048SD
Pasteurizer



NOTES 1. POWER WIRING IS BROWN, ORANGE, AND YELLOW. 2. REMOVE THE JUMPER IF USING AN OPTIONAL CONTROL SAFETY INTERLOCK. 3. REPLACEMENT FUSES MUST BE OF THE SAME SIZE AND RATING. 4. 5. This Product is Listed by UNDERWRITERS LABORATORIES, INC. and Bears the Mark: 	WIRE COLOR CODE BROWN, ORANGE, YELLOW - 480VAC POWER CIRCUITS VIOLET - AC POWER CIRCUITS RED - AC CONTROL CIRCUITS BLUE - DC CONTROL CIRCUITS BLUE w/WHITE STRIPE - DC COMMON YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE GREEN - EQUIPMENT GROUND CONDUCTOR WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)	LEGEND POWER TERMINAL, 600V GROUND TERMINAL, 600V CONTROL TERMINAL, 600V FUSED TERMINAL, 300V NUMBERED CONTROL WIRE — WIRE IN ENCLOSURES -- OTHER WIRING	SCALE: NONE	DRAWN BY: CH	TITLE: LOW VOLTAGE PANEL MSR WIRING P-1048 SD PASTEURIZER BLUE MARBLE INDIANAPOLIS, IN EPB970302
			DATE: 06-01-20	APP. CH	

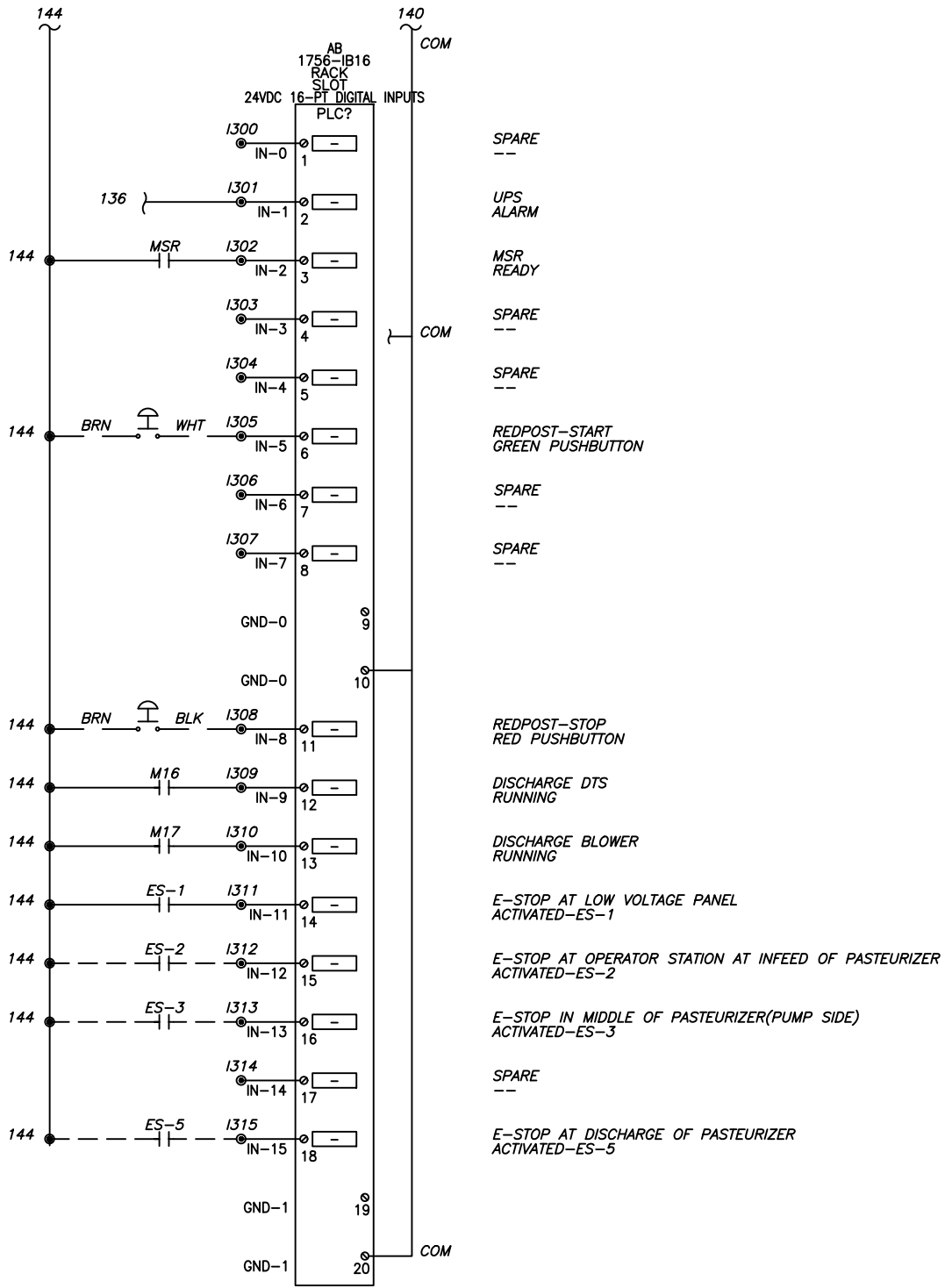


SLOT 2

401		431
402		432
403		433
404		434
405		435
406		436
407		437
408		438
409		439
410	SPARE	440
411		441
412		442
413		443
414		444
415		445
416		446
417		447
418		448
419		449
420		450
421		451
422		452

SLOT 3

16 PT. DC INPUT
TBNH TERM



NOTES

1. SHIELDED CABLE FOR ALL ANALOG INPUTS & ANALOG OUTPUTS MUST BE GROUNDED AT THE MAIN PANEL ONLY; THE SHIELD AND THE DRAIN WIRE MUST BE INSULATED AT BOTH THE SOURCE AND LOAD ENDS OF THE CABLE. MULTIPLE GROUNDS OF SHIELDED CABLES CAUSE NOISE AND CAN DESTROY THE CABLE OR EQUIPMENT IF THERE IS A SHORT CIRCUIT.
2. JUMPER TERMINAL 9 TO TERMINAL 1115 IF INTERLOCK IS NOT USED.
3. FUSES MUST BE OF SAME TYPE AND RATING
- 4.

This Product is Listed by
UNDERWRITERS LABORATORIES, INC.
and Bears the Mark:



LEGEND

- POWER TERMINAL, 600V
- ◆— GROUND TERMINAL, 600V
- CONTROL TERMINAL, 600V
- FUSED TERMINAL, 300V
- NUMBERED CONTROL WIRE
- WIRE IN ENCLOSURES
- OTHER WIRING

SCALE: NONE

DATE: 06-01-20

DRAWN BY: CH

APP. CH

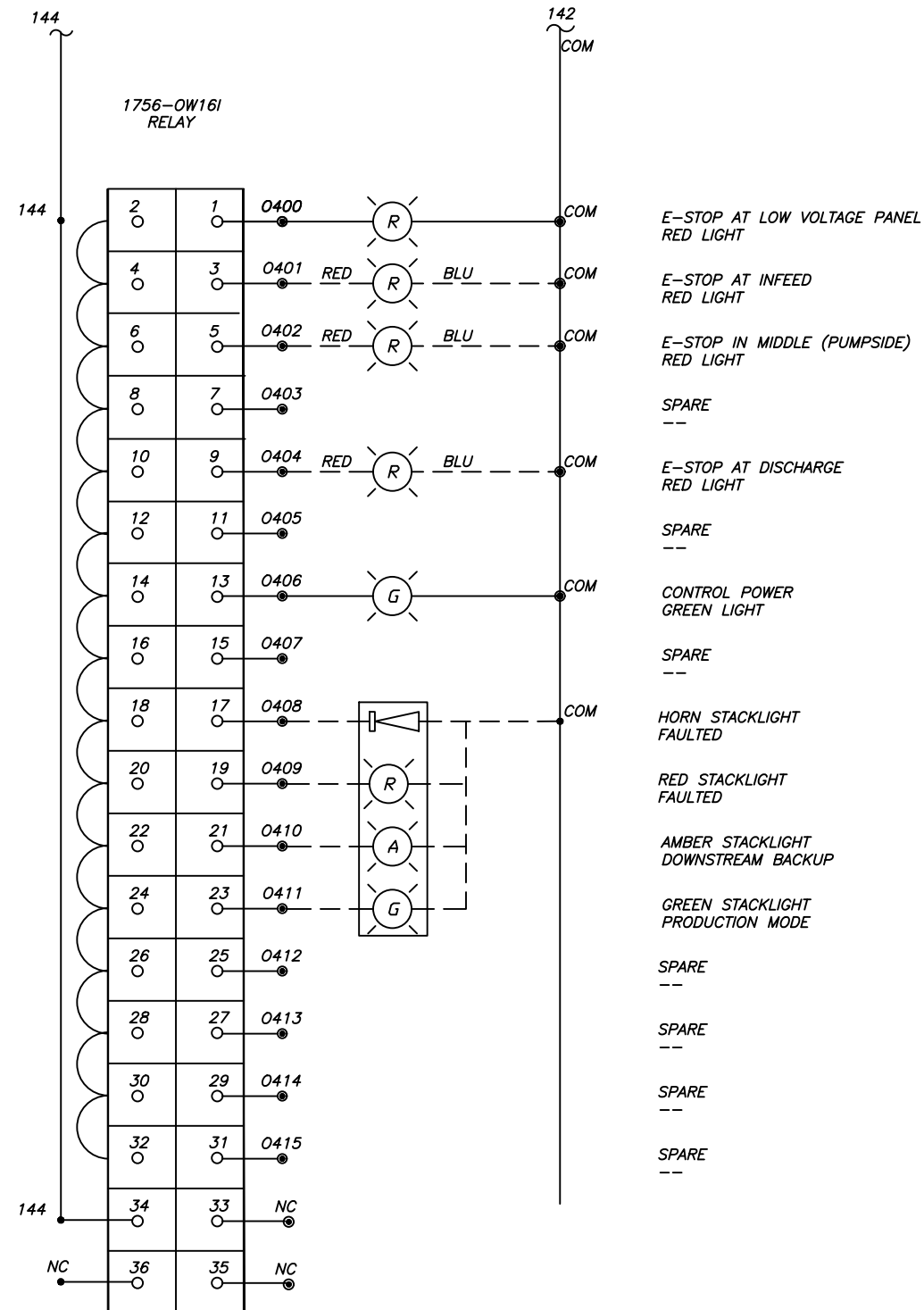
This drawing is the property of G. C. Evans Sales & Mfg. Co. Inc. It is loaned upon the express condition that it shall not be copied or reproduced in any manner, that it shall not be submitted to others for examination without the consent of this company, that it shall not be used in any other way detrimental to the interest of G. C. Evans Sales & Mfg. Co. Inc., and that it shall be returned upon demand.

TITLE:

LOW VOLTAGE PANEL
PLC SLOT 2 & 3
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970304

SLOT 4

16pt RELAY OUTPUT
TBCH TERM



NOTES

1. SHIELDED CABLE FOR ALL ANALOG INPUTS & ANALOG OUTPUTS MUST BE GROUNDED AT THE MAIN PANEL ONLY; THE SHIELD AND THE DRAIN WIRE MUST BE INSULATED AT BOTH THE SOURCE AND LOAD ENDS OF THE CABLE. MULTIPLE GROUNDS OF SHIELDED CABLES CAUSE NOISE AND CAN DESTROY THE CABLE OR EQUIPMENT IF THERE IS A SHORT CIRCUIT.
2. JUMPER TERMINAL 9 TO TERMINAL I115 IF INTERLOCK IS NOT USED.
3. FUSES MUST BE OF SAME TYPE AND RATING
- 4.

*This Product is Listed by
UNDERWRITERS LABORATORIES, INC.
and Bears the Mark:*



LEGEND

- POWER TERMINAL, 600V
- ◆— GROUND TERMINAL, 600V
- CONTROL TERMINAL, 600V
- FUSED TERMINAL, 300V
- NUMBERED CONTROL WIRE
- WIRE IN ENCLOSURES
- OTHER WIRING

SCALE: NONE

DATE: 06-01-20

DRAWN BY: CH

APP.	CH
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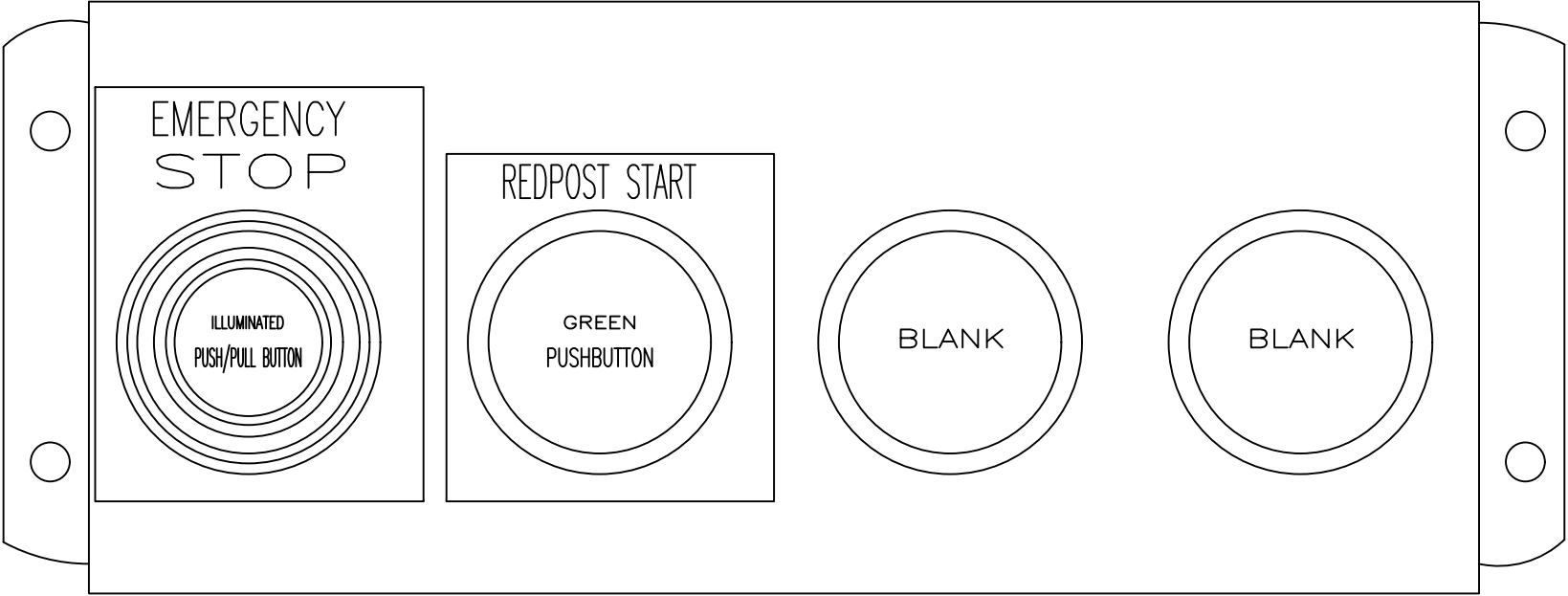
TITLE:

LOW VOLTAGE PANEL
PLC SLOT 4
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970305

NOTES 1. SHIELDED CABLE FOR ALL ANALOG INPUTS & ANALOG OUTPUTS MUST BE GROUNDED AT THE MAIN PANEL ONLY; THE SHIELD AND THE DRAIN WIRE MUST BE INSULATED AT BOTH THE SOURCE AND LOAD ENDS OF THE CABLE. MULTIPLE GROUNDS OF SHIELDED CABLES CAUSE NOISE AND CAN DESTROY THE CABLE OR EQUIPMENT IF THERE IS A SHORT CIRCUIT. 2. JUMPER TERMINAL 9 TO TERMINAL 1115 IF INTERLOCK IS NOT USED. 3. FUSES MUST BE OF SAME TYPE AND RATING 4.		This Product is Listed by UNDERWRITERS LABORATORIES, INC. and Bears the Mark: 		LEGEND  POWER TERMINAL, 600V  GROUND TERMINAL, 600V  CONTROL TERMINAL, 600V  FUSED TERMINAL, 300V  NUMBERED CONTROL WIRE  WIRE IN ENCLOSURES  OTHER WIRING		SCALE: NONE DATE: 06-01-20 This drawing is the property of G. C. Evans Sales & Mfg. Co. Inc. It is loaned upon the express condition that it shall not be copied or reproduced in any manner, that it shall not be submitted to others for examination without the consent of this company, that it shall not be used in any other way detrimental to the interest of G. C. Evans Sales & Mfg. Co. Inc., and that it shall be returned upon demand.	DRAWN BY: CH APP. CH	TITLE: LOW VOLTAGE PANEL BLANK P-1048 SD PASTEURIZER BLUE MARBLE INDIANAPOLIS, IN EPB970306

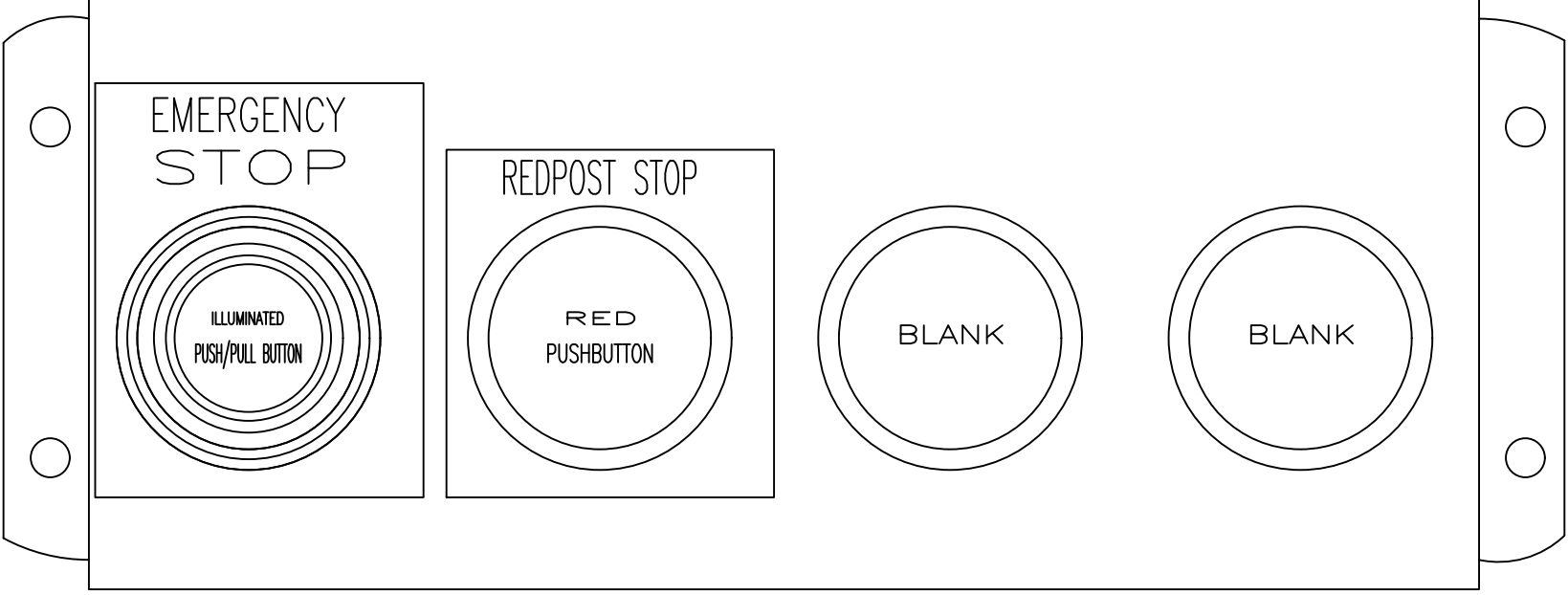
ES-2

INFEED



ES-5

DISCHARGE



NOTES

1. SHIELDED CABLE FOR ALL ANALOG INPUTS & ANALOG OUTPUTS MUST BE GROUNDED AT THE MAIN PANEL ONLY; THE SHIELD AND THE DRAIN WIRE MUST BE INSULATED AT BOTH THE SOURCE AND LOAD ENDS OF THE CABLE. MULTIPLE GROUNDS OF SHIELDED CABLES CAUSE NOISE AND CAN DESTROY THE CABLE OR EQUIPMENT IF THERE IS A SHORT CIRCUIT.
2. JUMPER TERMINAL 9 TO TERMINAL 1115 IF INTERLOCK IS NOT USED.
3. FUSES MUST BE OF SAME TYPE AND RATING
- 4.

This Product is Listed by
UNDERWRITERS LABORATORIES, INC.
and Bears the Mark:



LEGEND

- POWER TERMINAL, 600V
- ◆— GROUND TERMINAL, 600V
- CONTROL TERMINAL, 600V
- FUSED TERMINAL, 300V
- NUMBERED CONTROL WIRE
- WIRE IN ENCLOSURES
- -- OTHER WIRING

SCALE: NONE

DATE: 06-01-20

DRAWN BY: CH

APP. CH

This drawing is the property of G. C. Evans Sales & Mfg. Co. Inc. It is loaned upon the express condition that it shall not be copied or reproduced in any manner, that it shall not be submitted to others for examination without the consent of this company, that it shall not be used in any other way detrimental to the interest of G. C. Evans Sales & Mfg. Co. Inc., and that it shall be returned upon demand.

TITLE:

LOW VOLTAGE PANEL
OPERATOR STATIONS
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970307

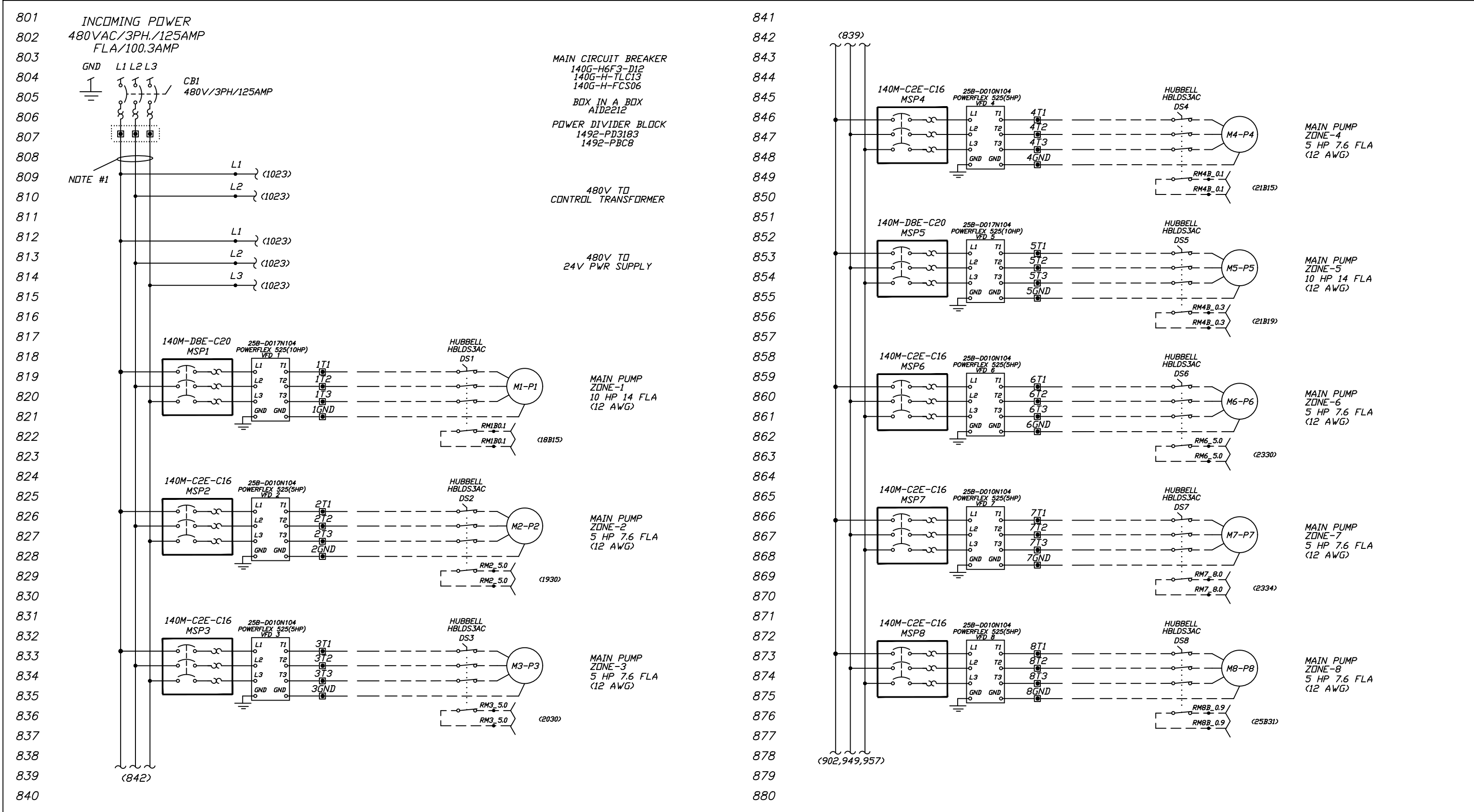


G.C. Evans Sales & Mfg Co Inc.

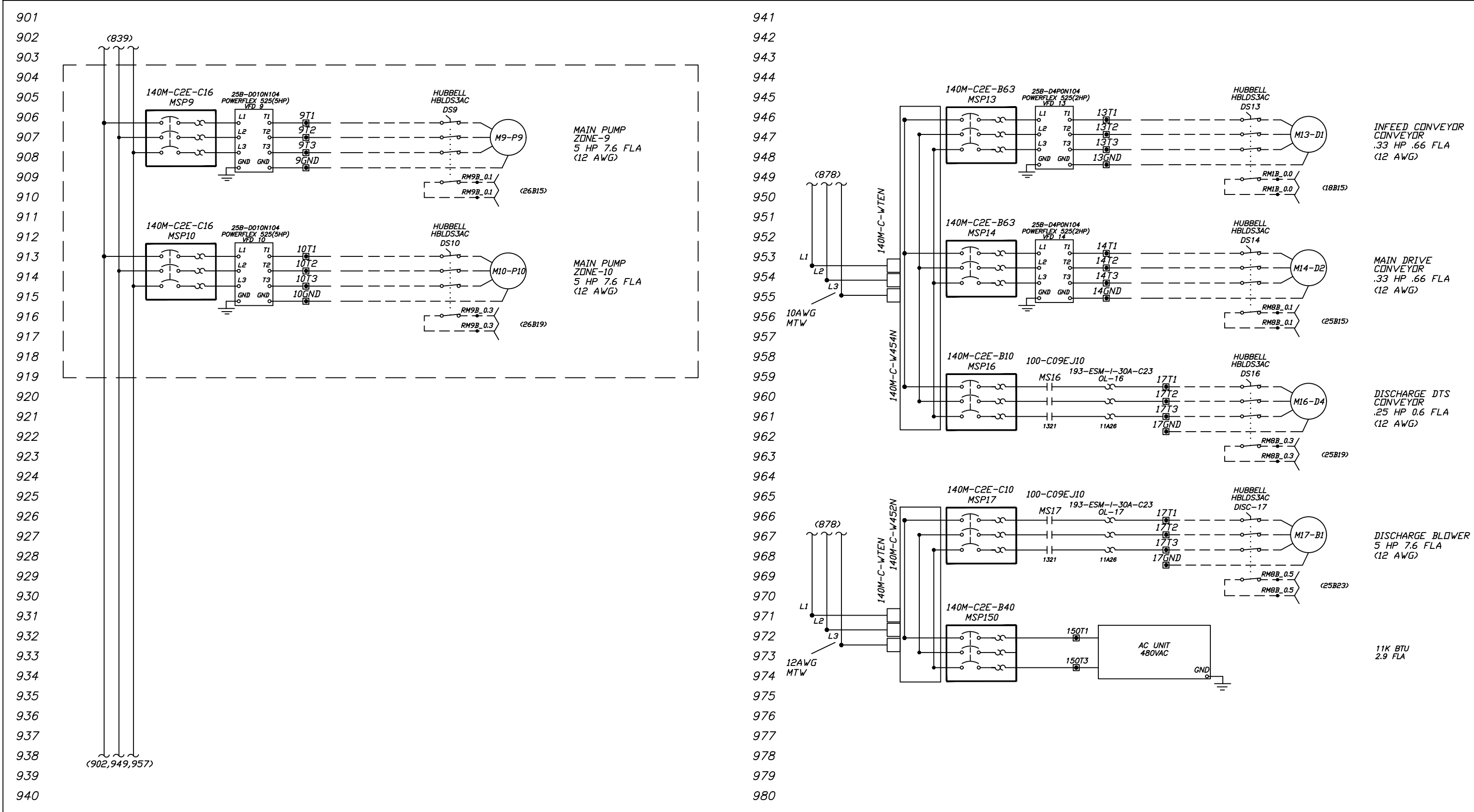
Section 3-II

High Voltage Panel

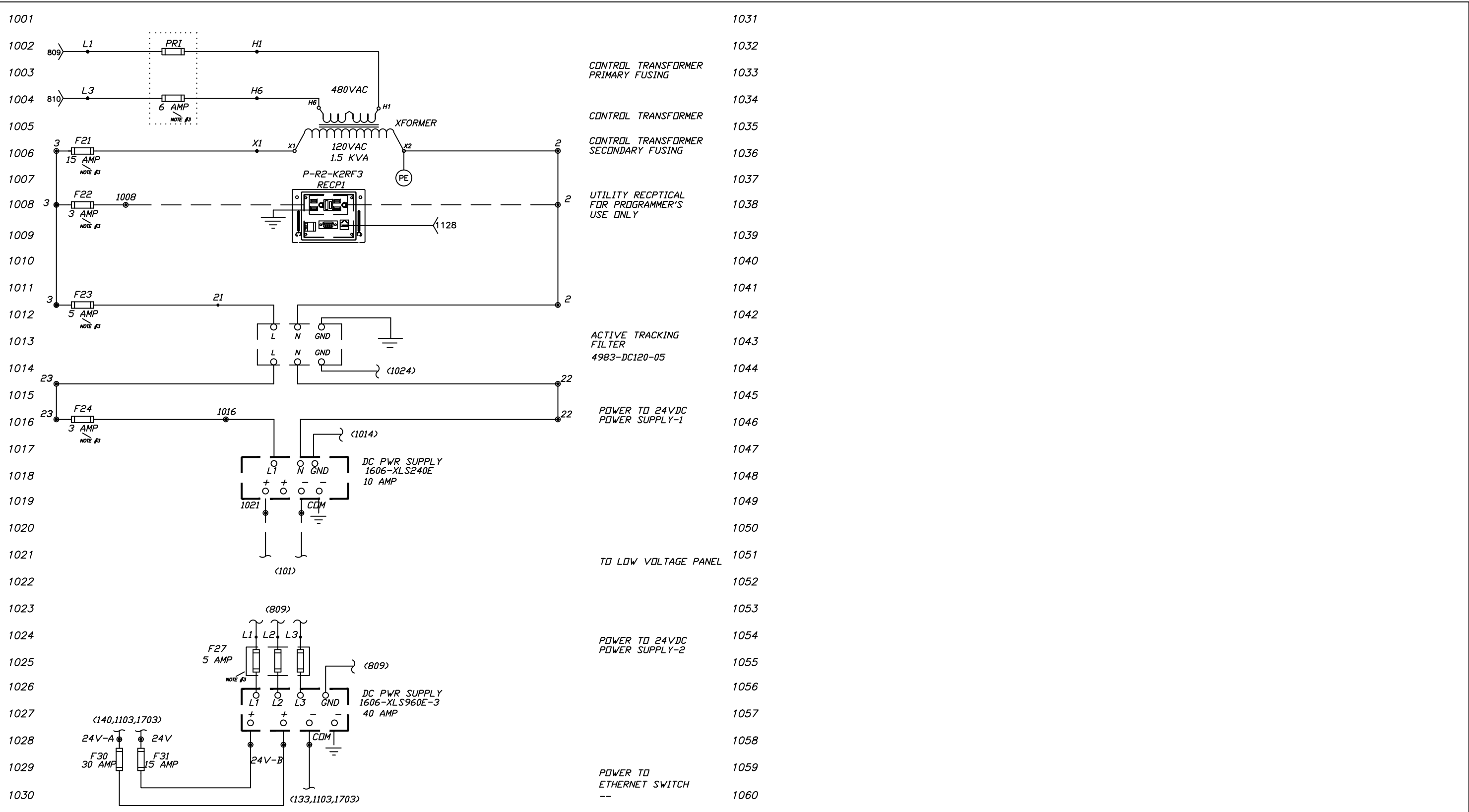
Model P-1048SD
Pasteurizer



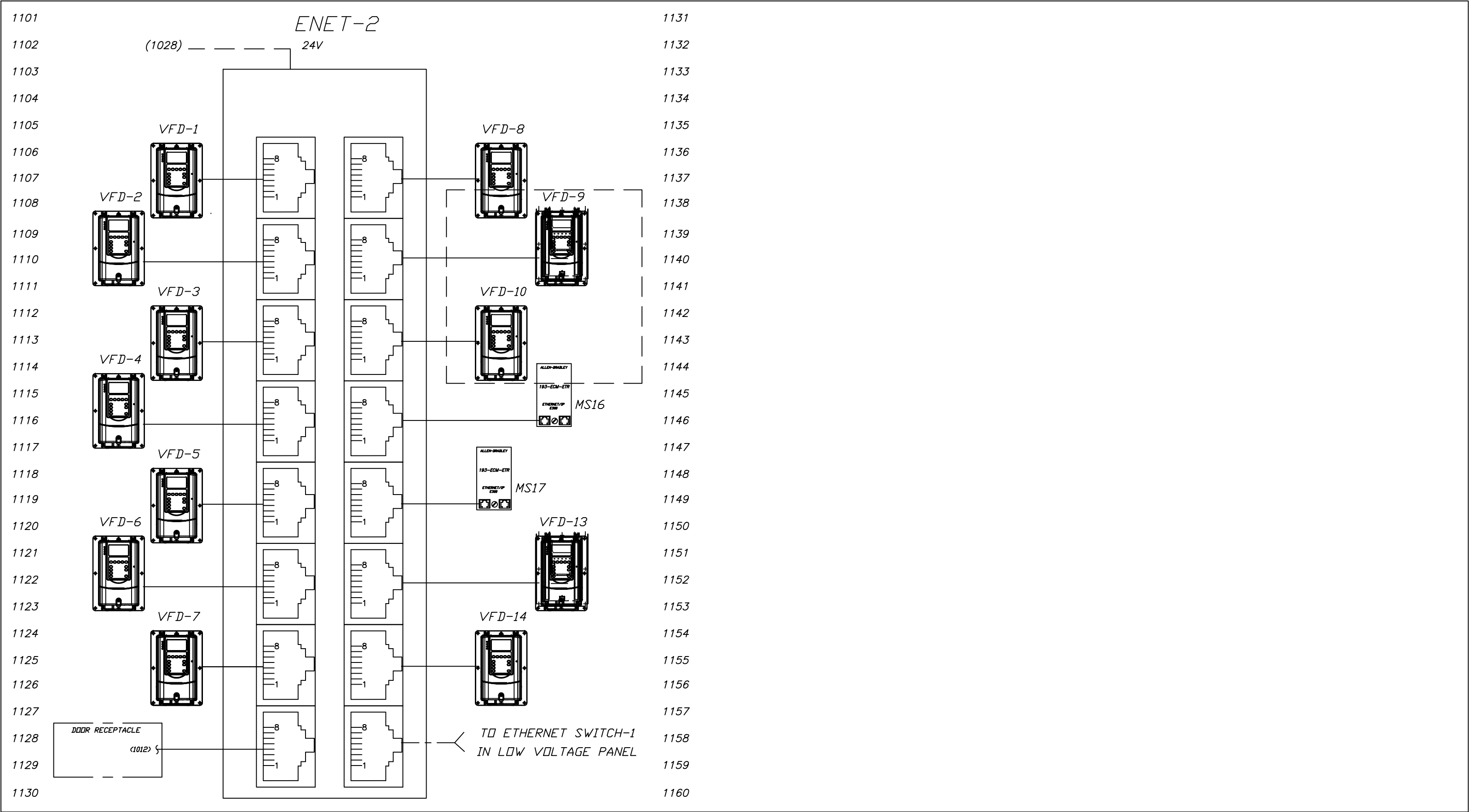
NOTES 1. POWER WIRING ARE BROWN, ORANGE, AND YELLOW. 2. 3. 4. 5.	This Product is Listed by UNDERWRITERS LABORATORIES, INC. and Bears the Mark: 	LEGEND — POWER TERMINAL, 600V — GROUND TERMINAL, 600V — CONTROL TERMINAL, 600V — FUSED TERMINAL, 300V — NUMBERED CONTROL WIRE — WIRE IN ENCLOSURES — OTHER WIRING	SCALE: NONE DRAWN BY: CH DATE: 06-01-20 APP. CH This drawing is the property of G. C. Evans Sales & Mfg. Co. Inc. It is loaned upon the express condition that it shall not be copied or reproduced in any manner, that it shall not be submitted to others for examination without the consent of this company, that it shall not be used in any other way detrimental to the interest of G. C. Evans Sales & Mfg. Co. Inc., and that it shall be returned upon demand.	TITLE: HIGH VOLTAGE PANEL 480V WIRING P-1048 SD PASTEURIZER BLUE MARBLE INDIANAPOLIS, IN EPB970308
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NOTES 1. POWER WIRING ARE BROWN, ORANGE, AND YELLOW. 2. 3. 4. 5.	This Product is Listed by UNDERWRITERS LABORATORIES, INC. and Bears the Mark: 	LEGEND  POWER TERMINAL, 600V  GROUND TERMINAL, 600V  CONTROL TERMINAL, 600V  FUSED TERMINAL, 300V  NUMBERED CONTROL WIRE  WIRE IN ENCLOSURES  OTHER WIRING	SCALE: NONE DRAWN BY: CH DATE: 06-01-20 APP. CH This drawing is the property of G. C. Evans Sales & Mfg. Co. Inc. It is loaned upon the express condition that it shall not be copied or reproduced in any manner, that it shall not be submitted to others for examination without the consent of this company, that it shall not be used in any other way detrimental to the interest of G. C. Evans Sales & Mfg. Co. Inc., and that it shall be returned upon demand.	TITLE: HIGH VOLTAGE PANEL-1 480V WIRING (cont) P-1048 SD PASTEURIZER BLUE MARBLE INDIANAPOLIS, IN EPB970309
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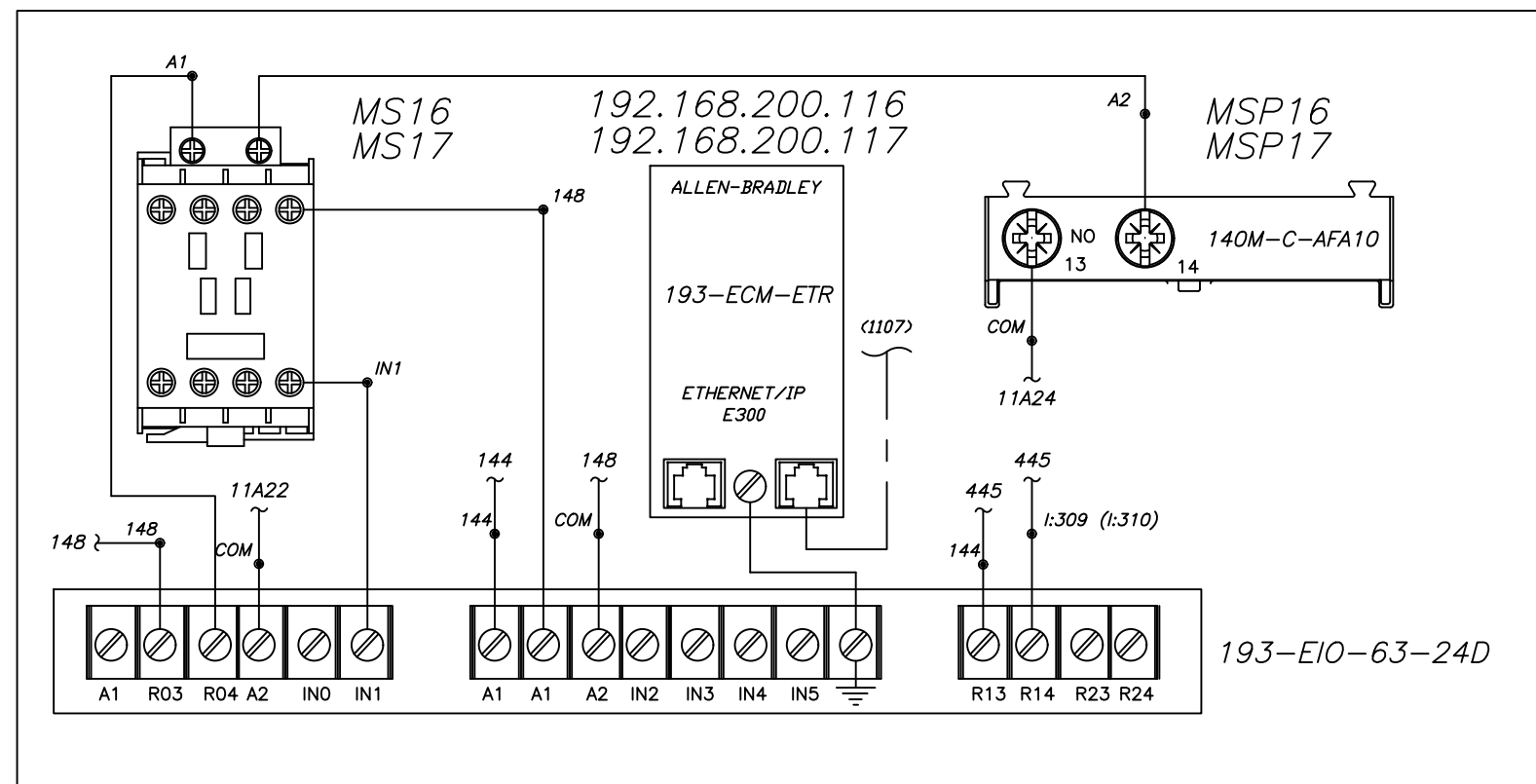
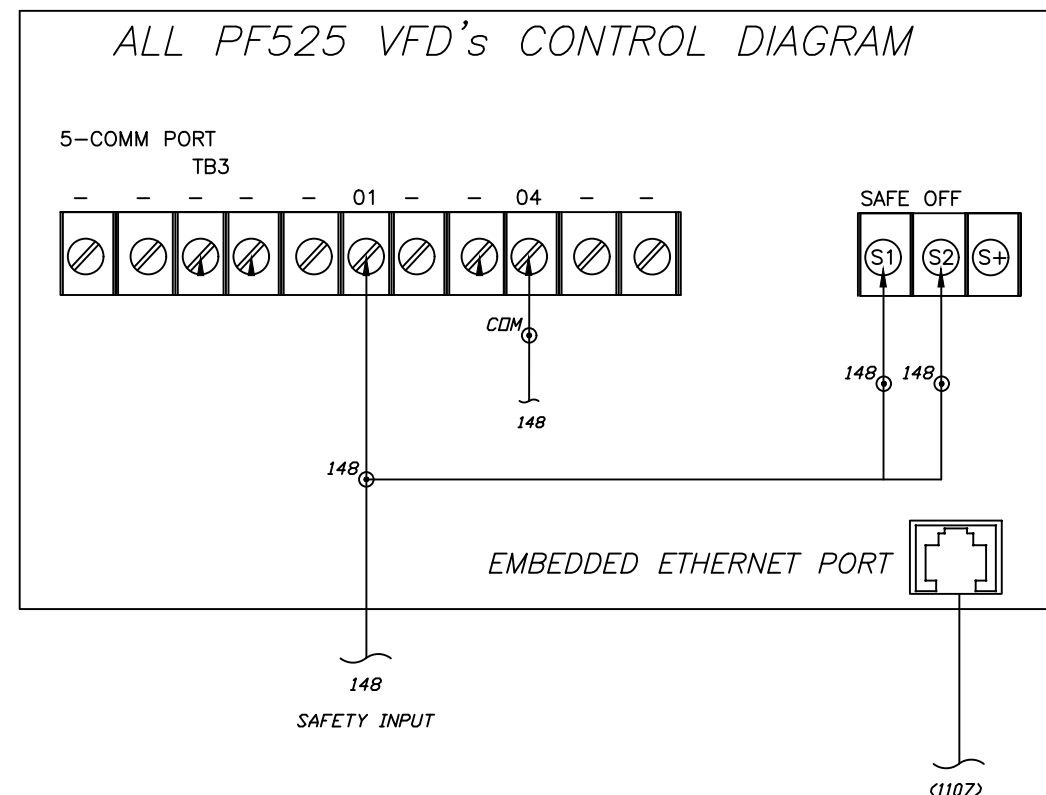


1. 2. 3. REPLACEMENT FUSES MUST BE OF SAME TYPE AND RATING. 4. 5. This Product is Listed by UNDERWRITERS LABORATORIES, INC. and Bears the Mark: 	NOTES	WIRE COLOR CODE BROWN, ORANGE, YELLOW - 480VAC POWER CIRCUITS RED - AC CONTROL CIRCUITS BLUE - DC CONTROL CIRCUITS BLUE w/WHITE STRIPE - DC COMMON YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE GREEN - EQUIPMENT GROUND CONDUCTOR WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)	LEGEND  POWER TERMINAL, 600V  GROUND TERMINAL, 600V  CONTROL TERMINAL, 600V  FUSED TERMINAL, 300V  NUMBERED CONTROL WIRE  WIRE IN ENCLOSURES  OTHER WIRING	SCALE: NONE	DRAWN BY: CH	TITLE: HIGH VOLTAGE PANEL 120VAC/24VDC WIRING P-1048 SD PASTEURIZER BLUE MARBLE INDIANAPOLIS, IN EPB970310
				DATE: 06-01-20	APP. CH	
				This drawing is the property of G. C. Evans Sales & Mfg. Co. Inc. It is loaned upon the express condition that it shall not be copied or reproduced in any manner, that it shall not be submitted to others for examination without the consent of this company, that it shall not be used in any other way detrimental to the interest of G. C. Evans Sales & Mfg. Co. Inc., and that it shall be returned upon demand.		



NOTES 1. POWER WIRING IS BROWN, ORANGE, AND YELLOW. 2. REMOVE THE JUMPER IF USING AN OPTIONAL CONTROL SAFETY INTERLOCK. 3. REPLACEMENT FUSES MUST BE OF THE SAME SIZE AND RATING. 4. 5. This Product is Listed by UNDERWRITERS LABORATORIES, INC. and Bears the Mark: C U L US	WIRE COLOR CODE BROWN, ORANGE, YELLOW – 480VAC POWER CIRCUITS VIOLET – AC POWER CIRCUITS RED – AC CONTROL CIRCUITS BLUE – DC CONTROL CIRCUITS BLUE w/WHITE STRIPE – DC COMMON YELLOW – INTERLOCK CIRCUITS FROM EXTERNAL SOURCE GREEN – EQUIPMENT GROUND CONDUCTOR WHITE – GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)	LEGEND POWER TERMINAL, 600V GROUND TERMINAL, 600V CONTROL TERMINAL, 600V FUSED TERMINAL, 300V NUMBERED CONTROL WIRE WIRE IN ENCLOSURES OTHER WIRING	SCALE: NONE	DRAWN BY: CH	TITLE: HIGH VOLTAGE PANEL COMMS/VFD WIRING P-1048 SD PASTEURIZER BLUE MARBLE INDIANAPOLIS, IN EPB970311
			DATE: 06-01-20	APP. CH	
			This drawing is the property of G. C. Evans Sales & Mfg. Co. Inc. It is loaned upon the express condition that it shall not be copied or reproduced in any manner, that it shall not be submitted to others for examination without the consent of this company, that it shall not be used in any other way detrimental to the interest of G. C. Evans Sales & Mfg. Co. Inc., and that it shall be returned upon demand.		

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PARAMETERS

PROGRAM GROUP

P031	MOTOR VOLTS	460
P033	OL CURRENT	see nameplate
P034	FLA	see nameplate
P041	ACCEL TIME	5
P042	DECAL TIME	5
P044	MAX FREQUENCY	90
P045	STOP MODE	1
P046	START SOURCE	5
P047	SPEED REF 1	15

COMMUNICATION GROUP

C125	COMM LOSS	1
C128	EN ADDR SEL	1
C129	EN IP ADDR CFG1	192
C130	EN IP ADDR CFG2	168
C131	EN IP ADDR CFG3	1
C132	EN IP ADDR CFG4	101–120
C133	EN SUBNET CFG1	255
C134	EN SUBNET CFG2	255
C135	EN SUBNET CFG3	255
C136	EN SUBNET CFG4	0

NOTES

1. POWER WIRING IS BROWN, ORANGE, AND YELLOW.
2. REMOVE THE JUMPER IF USING AN OPTIONAL CONTROL SAFETY INTERLOCK.
3. REPLACEMENT FUSES MUST BE OF THE SAME SIZE AND RATING.
- 4.
- 5.

*This Product is Listed by
UNDERWRITERS LABORATORIES, INC.
and Bears the Mark:*



WIRE COLOR CODE

BROWN, ORANGE, YELLOW - 480VAC POWER CIRCUITS
VIOLET - AC POWER CIRCUITS
RED - AC CONTROL CIRCUITS
BLUE - DC CONTROL CIRCUITS
BLUE w/WHITE STRIPE - DC COMMON
YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE
GREEN - EQUIPMENT GROUND CONDUCTOR
WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)

LEGEND

- POWER TERMINAL, 600V
- ◆— GROUND TERMINAL, 600V
- CONTROL TERMINAL, 600V
- FUSED TERMINAL, 300V
- NUMBERED CONTROL WIRE
- WIRE IN ENCLOSURES
- — OTHER WIRING

SCALE: NONF

DATE: 06-01-20

DRAWN BY: CH

APP. CH

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TITLE:

HIGH VOLTAGE PANEL
COMMS/VFD WIRING
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970311A



G.C. Evans Sales & Mfg Co Inc.

Section 3-III

Remote Modules

Model P-1048SD
Pasteurizer

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REMOTE MODULE 1
192.168.200.51
IFM AL1123

ETHERNET FROM
REMOTE MODULE-8

24VDC FROM
MAIN CONTROL PANEL

ZONE TANK-1
WATER TEMP

ZONE SPRAY-1
WATER TEMP

TO AL2241
INPUT MODULE

ZONE-1
PUMP PRESSURE

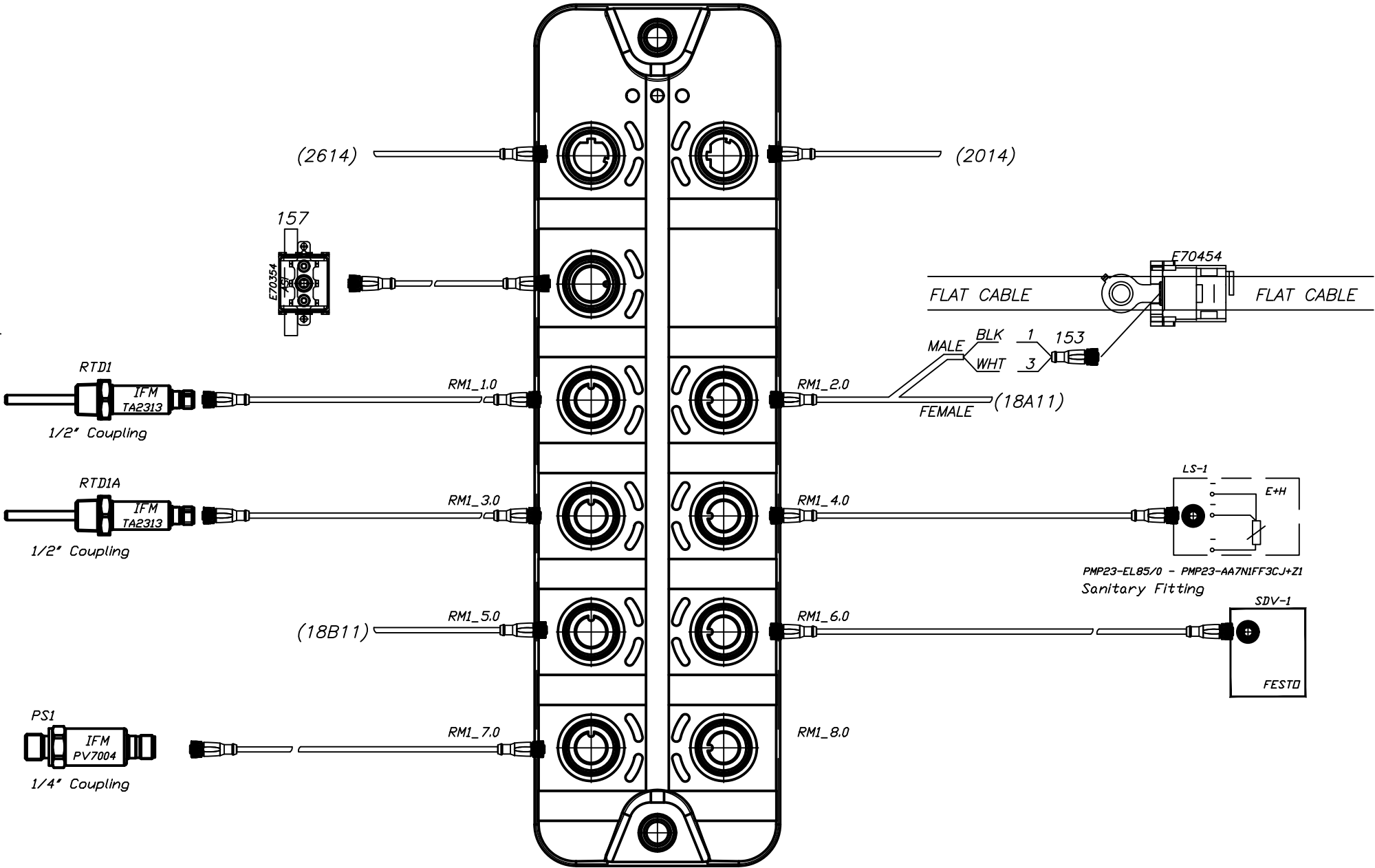
ETHERNET TO
REMOTE MODULE-1B

ANALOG BLOCK

ZONE-1
WATER LEVEL

STRAINER DRAIN-1
VALVE

SPARE
--



NOTES

WIRE COLOR CODE

LEGEND

SCALE: NONE

DRAWN BY: CH

DATE: 06-01-20

APP. CH

TITLE:

REMOTE MODULE-1
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970318

This Product is Listed by
UNDERWRITERS LABORATORIES, INC.
and Bears the Mark:

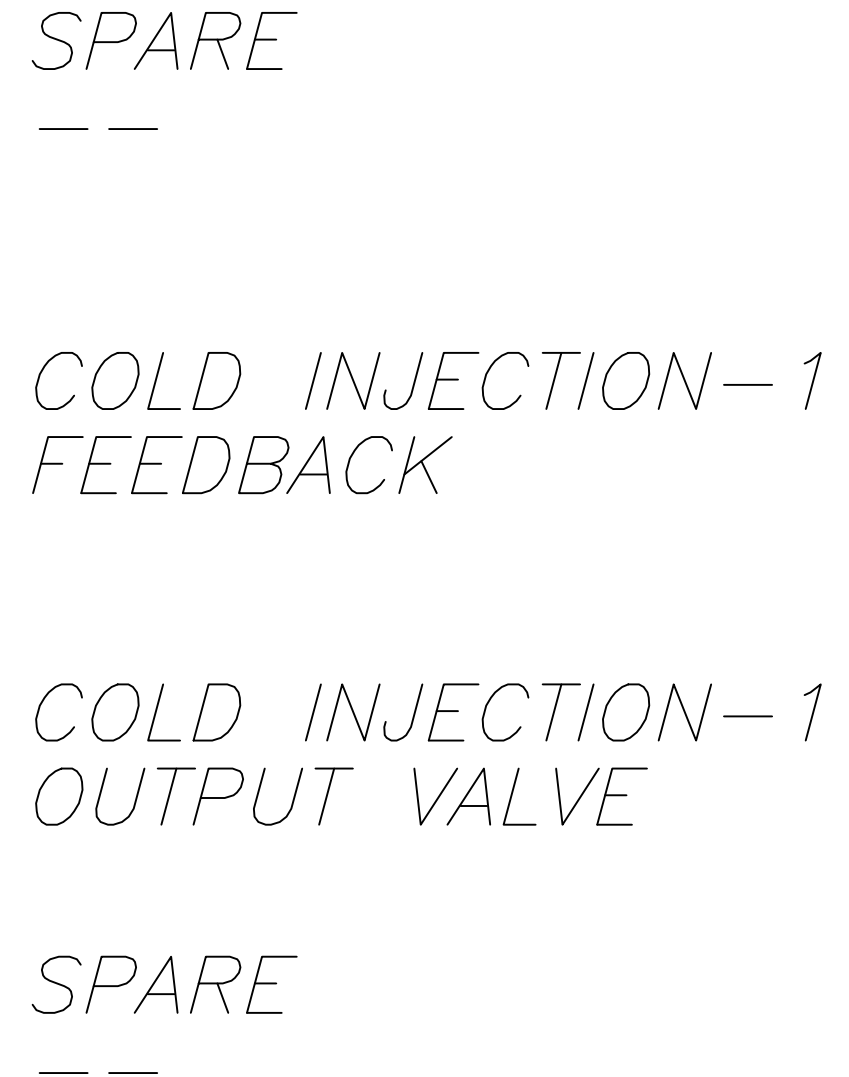


RED, BLACK, BLUE - 480VAC POWER CIRCUITS
BLACK - AC CONTROL CIRCUITS
BLUE - DC CONTROL CIRCUITS (OUTPUTS)
LIGHT BLUE - DC CONTROL CIRCUITS (INPUTS)
BLUE w/WHITE STRIPE - DC COMMON
YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE
GREEN - EQUIPMENT GROUND CONDUCTOR
WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)

POWER TERMINAL, 600V
GROUND TERMINAL, 600V
CONTROL TERMINAL, 600V
FUSED TERMINAL, 300V
NUMBERED CONTROL WIRE
WIRE IN ENCLOSURES
OTHER WIRING

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REMOTE MODULE-1A
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970318A

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$$c(U_L)_{US}$$

RED, BLACK, BLUE - 480VAC POWER CIRCUITS
BLACK - AC CONTROL CIRCUITS
BLUE - DC CONTROL CIRCUITS (OUTPUTS)
LIGHT BLUE - DC CONTROL CIRCUITS (INPUTS)
BLUE w/WHITE STRIPE - DC COMMON
YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE
GREEN - EQUIPMENT GROUND CONDUCTOR
WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)

-  POWER TERMINAL, 600V
-  GROUND TERMINAL, 600V
-  CONTROL TERMINAL, 600V
-  FUSED TERMINAL, 300V
-  NUMBERED CONTROL WIRE
-  WIRE IN ENCLOSURES
-  OTHER WIRING

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FROM AL1123
POWER/COMMS

INFEED CONVEYOR
MOTOR DISCONNECT

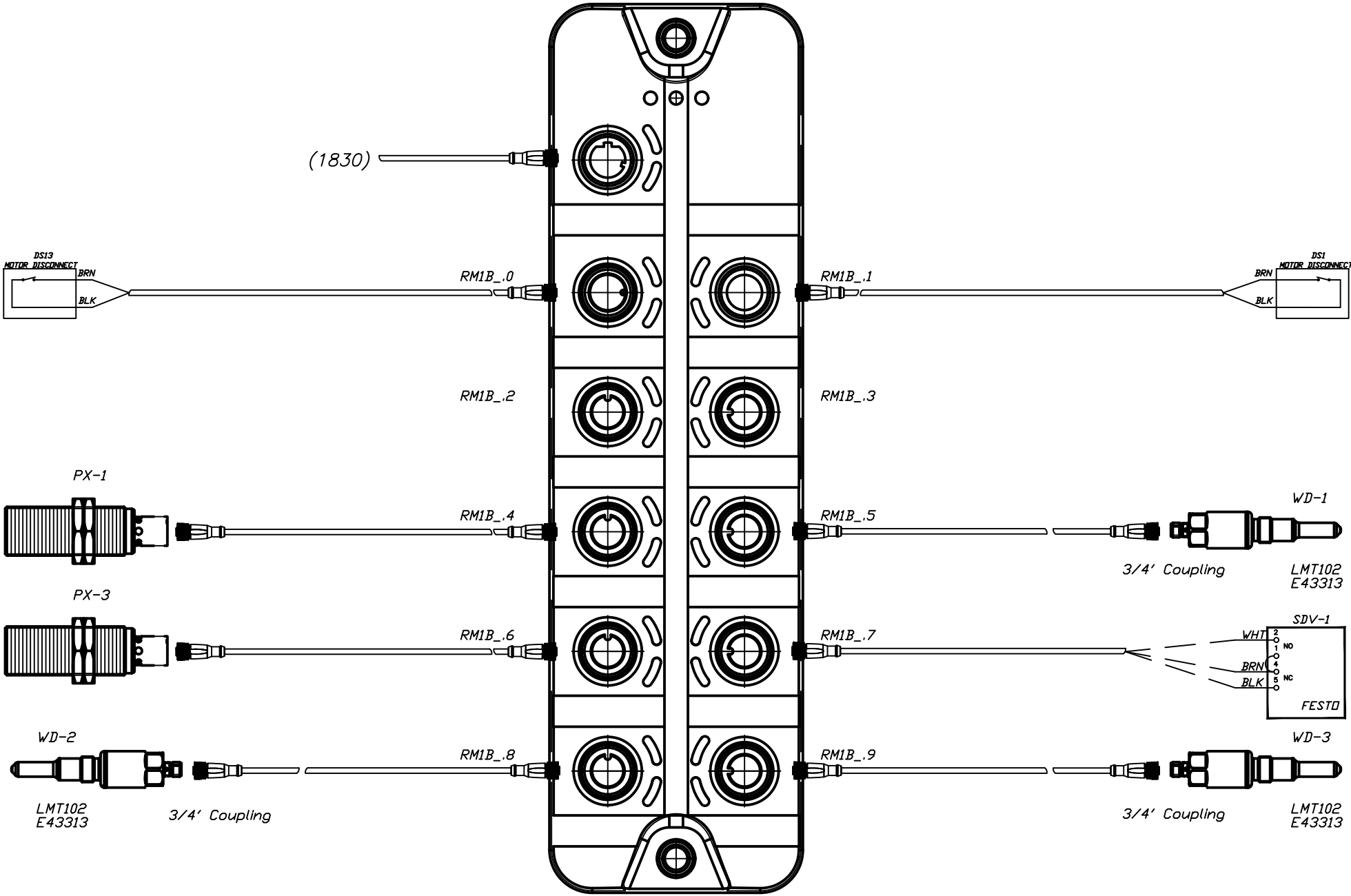
SPARE

INFEED
PROX-1

BELT LACE
PROX

TANK-2
WET/DRY SENSOR

REMOTE MODULE 1B
INPUTS
IFM AL2241



MAIN PUMP-1
MOTOR DISCONNECT

SPARE

TANK-1
WET/DRY SENSOR

STRAINER DRAINER-1
FEEDBACK

TANK-3
WET/DRY SENSOR

NOTES

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This Product is Listed by
UNDERWRITERS LABORATORIES, INC.
and Bears the Mark:

WIRE COLOR CODE

RED, BLACK, BLUE - 480VAC POWER CIRCUITS
BLACK - AC CONTROL CIRCUITS
BLUE - DC CONTROL CIRCUITS (OUTPUTS)
LIGHT BLUE - DC CONTROL CIRCUITS (INPUTS)
BLUE w/WHITE STRIPE - DC COMMON
YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE
GREEN - EQUIPMENT GROUND CONDUCTOR
WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)

LEGEND

■ POWER TERMINAL, 600V
◆ GROUND TERMINAL, 600V
● CONTROL TERMINAL, 600V
◻ FUSED TERMINAL, 300V
— NUMBERED CONTROL WIRE
— WIRE IN ENCLOSURES
-- OTHER WIRING

SCALE: NONE

DATE: 06-01-20

DRAWN BY: CH

APP. CH

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TITLE:

REMOTE MODULE-1B
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970318B

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REMOTE MODULE 2
192.168.200.52
IFM AL1123

ETHERNET FROM
REMOTE MODULE-1

24VDC FROM
MAIN CONTROL PANEL

ZONE TANK-2
WATER TEMP

ZONE SPRAY-2
WATER TEMP

MAIN PUMP-2
MOTOR DISCONNECT

ZONE-2
PUMP PRESSURE

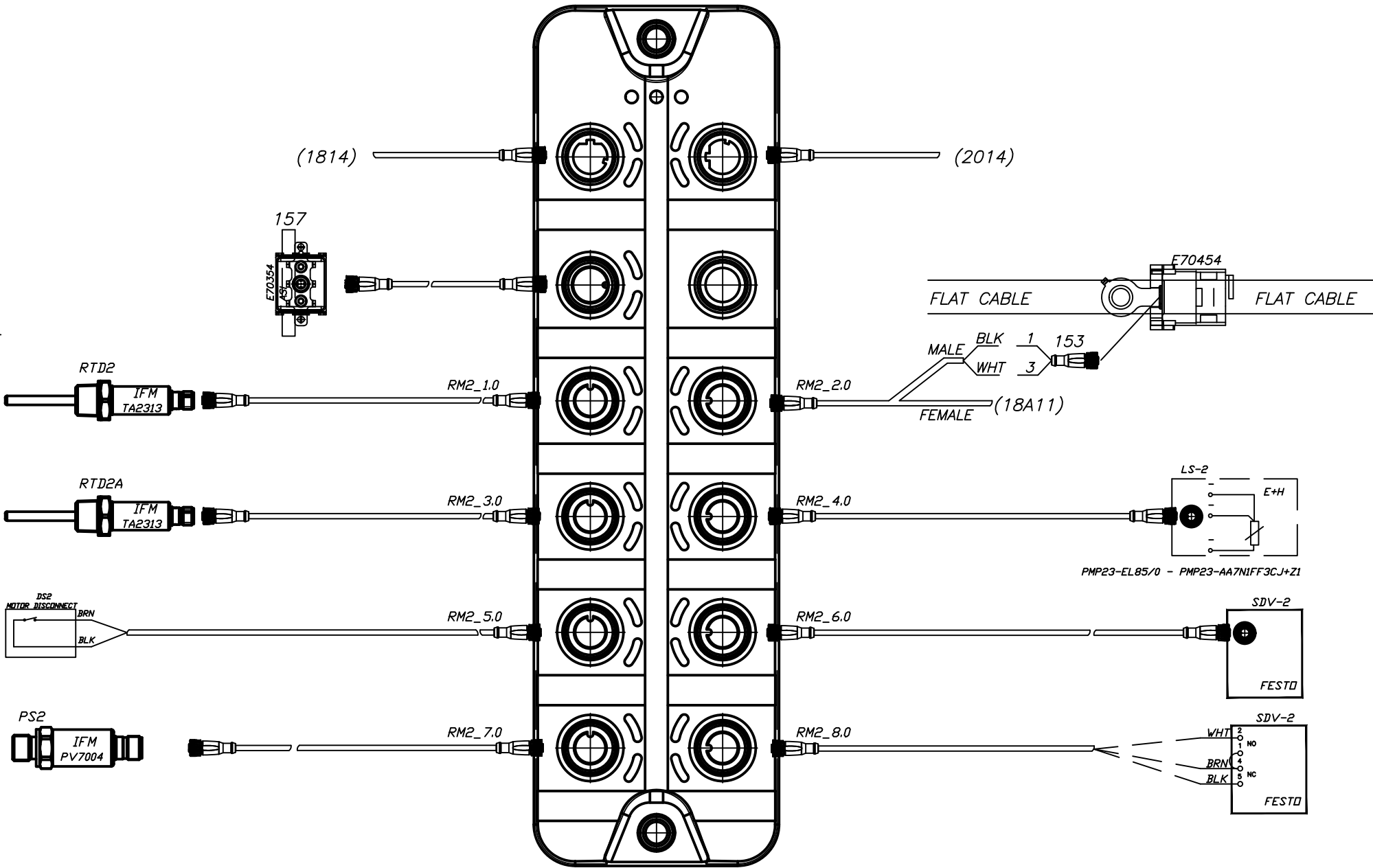
ETHERNET TO
REMOTE MODULE-3

TO IOLB-7214
ANALOG BLOCK

ZONE-2
WATER LEVEL

STRAINER DRAIN-2
VALVE

STRAINER DRAIN-2
FEEDBACK



NOTES

WIRE COLOR CODE

LEGEND

SCALE: NONE

DRAWN BY: CH

TITLE:

REMOTE MODULE-2
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970319

This Product is Listed by
UNDERWRITERS LABORATORIES, INC.
and Bears the Mark:



RED, BLACK, BLUE - 480VAC POWER CIRCUITS
BLACK - AC CONTROL CIRCUITS
BLUE - DC CONTROL CIRCUITS (OUTPUTS)
LIGHT BLUE - DC CONTROL CIRCUITS (INPUTS)
BLUE w/WHITE STRIPE - DC COMMON
YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE
GREEN - EQUIPMENT GROUND CONDUCTOR
WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)

■ POWER TERMINAL, 600V
◆ GROUND TERMINAL, 600V
● CONTROL TERMINAL, 600V
⊠ FUSED TERMINAL, 300V
➔ NUMBERED CONTROL WIRE
— WIRE IN ENCLOSURES
-- OTHER WIRING

DATE: 06-01-20

APP. CH

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SPARE
— —



COLD INJECTION-2
OUTPUT VALVE



REMOTE MODULE-2A
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970319A

APP. CH

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EPB970319A

$$c(U_L)_{US}$$

RED, BLACK, BLUE – 480VAC POWER CIRCUITS
BLACK – AC CONTROL CIRCUITS
BLUE – DC CONTROL CIRCUITS (OUTPUTS)
LIGHT BLUE – DC CONTROL CIRCUITS (INPUTS)
BLUE w/WHITE STRIPE – DC COMMON
YELLOW – INTERLOCK CIRCUITS FROM EXTERNAL SOURCE
GREEN – EQUIPMENT GROUND CONDUCTOR
WHITE – GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)

-  POWER TERMINAL, 600V
-  GROUND TERMINAL, 600V
-  CONTROL TERMINAL, 600V
-  FUSED TERMINAL, 300V
-  NUMBERED CONTROL WIRE
-  WIRE IN ENCLOSURES
-  OTHER WIRING

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ETHERNET FROM REMOTE MODULE-2

24VDC FROM
MAIN CONTROL PANEL

ZONE TANK-3
WATER TEMP

ZONE SPRAY-3
WATER TEMP

MAIN PUMP-3
MOTOR DISCONNECT

ZONE-3
PUMP PRESSURE



*This Product is Listed by
UNDERWRITERS LABORATORIES, INC.
and Bears the Mark:*



RED, BLACK, BLUE - 480VAC POWER CIRCUITS
BLACK - AC CONTROL CIRCUITS
BLUE - DC CONTROL CIRCUITS (OUTPUTS)
LIGHT BLUE - DC CONTROL CIRCUITS (INPUTS)
BLUE w/WHITE STRIPE - DC COMMON
YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE
GREEN - EQUIPMENT GROUND CONDUCTOR
WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)

- ⊕— POWER TERMINAL, 600V
- ⊕— GROUND TERMINAL, 600V
- ⊕— CONTROL TERMINAL, 600V
- ⊕—□—⊕ FUSED TERMINAL, 300V
- NUMBERED CONTROL WIRE
- WIRE IN ENCLOSURES
- OTHER WIRING

SCALE: NONE

DATE: 06-01-20

This drawing is the property of G. C. Evans Sales & Mfg. Co. Inc. It is loaned upon the express condition that it shall not be copied or reproduced in any manner, that it shall not be submitted to others for examination without the consent of this company, that it shall not be used in any other way detrimental to the interest of G. C. Evans Sales & Mfg. Co. Inc., and that it shall be returned upon demand.

DRAWN BY: CH

APP.	CH
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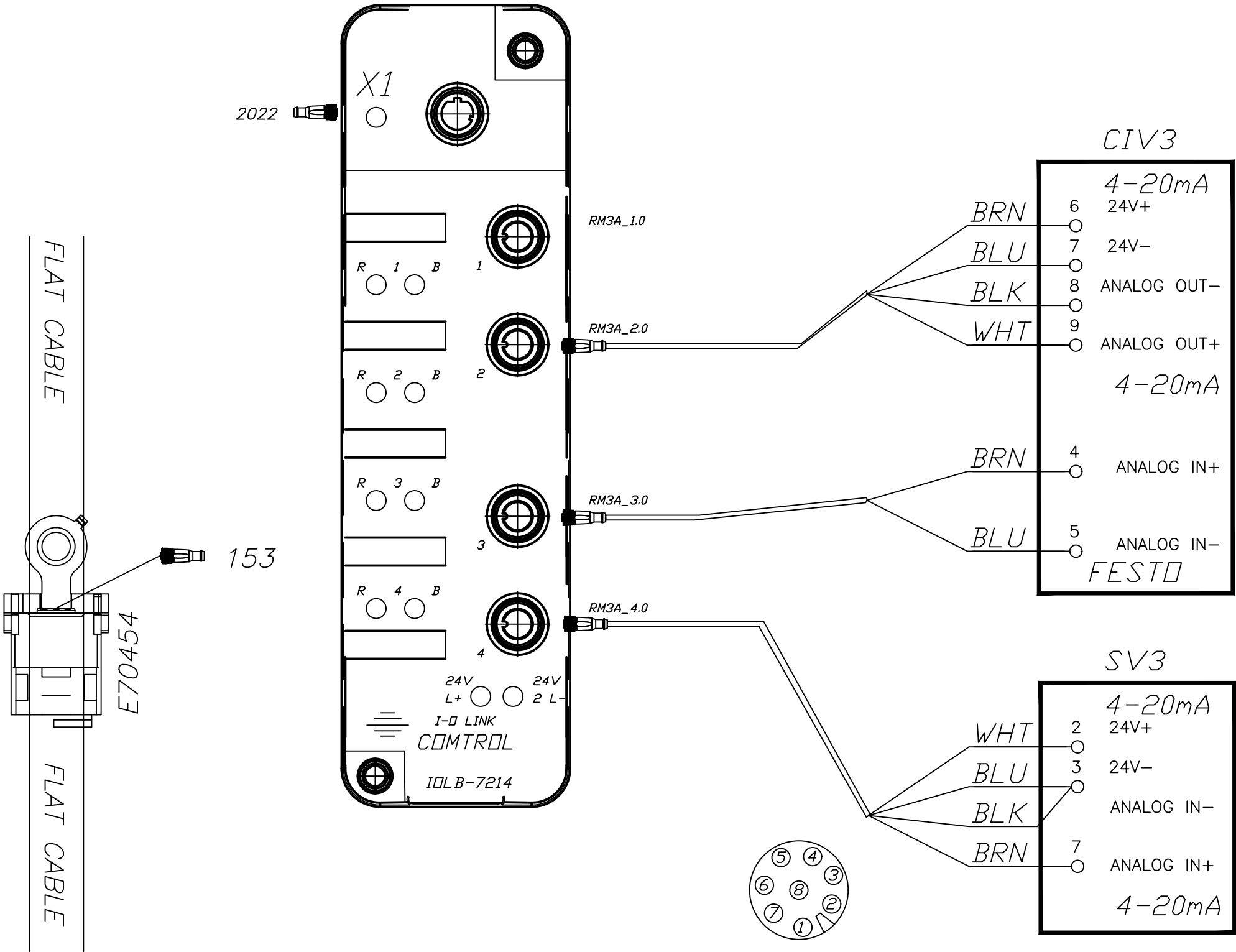
TITLE:

REMOTE MODULE-3
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970320

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REMOTE MODULE 3A
ANALOG
IOLB-7214

SPARE
--



COLD INJECTION-3
FEEDBACK

COLD INJECTION-3
OUTPUT VALVE

STEAM INJECTION-3
VALVE

NOTES

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5.

This Product is Listed by
UNDERWRITERS LABORATORIES, INC.
and Bears the Mark:

cULus

WIRE COLOR CODE

RED, BLACK, BLUE - 480VAC POWER CIRCUITS
BLACK - AC CONTROL CIRCUITS
BLUE - DC CONTROL CIRCUITS (OUTPUTS)
LIGHT BLUE - DC CONTROL CIRCUITS (INPUTS)
BLUE w/WHITE STRIPE - DC COMMON
YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE
GREEN - EQUIPMENT GROUND CONDUCTOR
WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)

LEGEND

POWER TERMINAL, 600V
GROUND TERMINAL, 600V
CONTROL TERMINAL, 600V
FUSED TERMINAL, 300V
NUMBERED CONTROL WIRE
WIRE IN ENCLOSURES
OTHER WIRING

SCALE: NONE

DATE: 06-01-20

DRAWN BY: CH

APP. CH

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TITLE:

REMOTE MODULE-3A
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970320A

2100 REVIEW SIGNATURE

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REMOTE MODULE 4
192.168.200.54
IFM AL1123

ETHERNET FROM
REMOTE MODULE-3

24VDC FROM
MAIN CONTROL PANEL

ZONE TANK-4
WATER TEMP

ZONE SPRAY-4
WATER TEMP

AIR KNIFE HEIGHT

ZONE-4
PUMP PRESSURE

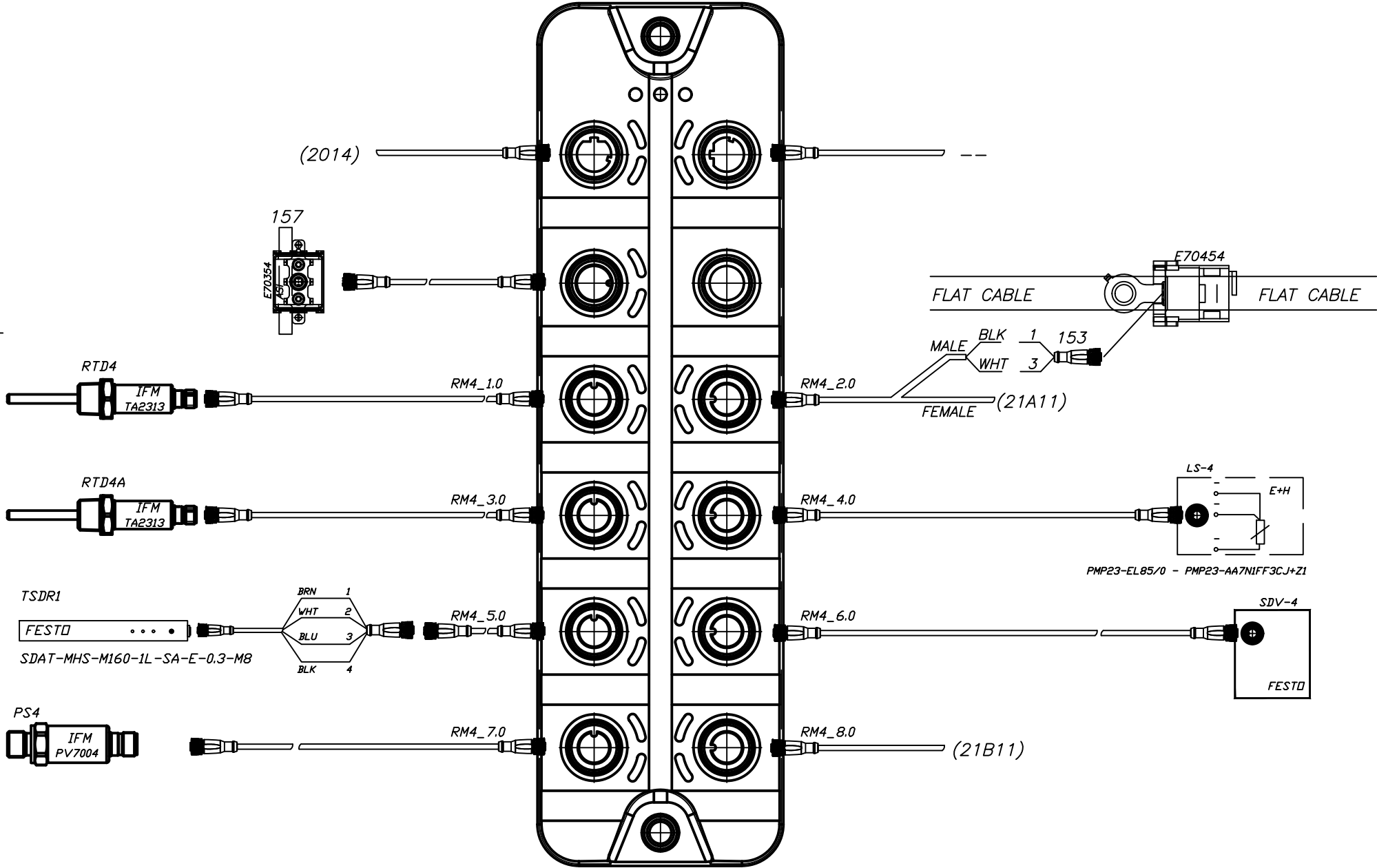
ETHERNET TO
JUNCTION BOX-1

TO IOLB-7214
ANALOG BLOCK

ZONE-4
WATER LEVEL

STRAINER DRAIN-4
VALVE

TO AL2241
INPUT MODULE



NOTES

- 1.
- 2.
- 3.
- 4.
- 5.

This Product is Listed by
UNDERWRITERS LABORATORIES, INC.
and Bears the Mark:

WIRE COLOR CODE

RED, BLACK, BLUE - 480VAC POWER CIRCUITS
BLACK - AC CONTROL CIRCUITS
BLUE - DC CONTROL CIRCUITS (OUTPUTS)
LIGHT BLUE - DC CONTROL CIRCUITS (INPUTS)
BLUE w/WHITE STRIPE - DC COMMON
YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE
GREEN - EQUIPMENT GROUND CONDUCTOR
WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)

LEGEND

- POWER TERMINAL, 600V
- ◆ GROUND TERMINAL, 600V
- CONTROL TERMINAL, 600V
- ⊠ FUSED TERMINAL, 300V
- ➔ NUMBERED CONTROL WIRE
- WIRE IN ENCLOSURES
- OTHER WIRING

SCALE: NONE

DATE: 06-01-20

DRAWN BY: CH

APP. CH

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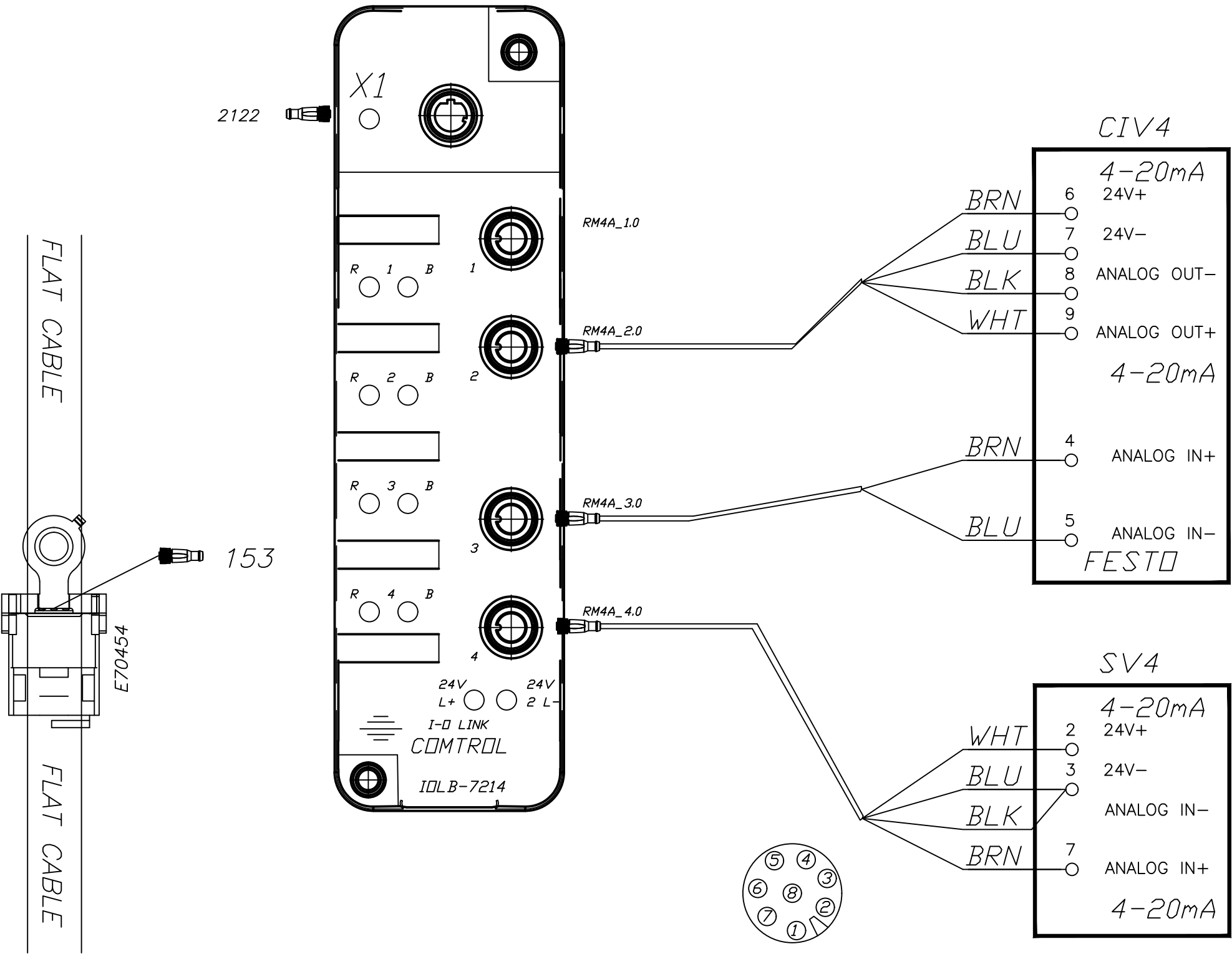
TITLE:

REMOTE MODULE-4
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970321

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REMOTE MODULE 4A
ANALOG
IOLB-7214

SPARE
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COLD INJECTION-4
FEEDBACK

COLD INJECTION-4
OUTPUT VALVE

STEAM INJECTION-4
VALVE

NOTES

1.
2.
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5.

This Product is Listed by
UNDERWRITERS LABORATORIES, INC.
and Bears the Mark:

UL US

WIRE COLOR CODE

RED, BLACK, BLUE - 480VAC POWER CIRCUITS
BLACK - AC CONTROL CIRCUITS
BLUE - DC CONTROL CIRCUITS (OUTPUTS)
LIGHT BLUE - DC CONTROL CIRCUITS (INPUTS)
BLUE w/WHITE STRIPE - DC COMMON
YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE
GREEN - EQUIPMENT GROUND CONDUCTOR
WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)

LEGEND

POWER TERMINAL, 600V
GROUND TERMINAL, 600V
CONTROL TERMINAL, 600V
FUSED TERMINAL, 300V
NUMBERED CONTROL WIRE
WIRE IN ENCLOSURES
OTHER WIRING

SCALE: NONE

DATE: 06-01-20

DRAWN BY: CH

APP. CH

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TITLE:

REMOTE MODULE-4A
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970321A

21B01
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FROM AL1123
POWER/COMMS

STRAINER DRAIN-3
FEEDBACK

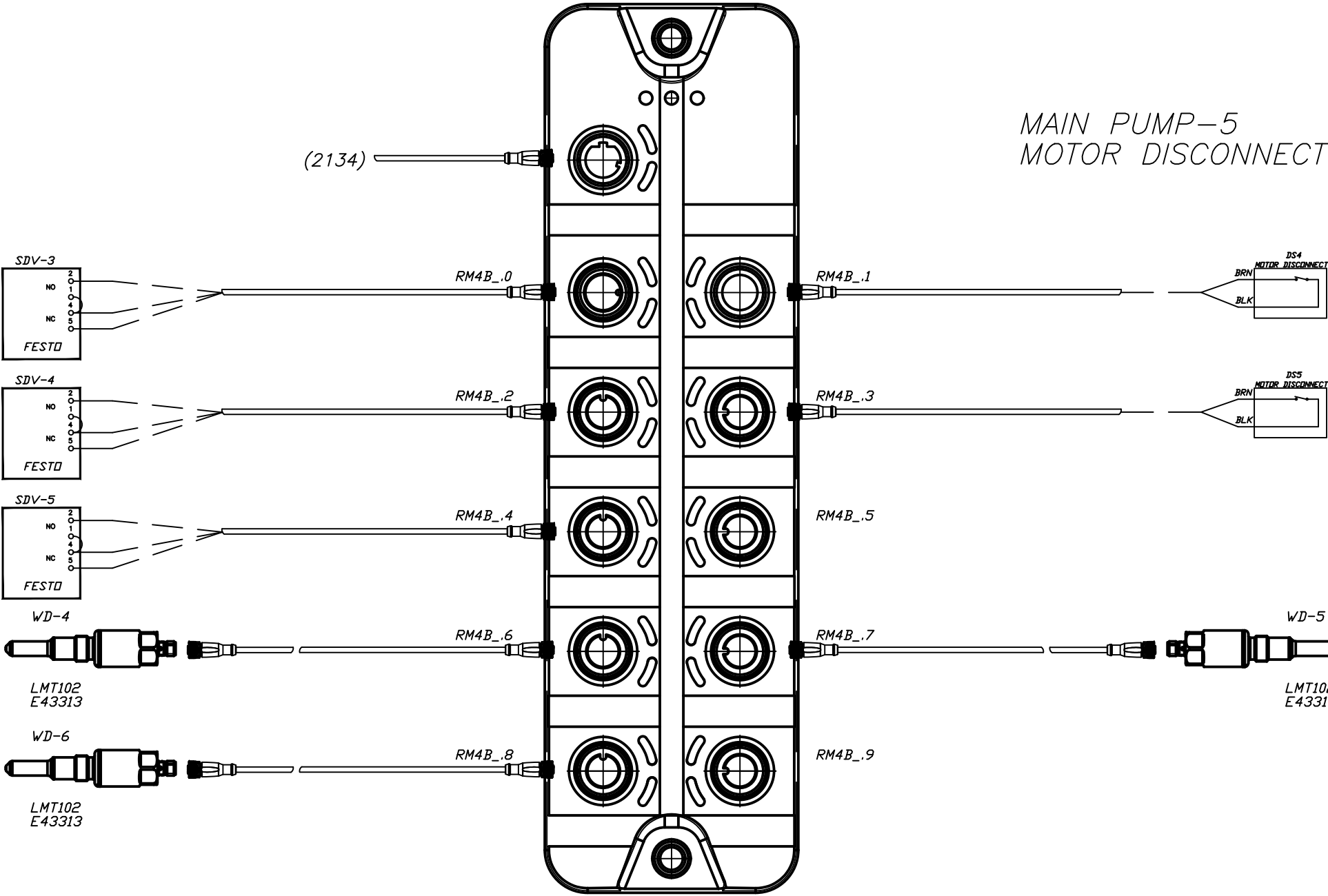
STRAINER DRAIN-4
FEEDBACK

STRAINER DRAIN-5
FEEDBACK

TANK-4
WET/DRY SENSOR

TANK-6
WET/DRY SENSOR

REMOTE MODULE 4B
INPUTS
IFM AL2241



MAIN PUMP-5
MOTOR DISCONNECT

MAIN PUMP-4
MOTOR DISCONNECT

MAIN PUMP-5
MOTOR DISCONNECT

SPARE
--

TANK-5
WET/DRY SENSOR

SPARE
--

NOTES

1.
2.
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5.

This Product is Listed by
UNDERWRITERS LABORATORIES, INC.
and Bears the Mark:

US

WIRE COLOR CODE

RED, BLACK, BLUE - 480VAC POWER CIRCUITS
BLACK - AC CONTROL CIRCUITS
BLUE - DC CONTROL CIRCUITS (OUTPUTS)
LIGHT BLUE - DC CONTROL CIRCUITS (INPUTS)
BLUE w/WHITE STRIPE - DC COMMON
YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE
GREEN - EQUIPMENT GROUND CONDUCTOR
WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)

LEGEND

POWER TERMINAL, 600V
 GROUND TERMINAL, 600V
 CONTROL TERMINAL, 600V
 FUSED TERMINAL, 300V
 NUMBERED CONTROL WIRE
 WIRE IN ENCLOSURES
 OTHER WIRING

SCALE: NONE

DATE: 06-01-20

DRAWN BY: CH

APP. CH

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TITLE:

REMOTE MODULE-4B
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970321B

REVIEW SIGNATURE

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REMOTE MODULE 5
192.168.200.55
IFM AL1123

ETHERNET FROM
JUNCTION BOX-1

24VDC FROM
MAIN CONTROL PANEL

ZONE TANK-5
WATER TEMP

ZONE SPRAY-5
WATER TEMP

SPARE
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ZONE-5
PUMP PRESSURE

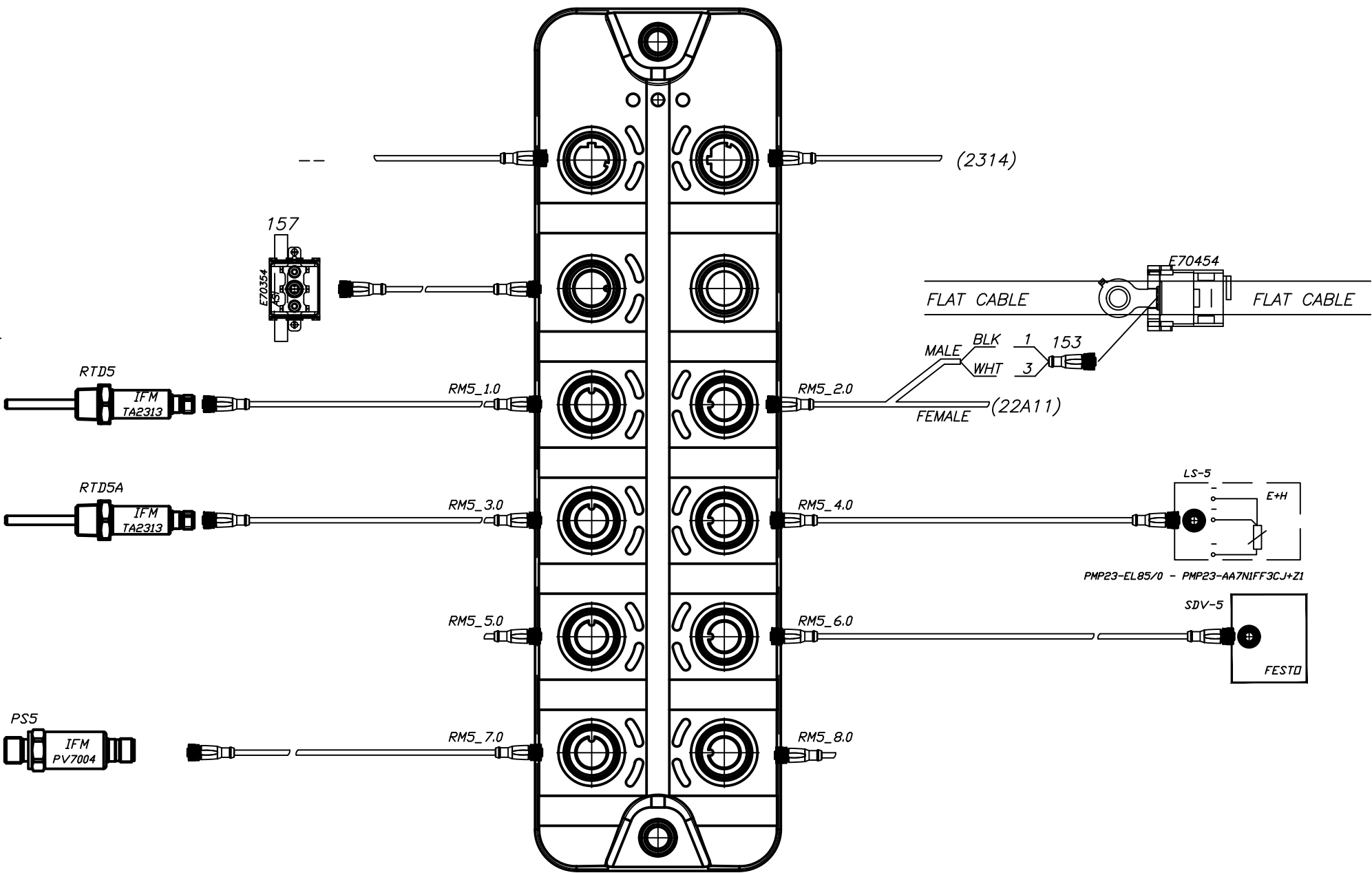
ETHERNET TO
REMOTE MODULE-6

TO IOLB-7214
ANALOG BLOCK

ZONE-5
WATER LEVEL

STRAINER DRAIN-5
VALVE

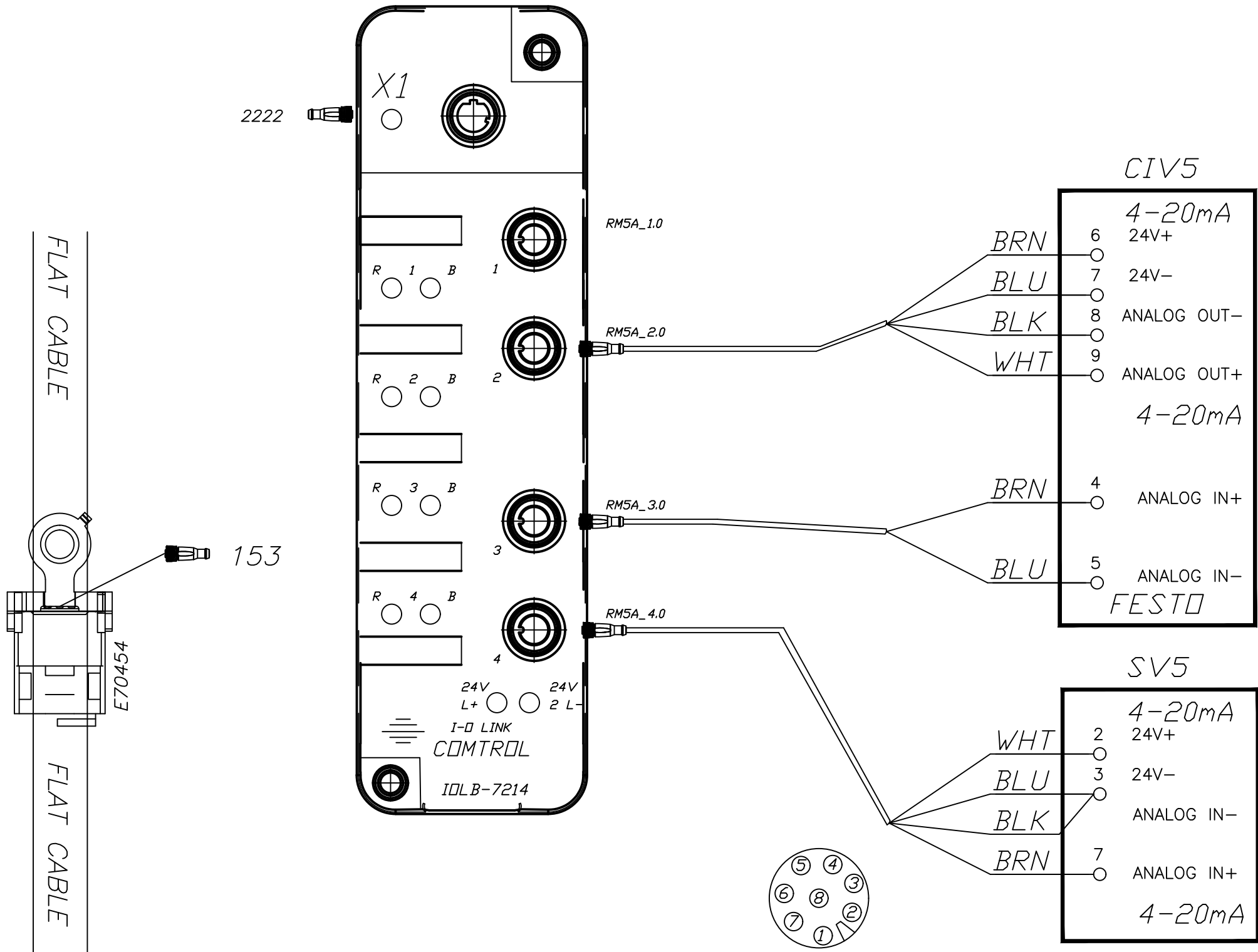
SPARE
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1. 2. 3. 4. 5.	NOTES	WIRE COLOR CODE	LEGEND	SCALE: NONE	DRAWN BY: CH	TITLE: REMOTE MODULE-5 P-1048 SD PASTEURIZER BLUE MARBLE INDIANAPOLIS, IN EPB970322
	This Product is Listed by UNDERWRITERS LABORATORIES, INC. and Bears the Mark: 	RED, BLACK, BLUE - 480VAC POWER CIRCUITS BLACK - AC CONTROL CIRCUITS BLUE - DC CONTROL CIRCUITS (OUTPUTS) LIGHT BLUE - DC CONTROL CIRCUITS (INPUTS) BLUE w/WHITE STRIPE - DC COMMON YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE GREEN - EQUIPMENT GROUND CONDUCTOR WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)	 POWER TERMINAL, 600V  GROUND TERMINAL, 600V  CONTROL TERMINAL, 600V  FUSED TERMINAL, 300V  NUMBERED CONTROL WIRE  WIRE IN ENCLOSURES  OTHER WIRING	DATE: 06-01-20	APP. CH	
				This drawing is the property of G. C. Evans Sales & Mfg. Co. Inc. It is loaned upon the express condition that it shall not be copied or reproduced in any manner, that it shall not be submitted to others for examination without the consent of this company, that it shall not be used in any other way detrimental to the interest of G. C. Evans Sales & Mfg. Co. Inc., and that it shall be returned upon demand.		

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REMOTE MODULE 5A
ANALOG
IOLB-7214



SPARE

COLD INJECTION-5
FEEDBACK

COLD INJECTION-5
OUTPUT VALVE

STEAM INJECTION-5
VALVE

NOTES

1.
2.
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5.

This Product is Listed by
UNDERWRITERS LABORATORIES, INC.
and Bears the Mark:

cULus

WIRE COLOR CODE

RED, BLACK, BLUE - 480VAC POWER CIRCUITS
BLACK - AC CONTROL CIRCUITS
BLUE - DC CONTROL CIRCUITS (OUTPUTS)
LIGHT BLUE - DC CONTROL CIRCUITS (INPUTS)
BLUE w/WHITE STRIPE - DC COMMON
YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE
GREEN - EQUIPMENT GROUND CONDUCTOR
WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)

LEGEND

—■— POWER TERMINAL, 600V
—◆— GROUND TERMINAL, 600V
—●— CONTROL TERMINAL, 600V
—□— FUSED TERMINAL, 300V
—●— NUMBERED CONTROL WIRE
— WIRE IN ENCLOSURES
-- OTHER WIRING

SCALE: NONE

DATE: 06-01-20

DRAWN BY: CH

APP. CH

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TITLE:

REMOTE MODULE-5A
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970322A

REVIEW SIGNATURE

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REMOTE MODULE 6
192.168.200.56
IFM AL1123

ETHERNET FROM
REMOTE MODULE-5

24VDC FROM
MAIN CONTROL PANEL

ZONE TANK-6
WATER TEMP

ZONE SPRAY-6
WATER TEMP

SPARE
--

ZONE-6
PUMP PRESSURE

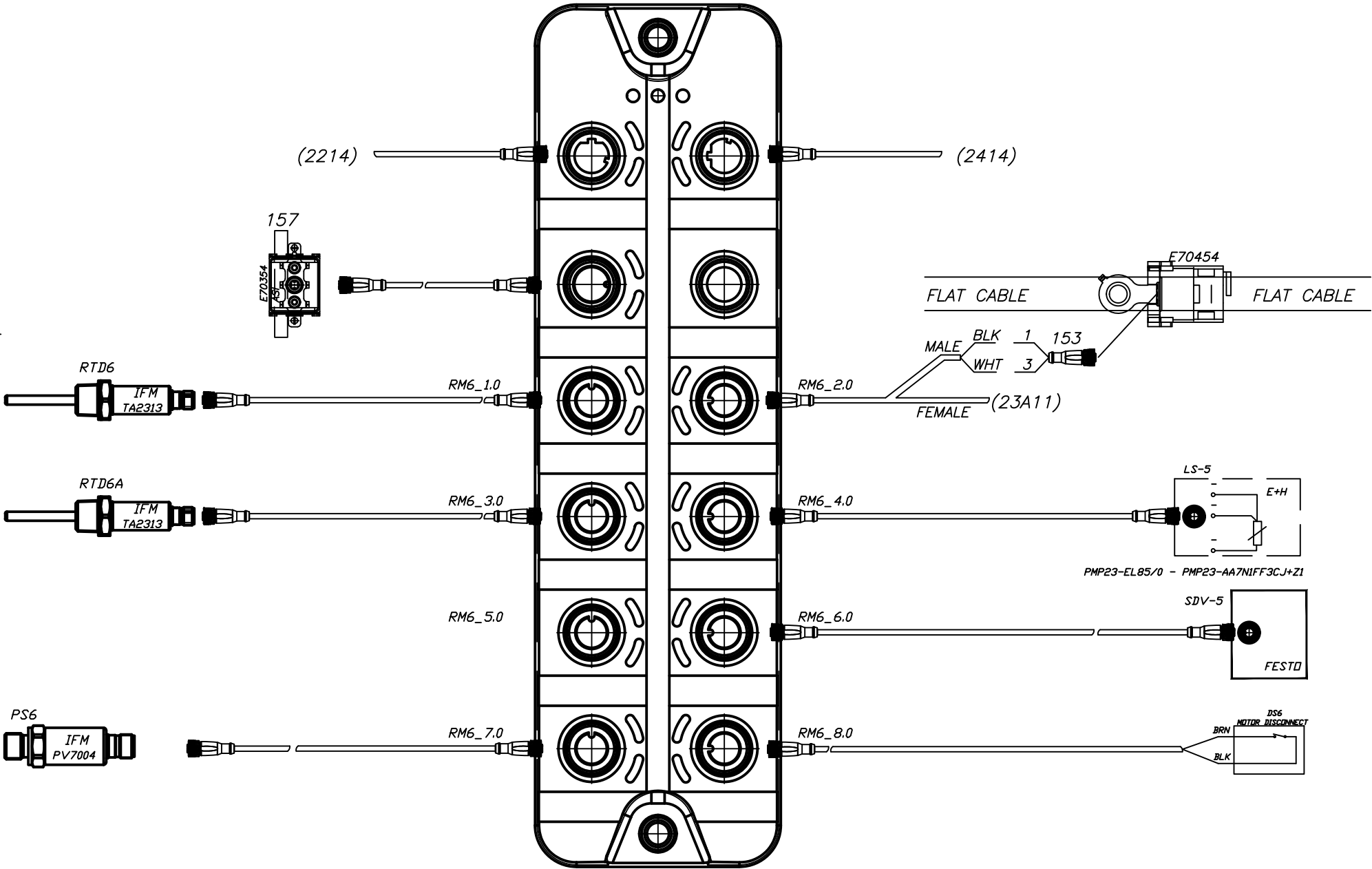
ETHERNET TO
REMOTE MODULE-7

TO IOLB-7214
ANALOG BLOCK

ZONE-6
WATER LEVEL

STRAINER DRAIN-6
VALVE

MAIN PUMP-6
MOTOR DISCONNECT



NOTES

- 1.
- 2.
- 3.
- 4.
- 5.

This Product is Listed by
UNDERWRITERS LABORATORIES, INC.
and Bears the Mark:



WIRE COLOR CODE

- RED, BLACK, BLUE - 480VAC POWER CIRCUITS
- BLACK - AC CONTROL CIRCUITS
- BLUE - DC CONTROL CIRCUITS (OUTPUTS)
- LIGHT BLUE - DC CONTROL CIRCUITS (INPUTS)
- BLUE w/WHITE STRIPE - DC COMMON
- YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE
- GREEN - EQUIPMENT GROUND CONDUCTOR
- WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)

LEGEND

- POWER TERMINAL, 600V
- GROUND TERMINAL, 600V
- CONTROL TERMINAL, 600V
- FUSED TERMINAL, 300V
- NUMBERED CONTROL WIRE
- WIRE IN ENCLOSURES
- OTHER WIRING

SCALE: NONE

DATE: 06-01-20

DRAWN BY: CH

APP. CH

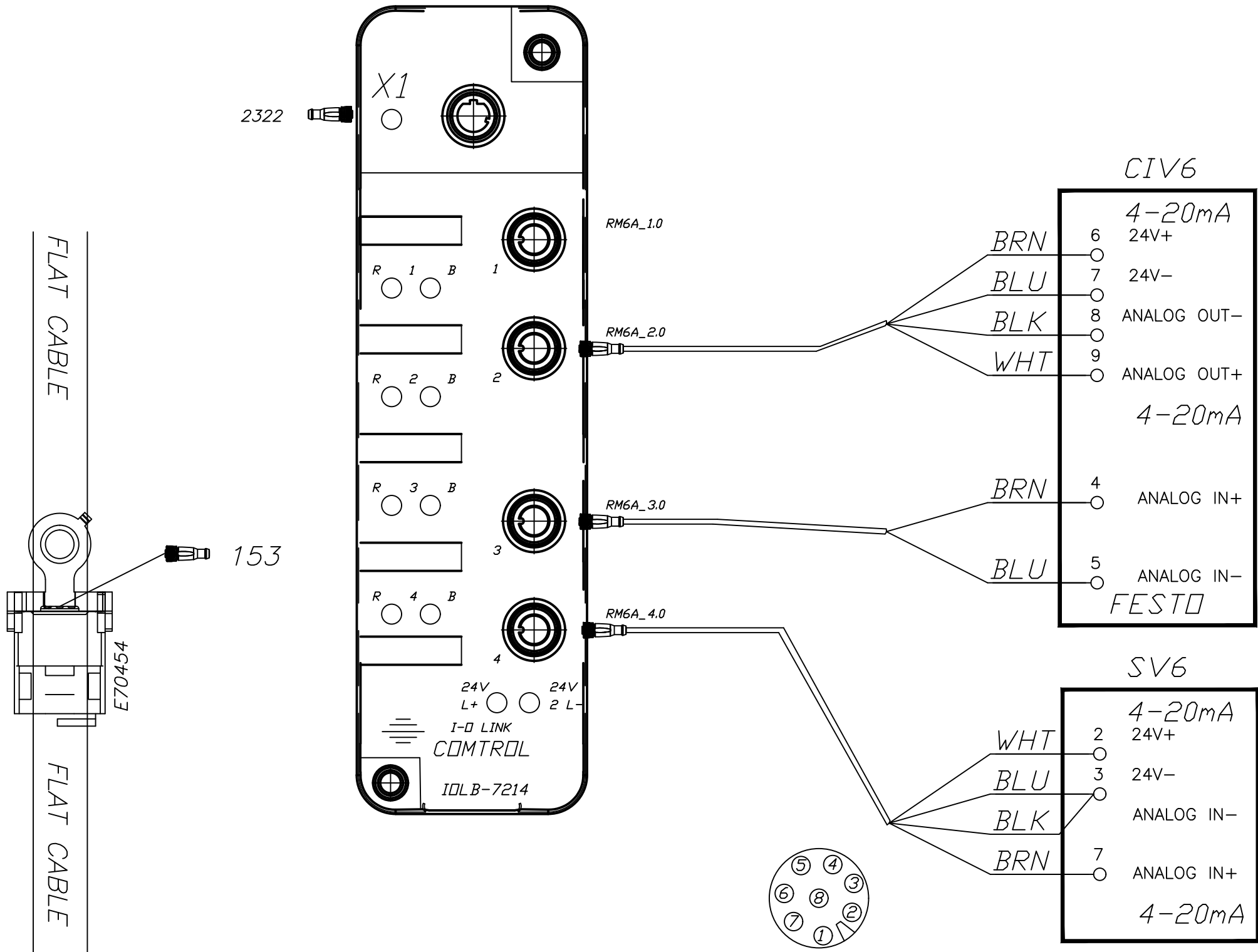
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TITLE:

REMOTE MODULE-6
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970323

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REMOTE MODULE 6A
ANALOG
IOLB-7214



SPARE
— —

COLD INJECTION-6
FEEDBACK

COLD INJECTION-6
OUTPUT VALVE

STEAM INJECTION-6
VALVE

NOTES

1.
2.
3.
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5.

This Product is Listed by
UNDERWRITERS LABORATORIES, INC.
and Bears the Mark:

cULus

WIRE COLOR CODE

RED, BLACK, BLUE - 480VAC POWER CIRCUITS
BLACK - AC CONTROL CIRCUITS
BLUE - DC CONTROL CIRCUITS (OUTPUTS)
LIGHT BLUE - DC CONTROL CIRCUITS (INPUTS)
BLUE w/WHITE STRIPE - DC COMMON
YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE
GREEN - EQUIPMENT GROUND CONDUCTOR
WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)

LEGEND

POWER TERMINAL, 600V
GROUND TERMINAL, 600V
CONTROL TERMINAL, 600V
FUSED TERMINAL, 300V
NUMBERED CONTROL WIRE
WIRE IN ENCLOSURES
OTHER WIRING

SCALE: NONE

DATE: 06-01-20

DRAWN BY: CH

APP. CH

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TITLE:

REMOTE MODULE-6A
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970323A

REVIEW SIGNATURE

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REMOTE MODULE 7
192.168.200.57
IFM AL1123

ETHERNET FROM
REMOTE MODULE-5

24VDC FROM
MAIN CONTROL PANEL

ZONE TANK-7
WATER TEMP

ZONE SPRAY-7
WATER TEMP

AIR KNIFE-UP
SOLENOID

ZONE-7
PUMP PRESSURE

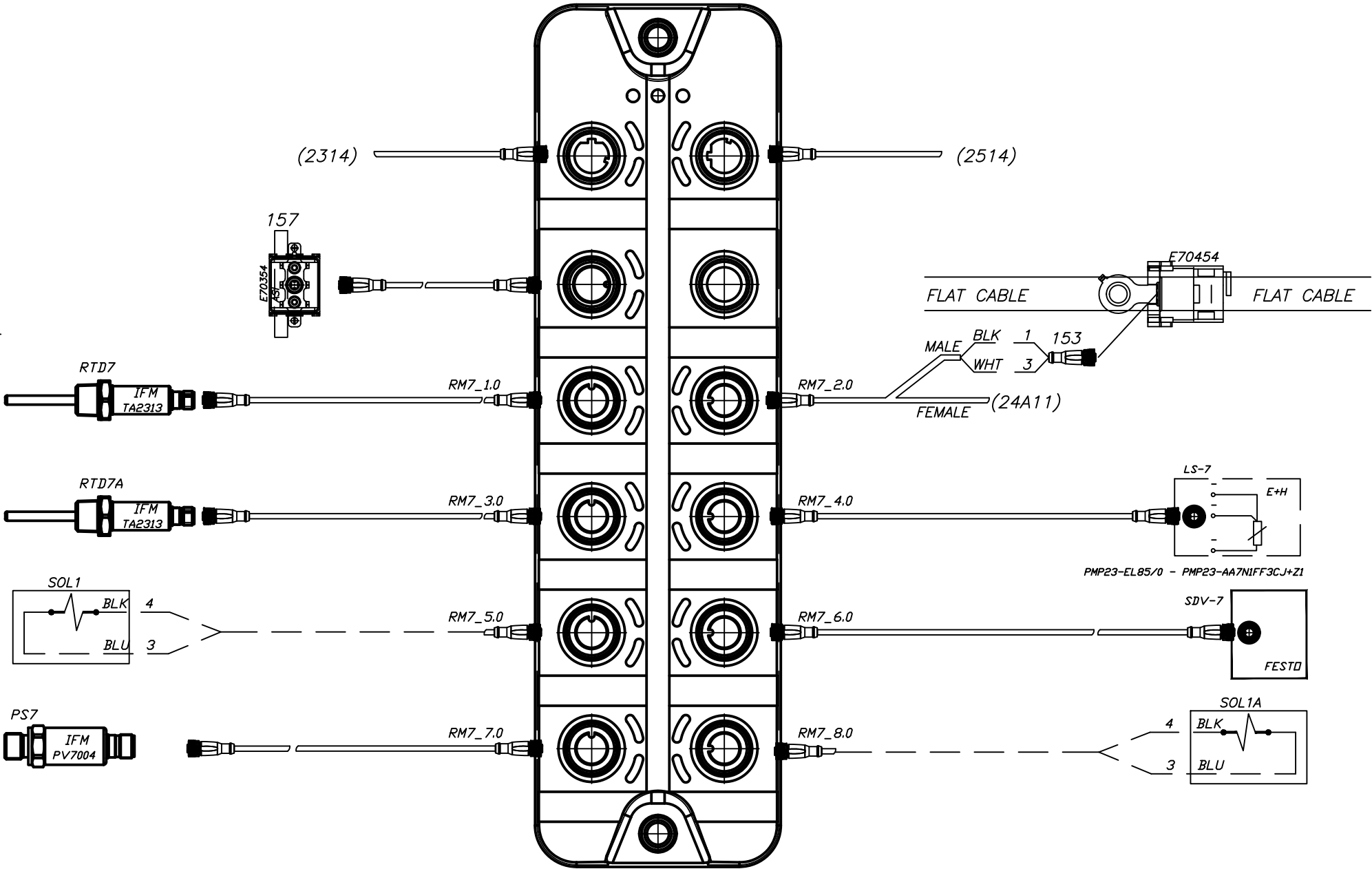
ETHERNET TO
REMOTE MODULE-8

TO IOLB-7214
ANALOG BLOCK

ZONE-7
WATER LEVEL

STRAINER DRAIN-7
VALVE

AIR KNIFE-DN
SOLENOID



NOTES

- 1.
- 2.
- 3.
- 4.
- 5.

This Product is Listed by
UNDERWRITERS LABORATORIES, INC.
and Bears the Mark:



WIRE COLOR CODE

- RED, BLACK, BLUE - 480VAC POWER CIRCUITS
- BLACK - AC CONTROL CIRCUITS
- BLUE - DC CONTROL CIRCUITS (OUTPUTS)
- LIGHT BLUE - DC CONTROL CIRCUITS (INPUTS)
- BLUE w/WHITE STRIPE - DC COMMON
- YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE
- GREEN - EQUIPMENT GROUND CONDUCTOR
- WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)

LEGEND

- POWER TERMINAL, 600V
- ◆ GROUND TERMINAL, 600V
- CONTROL TERMINAL, 600V
- ⊠ FUSED TERMINAL, 300V
- NUMBERED CONTROL WIRE
- WIRE IN ENCLOSURES
- OTHER WIRING

SCALE: NONE

DATE: 06-01-20

DRAWN BY: CH

APP. CH

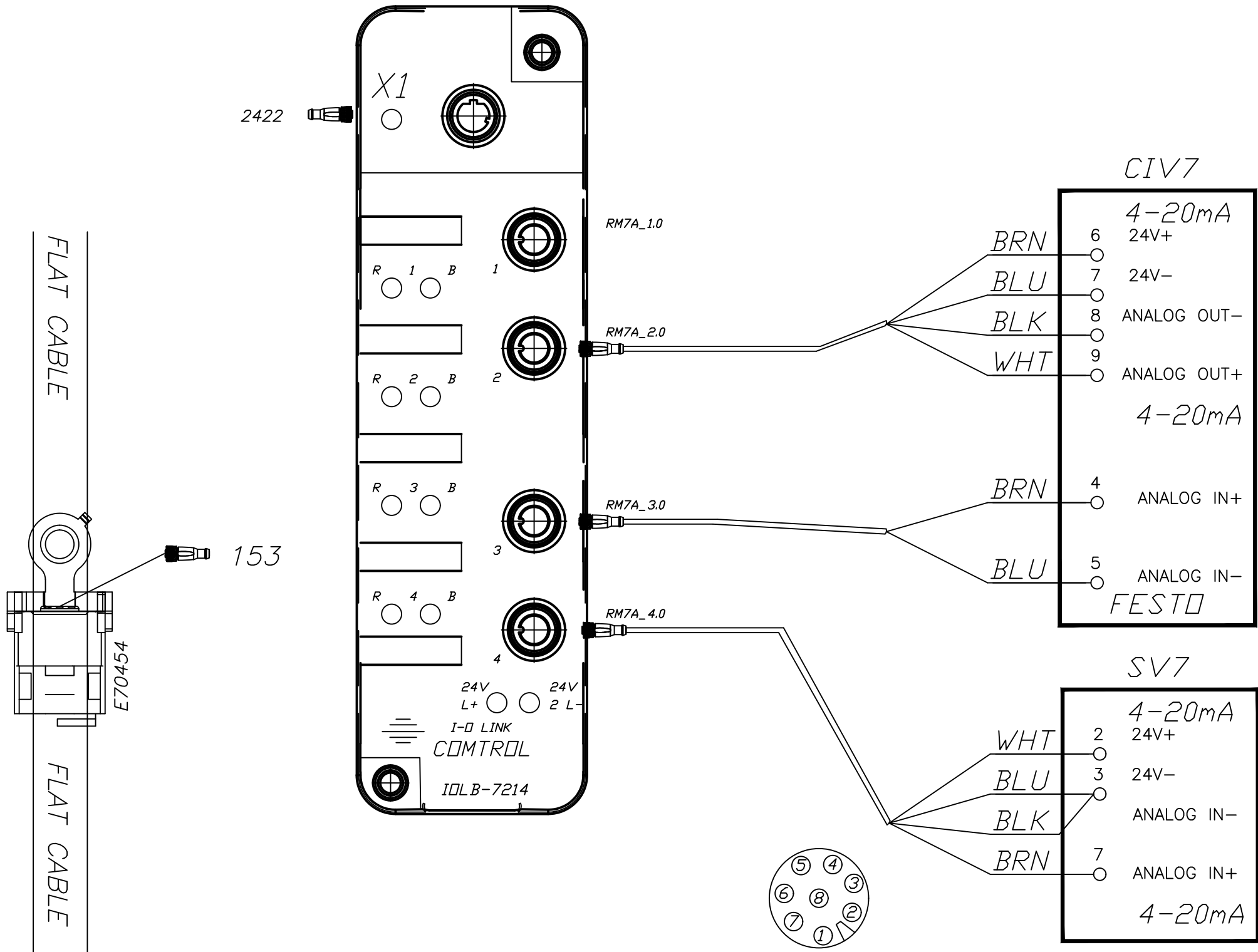
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TITLE:

REMOTE MODULE-7
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970324

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REMOTE MODULE 7A
ANALOG
IOLB-7214



SPARE
— —

COLD INJECTION-7
FEEDBACK

COLD INJECTION-7
OUTPUT VALVE

STEAM INJECTION-7
VALVE

NOTES

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5.

This Product is Listed by
UNDERWRITERS LABORATORIES, INC.
and Bears the Mark:

cULus

WIRE COLOR CODE

RED, BLACK, BLUE - 480VAC POWER CIRCUITS
BLACK - AC CONTROL CIRCUITS
BLUE - DC CONTROL CIRCUITS (OUTPUTS)
LIGHT BLUE - DC CONTROL CIRCUITS (INPUTS)
BLUE w/WHITE STRIPE - DC COMMON
YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE
GREEN - EQUIPMENT GROUND CONDUCTOR
WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)

LEGEND

—■— POWER TERMINAL, 600V
—◆— GROUND TERMINAL, 600V
—●— CONTROL TERMINAL, 600V
—□— FUSED TERMINAL, 300V
—●— NUMBERED CONTROL WIRE
— WIRE IN ENCLOSURES
-- OTHER WIRING

SCALE: NONE

DATE: 06-01-20

DRAWN BY: CH

APP. CH

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TITLE:

REMOTE MODULE-7A
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970324A

REVIEW SIGNATURE

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REMOTE MODULE 8
192.168.200.58
IFM AL1123

ETHERNET FROM
REMOTE MODULE-7

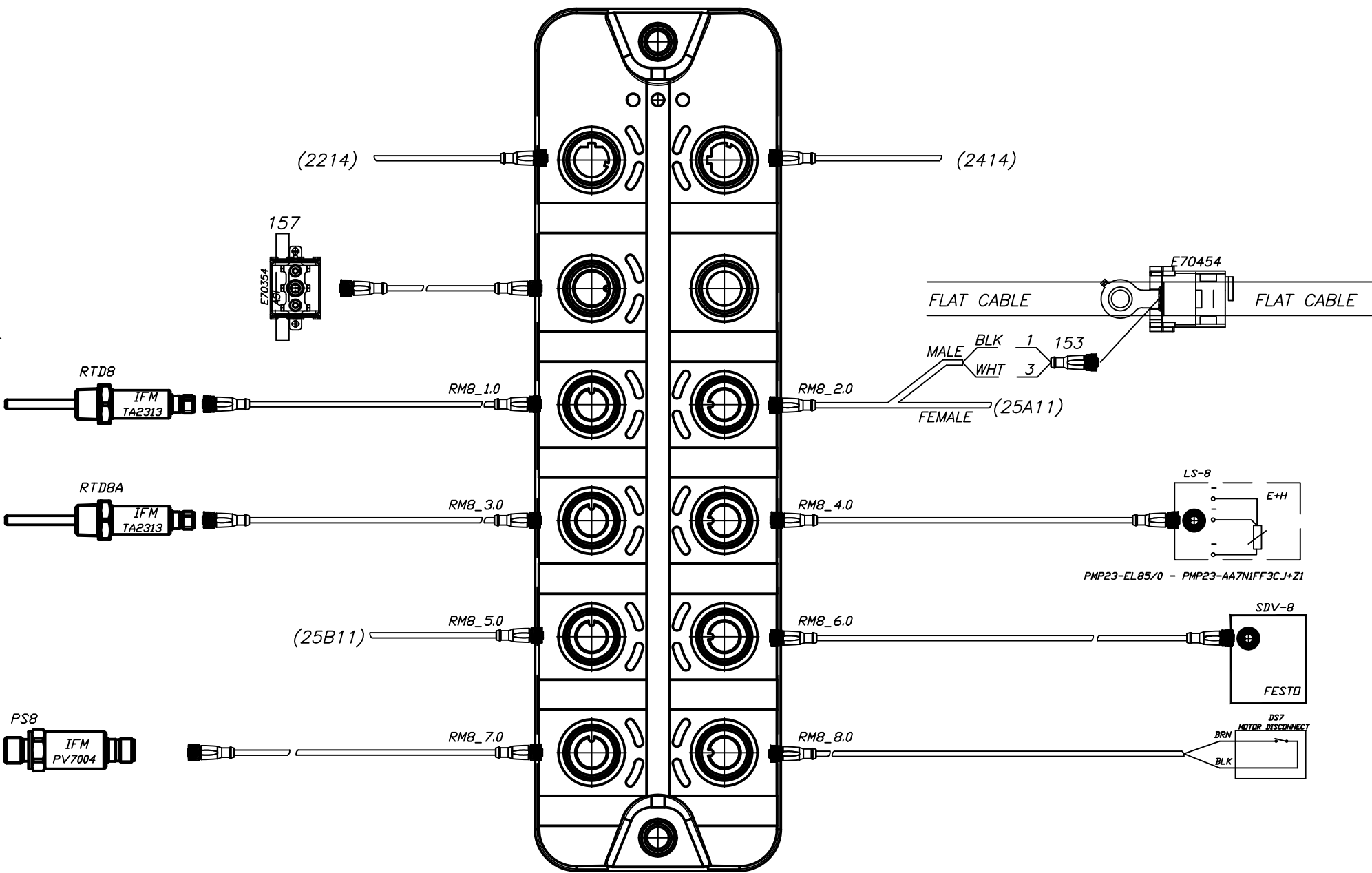
24VDC FROM
MAIN CONTROL PANEL

ZONE TANK-8
WATER TEMP

ZONE SPRAY-8
WATER TEMP

TO AL2241
INPUT MODULE

ZONE-8
PUMP PRESSURE



ETHERNET TO
REMOTE MODULE-1

TO IOLB-7214
ANALOG BLOCK

ZONE-8
WATER LEVEL

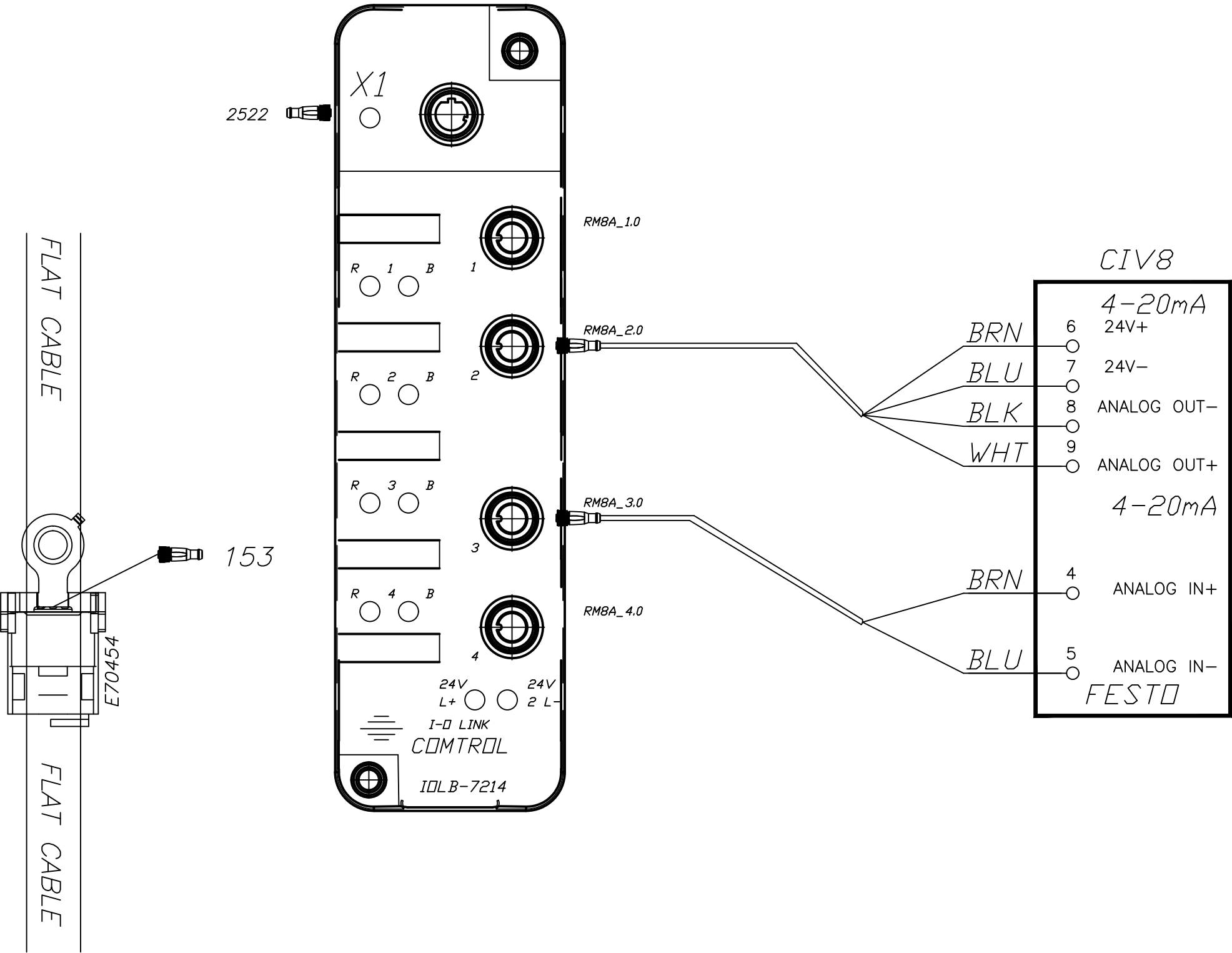
STRAINER DRAIN-8
VALVE

MAIN PUMP-7
MOTOR DISCONNECT

1. 2. 3. 4. 5.	NOTES	WIRE COLOR CODE	LEGEND	SCALE: NONE	DRAWN BY: CH	TITLE: REMOTE MODULE-8 P-1048 SD PASTEURIZER BLUE MARBLE INDIANAPOLIS, IN EPB970325
	This Product is Listed by UNDERWRITERS LABORATORIES, INC. and Bears the Mark: 	RED, BLACK, BLUE - 480VAC POWER CIRCUITS BLACK - AC CONTROL CIRCUITS BLUE - DC CONTROL CIRCUITS (OUTPUTS) LIGHT BLUE - DC CONTROL CIRCUITS (INPUTS) BLUE w/WHITE STRIPE - DC COMMON YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE GREEN - EQUIPMENT GROUND CONDUCTOR WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)	-■- POWER TERMINAL, 600V -◆- GROUND TERMINAL, 600V -⊙- CONTROL TERMINAL, 600V ⊙-□-⊙ FUSED TERMINAL, 300V -●- NUMBERED CONTROL WIRE - - WIRE IN ENCLOSURES - - OTHER WIRING	DATE: 06-01-20	APP. CH	
				This drawing is the property of G. C. Evans Sales & Mfg. Co. Inc. It is loaned upon the express condition that it shall not be copied or reproduced in any manner, that it shall not be submitted to others for examination without the consent of this company, that it shall not be used in any other way detrimental to the interest of G. C. Evans Sales & Mfg. Co. Inc., and that it shall be returned upon demand.		

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REMOTE MODULE 8A
ANALOG
IOLB-7214



SPARE

COLD INJECTION-8
FEEDBACK

COLD INJECTION-8
OUTPUT VALVE

SPARE

NOTES

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This Product is Listed by
UNDERWRITERS LABORATORIES, INC.
and Bears the Mark:

UL US

WIRE COLOR CODE

RED, BLACK, BLUE - 480VAC POWER CIRCUITS
BLACK - AC CONTROL CIRCUITS
BLUE - DC CONTROL CIRCUITS (OUTPUTS)
LIGHT BLUE - DC CONTROL CIRCUITS (INPUTS)
BLUE w/WHITE STRIPE - DC COMMON
YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE
GREEN - EQUIPMENT GROUND CONDUCTOR
WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)

LEGEND

POWER TERMINAL, 600V
GROUND TERMINAL, 600V
CONTROL TERMINAL, 600V
FUSED TERMINAL, 300V
NUMBERED CONTROL WIRE
WIRE IN ENCLOSURES
OTHER WIRING

SCALE: NONE

DATE: 06-01-20

DRAWN BY: CH

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TITLE:

REMOTE MODULE-8A
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970325A

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FROM AL1123
POWER/COMMS

STRAINER DRAIN-6
FEEDBACK

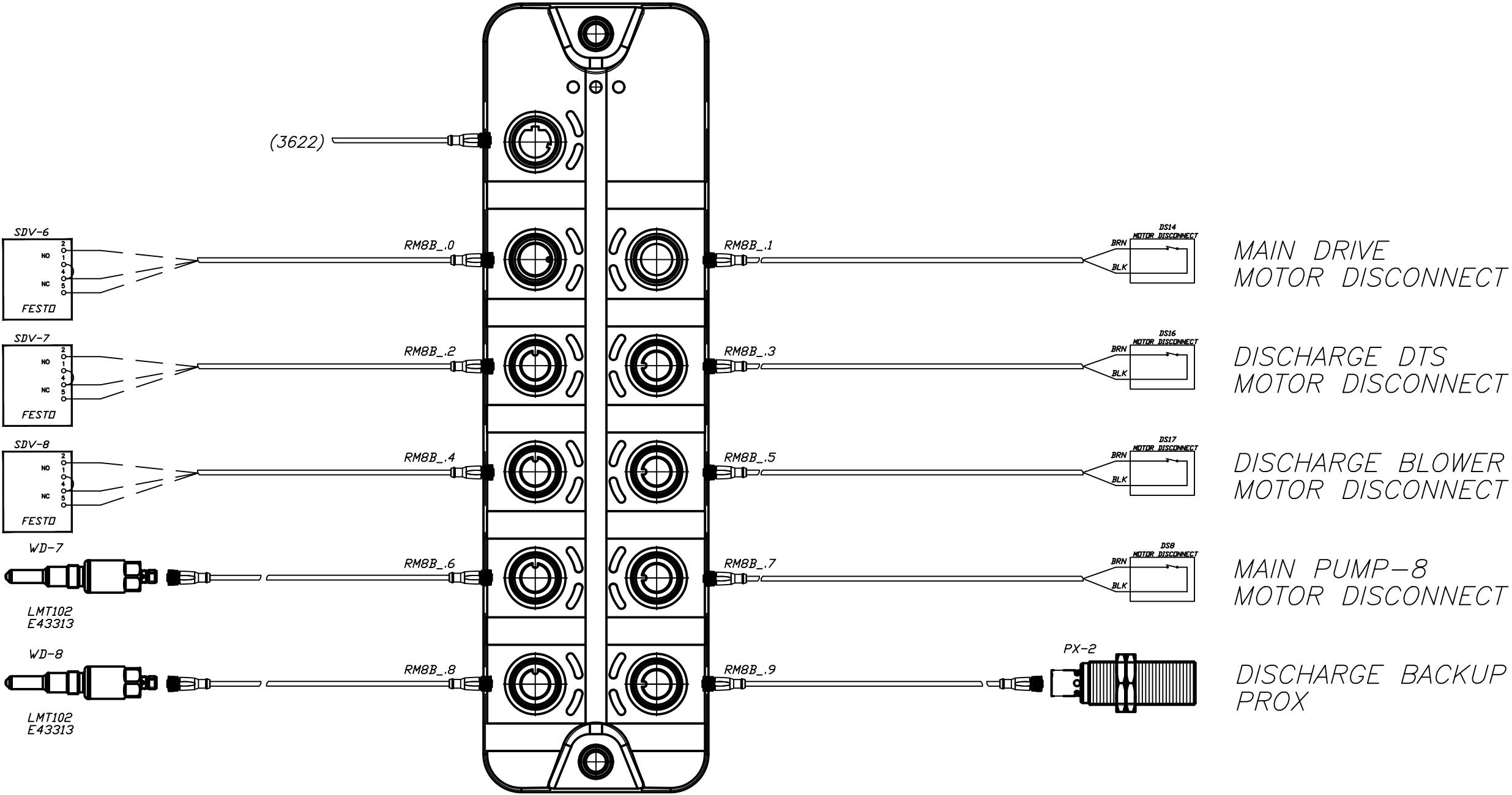
STRAINER DRAIN-7
FEEDBACK

STRAINER DRAIN-8
FEEDBACK

TANK-7
WET/DRY SENSOR

TANK-8
WET/DRY SENSOR

REMOTE MODULE 8B
INPUTS
IFM AL2241



MAIN DRIVE
MOTOR DISCONNECT

DISCHARGE DTS
MOTOR DISCONNECT

DISCHARGE BLOWER
MOTOR DISCONNECT

MAIN PUMP-8
MOTOR DISCONNECT

DISCHARGE BACKUP
PROX

NOTES

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This Product is Listed by
UNDERWRITERS LABORATORIES, INC.
and Bears the Mark:

US

WIRE COLOR CODE

RED, BLACK, BLUE - 480VAC POWER CIRCUITS
BLACK - AC CONTROL CIRCUITS
BLUE - DC CONTROL CIRCUITS (OUTPUTS)
LIGHT BLUE - DC CONTROL CIRCUITS (INPUTS)
BLUE w/WHITE STRIPE - DC COMMON
YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE
GREEN - EQUIPMENT GROUND CONDUCTOR
WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)

LEGEND

POWER TERMINAL, 600V
 GROUND TERMINAL, 600V
 CONTROL TERMINAL, 600V
 FUSED TERMINAL, 300V
 NUMBERED CONTROL WIRE
 WIRE IN ENCLOSURES
 OTHER WIRING

SCALE: NONE

DATE: 06-01-20

DRAWN BY: CH

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TITLE:

REMOTE MODULE-8B
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970325B

REVIEW SIGNATURE

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REMOTE MODULE 9
192.168.200.59
IFM AL1123

ETHERNET FROM
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ETHERNET TO
JUNCTION BOX-1

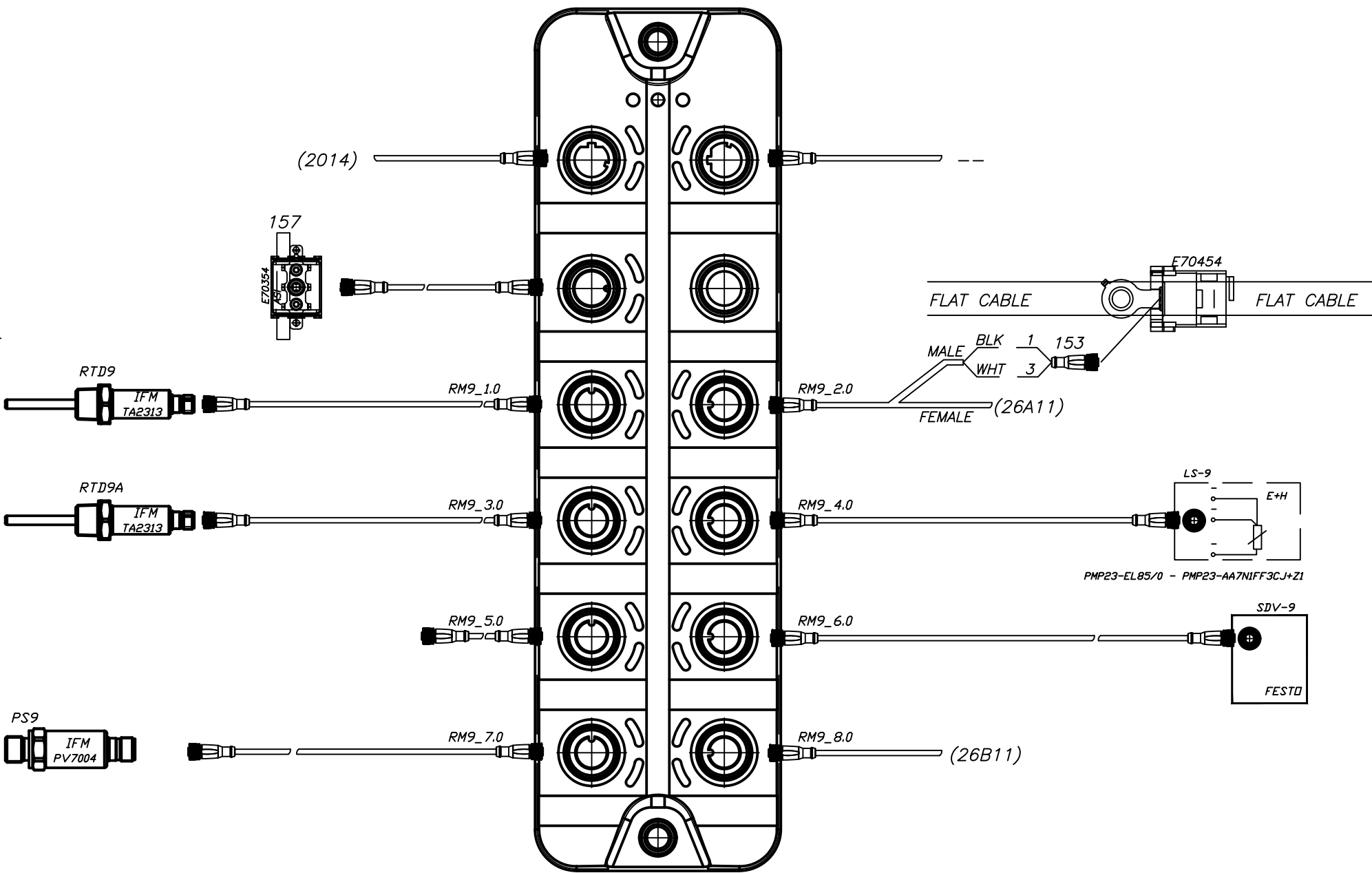
24VDC FROM
MAIN CONTROL PANEL

ZONE TANK-9
WATER TEMP

ZONE SPRAY-9
WATER TEMP

SPARE
--

ZONE-9
PUMP PRESSURE



TO IOLB-7214
ANALOG BLOCK

ZONE-9
WATER LEVEL

STRAINER DRAIN-9
VALVE

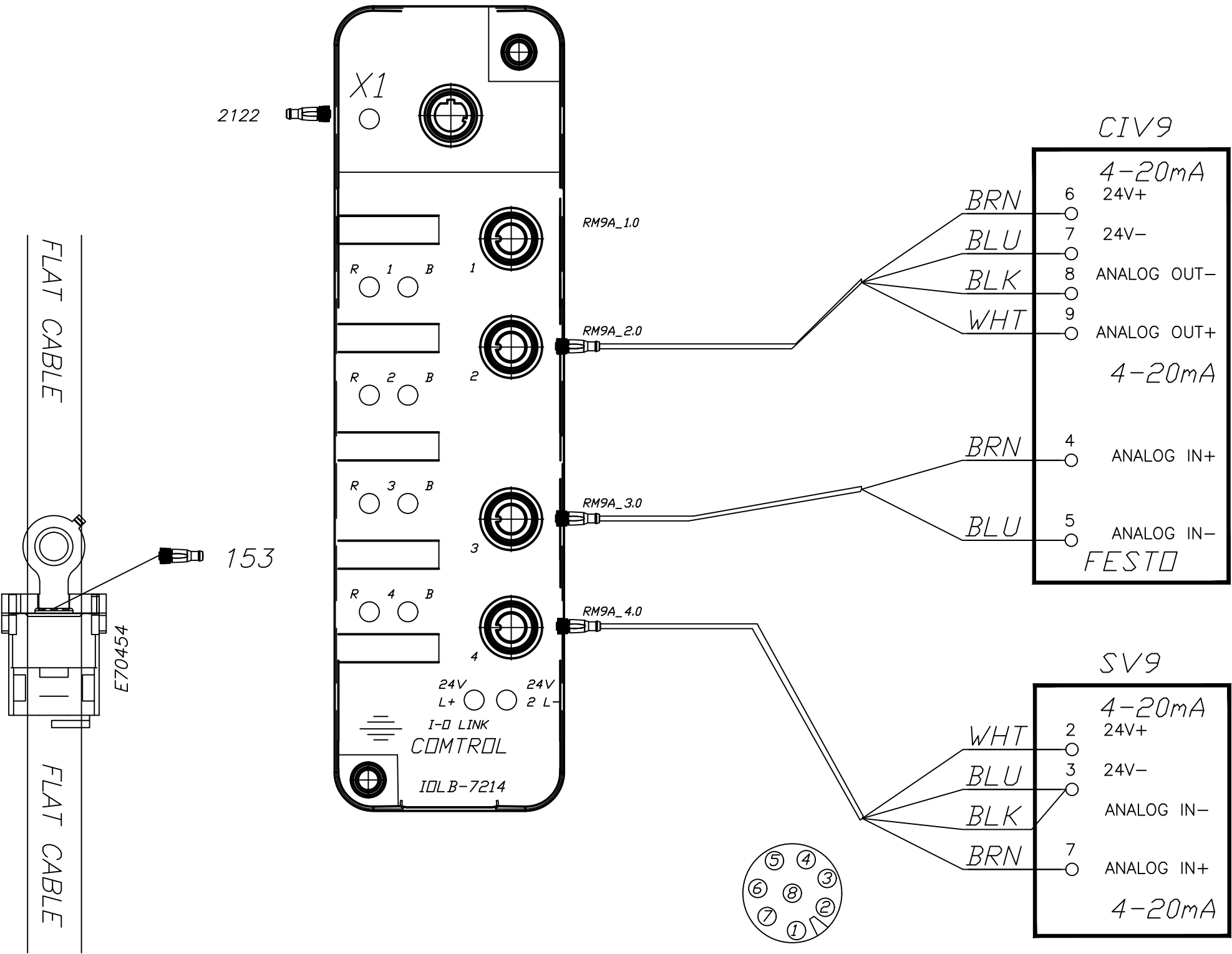
TO AL2241
INPUT MODULE

NOTES		WIRE COLOR CODE		LEGEND		SCALE: NONE		DRAWN BY: CH		TITLE: REMOTE MODULE-9 P-1048 SD PASTEURIZER BLUE MARBLE INDIANAPOLIS, IN EPB970326
1. 2. 3. 4. 5. This Product is Listed by UNDERWRITERS LABORATORIES, INC. and Bears the Mark: 		RED, BLACK, BLUE - 480VAC POWER CIRCUITS BLACK - AC CONTROL CIRCUITS BLUE - DC CONTROL CIRCUITS (OUTPUTS) LIGHT BLUE - DC CONTROL CIRCUITS (INPUTS) BLUE w/WHITE STRIPE - DC COMMON YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE GREEN - EQUIPMENT GROUND CONDUCTOR WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)		 POWER TERMINAL, 600V  GROUND TERMINAL, 600V  CONTROL TERMINAL, 600V  FUSED TERMINAL, 300V  NUMBERED CONTROL WIRE  WIRE IN ENCLOSURES  OTHER WIRING		DATE: 06-01-20		APP. CH		
						This drawing is the property of G. C. Evans Sales & Mfg. Co. Inc. It is loaned upon the express condition that it shall not be copied or reproduced in any manner, that it shall not be submitted to others for examination without the consent of this company, that it shall not be used in any other way detrimental to the interest of G. C. Evans Sales & Mfg. Co. Inc., and that it shall be returned upon demand.				

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REMOTE MODULE 9A
ANALOG
IOLB-7214

SPARE
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COLD INJECTION-9
FEEDBACK

COLD INJECTION-9
OUTPUT VALVE

STEAM INJECTION-9
VALVE

NOTES

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This Product is Listed by
UNDERWRITERS LABORATORIES, INC.
and Bears the Mark:

UL US

WIRE COLOR CODE

RED, BLACK, BLUE - 480VAC POWER CIRCUITS
BLACK - AC CONTROL CIRCUITS
BLUE - DC CONTROL CIRCUITS (OUTPUTS)
LIGHT BLUE - DC CONTROL CIRCUITS (INPUTS)
BLUE w/WHITE STRIPE - DC COMMON
YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE
GREEN - EQUIPMENT GROUND CONDUCTOR
WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)

LEGEND

POWER TERMINAL, 600V
GROUND TERMINAL, 600V
CONTROL TERMINAL, 600V
FUSED TERMINAL, 300V
NUMBERED CONTROL WIRE
WIRE IN ENCLOSURES
OTHER WIRING

SCALE: NONE

DATE: 06-01-20

DRAWN BY: CH

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TITLE:

REMOTE MODULE-9A
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970326A

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FROM AL1123
POWER/COMMS

STRAINER DRAIN-9
FEEDBACK

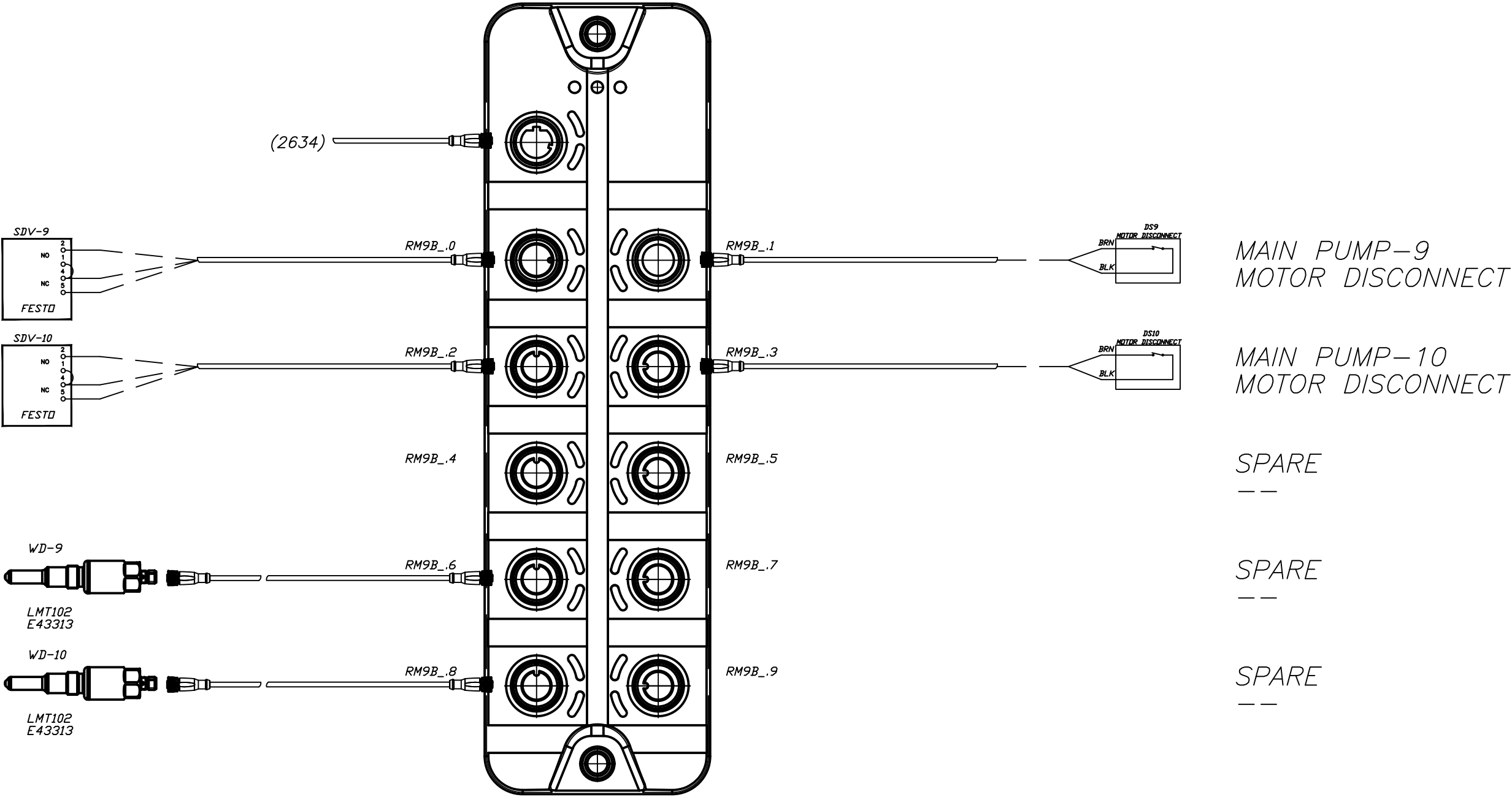
STRAINER DRAIN-10
FEEDBACK

SPARE
--

TANK-9
WET/DRY SENSOR

TANK-10
WET/DRY SENSOR

REMOTE MODULE 9B
INPUTS
IFM AL2241



NOTES

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5.

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WIRE COLOR CODE

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BLACK - AC CONTROL CIRCUITS
BLUE - DC CONTROL CIRCUITS (OUTPUTS)
LIGHT BLUE - DC CONTROL CIRCUITS (INPUTS)
BLUE w/WHITE STRIPE - DC COMMON
YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE
GREEN - EQUIPMENT GROUND CONDUCTOR
WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)

LEGEND

—■— POWER TERMINAL, 600V
—◆— GROUND TERMINAL, 600V
—●— CONTROL TERMINAL, 600V
—□— FUSED TERMINAL, 300V
—●— NUMBERED CONTROL WIRE
— WIRE IN ENCLOSURES
-- OTHER WIRING

SCALE: NONE

DATE: 06-01-20

DRAWN BY: CH

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TITLE:

REMOTE MODULE-9B
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970326B

REVIEW SIGNATURE

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REMOTE MODULE 10
192.168.200.60
IFM AL1123

ETHERNET FROM
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ETHERNET TO
JUNCTION BOX-1

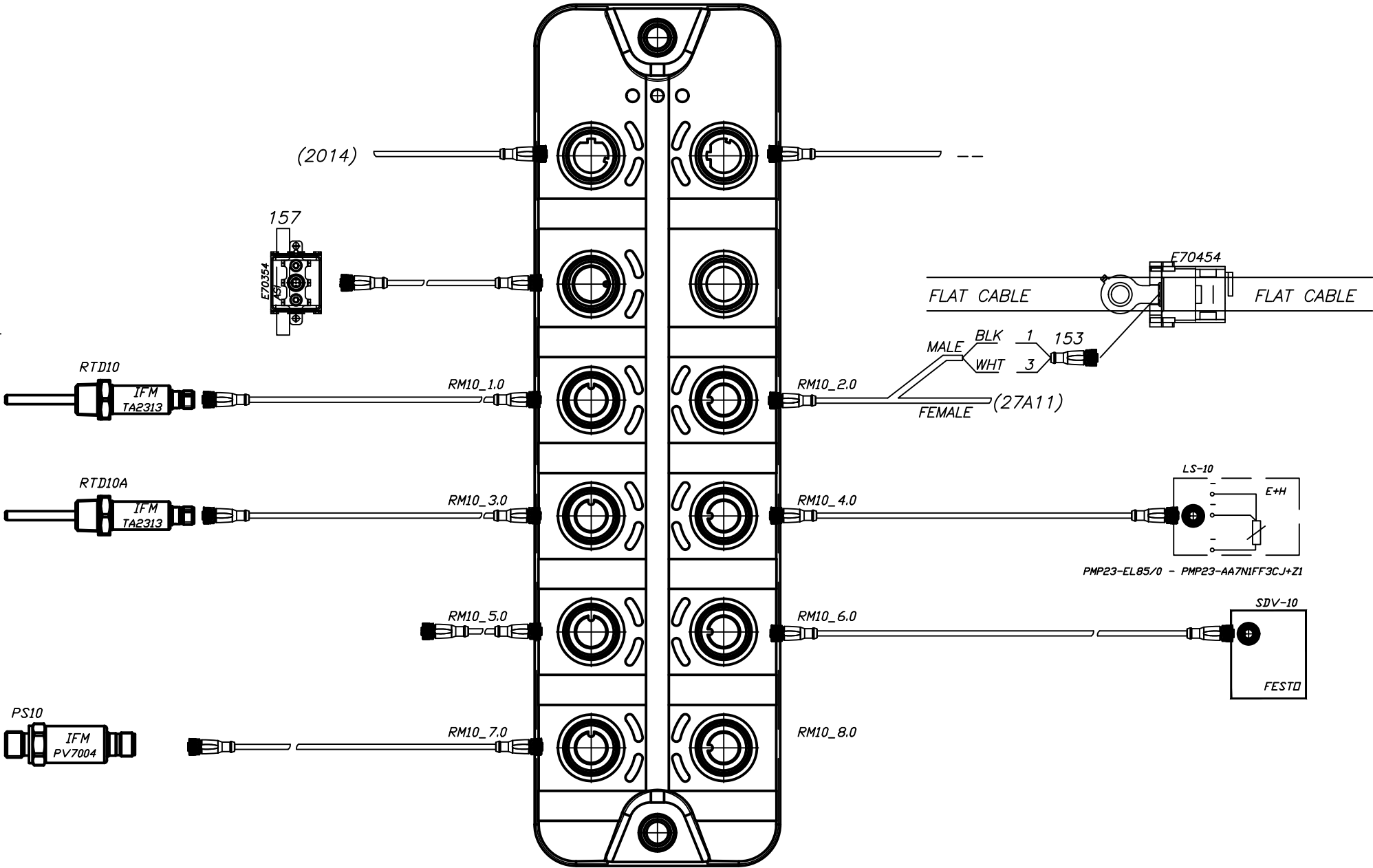
24VDC FROM
MAIN CONTROL PANEL

ZONE TANK-10
WATER TEMP

ZONE SPRAY-10
WATER TEMP

SPARE
--

ZONE-10
PUMP PRESSURE



TO IOLB-7214
ANALOG BLOCK

ZONE-10
WATER LEVEL

STRAINER DRAIN-10
VALVE

SPARE
--

NOTES

- 1.
- 2.
- 3.
- 4.
- 5.

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UNDERWRITERS LABORATORIES, INC.
and Bears the Mark:



WIRE COLOR CODE

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- BLUE - DC CONTROL CIRCUITS (OUTPUTS)
- LIGHT BLUE - DC CONTROL CIRCUITS (INPUTS)
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- YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE
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- WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)

LEGEND

- POWER TERMINAL, 600V
- GROUND TERMINAL, 600V
- CONTROL TERMINAL, 600V
- FUSED TERMINAL, 300V
- NUMBERED CONTROL WIRE
- WIRE IN ENCLOSURES
- OTHER WIRING

SCALE: NONE

DRAWN BY: CH

DATE: 06-01-20

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TITLE:

REMOTE MODULE-10
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970327

SPARE
— —



COLD INJECTION-10
OUTPUT VALVE



REMOTE MODULE-10A
P-1048 SD PASTEURIZER
BLUE MARBLE
INDIANAPOLIS, IN
EPB970327A

APP. CH

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UNDERWRITERS LABORATORIES, INC.
and Bears the Mark:*



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BLUE - DC CONTROL CIRCUITS (OUTPUTS)
LIGHT BLUE - DC CONTROL CIRCUITS (INPUTS)
BLUE w/WHITE STRIPE - DC COMMON
YELLOW - INTERLOCK CIRCUITS FROM EXTERNAL SOURCE
GREEN - EQUIPMENT GROUND CONDUCTOR
WHITE - GROUNDED CIRCUIT CONDUCTOR (NEUTRAL)

- POWER TERMINAL, 600V
- ◆— GROUND TERMINAL, 600V
- CONTROL TERMINAL, 600V
- FUSED TERMINAL, 300V
- NUMBERED CONTROL WIRE
- WIRE IN ENCLOSURES
- OTHER WIRING



G.C. Evans Sales & Mfg Co Inc.

Section 4

Subcomponent Product Information

Model P-1048SD
Pasteurizer

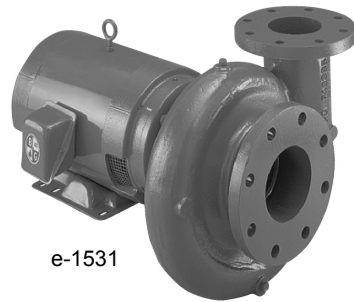


G.C. Evans Sales & Mfg Co Inc.

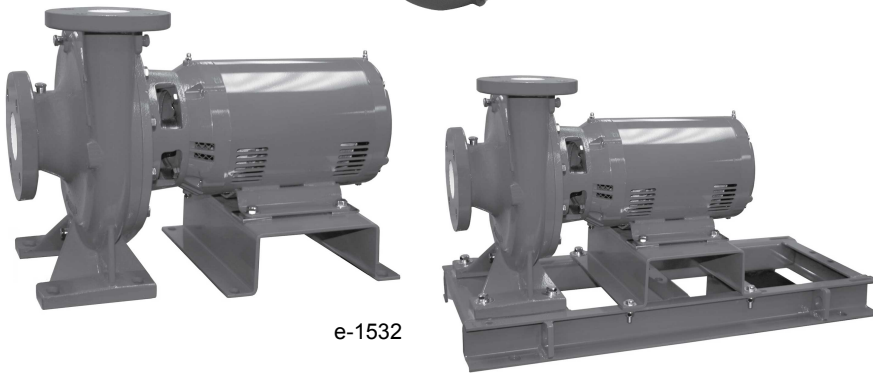
Section 4-I

Water Delivery System

Model P-1048SD
Pasteurizer



e-1531



e-1532

Series e-1531 and e-1532

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Introduction and Safety

Introduction

Purpose of this manual

The purpose of this manual is to provide necessary information for:

- Installation
- Operation
- Maintenance



CAUTION:

Read this manual carefully before installing and using the product. Improper use of the product can cause personal injury and damage to property, and may void the warranty.

NOTICE:

Save this manual for future reference, and keep it readily available at the location of the unit.

Safety



WARNING:

- The operator must be aware of safety precautions to prevent physical injury.
 - Operating, installing, or maintaining the unit in any way that is not covered in this manual could cause death, serious personal injury, or damage to the equipment. This includes any modification to the equipment or use of parts not provided by Xylem. If there is a question regarding the intended use of the equipment, please contact a Xylem representative before proceeding.
 - Do not change the service application without the approval of an authorized Xylem representative.
-



CAUTION:

You must observe the instructions contained in this manual. Failure to do so could result in physical injury, damage, or delays.

Safety terminology and symbols

About safety messages

It is extremely important that you read, understand, and follow the safety messages and regulations carefully before handling the product. They are published to help prevent these hazards:

- Personal accidents and health problems
- Damage to the product
- Product malfunction

Hazard levels

Hazard level		Indication
 DANGER:		A hazardous situation which, if not avoided, will result in death or serious injury

Hazard level	Indication
 WARNING:	A hazardous situation which, if not avoided, could result in death or serious injury
 CAUTION:	A hazardous situation which, if not avoided, could result in minor or moderate injury
NOTICE:	• A potential situation which, if not avoided, could result in undesirable conditions • A practice not related to personal injury

Hazard categories

Hazard categories can either fall under hazard levels or let specific symbols replace the ordinary hazard level symbols.

Electrical hazards are indicated by the following specific symbol:



Electrical Hazard:

These are examples of other categories that can occur. They fall under the ordinary hazard levels and may use complementing symbols:

- Crush hazard
- Cutting hazard
- Arc flash hazard

Safety instruction decals



WARNING:

The maximum working pressure of the pump is listed on the nameplate. Do not exceed this pressure. Failure to follow these instructions can result in serious personal injury, death, and/or property damage.

Alert symbol

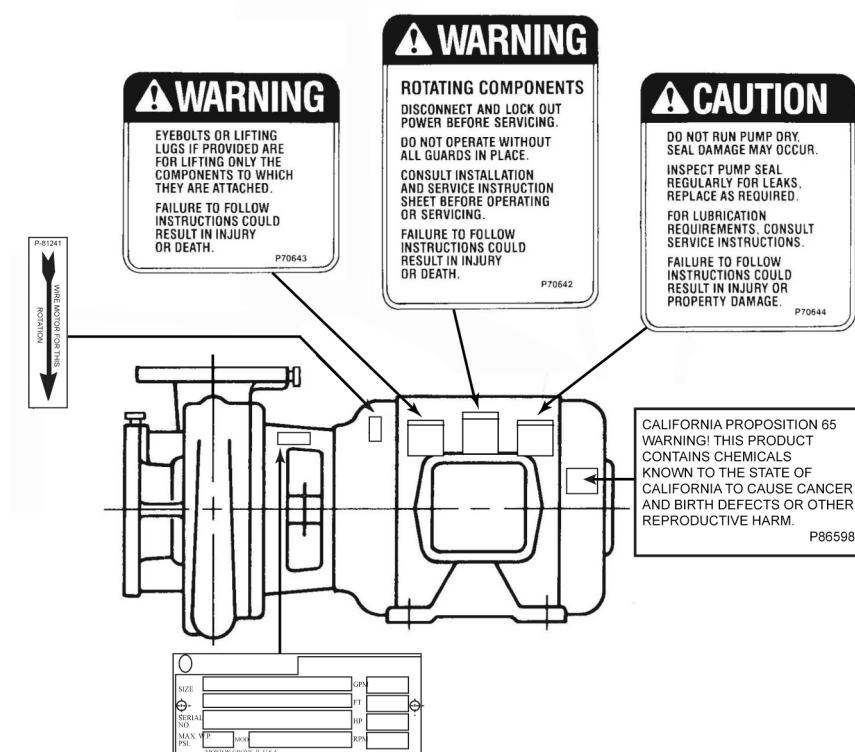


This safety alert symbol is used in manuals and on the safety instruction decals on the pump to draw attention to safety-related instructions.

When used, the safety alert symbol means that failure to follow the instructions may result in a safety hazard.

Decals

Make sure your pump has these safety instruction decals and that they are located as this figure shows. If the decals are missing or illegible, contact your local sales and service representative for a replacement.



Make sure that all safety instruction decals are always clearly visible and readable.

User safety

General safety rules

These safety rules apply:

- Always keep the work area clean.
- Pay attention to the risks presented by gas and vapors in the work area.
- Avoid all electrical dangers. Pay attention to the risks of electric shock or arc flash hazards.
- Always bear in mind the risk of drowning, electrical accidents, and burn injuries.

Safety equipment

Use safety equipment according to the company regulations. Use this safety equipment within the work area:

- Hard hat
- Safety goggles, preferably with side shields
- Protective shoes
- Protective gloves
- Gas mask
- Hearing protection
- First-aid kit
- Safety devices

NOTICE:

Never operate a unit unless safety devices are installed. Also see specific information about safety devices in other chapters of this manual.

Electrical connections

Electrical connections must be made by certified electricians in compliance with all international, national, state, and local regulations. For more information about requirements, see sections dealing specifically with electrical connections.

Precautions before work

Observe these safety precautions before you work with the product or are in connection with the product:

- Provide a suitable barrier around the work area, for example, a guard rail.
- Make sure that all safety guards are in place and secure.
- Make sure that you have a clear path of retreat.
- Make sure that the product cannot roll or fall over and injure people or damage property.
- Make sure that the lifting equipment is in good condition.
- Use a lifting harness, a safety line, and a breathing device as required.
- Allow all system and pump components to cool before you handle them.
- Make sure that the product has been thoroughly cleaned.
- Disconnect and lock out power before you service the pump.
- Check the explosion risk before you weld or use electric hand tools.

Wash the skin and eyes

Follow these procedures for chemicals or hazardous fluids that have come into contact with your eyes or your skin:

Condition	Action
Chemicals or hazardous fluids in eyes	1. Hold your eyelids apart forcibly with your fingers. 2. Rinse the eyes with eyewash or running water for at least 15 minutes. 3. Seek medical attention.
Chemicals or hazardous fluids on skin	1. Remove contaminated clothing. 2. Wash the skin with soap and water for at least 1 minute. 3. Seek medical attention, if necessary.

Environmental safety

The work area

Always keep the station clean.

Waste and emissions regulations

Observe these safety regulations regarding waste and emissions:

- Appropriately dispose of all waste.
- Handle and dispose of the processed liquid in compliance with applicable environmental regulations.
- Clean up all spills in accordance with safety and environmental procedures.
- Report all environmental emissions to the appropriate authorities.



CAUTION: Radiation Hazard

Do NOT send the product to Xylem if it has been exposed to nuclear radiation, unless Xylem has been informed and appropriate actions have been agreed upon.

Electrical installation

For electrical installation recycling requirements, consult your local electric utility.

Recycling guidelines

Always follow local laws and regulations regarding recycling.

Transportation and Storage

Inspect the delivery

Inspect the package

1. Inspect the package for damaged or missing items upon delivery.
2. Note any damaged or missing items on the receipt and freight bill.
3. File a claim with the shipping company if anything is out of order.
If the product has been picked up at a distributor, make a claim directly to the distributor.

Inspect the unit

1. Remove packing materials from the product.
Dispose of all packing materials in accordance with local regulations.
2. Inspect the product to determine if any parts have been damaged or are missing.
3. If applicable, unfasten the product by removing any screws, bolts, or straps.
For your personal safety, be careful when you handle nails and straps.
4. Contact the local sales representative if there is any issue.

Lifting methods



WARNING:

- Assembled units and their components are heavy. Failure to properly lift and support this equipment can result in serious physical injury and/or equipment damage. Lift equipment only at the specifically identified lifting points. Lifting devices such as eyebolts, slings, and spreaders must be rated, selected, and used for the entire load being lifted.
- Crush hazard. The unit and the components can be heavy. Use proper lifting methods and wear steel-toed shoes at all times.

Table 1: Methods

Pump type	Lifting method
A pump without base.	Use a suitable sling attached properly to solid points under the casing and motor.
A base-mounted pump. (e-1532 only)	Use slings under the pump casing and the drive unit, under the base rails, or through lifting lugs, when provided.

Examples

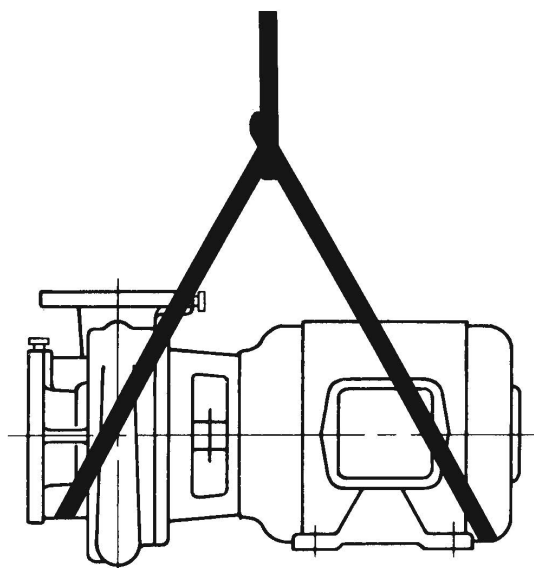


Figure 1: Example of a proper lifting method for pump without base

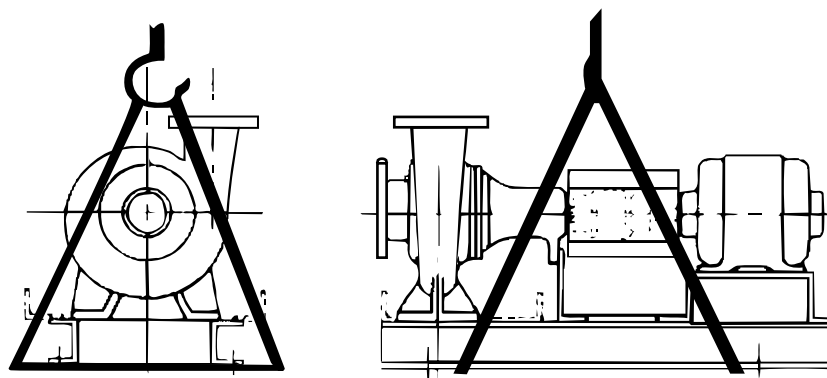


Figure 2: Example of a proper lifting method for base mounted pump (e-1532 only)

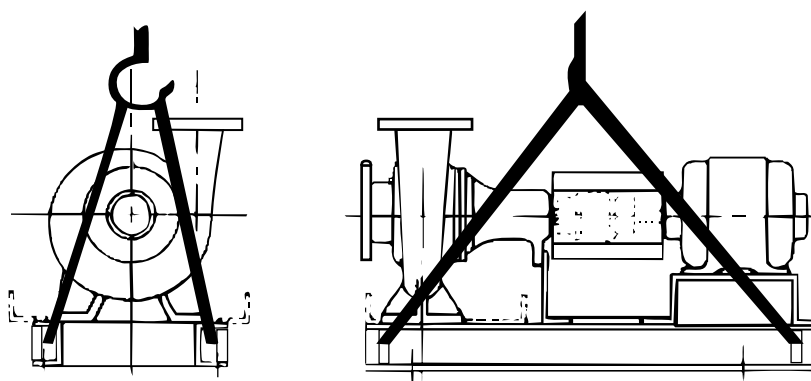


Figure 3: Example of a proper lifting method using lifting lugs for base mounted pump (e-1532 only)

Long-term storage

If the unit is stored for more than 6 months, these requirements apply:

- Store in a covered and dry location.
- Store the unit free from heat, dirt, and vibrations.
- Rotate the shaft by hand several times at least every three months.

Treat bearing and machined surfaces so that they are well preserved. Refer to the drive unit manufacturer for their long-term storage procedures.

For questions about possible long-term storage treatment services, please contact your local sales and service representative.

Product Description

General description

Description

The pump is a centrifugal, close-coupled pump. The following pump features make it easy to install, operate, and service:

- High efficiency
- Rugged stainless steel-fitted construction
- Footless (e-1531) or Foot-mounted (e-1532) volute

Intended applications



WARNING:

California Proposition 65 warning! This product contains chemicals known to the state of California to cause cancer and birth defects or other reproductive harm.

The pump is intended for use with these pumped fluids:

- Unheated domestic and fresh water
- Boiler feed water
- Condensate
- Hydronic cooling or heating
- Benign liquids
- Pressure boosting
- General liquid transfer

Rotation

Pump rotation is clockwise when viewed from the back of the motor. An arrow is also located on the pump to show the direction of rotation.

Operational specifications

Mechanical seal specifications

Seal type/ Parameter	Standard seal, BUNA/Carbon/ Ceramic	Optional seal, EPR/Carbon / Tungsten Carbide	Optional seal, FKM/Carbon / Ceramic	Optional seal, EPR/Silicon Carbide/Silicon Carbide	Optional seal, EPR/Carbon / Tungsten Carbide with external flush ^{1,3,4}	Packing ²
Operating temperature range, °F (°C)	-20 to 225 (-29 to 107)	-20 to 250 (-29 to 121)	-10 to 225 (-23 to 107)	-20 to 250 (-29 to 121)	-20 to 250 (-29 to 121)	0 to 200 (-18 to 93)
pH range limits	7.0 to 9.0	7.0 to 11.0	7.0 to 9.0	7.0 to 12.5	7.0 to 9.0	7.0 to 9.0
Resistance to dissolved solids	Low	Low-Medium	Low	Medium-High	Low-Medium	Medium
Maximum glycol/water concentration	50/50%	50/50%	50/50%	60/40%	50/50%	Not recommended

Table notes

1. An external flush is required on low pressure systems that contain a high concentration of abrasives.
2. Use packing on open or closed systems which require a large amount of makeup water, as well as systems that are subjected to a wide variety of chemical conditions and solids buildup.
3. For operating temperatures above 250°F, a cooled flush is required and is recommended for temperatures above 225°F for optimum seal life. On closed systems, cooling is accomplished by inserting a small heat exchanger in the flush line to cool the seal flushing fluid.
4. Flush-line filters and sediment separators are available on request.

Installation

Preinstallation

Precautions


WARNING:

- When installing in a potentially explosive environment, make sure that the motor is properly certified.
- You must ground (earth) all electrical equipment. This applies to the pump equipment, the driver, and any monitoring equipment. Test the ground (earth) lead to verify that it is connected correctly.

NOTICE:

Supervision by an authorized Xylem representative is recommended to ensure proper installation. Failure to do so may result in equipment damage or decreased performance.

Evaluate the installation in order to determine that the Net Positive Suction Head Available (NPSH_A) meets or exceeds the Net Positive Suction Head Required (NPSH_R), as stated by the pump performance curve.

Pump location guidelines


WARNING:

Assembled units and their components are heavy. Failure to properly lift and support this equipment can result in serious physical injury and/or equipment damage. Lift equipment only at the specifically identified lifting points. Lifting devices such as eyebolts, slings, and spreaders must be rated, selected, and used for the entire load being lifted.

Guideline	Explanation/comment
Keep the pump as close to the liquid source as practically possible.	This minimizes the friction loss and keeps the suction piping as short as possible.
Make sure that the space around the pump is sufficient.	This facilitates ventilation, inspection, maintenance, and service.
If you require lifting equipment such as a hoist or tackle, make sure that there is enough space above the pump.	This makes it easier to properly use the lifting equipment and safely remove and relocate the components to a safe location.
Protect the unit from weather and water damage due to rain, flooding, and freezing temperatures.	This is applicable if nothing else is specified.
Do not install and operate the equipment in closed systems unless the system is constructed with properly-sized safety devices and control devices.	Acceptable devices: • Pressure relief valves • Compression tanks • Pressure controls • Temperature controls • Flow controls If the system does not include these devices, consult the engineer or architect in charge before you operate the pump.
Take into consideration the occurrence of unwanted noise and vibration.	The best pump location for noise and vibration absorption is on a concrete floor with subsoil underneath.
If the pump location is overhead, undertake special precautions to reduce possible noise transmission.	Consider a consultation with a noise specialist.
When possible, locate the pump below the fluid level.	This facilitates priming, ensures a steady flow of liquid, and provides a positive suction head on the pump.

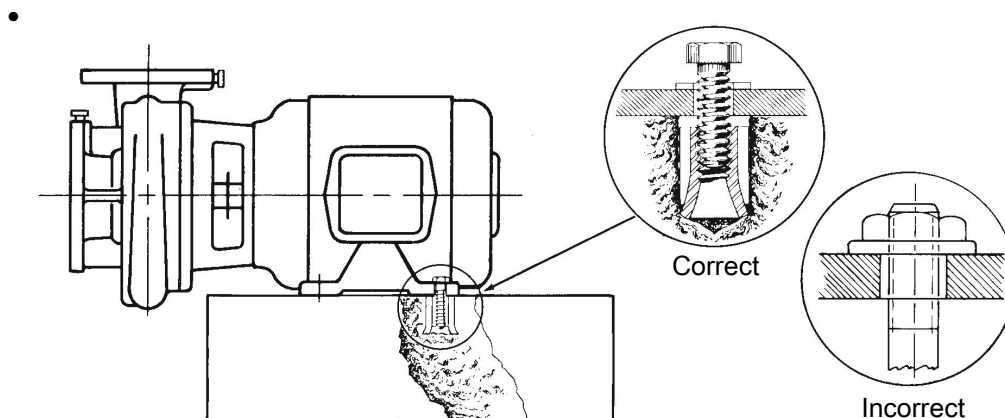
Foundation requirements

Requirements

- The foundation must be able to absorb any type of vibration and form a permanent, rigid support for the unit.
- The foundation must weigh at least 2-1/2 times the weight of the pump unit.
- Provide a flat, substantial concrete foundation in order to prevent strain and distortion when you tighten the foundation bolts. Tie the concrete pad in with the finished floor.

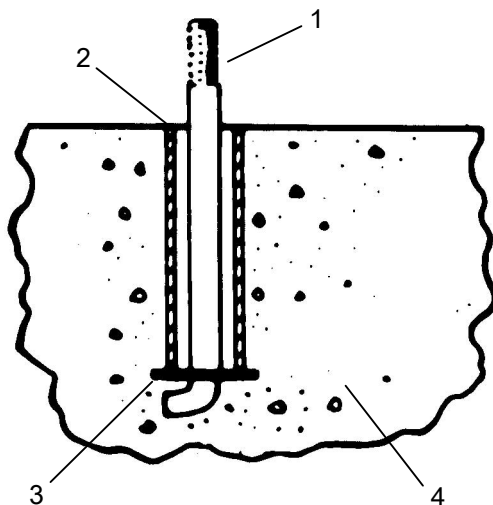
Bolt installation – pump to concrete

- Use some type of expansion fitting in order to facilitate easy servicing. Insert the female portion into a suitable hole in the pad so that its top surface is flush with the pad surface. Thus, when the hold-down bolts are removed, the motor can be removed by sliding it back from the pump.



Bolt installation with baseplate (e-1532)

- Sleeve-type and J-type foundation bolts are most commonly used. Both designs allow movement for the final bolt adjustment.
- Use foundation bolts and larger pipe sleeves to give room for final bolt location.



1. Foundation bolt
2. Pipe sleeve
3. Washer
4. Built-up concrete foundation

Piping checklist

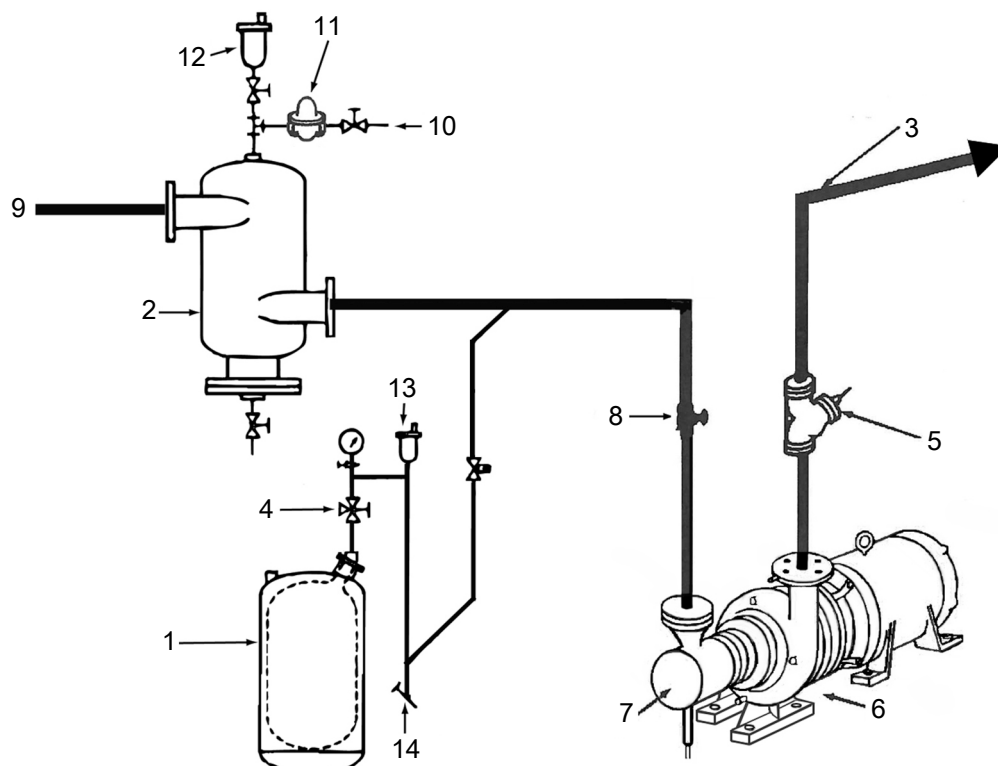


WARNING:

- The heating of water and other fluids causes volumetric expansion. The associated forces can cause the failure of system components and the release of high-temperature fluids. In order to prevent this, install properly sized and located compression tanks and pressure-relief valves. Failure to follow these instructions can result in serious personal injury or death, or property damage.
- Avoid serious personal injury and property damage. Make sure that the flange bolts are adequately torqued.
- Never force piping to make a connection with a pump.

Check	Explanation/comment	Checked
Check that a section of straight pipe, with a length that is five times its diameter, is installed between the suction side of the pump and the first elbow, or that a B&G Suction Diffuser is installed.	This reduces suction turbulence by straightening the flow of liquid before it enters the pump.	
Check that the suction and discharge pipes are supported independently by use of pipe hangers near the pump .	This eliminates pipe strain on the pump .	
Check that there is a strong, rigid support for the suction and discharge lines.	As a rule, ordinary wire or band hangers are not adequate to maintain proper alignment.	
For pumps with flanges, check that the bolt holes in the pump flanges match the bolt holes in the pipe flanges.	–	
Check that the suction or discharge lines are not forced into position.	Coupling and bearing wear will result if suction or discharge lines are forced into position.	
Check that fittings for absorbing expansion are installed in the system when considerable temperature changes are expected.	This helps to avoid strain on the pump.	
Check that you have a foot valve of equal or greater area than the pump suction piping when you use in an open system with a suction lift.	Prevent clogging by using a strainer at the suction inlet next to the foot valve. Make sure that the strainer has an area three times that of the suction pipe with a mesh hole diameter of no less than 0.25 in. (0.64 cm).	
Check that flexible piping is used on both the suction and discharge sides of the pump when you use an isolation base.	–	
Check that a B&G Triple Duty® valve is installed in the discharge line.	This valve serves as a check valve that protects the pump from water hammer, and serves as an isolation valve for servicing and for throttling.	
Check that the pipeline has isolation valves around the pump and has a drain valve in the suction pipe.	–	
Use PTFE tape sealer or a high quality thread sealant when you install the suction and discharge connections to a threaded pump housing.	–	

Typical installation



1. Expansion tank
2. B&G Rolairtrol® air separator
3. Supply to system
4. TPV Tank Purge Valve
5. B&G Triple Duty® valve
6. B&G Series e-1531 or e-1532 Pump
7. B&G Suction Diffuser
8. Isolation valve
9. Pipe from boiler, chiller, or converter
10. Cold water supply
11. B&G Pressure Reducing Valve
12. B&G Model 107A – High capacity vent
13. B&G #7 or #87 Air Vent
14. Drain valve

Special installation

Installation with suction diffuser and triple-duty valve

Do not install and operate triple-duty valves and suction diffusers in closed systems unless the system is designed with these safety and control devices:

- Pressure relief valves
- Compression tanks
- Pressure controlling equipment
- Temperature controlling equipment
- Flow controlling equipment

Check that the control and safety devices have these characteristics:

- Properly sized for their purpose
- Placed correctly in the system before putting the system into operation

Installation with isolation base

When using an isolation base, flexible piping should be used on both suction and discharge sides to reduce the strain on the flanges.

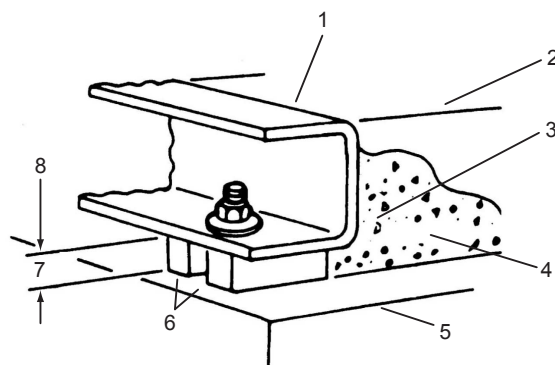
Install the pump with motor (e-1532)

1. Place the pump with motor where it will be mounted, on the floor, on a raised concrete pad or on a base, with two 0.060 in (1.5 mm) thick shims provided under each of the four hold down bolt locations of the pump volute feet. With certain tall motors and short pumps, one or two additional 1" (25.4 mm) thick steel shims will be provided to go under the pump casing feet to make the volute level with the bottom of the motor support or motor feet.
2. Then add additional shims at each of the four volute hold down bolt locations, as required, until the volute feet are fully supported, the pump discharge flange is level, and there is a gap under the motor saddle or motor feet. Tighten the four bolts at the volute feet.
3. Loosen the bolts between the motor and the motor saddle, when a saddle is used, and fill any gaps to fully support the motor by adding shims under the motor feet at each of the motor's four hold down bolt locations, as required, until all four hold down hole locations of the motor saddle or motor feet contact the floor, pad, or base. Tighten the bolting between the motor and motor saddle, when a saddle is used.
4. When mounted on a baseplate, then tighten the four hold down bolts at the corners of the motor support or motor feet. For pumps mounted directly on the floor or concrete pad, all four motor saddle or motor hold down bolt locations must be in contact with the floor or pad, but hold down bolting at these locations is optional.
5. If any hold down bolt tightening results in pump movement that could induce stress in the pump frame, stop and re-shim the pump volute, motor saddle or motor.

Level the base on a concrete foundation for pumps with base (e-1532)

1. Place the pump on its concrete foundation.
2. Place 1.00 in. (25.40 mm) thick steel shims or wedges on both sides of each anchor bolt in order to support the pump.

This also provides a means of leveling the base.



1. Pump Base Rail
2. Grout only to top of base rail
3. Locate the shims to allow removal after grouting.
4. Grout
5. Concrete foundation
6. Shims
7. 1" (25.40 mm) Gap
8. Allow 1" for shims. Place on both sides of anchor bolts.

Grout the baseplate (e-1532)

Required equipment:

- Cleaners: Do not use an oil-based cleaner because the grout will not bond to it. See the instructions provided by the grout manufacturer.
- Grout: Non-shrink grout is required.

1. Clean all the areas of the baseplate that will come into contact with the grout.
2. Build a dam around the foundation.
3. Thoroughly wet the foundation that will come into contact with the grout.
4. Pour grout into the baseplate up to top of the base rails.

Locate shims to allow removal after grouting.

When you pour the grout, remove air bubbles from it by using one of these methods:

- Puddle with a vibrator.
 - Pump the grout into place.
5. Allow the grout to set. It is recommended to remove shims, retighten anchor bolts, and fill shim gaps with grout.

Install the piping

Connect piping to pump without pipe strain on the pump.

Commissioning, Startup, Operation, and Shutdown

Preparation for startup



WARNING:

- Failure to follow these precautions before you start the unit will lead to serious personal injury and equipment failure.
 - Do not operate the pump below the minimum rated flows or with the suction or discharge valves closed. These conditions can create an explosive hazard due to vaporization of pumped fluid and can quickly lead to pump failure and physical injury.
 - If the pump, motor, or piping operate at extremely high or low temperatures, then guarding or insulation is required. Failure to follow these instructions can result in serious personal injury or death, and property damage.
 - Always disconnect and lock out power to the driver before you perform any installation or maintenance tasks. Failure to disconnect and lock out driver power will result in serious physical injury.
 - Operating the pump in reverse rotation can result in the contact of metal parts, heat generation, and breach of containment.
-

NOTICE:

- Verify the driver settings before you start any pump.
 - Make sure that the warm-up rate does not exceed 2.5°F (1.4°C) per minute.
-

You must follow these precautions before you start the pump:

- Flush and clear the system thoroughly to remove dirt or debris in the pipe system in order to prevent premature failure at initial startup.
- Bring variable-speed drivers to the rated speed as quickly as possible.
- If temperatures of the pumped fluid will exceed 200°F (93°C), then warm up the pump prior to operation. Circulate a small amount of fluid through the pump until the casing temperature is within 100°F (38°C) of the fluid temperature.

At initial startup, do not adjust the variable-speed drivers or check for speed governor or over-speed trip settings while the variable-speed driver is coupled to the pump. If the settings have not been verified, then uncouple the unit and refer to instructions supplied by the driver manufacturer.

Prime the pump



CAUTION:

Do not run the pump dry.

Make sure that the pump body is full of liquid before startup. If the system does not automatically fill the pump body with liquid, then you must manually prime the pump.

1. Loosen the vent plugs on the pump body.
2. While venting the air from the pump body, rotate the pump shaft a few times by hand.
3. After all air has been purged from the pump, close the vent plugs.

Start the pump



CAUTION:

- Observe the pump for vibration levels, bearing temperature, and excessive noise. If normal levels are exceeded, shut down the pump and resolve the issue.

Before you start the pump, you must perform these tasks:

- Open the suction valve.
 - Open any recirculation or cooling lines.
1. Fully close or partially open the discharge valve, depending on system conditions.
 2. Start the driver.
 3. Slowly open the discharge valve until the pump reaches the desired flow.
 4. Immediately check the pressure gauge to ensure that the pump quickly reaches the correct discharge pressure.
 5. If the pump fails to reach the correct pressure, perform these steps:
 - a) Stop the driver.
 - b) Prime the pump again.
 - c) Restart the driver.
 6. Monitor the pump while it is operating:
 - a) Check the pump for bearing temperature, excessive vibration, and noise.
 - b) If the pump exceeds normal levels, then shut down the pump immediately and correct the problem.
 7. Repeat steps 5 and 6 until the pump runs properly.

Pump operation precautions

General considerations



WARNING:

Do NOT exceed the maximum working pressure of the pump. This information is listed on the nameplate of the pump.



CAUTION:

- Vary the capacity with the regulating valve in the discharge line. Never throttle the flow from the suction side since this can result in decreased performance, unexpected heat generation, and equipment damage.
- Do not overload the driver. Driver overload can result in unexpected heat generation and equipment damage. The driver can overload in these circumstances:
 - The specific gravity of the pumped fluid is greater than expected.
 - The pumped fluid exceeds the rated flow rate.
- Make sure to operate the pump at or near the rated conditions. Failure to do so can result in pump damage from cavitation or recirculation.

Operation at reduced capacity



WARNING:

Never operate any pumping system with a blocked suction and discharge. Operation, even for a brief period under these conditions, can cause confined pumped fluid to overheat, which results in a violent explosion. You must take all necessary measures to avoid this condition.

**CAUTION:**

Avoid excessive vibration levels. Excessive vibration levels can damage the bearings, stuffing box or seal chamber, and the mechanical seal, which can result in decreased performance.

NOTICE:

- Avoid increased radial load. Failure to do so can cause stress on the shaft and bearings.
 - Avoid heat build-up. Failure to do so can cause rotating parts to score or seize.
 - Avoid cavitation. Failure to do so can cause damage to the internal surfaces of the pump.
-

Operation under freezing conditions

NOTICE:

Do not expose an idle pump to freezing conditions. Drain all liquid that is inside the pump. Failure to do so can cause liquid to freeze and damage the pump.

Shut down the pump

1. Slowly close the discharge valve.
2. Shut down and lock the driver to prevent accidental rotation.

Note on the packed pump operation

Tighten the gland nuts

Before you start the pump, back off the packing gland nuts or screws until the gland is loose.

Hand tighten until the gland is snug against the first packing ring. Initially, water might freely run from the packing. This is normal and should be allowed to continue for a period of time before you continue to tighten the gland. Tighten the gland nuts slowly and one flat at a time.

Leakage rate

An adequate leakage rate is not one single value for all pumps and installations, but is the amount required to provide adequate cooling and lubrication. The required leakage is influenced by operating pressure, fluid temperature, shaft speed, and so forth. For fluid temperatures in the range of 32°F to 190°F (0°C to 88°C), average leakage rates of 60 to 80 drops per minute are recommended. However, each individual pump and installation has unique operating conditions that result in widely-variable leakage rate requirements.

Maximum fluid temperature

At fluid operating temperatures near the upper limit of 190°F (88°C), the maximum temperature rise of the leakage is important. Never operate a packed pump with steam forming at the gland. This limits the temperature rise to a maximum of about 20°F (-7°C). If the formation of steam persists at higher leakage rates, you must provide cooling water by means of an external supply, or a heat exchanger used to cool the bypass flush.

Maintenance

Bearing maintenance

Bearing lubrication schedule

Type of bearing	First lubrication	Lubrication intervals
Motor bearings	No initial lubrication. The motor was lubricated at the factory.	Refer to the motor manufacturer's recommendations for lubrication intervals.

Disassembly

Disassembly precautions

This manual clearly identifies accepted methods for disassembling units. These methods must be adhered to.



WARNING:

- Make sure that the pump is isolated from the system and that pressure is relieved before you disassemble the pump, remove plugs, open vent or drain valves, or disconnect the piping.
- Always disconnect and lock out power to the driver before you perform any installation or maintenance tasks. Failure to disconnect and lock out driver power will result in serious physical injury.
- Crush hazard. The unit and the components can be heavy. Use proper lifting methods and wear steel-toed shoes at all times.

NOTICE:

Make sure that all replacement parts are available before you disassemble the pump for overhaul.

Drain the pump



CAUTION:

- Allow all system and pump components to cool before you handle them to prevent physical injury.

1. Close the isolation valves on the suction and discharge sides of the pump.
You must drain the system if no valves are installed.
2. Open the drain valve.
Do not proceed until liquid stops coming out of the drain valve. If liquid continues to flow from the drain valve, the isolation valves are not sealing properly and you must repair them before you proceed.
3. Leave the drain valve open and remove the drain plug located on the bottom of the pump housing.
Do not reinstall the plug or close the drain valve until the reassembly is complete.
4. Drain the liquid from the piping and flush the pump if it is necessary.
5. Disconnect all auxiliary piping and tubing.

Remove the rotating assembly and motor

1. Remove the motor foot capscrews.
2. Loosen the volute capscrews but do not remove them.

3. Loosen the rotating assembly from the volute.

**WARNING:**

Make certain that the internal pressure of the pump is relieved before you continue. Failure to follow these instructions could result in serious personal injury or death, or property damage.

4. Remove the seal flushing tube if it is used.
5. Remove the volute capscrews.
6. Remove the rotating assembly and motor from the volute.
7. Remove the impeller capscrew, lock washer, and washer.
8. Remove the impeller.

Remove the mechanical seal (e-1531/e-1532 and e-1531/e-1532-F)

1. Remove the rotating portion of the seal.
If necessary, use a screwdriver to loosen the rubber ring.
2. Remove the seal insert, the insert gasket, and the retainer if it is used.

Remove the seal or packing rings (e-1531/e-1532-S, e-1531/e-1532-D, and e-1531/e-1532-PF)

1. Remove the hex nuts from the seal cap bolts.
2. For the e-1531/2-PF, remove the hex nuts from the packing gland.
3. Remove the coverplate screws.
4. Remove the coverplate from the bracket.
5. Remove the seal assembly or packing rings.

Impeller trimming guidelines**Machining**

When it is necessary to reduce the pump flow rate and generated head by trimming the impeller diameter, the following guidelines apply for stainless steel impellers:

- Review the pump hydraulic selection data and consult your local Xylem representative to select the proper reduced diameter.
- For the e-1531 or e-1532 4AD model, before trimming the impeller refer to the 4AD angle cut guidelines.
- For machining recommendations, see P2002535 Stainless Steel Impeller Trimming Guidelines.

Balancing

It is recommended that impellers trimmed more than 5% in diameter be rebalanced per ISO 1940 grade G6.3.

Angle cut guidelines

Model e-1531 and e-1532 4AD pump impellers must be angle cut at reduced diameters according to the following information.

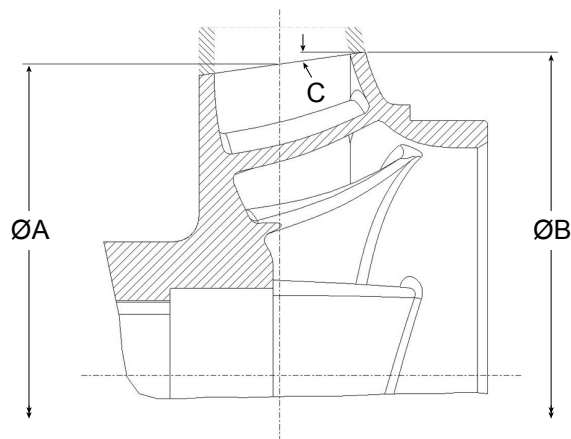


Figure 4: 4AD impeller trim – 0.125 in. (3.17 mm) increments

A	B	C
Hydraulic diameter, nominal, as shown on selection curves	Diameter at impeller inlet side shroud	Trim angle
From maximum diameter 7 in. (177.8 mm) to 6.125 in. (155.6 mm)	Use diameter from selection curves	0 degrees, no angle
6, 5.875, 5.75, 5.625 in. (162.4 to 142.9 mm)	B = A plus 0.250 in. (6.35 mm)	8 degrees
5.5, 5.375, 5.25, 5.125, minimum 5 in. (139.7 to 127.0 mm)	B = A plus 0.375 in. (9.53 mm)	8 degrees

Pre-assembly inspections

Guidelines

Before you assemble the pump parts, make sure you follow these guidelines:

- Inspect the pump parts according to the information in these pre-assembly topics before you reassemble your pump. Replace any part that does not meet the required criteria.
- Make sure that the parts are clean. Clean the pump parts in solvent in order to remove oil, grease, and dirt.

NOTICE:

Protect machined surfaces while you clean the parts. Failure to do so may result in equipment damage.

Areas to inspect

Inspect the pump for leaking seals, worn gaskets, and loose or damaged components. Replace or repair these parts as required.

Shaft and sleeve inspection

Inspection criteria

Inspect the shaft and sleeve according to this criteria:

- Thoroughly clean the shaft and sleeve.
- Thoroughly clean the coverplate seal cavity.
- Inspect the surface for damage such as pitting, corrosion, nicks, and scratches.

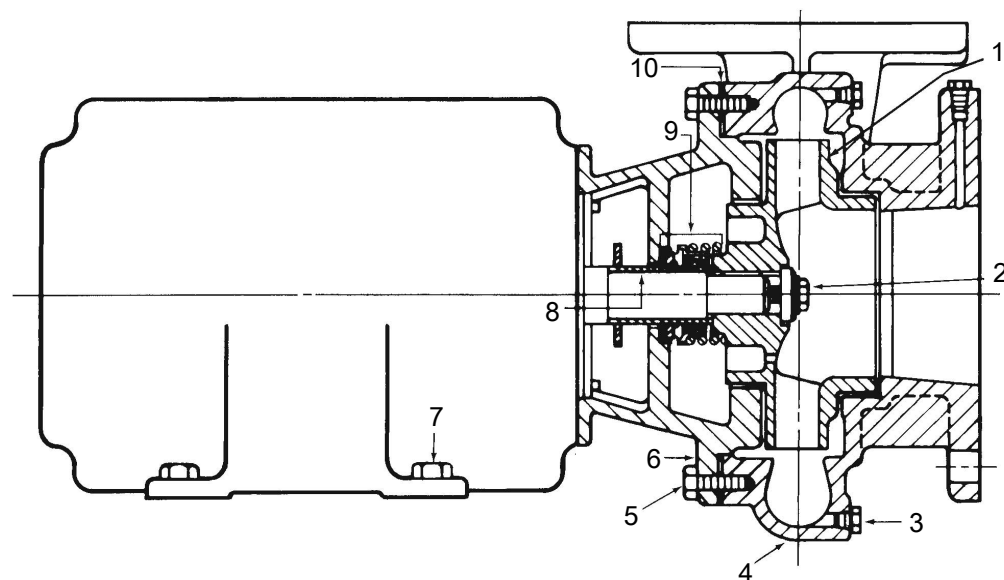
Replace these parts if they are damaged.

Reassembly

Seal assembly

Assemble the standard mechanical seal (e-1531/e-1532 and e-1531/e-1532-F)

- 1. Lubricate the shaft sleeve and coverplate seal cavity with soapy water.
Do not use a petroleum lubricant.
- 2. Install a new cup gasket and a new seal insert with the indentation side down into the cup.
- 3. Slide a new rotating seal assembly onto the shaft sleeve.
- 4. Push the top of the compression ring with a screwdriver until the seal is tight against the seal insert.
- 5. Install the seal spring and point the narrow end toward the seal.



- 1. Impeller
- 2. Impeller capscrew
- 3. Drain plug
- 4. Volute
- 5. Volute capscrews
- 6. Motor bracket
- 7. Motor foot capscrews
- 8. Shaft sleeve
- 9. Seal assembly
- 10. Volute gasket

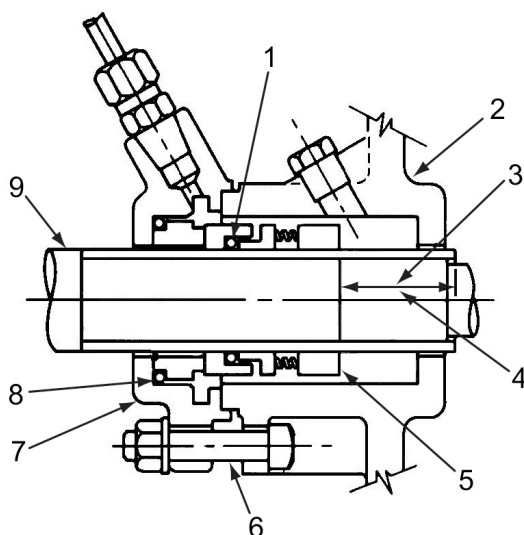
Assemble the single mechanical seal (e-1531/e-1532-S)

- 1. Lubricate the shaft sleeve and seal cap with soapy water.
Do not use a petroleum lubricant.
- 2. Insert a stationary seal with an O-ring into the seal cap and slide it onto the shaft.
- 3. Replace the seal cap gasket.
- 4. Slide the rotating portion of the seal assembly onto the shaft sleeve and lock it in place.

ID seal size	Distance between collar and impeller end of the shaft sleeve
1-1/4 in. (3.175 cm)	1-13/32 in. (3.571 cm)
1-5/8 in. (4.128 cm)	1-1/4 in. (3.175 cm)

- 5. Assemble the coverplate onto the bracket.
- 6. Tighten the capscrews according to the Capscrew torque table.

7. Attach the seal cap to the coverplate.
8. Tighten the hex nuts on the seal cap bolts according to the Capscrew torque table.

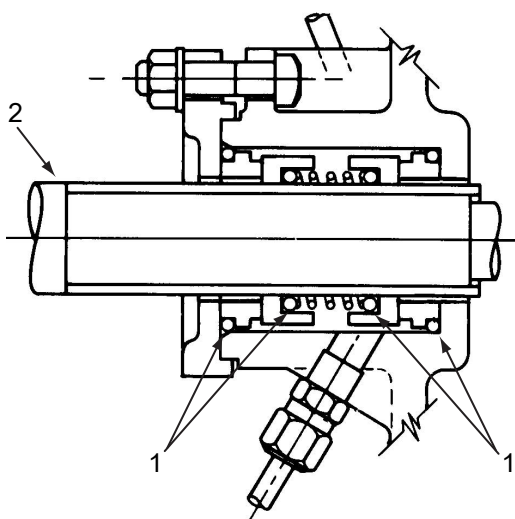


1. O-ring
2. Coverplate
3. For 1-1/4 in. seal: 1-13/32 in. (3.571 cm)
4. For 1-5/8 in. seal: 1-1/4 in. (3.175 cm)
5. Seal locking collar
6. Seal cap bolt
7. Seal cap
8. O-ring
9. Motor end

Figure 5: Single mechanical seal (e-1531/e-1532-S)

Assemble the double mechanical seal (e-1531/e-1532-D)

1. Lubricate the shaft sleeve, seal cap, and coverplate cavity with soapy water. Do not use a petroleum lubricant.
2. Insert a stationary seal and O-ring into the seal cap. For the 1-1/4 in. ID seal, both parts are housed in the coverplate. A seal cap gasket is not used.



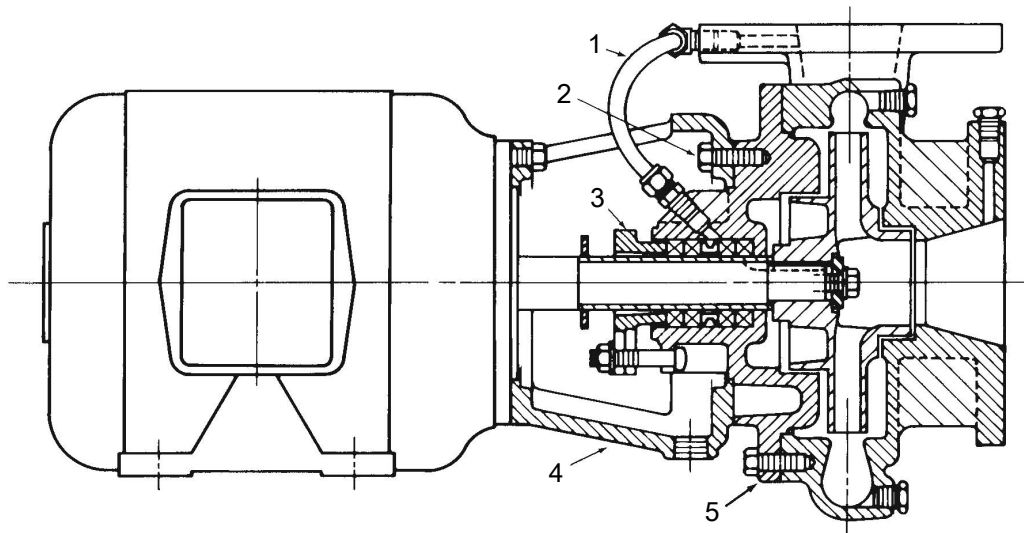
1. O-rings
2. Motor end

Figure 6: Double mechanical seal (e-1531/e-1532-D)

3. Insert another stationary seal and O-ring into the coverplate.
4. Slide the seal cap onto the shaft.
5. Replace the seal cap gasket.
6. Slide the rotating portion of the seal assembly onto the shaft sleeve.
7. Assemble the coverplate onto the bracket.
8. Tighten the capscrews according to the Capscrew torque values table.
9. Attach the seal cap to the coverplate.
10. Tighten the hex nuts on the seal cap bolts according to the Capscrew torque values table.

Assemble the packed stuffing box (e-1531/e-1532-PF)

1. Insert two packing rings into the stuffing box.
2. Insert the lantern ring and the last two pieces of packing.
Make sure that the joints on the packing rings are staggered 90°.
3. Install, but do not tighten, the packing gland.
4. Install the coverplate over the pump shaft.
5. Tighten the capscrews according to the Capscrew torque table in the Maintenance chapter.
6. Tighten the packing gland to compress the packing.
See the note on the packed pump operation in the Operations chapter for more information.



1. Flushing tube
2. Coverplate capscrew
3. Packing gland
4. Bracket
5. Coverplate

Reinstall the rotating assembly and motor

1. Install the impeller, impeller washer, lock washer, and capscrew, and then tighten per the Capscrew torque values table.
2. Install a new volute gasket.
3. Install the rotating assembly and motor into the volute.
4. Tighten the volute capscrews according to the Capscrew torque values table.

5. Install a seal flushing tube if it is used.
 6. Install the drain plug and close the drain valve.
 7. Open the isolation valves and inspect the pump for leaks.
- Return the pump to service if you do not detect any leaks. See the Note on the packed pump operation in the Commissioning, Startup, Operations, and Shutdown chapter.

Capscrew torque values

Capscrew torque in ft-lbs (Nm)

Capscrew type	Head marking	1/4 in.	5/16 in.	3/8 in.	7/16 in.	1/2 in.	5/8 in.	3/4 in.	7/8 in.	1 in.
SAE grade 2		6 (8)	13 (18)	25 (34)	38 (52)	60 (81)	120 (163)	190 (258)	210 (285)	300 (407)
Brass or stainless steel	 or 	4 (5)	10 (14)	17 (23)	27 (37)	42 (57)	83 (113)	130 (176)	200 (271)	300 (407)
SAE grade 5		10 (14)	20 (27)	35 (47)	60 (81)	90 (122)	180 (244)	325 (441)	525 (712)	800 (1085)

Pipe plug torque values

Table 2: Pipe plug torque, ft-lb (Nm)

Size	Turns past finger tight	Approximate torque
1/8 in NPT	1.5 to 3	12 (16)
1/4 in NPT	1.5 to 3	25 (34)
3/8 in NPT	1.5 to 3	40 (54)
1/2 in NPT	1.5 to 3	54 (73)

Dealer servicing

If trouble occurs that cannot be rectified, contact your local sales and service representative and be prepared to provide this information:

1. Complete nameplate data of pump and motor
2. Suction and discharge pipe pressure gauge readings
3. Ampere draw of the motor
4. A sketch of the pump hook-up and piping

Product warranty

Commercial warranty

Warranty. For goods sold to commercial buyers, Seller warrants the goods sold to Buyer hereunder (with the exception of membranes, seals, gaskets, elastomer materials, coatings and other "wear parts" or consumables all of which are not warranted except as otherwise provided in the quotation or sales form) will be (i) be built in accordance with the specifications referred to in the quotation or sales form, if such specifications are expressly made a part of this Agreement, and (ii) free from defects in material and workmanship for a period of one (1) year from the date of installation or eighteen (18) months from the date of shipment (which date of shipment shall not be greater than thirty (30) days after receipt of notice that the goods are ready to ship), whichever shall occur first, unless a longer period is specified in the product documentation (the "Warranty").

Except as otherwise required by law, Seller shall, at its option and at no cost to Buyer, either repair or replace any product which fails to conform with the Warranty provided Buyer gives written notice to Seller of any defects in material or workmanship within ten (10) days of the date when any defects or non-conformance are first manifest. Under either repair or replacement option, Seller shall not be obligated to remove or pay for the removal of the defective product or install or pay for the installation of the replaced or repaired product and Buyer shall be responsible for all other costs, including, but not limited to, service costs, shipping fees and expenses. Seller shall have sole discretion as to the method or means of repair or replacement. Buyer's failure to comply with Seller's repair or replacement directions shall terminate Seller's obligations under this Warranty and render the Warranty void. Any parts repaired or replaced under the Warranty are warranted only for the balance of the warranty period on the parts that were repaired or replaced. Seller shall have no warranty obligations to Buyer with respect to any product or parts of a product that have been: (a) repaired by third parties other than Seller or without Seller's written approval; (b) subject to misuse, misapplication, neglect, alteration, accident, or physical damage; (c) used in a manner contrary to Seller's instructions for installation, operation and maintenance; (d) damaged from ordinary wear and tear, corrosion, or chemical attack; (e) damaged due to abnormal conditions, vibration, failure to properly prime, or operation without flow; (f) damaged due to a defective power supply or improper electrical protection; or (g) damaged resulting from the use of accessory equipment not sold or approved by Seller. In any case of products not manufactured by Seller, there is no warranty from Seller; however, Seller will extend to Buyer any warranty received from Seller's supplier of such products.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ANY AND ALL OTHER EXPRESS OR IMPLIED WARRANTIES, GUARANTEES, CONDITIONS OR TERMS OF WHATEVER NATURE RELATING TO THE GOODS PROVIDED HEREUNDER, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY EXPRESSLY DISCLAIMED AND EXCLUDED. EXCEPT AS OTHERWISE REQUIRED BY LAW, BUYER'S EXCLUSIVE REMEDY AND SELLER'S AGGREGATE LIABILITY FOR BREACH OF ANY OF THE FOREGOING WARRANTIES ARE LIMITED TO REPAIRING OR REPLACING THE PRODUCT AND SHALL IN ALL CASES BE LIMITED TO THE AMOUNT PAID BY THE BUYER FOR THE DEFECTIVE PRODUCT. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY OTHER FORM OF DAMAGES, WHETHER DIRECT, INDIRECT, LIQUIDATED, INCIDENTAL, CONSEQUENTIAL, PUNITIVE, EXEMPLARY OR SPECIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFIT, LOSS OF ANTICIPATED SAVINGS OR REVENUE, LOSS OF INCOME, LOSS OF BUSINESS, LOSS OF PRODUCTION, LOSS OF OPPORTUNITY OR LOSS OF REPUTATION.

Limited consumer warranty

Warranty. For goods sold for personal, family or household purposes, Seller warrants the goods purchased hereunder (with the exception of membranes, seals, gaskets, elastomer

materials, coatings and other "wear parts" or consumables all of which are not warranted except as otherwise provided in the quotation or sales form) will be free from defects in material and workmanship for a period of one (1) year from the date of installation or eighteen (18) months from the product date code, whichever shall occur first, unless a longer period is provided by law or is specified in the product documentation (the "Warranty").

Except as otherwise required by law, Seller shall, at its option and at no cost to Buyer, either repair or replace any product which fails to conform with the Warranty provided Buyer gives written notice to Seller of any defects in material or workmanship within ten (10) days of the date when any defects or non-conformance are first manifest. Under either repair or replacement option, Seller shall not be obligated to remove or pay for the removal of the defective product or install or pay for the installation of the replaced or repaired product and Buyer shall be responsible for all other costs, including, but not limited to, service costs, shipping fees and expenses. Seller shall have sole discretion as to the method or means of repair or replacement. Buyer's failure to comply with Seller's repair or replacement directions shall terminate Seller's obligations under this Warranty and render this Warranty void. Any parts repaired or replaced under the Warranty are warranted only for the balance of the warranty period on the parts that were repaired or replaced. The Warranty is conditioned on Buyer giving written notice to Seller of any defects in material or workmanship of warranted goods within ten (10) days of the date when any defects are first manifest.

Seller shall have no warranty obligations to Buyer with respect to any product or parts of a product that have been: (a) repaired by third parties other than Seller or without Seller's written approval; (b) subject to misuse, misapplication, neglect, alteration, accident, or physical damage; (c) used in a manner contrary to Seller's instructions for installation, operation and maintenance; (d) damaged from ordinary wear and tear, corrosion, or chemical attack; (e) damaged due to abnormal conditions, vibration, failure to properly prime, or operation without flow; (f) damaged due to a defective power supply or improper electrical protection; or (g) damaged resulting from the use of accessory equipment not sold or approved by Seller. In any case of products not manufactured by Seller, there is no warranty from Seller; however, Seller will extend to Buyer any warranty received from Seller's supplier of such products.

THE FOREGOING WARRANTY IS PROVIDED IN PLACE OF ALL OTHER EXPRESS WARRANTIES. ALL IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO ONE (1) YEAR FROM THE DATE OF INSTALLATION OR EIGHTEEN (18) MONTHS FROM THE PRODUCT DATE CODE, WHICHEVER SHALL OCCUR FIRST. EXCEPT AS OTHERWISE REQUIRED BY LAW, BUYER'S EXCLUSIVE REMEDY AND SELLER'S AGGREGATE LIABILITY FOR BREACH OF ANY OF THE FOREGOING WARRANTIES ARE LIMITED TO REPAIRING OR REPLACING THE PRODUCT AND SHALL IN ALL CASES BE LIMITED TO THE AMOUNT PAID BY THE BUYER FOR THE DEFECTIVE PRODUCT. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY OTHER FORM OF DAMAGES, WHETHER DIRECT, INDIRECT, LIQUIDATED, INCIDENTAL, CONSEQUENTIAL, PUNITIVE, EXEMPLARY OR SPECIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFIT, LOSS OF ANTICIPATED SAVINGS OR REVENUE, LOSS OF INCOME, LOSS OF BUSINESS, LOSS OF PRODUCTION, LOSS OF OPPORTUNITY OR LOSS OF REPUTATION.

Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusions may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which may vary from state to state.

To make a warranty claim, check first with the dealer from whom you purchased the product or visit www.xyleminc.com for the name and location of the nearest dealer providing warranty service.

Xylem |'zīləm|

- 1) The tissue in plants that brings water upward from the roots
- 2) A leading global water technology company

We're a global team unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

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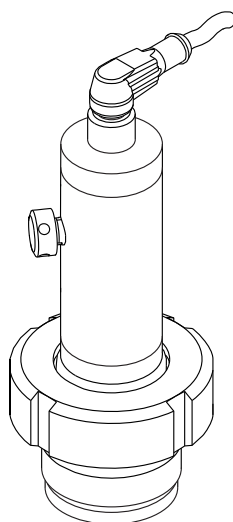
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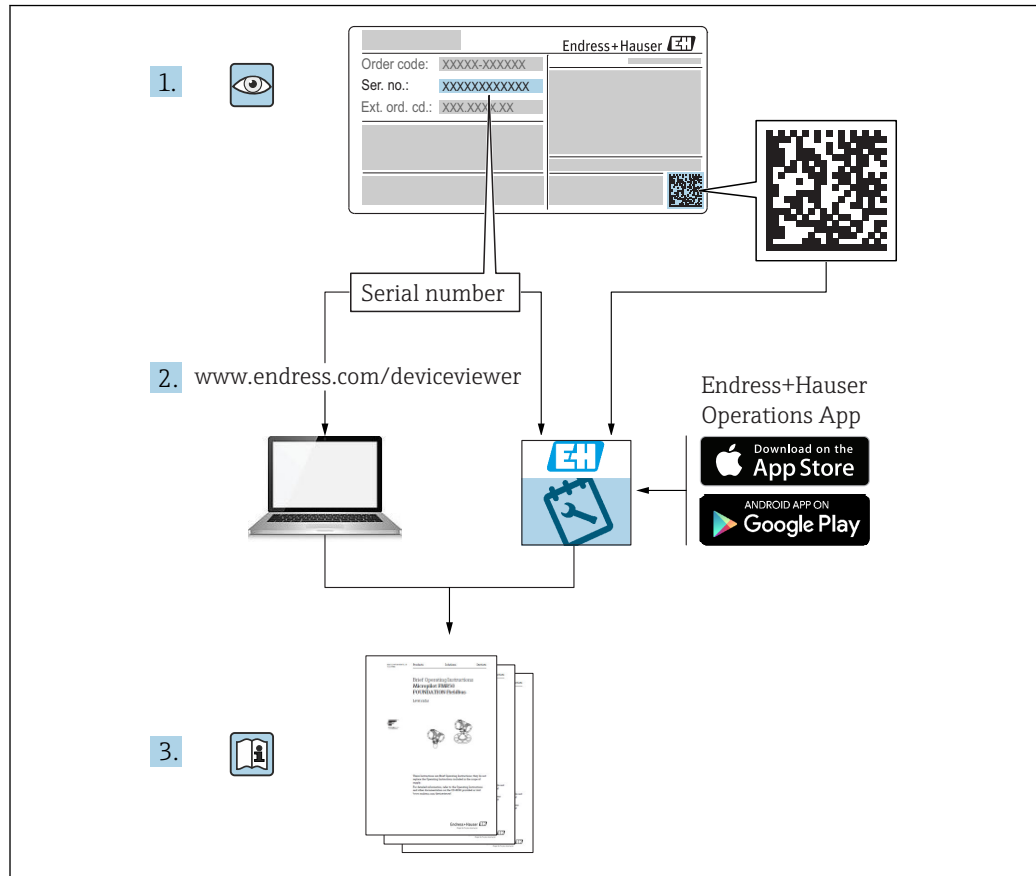
Operating Instructions

Cerabar PMP23

IO-Link

Process pressure measurement
Pressure transducer for safe measurement and
monitoring of absolute and gauge pressure





A0023555

- Make sure the document is stored in a safe place such that it is always available when working on or with the device.
- To avoid danger to individuals or the facility, read the "Basic safety instructions" section carefully, as well as all other safety instructions in the document that are specific to working procedures.
- The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser distributor will supply you with current information and updates to these Operating Instructions.

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1 About this document

1.1 Document function

These Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

1.2 Symbols used

1.2.1 Safety symbols

Symbol	Meaning
 DANGER	DANGER! This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
 WARNING	WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
 CAUTION	CAUTION! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
 NOTICE	NOTICE! This symbol contains information on procedures and other facts which do not result in personal injury.

1.2.2 Electrical symbols

Symbol	Meaning	Symbol	Meaning
	Protective ground connection A terminal which must be connected to ground prior to establishing any other connections.		Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.

1.2.3 Tool symbols

Symbol	Meaning
 A0011222	Open-ended wrench

1.2.4 Symbols for certain types of information

Symbol	Meaning
	Permitted Procedures, processes or actions that are permitted.
	Forbidden Procedures, processes or actions that are forbidden.
	Tip Indicates additional information.

Symbol	Meaning
	Reference to documentation
	Reference to page
	Reference to graphic
	Series of steps
	Result of a step
	Visual inspection

1.2.5 Symbols in graphics

Symbol	Meaning
1, 2, 3 ...	Item numbers
	Series of steps
A, B, C, ...	Views

1.3 Documentation

 The document types listed are available:
In the Download Area of the Endress+Hauser Internet site: www.endress.com → Download

1.3.1 Technical Information (TI): planning aid for your device

TI01203P

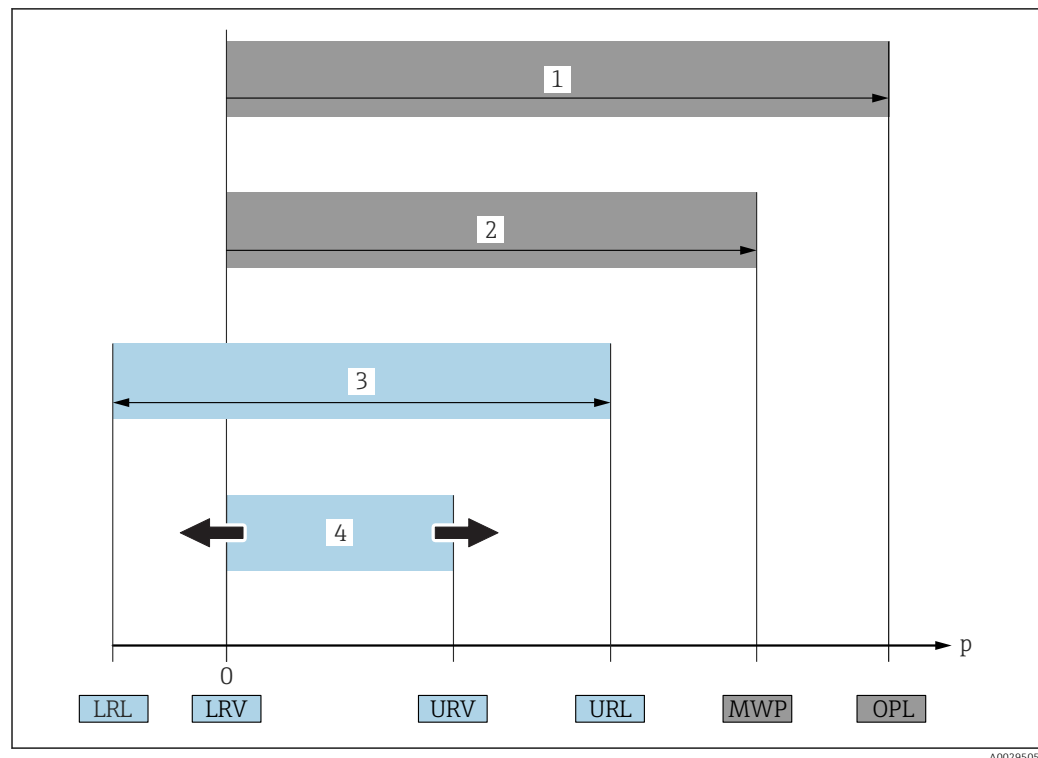
The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.

1.3.2 Brief Operating Instructions (KA): getting the 1st measured value quickly

KA01164P

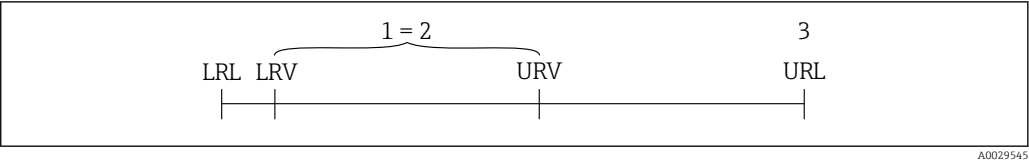
These instructions contain all the essential information from incoming acceptance to initial commissioning.

1.4 Terms and abbreviations



Item	Term/abbreviation	Explanation
1	OPL	The OPL (over pressure limit = sensor overload limit) for the measuring device depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection has to be taken into consideration in addition to the measuring cell. Also observe pressure-temperature dependency. For the relevant standards and additional notes, see the "Pressure specifications" section → 67 . The OPL may only be applied for a limited period of time.
2	MWP	The MWP (maximum working pressure) for the sensors depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection has to be taken into consideration in addition to the measuring cell. Also observe pressure-temperature dependency. For the relevant standards and additional notes, see the "Pressure specifications" section → 67 . The MWP may be applied at the device for an unlimited period. The MWP can also be found on the nameplate.
3	Maximum sensor measuring range	Span between LRL and URL This sensor measuring range is equivalent to the maximum calibratable/adjustable span.
4	Calibrated/adjusted span	Span between LRV and URV Factory setting: 0 to URL Other calibrated spans can be ordered as customized spans.
p	-	Pressure
-	LRL	Lower range limit
-	URL	Upper range limit
-	LRV	Lower range value
-	URV	Upper range value
-	TD (turn down)	Turn down The turn down is preset at the factory and cannot be changed. Example - see the following section.

1.5 Turn down calculation



- 1 *Calibrated/adjusted span*
- 2 *Zero point-based span*
- 3 *URL sensor*

Example

- Sensor:10 bar (150 psi)
- Upper range value (URL) = 10 bar (150 psi)

Turn down (TD):

$$TD = \frac{URL}{|URV - LRV|}$$
$$TD = \frac{10 \text{ bar (150 psi)}}{|5 \text{ bar (75 psi)} - 0 \text{ bar (0 psi)}|} = 2$$

In this example, the TD is 2:1.
This span is based on the zero point.

- Calibrated/adjusted span: 0 to 5 bar (0 to 75 psi)
- Lower range value (LRV) = 0 bar (0 psi)
- Upper range value (URV) = 5 bar (75 psi)

1.6 Registered trademarks

 **IO-Link**

is a registered trademark of the IO-Link company group.

2 Basic safety instructions

2.1 Requirements concerning the staff

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:

- ▶ Trained, qualified specialists: must have a relevant qualification for this specific function and task
- ▶ Are authorized by the plant owner/operator
- ▶ Are familiar with federal/national regulations
- ▶ Before beginning work, the specialist staff must have read and understood the instructions in the Operating Instructions and supplementary documentation as well as in the certificates (depending on the application)
- ▶ Following instructions and basic conditions

The operating personnel must fulfill the following requirements:

- ▶ Being instructed and authorized according to the requirements of the task by the facility's owner-operator
- ▶ Following the instructions in these Operating Instructions

2.2 Designated use

2.2.1 Application and media

The Cerabar is used to measure absolute and gauge pressure in gases, vapors and liquids. The process-wetted materials of the measuring device must have an adequate level of resistance to the media.

The measuring device may be used for the following measurements (process variables)

- in compliance with the limit values specified under "Technical data"
- in compliance with the conditions that are listed in this manual.

Measured process variable

Gauge pressure or absolute pressure

Calculated process variable

Pressure

2.2.2 Incorrect use

The manufacturer is not liable for damage caused by improper or non-designated use.

Verification for borderline cases:

- ▶ For special fluids and fluids for cleaning, Endress+Hauser is glad to provide assistance in verifying the corrosion resistance of process-wetted materials, but does not accept any warranty or liability.

2.2.3 Residual risks

When in operation, the housing may reach a temperature close to the process temperature.

Danger of burns from contact with surfaces!

- ▶ For elevated process temperatures, ensure protection against contact to prevent burns.

2.3 Workplace safety

For work on and with the device:

- ▶ Wear the required personal protective equipment according to federal/national regulations.
- ▶ Switch off the supply voltage before connecting the device.

2.4 Operational safety

Risk of injury!

- ▶ Operate the device in proper technical condition and fail-safe condition only.
- ▶ The operator is responsible for interference-free operation of the device.

Conversions to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers.

- ▶ If, despite this, modifications are required, consult with Endress+Hauser.

Hazardous area

To eliminate the risk of danger to persons or the facility when the device is used in the approval-related area (e.g. pressure equipment safety):

- ▶ Check the nameplate to verify if the device ordered can be put to its intended use in the approval-related area.

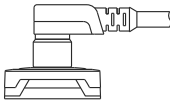
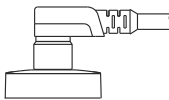
2.5 Product safety

This measuring device is designed in accordance with good engineering practice to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate.

It meets general safety standards and legal requirements. It also complies with the EU directives listed in the device-specific EU Declaration of Conformity. Endress+Hauser confirms this by affixing the CE mark to the device.

3 Product description

3.1 Product design

Overview		Item	Description
C - 1  A0021987 C - 2  A0027289 D  A0027227 E  A0027227	C- 1	M12 plug Housing cap made of plastic	
	C- 2	M12 plug IP69: metal housing cap	
	D E	Housing Process connection (sample illustration)	

3.2 Function

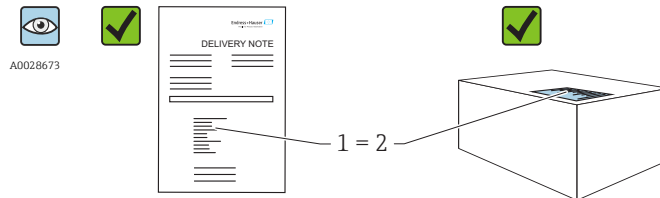
3.2.1 Calculating the pressure

Devices with metallic process isolating diaphragm

The process pressure deflects the metal process isolating diaphragm of the sensor and a fill fluid transfers the pressure to a Wheatstone bridge (semiconductor technology). The pressure-dependent change in the bridge output voltage is measured and evaluated.

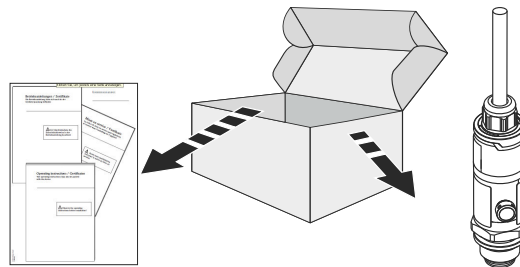
4 Incoming acceptance and product identification

4.1 Incoming acceptance

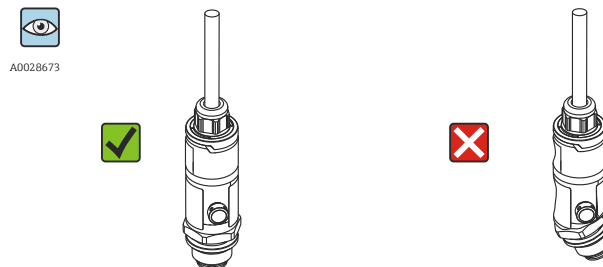


A0016870

Is the order code on the delivery note (1) identical to the order code on the product sticker (2)?

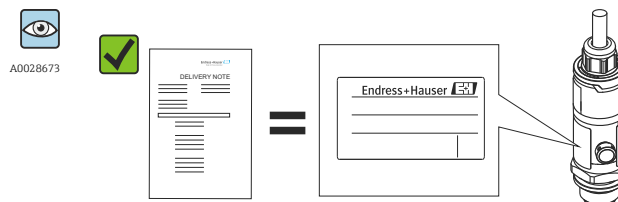


A0022100



A0022103

Are the goods undamaged?



A0022105

Do the data on the nameplate correspond to the order specifications and the delivery note?



If one of these conditions does not apply, please contact your Endress+Hauser sales office.

4.2 Product identification

The following options are available for the identification of the measuring device:

- Nameplate specifications
- Order code with a breakdown of the device features on the delivery note
- Enter the serial numbers from the nameplates in *W@M Device Viewer* (www.endress.com/deviceviewer): All the information about the measuring device is displayed.

For an overview of the technical documentation provided, enter the serial number from the nameplates in *W@M Device Viewer* (www.endress.com/deviceviewer)

4.2.1 Manufacturer address

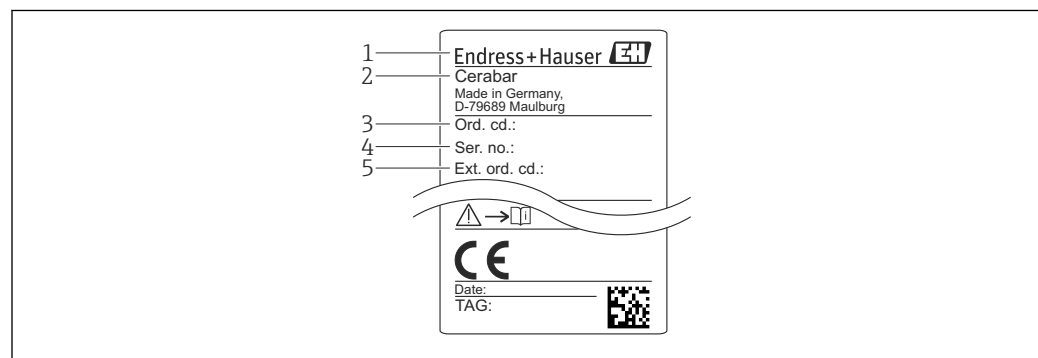
Endress+Hauser SE+Co. KG

Hauptstraße 1

79689 Maulburg, Germany

Address of the manufacturing plant: See nameplate.

4.2.2 Nameplate



- 1 Manufacturer's address
- 2 Device name
- 3 Order number
- 4 Serial number
- 5 Extended order number

4.3 Storage and transport

4.3.1 Storage conditions

Use original packaging.

Store the measuring device in clean and dry conditions and protect from damage caused by shocks (EN 837-2).

Storage temperature range

-40 to +85 °C (-40 to +185 °F)

4.3.2 Transporting the product to the measuring point

WARNING

Incorrect transport!

Housing and diaphragm may become damaged, and there is a risk of injury!

- Transport the measuring device to the measuring point in its original packaging or by the process connection.

5 Installation

5.1 Mounting dimensions

For dimensions, see the "Mechanical construction" section in the Technical Information.

5.2 Installation conditions

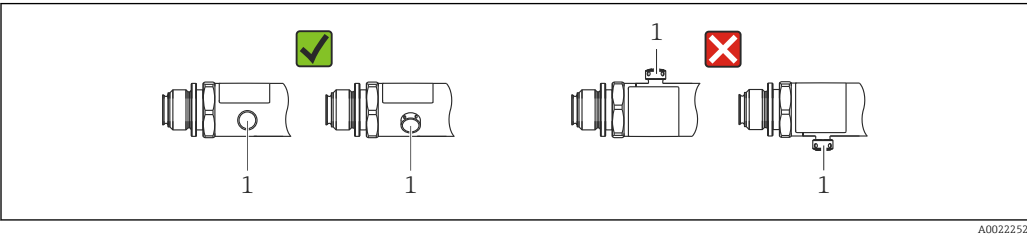
- Moisture must not penetrate the housing when mounting the device, establishing the electrical connection and during operation.
- For M12 plug made of metal: Do not remove the protection cap (only in IP69) of M12 plug connection until shortly before electrical connection.
- Do not clean or touch process isolating diaphragms with hard and/or pointed objects.
- Do not remove process isolating diaphragm protection until shortly before installation.
- Always tighten the cable entry firmly.
- Point the cable and connector downwards where possible to prevent moisture from entering (e.g. rain or condensation water).
- Protect housing against impact.
- For devices with gauge pressure sensor, the following applies:

NOTICE

If a heated device is cooled in the course of a cleaning process (by cold water, for example), a vacuum develops for a short time causing moisture to penetrate the sensor via the pressure compensation element (1).

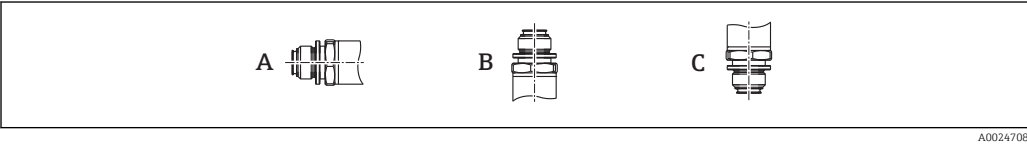
Device could be destroyed!

- In the event of this happening, mount the device in such a way that the pressure compensation element (1) is pointing downwards at an angle or to the side, if possible.



5.3 Influence of the installation position

Any orientation is possible. However, the orientation may cause a zero point shift i.e. the measured value does not show zero when the vessel is empty or partially full.



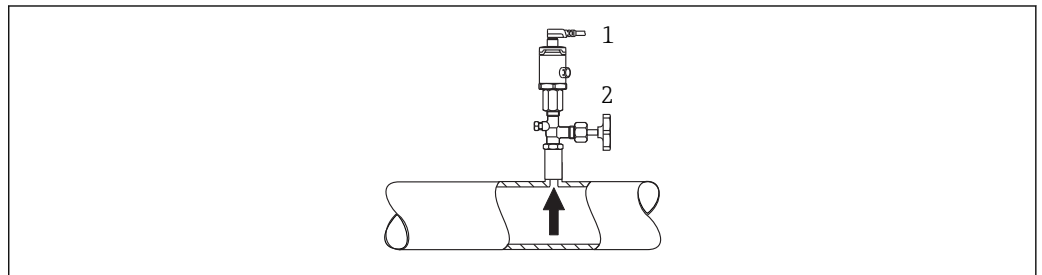
Type	Process isolating diaphragm axis is horizontal (A)	Process isolating diaphragm pointing upwards (B)	Process isolating diaphragm pointing downwards (C)
PMP23	Calibration position, no effect	Up to +4 mbar (+0.058 psi)	Up to -4 mbar (-0.058 psi)

5.4 Mounting location

5.4.1 Pressure measurement

Pressure measurement in gases

Mount the device with shutoff device above the tapping point so that any condensate can flow into the process.



A0021904

- 1 Device
- 2 Shutoff device

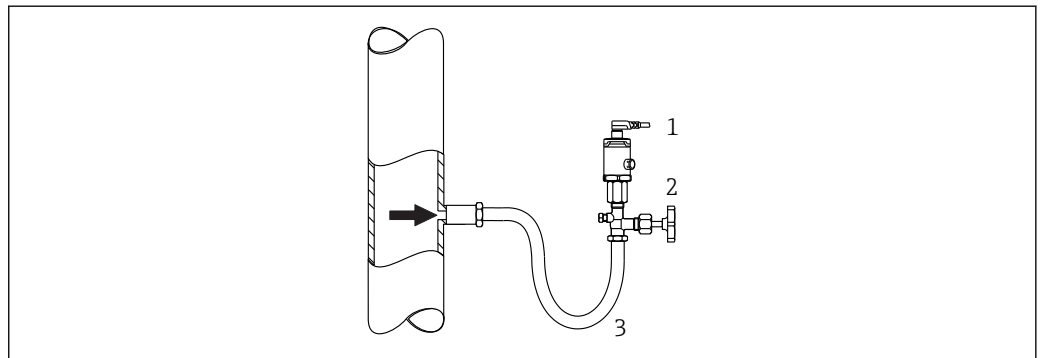
Pressure measurement in vapors

For pressure measurement in vapors, use a siphon. The siphon reduces the temperature to almost ambient temperature. Mount the device with a shutoff device at the same height as the tapping point.

Advantage:

only minor/negligible heat effects on the device.

Note the max. permitted ambient temperature of the transmitter!

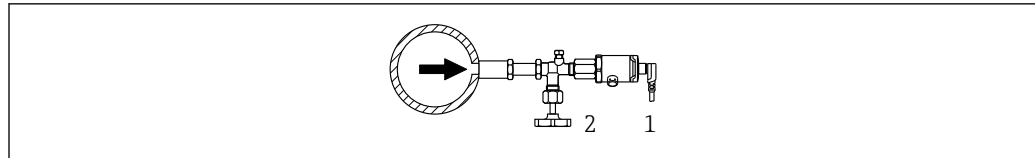


A0024395

- 1 Device
- 2 Shutoff device
- 3 Siphon

Pressure measurement in liquids

Mount the device with a shutoff device at the same height as the tapping point.

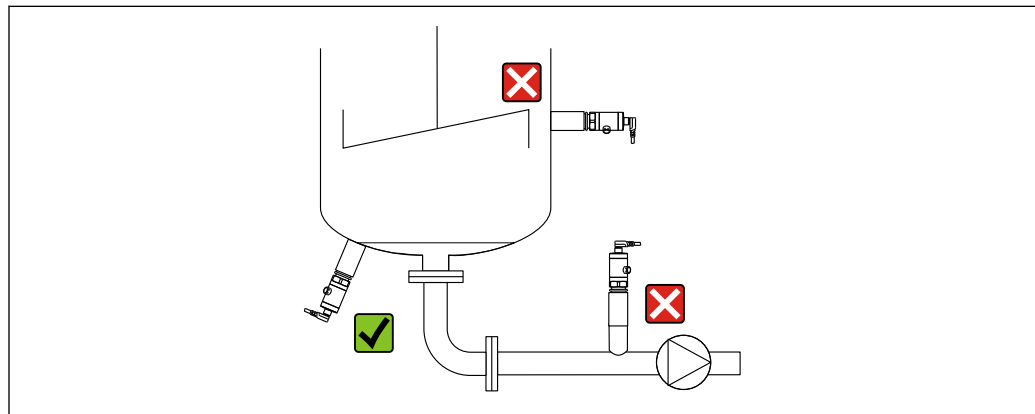


A0024399

- 1 Device
2 Shutoff device

5.4.2 Level measurement

- Always install the device below the lowest measuring point.
- Do not install the device at the following positions:
 - In the filling curtain
 - In the tank outlet
 - in the suction area of a pump
 - Or at a point in the tank which could be affected by pressure pulses from the agitator.



A0024405

5.5 Mounting of the profile seal for universal process mounting adapter

For details on mounting, see KA00096F/00/A3.

5.6 Post-installation check

☐	Is the device undamaged (visual inspection)?
☐	Does the device comply with the measuring point specifications? For example: ■ Process temperature ■ Process pressure ■ Ambient temperature range ■ Measuring range
☐	Are the measuring point identification and labeling correct (visual inspection)?
☐	Is the device adequately protected against precipitation and direct sunlight?
☐	Are the securing screws tightened securely?
☐	Is the pressure compensation element pointing downwards at an angle or to the side?
☐	To prevent moisture from penetrating, ensure that the connecting cables/plugs are pointing downwards.

6 Electrical connection

6.1 Connecting the measuring unit

6.1.1 Terminal assignment

⚠ WARNING

Risk of injury from the uncontrolled activation of processes!

- ▶ Switch off the supply voltage before connecting the device.
- ▶ Make sure that downstream processes are not started unintentionally.

⚠ WARNING

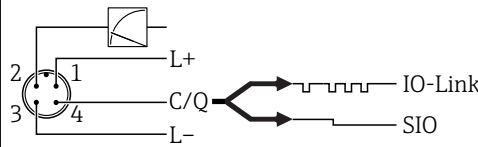
Electrical safety is compromised by an incorrect connection!

- ▶ In accordance with IEC/EN61010 a suitable circuit breaker must be provided for the device .
- ▶ The device must be operated with a 500 mA fine-wire fuse (slow-blow).
- ▶ Protective circuits against reverse polarity are integrated.

Connect the device in the following order:

1. Check that the supply voltage corresponds to the supply voltage indicated on the nameplate.
2. Connect the device in accordance with the following diagram.

Switch on the supply voltage.

Device	M12 plug
PMP23	 1 Supply voltage + 2 4-20 mA 3 Supply voltage - 4 C/Q (IO-Link communication or SIO mode)

6.1.2 Supply voltage

Electronic version	Device	Supply voltage
IO-Link	PMP23	10 to 30 V DC IO-Link communication is guaranteed only if the supply voltage is at least 18 V.

6.1.3 Current consumption and alarm signal

Electronic version	Device	Current consumption	Alarm signal ¹⁾
IO-Link	PMP23	Maximum current consumption: ≤ 300 mA	

1) For MAX alarm (factory setting)

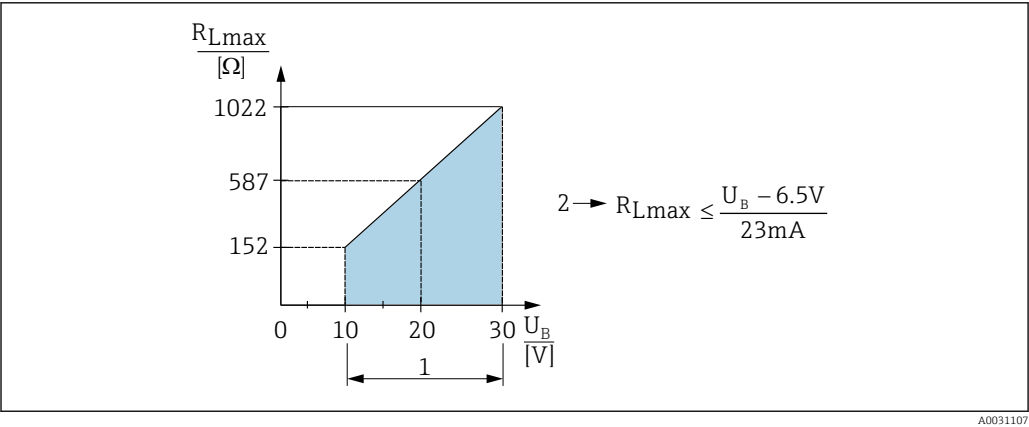
6.2 Switching capacity

- Switch status ON: $I_a \leq 200\text{ mA}$ ^{1) 2)}; switch status OFF: $I_a \leq 1\text{ mA}$
- Switch cycles: >10,000,000
- Voltage drop PNP: $\leq 2\text{ V}$
- Overload protection: Automatic load testing of switching current;
 - Max. capacitive load: $1\text{ }\mu\text{F}$ at max. supply voltage (without resistive load)
 - Max. cycle duration: 0.5 s ; min. t_{on} : $40\text{ }\mu\text{s}$
 - Periodic disconnection from protective circuit in the event of overcurrent ($f = 2\text{ Hz}$) and "F804" displayed

6.3 Connection data

6.3.1 Load (for 4 to 20 mA devices)

In order to guarantee sufficient terminal voltage, a maximum load resistance R_L (including line resistance) must not be exceeded depending on the supply voltage U_B of the supply unit.



- 1 Power supply 10 to 30 V DC
- 2 R_{Lmax} Maximum load resistance
- U_B Supply voltage

- Error current is output and "S803" displayed (output: MIN alarm current)
- Periodic checking to establish if it is possible to quit fault state

6.4 Post-connection check

☐	Is the device or cable undamaged (visual check)?
☐	Do the cables comply with the requirements?
☐	Do the mounted cables have adequate strain relief?
☐	Are all the cable glands installed, firmly tightened and leak-tight?
☐	Does the supply voltage match the specifications on the nameplate?

1) 100 mA can be guaranteed over the entire temperature range for the switch output 1 x PNP + 4 to 20 mA output. For lower ambient temperatures, higher currents are possible but cannot be guaranteed. Typical value at 20 °C (68 °F) approx. 200 mA. 200 mA can be guaranteed over the entire temperature range for the "1 x PNP" switch output.

2) Larger currents are supported, thus deviating from the IO-Link standard.

☐	Is the terminal assignment correct ?
☐	If required: has protective ground connection been established?

7 Operation options

7.1 Operation with an operating menu

7.1.1 IO-Link

IO-Link information

IO-Link is a point-to-point connection for communication between the measuring device and an IO-Link master. The measuring device features an IO-Link communication interface type 2 with a second IO function on pin 4. This requires an IO-Link-compatible assembly (IO-Link master) for operation. The IO-Link communication interface enables direct access to the process and diagnostic data. It also provides the option of configuring the measuring device while in operation.

Physical layer, the measuring device supports the following features:

- IO-Link specification: version 1.1
- IO-Link Smart Sensor Profile 2nd Edition (supports minimum scope of IdentClass)
- SIO mode: Yes
- Speed: COM2; 38.4 kBaud
- Minimum cycle time: 2.5 msec.
- Process data width: 32 bit
- IO-Link data storage: Yes
- Block configuration: Yes

IO-Link download

<http://www.endress.com/download>

- Select "Software" as the media type.
- Select "Device Driver" as the software type.
Select IO-Link (IODD).
- In the "Text Search" field enter the device name.

<https://ioddfinder.io-link.com/>

Search by

- Manufacturer
- Article number
- Product type

7.1.2 Structure of the operating menu

The menu structure has been implemented according to VDMA 24574-1 and complemented by Endress+Hauser-specific menu items.



For an overview of the operating menu, see the → 43

8 System integration

8.1 Process data

The measuring device has a current output and a switch output. The status of the switch output is transmitted in the form of process data via IO-Link.

- In the SIO mode, switch output 1 is switched at pin 4 of the M12 plug. In the IO-Link communication mode, this pin is reserved exclusively for communication.
- The current output at pin 2 of the M12 plug is always active or can be optionally deactivated via IO-Link.
- The device's process data are transmitted cyclically in 32-bit chunks.

Bit	0 (LSB)	1	...	28	29 (MSB)	30	31
Measuring device	Pressure value					OU1	res.

Bit 31 is reserved. Bit 30 provides the status of the switch output.

Here, 1 or DC 24 V corresponds to the logical "closed" state on the switch output. The remaining 30 bits contain the analog raw measured value of the device. This value has yet to be scaled by the target system to the nominal operating range of the existing measuring device.

Bit	Process value	Value range
30	OU1	0 = open 1 = closed
0 to 29	Raw value	Int30

The decimal separator must be set with a gradient. The gradients depend on the unit in question. The following units are available:

- bar: 0.0001
- kPa: 0.01
- MPa: 0.00001
- psi: 0.001

Examples:

Pressure value	Transmitted	Scaled with gradient
-320 mbar	-3 200	-0.32
22 bar	220 000	22
133 Pa	13 300	133
665 psi	665 000	665
399.5 bar	3 995 000	399.5

8.2 Reading out and writing device data (ISDU – Indexed Service Data Unit)

Device data are always exchanged acyclically and at the request of the IO-Link master. Using the device data, the following parameter values or device statuses can be read out:

8.2.1 Endress+Hauser-specific device data

Designation	ISDU (dec)	ISDU (hex)	Size (byte)	Data type	Access	Default value	Value range	Offset/Gradient	Data storage	Range limits
Extended Ordercode	259	0x0103	60	String	ro					
ENP_VERSION	257	0x0101	16	String	ro	36587				
Device Type	256	0x0100	2	UInteger16	ro	0x92FF				
Simulation Switch Output (OU1)	85	0x0055	1	unit	r/w		0 ~ off 1 ~ low 2 ~ high		No	
Simulation Current Output (OU2)	66	0x0042	1	unit	r/w		0 ~ off 3 ~ 3.5 mA 4 ~ 4 mA 5 ~ 8 mA 6 ~ 12 mA 7 ~ 16 mA 8 ~ 20 mA 9 ~ 21.95 mA		No	
Unit changeover (UNI)	67	0x0043	1	unit	r/w		0 ~ bar 1 ~ kPa 2 ~ psi 3 ~ MPa		Yes	
Zero point configuration (ZRO)	68	0x0044	4	int	r/w	0	as 00.00% Default 0.00%		Yes	
Zero point adoption (GTZ)	69	0x0045	1	unit	w				No	
Damping (TAU)	70	0x0046	2	unit	r/w	20	in 000.0 sec Default 2.0 sec	0.1	Yes	
Value for 4 mA (STL)	71	0x0047	4	int	r/w	0	as 00.00% Default 0.00%	bar: 0/0.001 kPa: 0/0.1 MPa: 0/0.0001 psi: 0/0.01	Yes	
Value for 20 mA (STU)	72	0x0048	4	int	r/w	10000	as 00.00% Default 100.00%	bar: 0/0.001 kPa: 0/0.1 MPa: 0/0.0001 psi: 0/0.01	Yes	
Pressure applied for 4mA (GTL)	73	0x0049	1	unit	w				No	
Pressure applied for 20mA (GTU)	74	0x004A	1	unit	w				No	
Alarm current (FCU)	75	0x004B	1	unit	r/w	MAX	0 ~ MIN 1 ~ MAX		Yes	
FUNC	88	0x0058	1	unit	r/w	1	0 ~ off 1 ~ I		Yes	
Switch point value/Upper value for pressure window, output 1 (SP1/FH1)	77	0x004D	4	int	r/w	9000	as 00.00% Default 90%	bar: 0/0.001 kPa: 0/0.1 MPa: 0/0.0001 psi: 0/0.01	Yes	
Switchback point value/Lower value for pressure window, output 1 (rP1/FL1)	78	0x004E	4	int	r/w	1000	as 00.00% Default 10%	bar: 0/0.001 kPa: 0/0.1 MPa: 0/0.0001 psi: 0/0.01	Yes	
Switching delay time, Output 1 (dS1)	79	0x004F	2	unit	r/w	0	in 00.00 sec	0/0.01	Yes	

Designation	ISDU (dec)	ISDU (hex)	Size (byte)	Data type	Access	Default value	Value range	Offset/Gradient	Data storage	Range limits
Switchback delay time, Output 1 (dR1)	80	0x0050	2	unit	r/w	0	in 00.00 sec	0/0.01	Yes	
Output 1 (Ou1)	81	0x0051	1	unit	r/w	HNO	0 ~ HNO ¹⁾ 1 ~ HNC ¹⁾ 2 ~ FNO ¹⁾ 3 ~ FNC ¹⁾		Yes	
Hi Max value (maximum indicator)	82	0x0052	4	int	ro				No	
Lo Min value (minimum indicator)	83	0x0053	4	int	ro				No	
Revisioncounter (RVC)	84	0x0054	2	unit	ro				No	

1) For an explanation of the abbreviations, see the parameter description → 44

8.2.2 IO-Link-specific device data

Designation	ISDU (dec)	ISDU (hex)	Size (byte)	Data type	Access	Default value	Data storage
Serial number	21	0x0015	max. 16	String	ro		
Firmware version	23	0x0017	max. 64	String	ro		
ProductID	19	0x0013	max. 64	String	ro	PMP23	
ProductName	18	0x0012	max. 64	String	ro	Cerabar	
ProductText	20	0x0014	max. 64	String	ro	Absolute and gauge pressure	
VendorName	16	0x0010	max. 64	String	ro	Endress+Hauser	
VendorText	17	0x0011	max. 64	String	ro	People for Process Automation	
Hardware Revision	22	0x0016	max. 64	String	ro		
Application Specific Tag	24	0x0018	32	String	r/w		
Actual Diagnostics (STA)	260	0x0104	4	String	ro		No
Last Diagnostic (LST)	261	0x0105	4	String	ro		No

8.2.3 System commands

Designation	ISDU (dec)	ISDU (hex)	Value range	Access
Reset to factory settings (RES)	2	0x0002	130	w
Device Access Locks.Data Storage Lock	12	0x000C	0 ~ False 2 ~ True	rw

9 Commissioning

If an existing configuration is changed, measuring operation continues! The new or modified entries are only accepted once the setting has been made.

If block parameter configuration is used, a parameter change is only adopted after the parameter download.

WARNING

Risk of injury from the uncontrolled activation of processes!

- ▶ Make sure that downstream processes are not started unintentionally.

WARNING

If a pressure smaller than the minimum permitted pressure or greater than the maximum permitted pressure is present at the device, the following messages are output in succession:

- ▶ S140
- ▶ F270

NOTICE

An IO-DD with corresponding default values is used for all pressure measuring ranges. This IO-DD applies for all measuring ranges! The default values of this IO-DD can be inadmissible for this device. IO-Link messages (e.g. "Parameter value above limit") may be displayed when the device is updated with these default values. Existing values are not accepted in this case. The default values apply exclusively to the 10 bar (150 psi) sensor.

- ▶ The data must first be read out of the device before default values are written from the IO-DD to the device.

9.1 Function check

Before commissioning your measuring point, ensure that the post-installation and post-connection check have been performed:

- "Post-installation check" checklist →  16
- "Post-connection check" checklist →  18

9.2 Commissioning with an operating menu

Commissioning comprises the following steps:

- Configure pressure measurement →  25
- Where applicable, perform position adjustment →  27
- Where applicable, configure process monitoring →  29

9.3 Configuring pressure measurement

9.3.1 Calibration without reference pressure (dry calibration = calibration without medium)

Example:

In this example, a device with a 400 mbar (6 psi) sensor is configured for the measuring range 0 to 300 mbar (0 to 4.4 psi).

The following values should be assigned:

- 0 mbar = 4 mA value
- 300 mbar (4.4 psi) = 20 mA value

Prerequisite:

This is a theoretical calibration, i.e. the pressure values for the lower and upper range are known. It is not necessary to apply pressure.

 Due to the orientation of the device, there may be pressure shifts in the measured value, i.e. the measured value is not zero in a pressureless condition. For information on how to perform position adjustment, see the "Performing position adjustment" section →  27.

 For a description of the parameters mentioned and possible error messages, see the "Description of device parameters" section →  44 and →  37.

Performing the configuration

1. Select a pressure unit, here "bar" for example, via the **Unit changeover (UNI)** parameter.
2. Select **Value for 4 mA (STL)** parameter. Enter the value (0 bar (0 psi)) and confirm.
 - ↳ This pressure value is assigned to the lower current value (4 mA).
3. Select **Value for 20 mA (STU)** parameter. Enter the value (300 mbar (4.4 psi)) and confirm.
 - ↳ This pressure value is assigned to the upper current value (20 mA).

The measuring range is configured for 0 to 300 mbar (0 to 4.4 psi).

9.3.2 Calibration with reference pressure (wet calibration = calibration with medium)

Example:

In this example, a device with a 400 mbar (6 psi) sensor is configured for the measuring range 0 to 300 mbar (0 to 4.4 psi).

The following values should be assigned:

- 0 mbar = 4 mA value
- 300 mbar (4.4 psi) = 20 mA value

Prerequisite:

The pressure values 0 mbar and 300 mbar (4.4 psi) can be specified. The device is already mounted, for example.

 Due to the orientation of the device, there may be pressure shifts in the measured value, i.e. the measured value is not zero in a pressureless condition. For information on how to perform position adjustment, see the "Performing position adjustment" section →  27.

 For a description of the parameters mentioned and possible error messages, see the "Description of device parameters" section →  44 and →  37.

Performing the configuration

1. Select a pressure unit, here "bar" for example, via the **Unit changeover (UNI)** parameter.
2. The pressure for the LRV (4 mA value) is present at the device, here 0 bar (0 psi) for example. Select **Pressure applied for 4mA (GTL)** parameter. The selection is confirmed by pressing "Get Lower Limit".
 - ↳ The pressure value present is assigned to the lower current value (4 mA).
3. The pressure for the URV (20 mA value) is present at the device, here 300 mbar (4.4 psi) for example. Select **Pressure applied for 20mA (GTU)** parameter. The selection is confirmed by pressing "Get Lower Limit".
 - ↳ The pressure value present is assigned to the upper current value (20 mA).

The measuring range is configured for 0 to 300 mbar (0 to 4.4 psi).

9.4 Performing position adjustment

Zero point configuration (ZRO)

Navigation	Parameter → Application → Sensor → Zero point configuration (ZRO)
Description	(Typically absolute pressure sensor) A pressure shift resulting from the orientation of the device can be corrected by the position adjustment. The pressure difference between zero (set point) and the measured pressure must be known.
Prerequisite	An offset is possible (parallel shifting of the sensor characteristic) to correct the orientation and any zero point drift. The set value of the parameter is subtracted from the "raw measured value". The requirement to be able to perform a zero point shift without changing the span is met with the offset function. Maximum offset value = $\pm 20\%$ of the sensor nominal range. If an offset value is entered that shifts the span beyond the physical limits of the sensor, the value is admitted but a warning message is generated and displayed via IO-Link. The warning message only disappears when the span is within the sensor limits, taking the offset value currently configured into consideration. The sensor can ■ be operated in a physically unfavorable range, i.e. outside its specifications, or ■ be operated by making appropriate corrections to the offset or span. Raw measured value – (manual offset) = display value (measured value)
Example	■ Measured value = 0.002 bar (0.029 psi) ■ Set the manual offset to 0.002. ■ Display value (measured value) after position adjustment = 0 bar (0 psi) ■ The current value is also corrected.
Note	Setting in increments of 0.001. As the value is entered numerically, the increment depends on the measuring range
Options	No selection. The user is free to edit the values.
Factory setting	0

Zero point adoption (GTZ)

Navigation	Parameter → Application → Sensor → Zero point adoption (GTZ)
Description	(Typically gauge pressure sensor) A pressure shift resulting from the orientation of the device can be corrected by the position adjustment. The pressure difference between zero (set point) and the measured pressure need not be known.

Prerequisite

The pressure value present is automatically adopted as the zero point.

An offset is possible (parallel shifting of the sensor characteristic) to correct the orientation and any zero point drift. The accepted value of the parameter is subtracted from the "raw measured value". The requirement to be able to perform a zero point shift without changing the span is met with the offset function.

Maximum offset value = $\pm 20\%$ of the sensor nominal range.

If an offset value is entered that shifts the span beyond the physical limits of the sensor, the value is admitted but a warning message is generated and displayed via IO-Link. The warning message only disappears when the span is within the sensor limits, taking the offset value currently configured into consideration.

The sensor can

- be operated in a physically unfavorable range, i.e. outside its specifications, or
- be operated by making appropriate corrections to the offset or span.

Raw measured value – (manual offset) = display value (measured value)

Example 1

- Measured value = 0.002 bar (0.029 psi)
- Use the **Zero point adoption (GTZ)** parameter to correct the measured value with the value, e.g. 0.002 bar (0.029 psi). This means that you are assigning the value 0 bar (0 psi) to the pressure present.
- Display value (measured value) after position adjustment = 0 bar (0 psi)
- The current value is also corrected.
- Where applicable, check and correct switch points and span settings.

Example 2

Sensor measuring range: -0.4 to +0.4 bar (-6 to +6 psi) (SP1 = 0.4 bar (6 psi); STU = 0.4 bar (6 psi))

- Measured value = 0.08 bar (1.2 psi)
 - Use the **Zero point adoption (GTZ)** parameter to correct the measured value with the value, e.g. 0.08 bar (1.2 psi). This means that you are assigning the value 0 mbar (0 psi) to the pressure present.
 - Display value (measured value) after position adjustment = 0 bar (0 psi)
 - The current value is also corrected.
 - Warnings C431 or C432 appear because the value 0 bar (0 psi) was assigned to the real value of 0.08 bar (1.2 psi) present and the sensor measuring range was thus exceeded by $\pm 20\%$.
- SP1 and STU values must be readjusted downwards by 0.08 bar (1.2 psi).

9.5 Configuring process monitoring

To monitor the process, it is possible to specify a pressure range which is monitored by the limit switch. Both monitoring versions are described below. The monitoring function allows the user to define optimum ranges for the process (with high yields etc.) and deploy limit switches to monitor the ranges.

9.5.1 Digital process monitoring (switch output)

It is possible to select defined switch points and switchback points which act as NO or NC contacts depending on whether a window function or hysteresis function is configured.

Function	Selection	Output	Abbreviation for operation
Hysteresis	Hysteresis normally open	NO contact	HNO
Hysteresis	Hysteresis normally closed	NC contact	HNC
Window	Window normally open	NO contact	FNO
Window	Window normally closed	NC contact	FNC

If the device is restarted within the given hysteresis, the switch output is open (0 V present at the output).

9.5.2 Analog process monitoring (4 to 20 mA output)

- The 3.8 to 20.5 mA signal range is controlled according to NAMUR NE 43.
- The alarm current and current simulation are exceptions:
 - If the defined limit is exceeded, the device continues measuring linearly. The output current increases linearly up to 20.5 mA and holds the value until the measured value drops below 20.5 mA again or the device detects an error →  37.
 - If the defined limit is undershot, the device continues measuring linearly. The output current decreases linearly to 3.8 mA and holds the value until the measured value rises above 3.8 mA again or the device detects an error →  37.

9.5.3 Switch output 1

Behavior of switch output

Switch point value/Upper value for pressure window, output 1 (SP1/FH1)
Switchback point value/Lower value for pressure window, output 1 (RP1/FL1)

Navigation

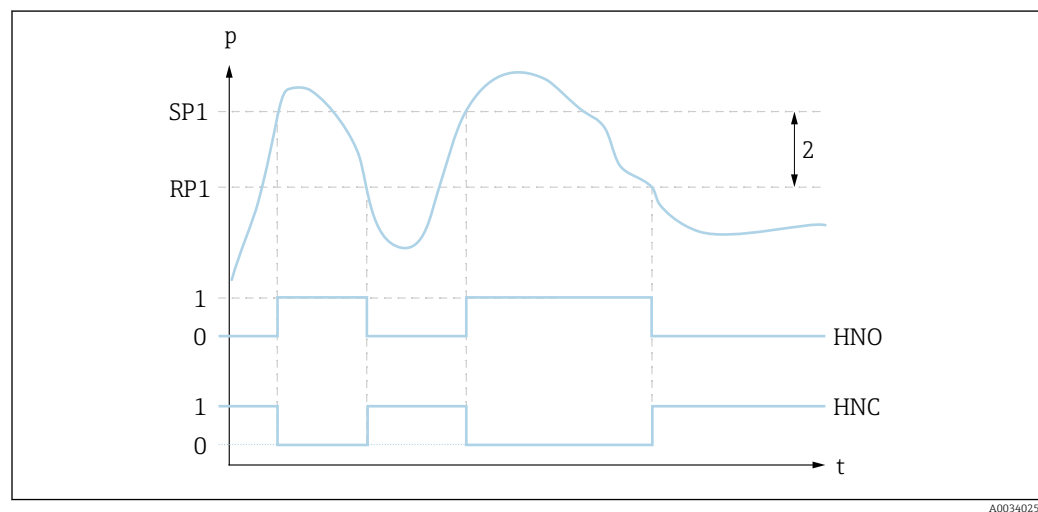
Parameter → Application → Switch output 1 → Switch point value.../Switchback point value...

Prerequisite

The following functions are available only if a hysteresis function has been configured for the switch output (output 1 (Ou1)).

Description of behavior of SP1/RP1

The hysteresis is implemented using the **SP1** and **RP1** parameters. Since the parameter settings depend on one another, the parameters are described all together. The switch point "SP1" and switchback point "RP1" can be defined with these functions (e.g. for pump control). When the set switch point "SP1" is reached (with increasing pressure), an electrical signal change takes place at the switch output. When the set switchback point "RP1" is reached (with decreasing pressure), an electrical signal change takes place at the switch output. The difference between the value of switch point "SP1" and the value of switchback point "RP1" is known as the hysteresis. The configured value for the switch point "SP1" must be greater than the switchback point "RP1"! A diagnostic message is displayed if a switch point "SP1" is entered that is $\leq$ the switchback point "RP1". While it is possible to make this entry, it does not take effect in the device. The entry must be corrected!



0 0-signal. Output open in quiescent state
1 1-signal. Output closed in quiescent state
2 Hysteresis
SP1 Switch point
RP1 Switchback point
HNO NO contact
HNC NC contact

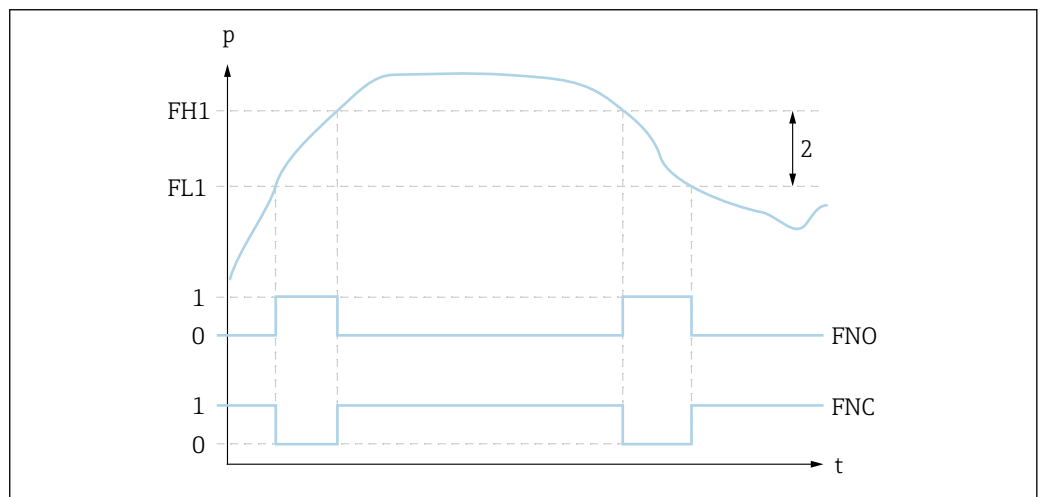
i To prevent switch-on and switch-off if values are around the switch point "SP1" or switchback point "RP1", a delay can be set for the relevant points. In this regard, see the **Switching delay time, output 1 (dS1)** and **Switchback delay time, output 1 (dR1)** parameter descriptions.

Prerequisite

The following functions are available only if a window function has been configured for the switch output (output 1 (Ou1)).

Description of behavior of FH1/FL1

The window function is implemented using the **FH1** and **FL1** parameters. Since the parameter settings depend on one another, the parameters are described all together. The upper value of the pressure window "FH1" and the lower value of the pressure window "FL1" can be defined with these functions (e.g., for monitoring a certain pressure range). When the lower value of the pressure window "FL1" is reached (with increasing or decreasing pressure), an electrical signal change takes place at the switch output. When the upper value of the pressure window "FH1" is reached (with increasing or decreasing pressure), an electrical signal change takes place at the switch output. The difference between the upper value of the pressure window "FH1" and the lower value of the pressure window "FL1" is known as the pressure window. The upper value of the pressure window "FH1" must be greater than the lower value of the pressure window "FL1"! A diagnostic message is displayed if the upper value entered for the pressure window "FH1" is less than the lower value of the pressure window "FL1". While it is possible to make this entry, it does not take effect in the device. The entry must be corrected!



A0034026

0 0-signal. Output open in quiescent state

1 1-signal. Output closed in quiescent state

2 Pressure window (difference between the value of the high window "FH1" and the low window "FL1")

FNO NO contact

FNC NC contact

FH1 Upper value of the pressure window

FL1 Lower value of the pressure window

Options

No selection. The user is free to edit the values.

Factory setting

Factory setting (if no customer-specific setting is ordered):
Switch point SP1/FH1: 90%; switchback point RP1/FL1: 10%

Switching delay

Switching delay time, output 1 (dS1) Switchback delay time, output 1 (dR1)

Note

The switching delay time/switchback delay time function is implemented using the **dS1** and **dR1** parameters. Since the parameter settings depend on one another, the parameters are described all together.

- dS1 = switching delay time, output 1
- dR1 = switchback delay time, output 1

Navigation

Parameter → Application → Switch output 1 → Switching delay.../Switchback delay...

Description

To prevent switch-on and switch-off if values are around the switch point "SP1" or the switchback point "RP1", a delay in a range of 0 – 50 seconds, to two decimal places, can be set for the individual points.

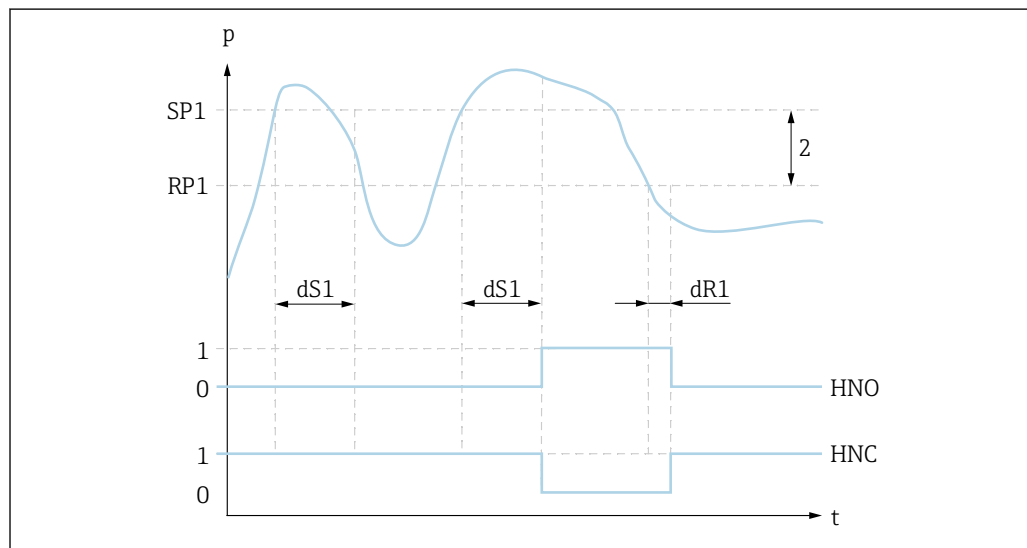
If the measured value leaves the switching range during the delay time, the delay time starts again.

Example

- SP1 = 2 bar (29 psi)
- RP1 = 1 bar (14.5 psi)
- dS1 = 5 seconds
- dR1 = 2 seconds

dS1/: ≥ 2 bar (29 psi) must be present for at least 5 seconds for SP1 to become active.

dR1/: ≥ 1 bar (14.5 psi) must be present for at least 2 seconds for RP1 to become active.



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0 0-signal. Output open in quiescent state

1 1-signal. Output closed in quiescent state

2 Hysteresis (difference between the value of the switch point "SP1" and the value of the switchback point "RP1")

HNO NO contact

HNC NC contact

SP1 Switch point 1

RP1 Switchback point 1

dS1 Set time for which the specific switch point must be reached continuously without interruption until an electrical signal change takes place

dR1 Set time for which the specific switchback point must be reached continuously without interruption until an electrical signal change takes place

Input range 0.00 - 50.00 seconds

Factory setting 0

Output 1 (OU1)

Navigation Parameter → Application → Switch output 1 → Output 1 (OU1)

Description

- Hysteresis normally open (HNO):
The switch output is specified as a NO contact with hysteresis properties.
- Hysteresis normally closed (HNC):
The switch output is specified as an NC contact with hysteresis properties.
- Window normally open (FNO):
The switch output is specified as a NO contact with window properties.
- Window normally closed (FNC):
The switch output is specified as an NC contact with window properties.

Options

- Hysteresis normally open (HNO)
- Hysteresis normally closed (HNC)
- Window normally open (FNO)
- Window normally closed (FNC)

Factory setting Hysteresis normally open (HNO) or as per order specifications

9.6 Current output

Operating Mode (FUNC)

Navigation Parameter → Application → Sensor → Operating Mode (FUNC)

Description Enables the desired behavior of output 2 (not IO-Link output)

Options

Options:

- OFF
- 4-20 mA (I)

Value for 4 mA (STL)

Navigation Parameter → Application → Current output → Value for 4 mA (STL)

Description Assignment of the pressure value which should correspond to the 4 mA value. It is possible to invert the current output. To do so, assign the pressure upper range value to the lower measuring current.

Note Enter the value for 4 mA in the selected pressure unit anywhere within the measuring range. The value can be entered in increments of 0.1 (increment depends on the measuring range).

Options No selection. The user is free to edit the values.

Factory setting 0.0 or as per order specifications

Value for 20 mA (STU)

Navigation Parameter → Application → Current output → Value for 20 mA (STU)

Description Assignment of the pressure value which should correspond to the 20 mA value. It is possible to invert the current output. To do so, assign the pressure lower range value to the upper measuring current.

Note Enter the value for 20 mA in the selected pressure unit anywhere within the measuring range. The value can be entered in increments of 0.1 (increment depends on the measuring range).

Options No selection. The user is free to edit the values.

Factory setting Upper measuring limit or as per order specifications.

Pressure applied for 4mA (GTL)

Navigation Parameter → Application → Current output → Pressure applied for 4mA (GTL)

Description The pressure value present is automatically adopted for the 4 mA current signal. Parameter for which the current range can be assigned to any section of the nominal range. This occurs by assigning the pressure lower range value to the lower measuring current and the pressure upper range value to the upper measuring current. The pressure lower range value and upper range value can be configured independently of one another so the pressure measuring span does not remain constant. The LRV and URV pressure measuring span can be edited over the entire sensor range. An invalid TD value is indicated by diagnostic message S510. An invalid position offset is indicated by diagnostic message C431. The editing operation cannot result in the device being operated outside the minimum and maximum sensor limits.

Incorrect entries are declined as indicated by the following messages, and the last valid value prior to the change is used again:

- Parameter value above limit (0x8031)
- Parameter value below limit (0x8032)

The measured value currently present is accepted as the value for 4mA anywhere within the measuring range. The sensor characteristic curve is shifted such that the pressure present becomes the zero value.

Pressure applied for 20mA (GTU)

Navigation Parameter → Application → Current output → Pressure applied for 20mA (GTU)

Description

The pressure value present is automatically adopted for the 20 mA current signal. Parameter for which the current range can be assigned to any section of the nominal range. This occurs by assigning the pressure lower range value to the lower measuring current and the pressure upper range value to the upper measuring current. The pressure lower range value and upper range value can be configured independently of one another so the pressure measuring span does not remain constant. The LRV and URV pressure measuring span can be edited over the entire sensor range. An invalid TD value is indicated by diagnostic message S510. An invalid position offset is indicated by diagnostic message C431. The editing operation cannot result in the device being operated outside the minimum and maximum sensor limits. Incorrect entries are declined, and the last valid value prior to the change is used again. The measured value currently present is accepted as the value for 20 mA anywhere within the measuring range. There is a parallel shift of the sensor characteristic so that the pressure present becomes the max value.

9.7 Application examples

9.7.1 Compressor control with hysteresis function

Example: The compressor is started when the pressure drops below a certain value. The compressor is switched off when a certain value is exceeded.

1. Set the switch point to 2 bar (29 psi)
2. Set the switchback point to 1 bar (14.5 psi)
3. Configure the switch output as an "NC contact" (HNC function)

The compressor is controlled by the defined settings.

9.7.2 Pump control with hysteresis function

Example: The pump should switch on when 2 bar (29 psi) is reached (increasing pressure) and switch off when 1 bar (14.5 psi) is reached (decreasing pressure).

1. Set the switch point to 2 bar (29 psi)
2. Set the switchback point to 1 bar (14.5 psi)
3. Configure the switch output as an "NO contact" (HNO function)

The pump is controlled by the defined settings.

10 Diagnostics and troubleshooting

10.1 Troubleshooting

If an illegal configuration exists in the device, the device switches to the failsafe mode.

Example:

- The diagnostic message "C485" is displayed via IO-Link.
- The device is in the simulation mode.
- If the device configuration is corrected, e.g., by resetting the device, the device quits the fault state and switches to the measuring mode.

General errors

Error	Possible cause	Remedy
Device does not respond	Supply voltage does not match the value indicated on the nameplate.	Apply correct voltage.
	The polarity of the supply voltage is wrong.	Correct the polarity.
	Connecting cables are not in contact with the terminals.	Check for electrical contact between cables and correct.
No communication	■ Communication cable not connected. ■ Communication cable incorrectly attached to device. ■ Communication cable incorrectly attached to the IO-Link master.	Check wiring and cables.
Output current ≤ 3.6 mA	Signal line is not wired correctly.	Check wiring.
No transmission of process data	There is an error in the device.	Correct errors that are displayed as a diagnostic event →  39.

10.2 Diagnostic events

10.2.1 Diagnostic message

Faults that are detected by the device's self-monitoring system are displayed as a diagnostic message via IO-Link.

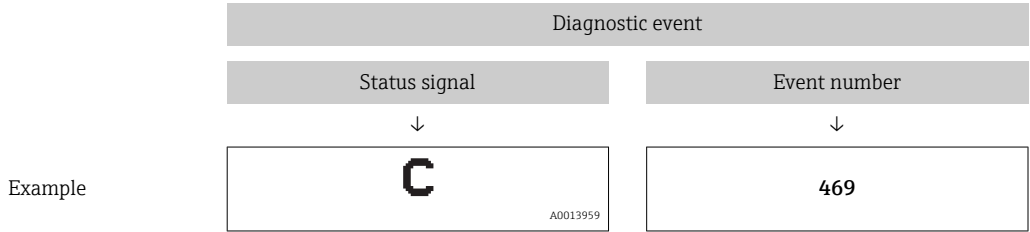
Status signals

The table →  39 lists the messages that may occur. The Actual Diagnostic (STA) parameter displays the message with the highest priority. The device has four different status information codes according to NE107:

F A0013956	"Failure" A device error has occurred. The measured value is no longer valid.
M A0013957	"Maintenance required" Maintenance is required. The measured value is still valid.
C A0013959	"Function check" The device is in the service mode (e. g. during a simulation).
S A0013958	"Out of specification" The device is being operated: ▪ Outside its technical specifications (e. g. during warm-up or cleaning process) ▪ Outside the parameter configuration undertaken by the user (e. g. level outside of configured span)

Diagnostics event and event text

The fault can be identified by means of the diagnostic event.



If two or more diagnostic events are pending simultaneously, only the message with the highest priority is shown.

 The last diagnostic message is displayed - see Last Diagnostic (LST) in the **Diagnosis** submenu →  44.

10.2.2 Overview of diagnostic events

Status signal/ Diagnostic event	Diagnostic behavior	EventCode	Event text	Reason	Corrective measure
S140	Warning	0x180F	Sensor signal outside of permitted ranges	Overpressure or low pressure present	Operate device in the specified measuring range
S140	Warning	0x180F	Sensor signal outside of permitted ranges	Sensor defective	Replace device
F270 ^{1) 2)}	Fault	0x1800	Overpressure/low pressure	Overpressure or low pressure present	- Check the process pressure - Check sensor range - Restart device
F270 ^{1) 2)}	Fault	0x1800	Defect in electronics/sensor	Defect in electronics/sensor	Replace device
C431 ³⁾	Warning	0x1805	Invalid position adjustment (Current output)	The adjustment performed would cause the sensor nominal range to be exceeded or undershot.	Position adjustment + parameter of the current output must be within the sensor nominal range - Check position adjustment (see Zero point configuration (ZRO) parameter) - Check measuring range (see Value for 20 mA (STU) and Value for 4 mA (STL) parameters)
C432	Warning	0x1806	Invalid position adjustment (Switching output)	The adjustment performed causes the switch points to be outside the sensor nominal range.	Position adjustment + parameter of the hysteresis and window function must be within the sensor nominal range - Check position adjustment (see Zero point configuration (ZRO) parameter) - Check the switch point, switchback point for hysteresis and window function
F437	Fault	0x1810	Incompatible configuration	Invalid device configuration	- Restart device - Reset device - Replace device
C469	Fault	0x1803	Switch points output violated	Switch point ≤ switchback point	Check switch points at output
C485	Warning	0x8C01 ⁴⁾	Simulation active	During simulation of the switch output or current output, the device issues a warning message	Switch off simulation
S510	Fault	0x1802	Turn down violated	A change in the span results in a violation of the turn down (max. TD 5:1) Values for adjustment (lower range value and upper range value) are too close together	- Operate device in the specified measuring range - Check the measuring range
S803	Fault	0x1804	Current loop	Impedance of load resistance at analog output is too high	- Check the cabling and load at the current output - If the current output is not required, switch the current output off via the configuration
S803	Fault	0x1804	Current output not connected	Current output not connected	- Connect current output with load - If the current output is not required, switch the current output off via the configuration
F804	Fault	-	Overload at switch output	Load current too high	Increase load resistance at switch output

Status signal/ Diagnostic event	Diagnostic behavior	EventCode	Event text	Reason	Corrective measure
F804	Fault	-	Overload at switch output	Switch output defective	- Check output wiring - Replace device
S971	Warning	0x1811	Measured value is outside sensor range	The current is outside the permitted range 3.8 to 20.5 mA The present pressure value is outside the configured measuring range (but within the sensor range, if applicable)	Operate the device within the set span

- 1) The switch output is open and the current output adopts the configured alarm current. Therefore, errors affecting the switch output are not displayed since the switch output is in the safe state.
- 2) The device outputs a failure current of 0 mA if an internal communication error occurs. In all other cases the device returns the configured failure current.
- 3) If no remedial measures are taken, the warning messages are displayed following a device restart if configuration (span, switch points and offset) is performed with a gauge pressure device and readings are $> \text{URL} + 10\%$ or $< \text{LRL} + 5\%$ and with an absolute pressure device and readings are $> \text{URL} + 10\%$ or $< \text{LRL}$.
- 4) EventCode as per IO-Link standard 1.1

10.3 Behavior of the device in the event of a fault

The device displays warnings and faults via IO-Link. All the device warnings and faults are for information purposes only and do not have a safety function. The errors diagnosed by the device are displayed via IO-Link in accordance with NE107. Depending on the diagnostic message, the device behaves as per a warning or fault condition. A distinction must be made between the following types of error here:

- Warning:
 - The device continues measuring if this type of error occurs. The output signal is not affected (exception: simulation is active).
 - The switch output remains in the state defined by the switch points.
- Fault:
 - The device does **not** continue measuring if this type of error occurs. The output signal adopts its fault state (value in the event of an error - see the following section).
 - The fault state is displayed via IO-Link.
 - The switch output changes to the "open" state.
 - For the analog output option, an error is signaled with the configured alarm current behavior.

10.4 Behavior of current output in the event of a fault

The behavior of the current output in the event of a fault is regulated in accordance with NAMUR NE43.

The behavior of the current output in the event of faults is defined in the following parameters:

- Alarm current FCU "MIN"**: Lower alarm current (≤ 3.6 mA) (optional, see the following table)
- Alarm current FCU "MAX"** (factory setting): Upper alarm current (≥ 21 mA)



- The selected alarm current is used for all errors.
- Errors and warning messages are displayed via IO-Link.
- It is not possible to acknowledge errors and warnings. The relevant message disappears if the event is no longer pending.
- The failsafe mode can be changed directly when a device is running (see the following table).

Changing the failsafe mode	After writing to the device
From MAX to MIN	Active immediately
From MIN to MAX	Active immediately

10.4.1 Alarm current

Device	Designation	Option
PMP23	Adjusted min. alarm current	IA ¹⁾

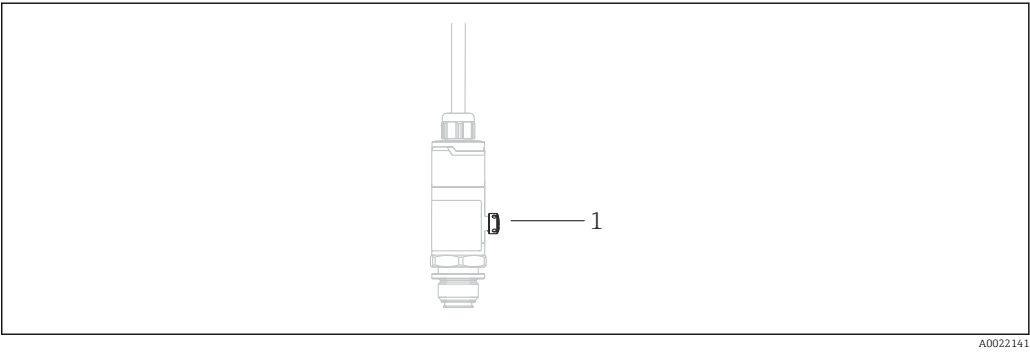
1) Product Configurator order code for "Service"

10.5 Resetting to factory settings (reset)

See the Reset to factory settings (RES) parameter description → 56.

11 Maintenance

No special maintenance work is required.
Keep the pressure compensation element (1) free from contamination.



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11.1 Exterior cleaning

- Please note the following points when cleaning the device:**
- The cleaning agents used should not corrode the surface and the seals.
 - Mechanical damage to the process isolating diaphragm, e.g. due to sharp objects, must be avoided.
 - Observe the degree of protection of the device. See the nameplate if necessary → 12.

12 Repairs

12.1 General notes

12.1.1 Repair concept

Repairs are not possible.

12.2 Return

The measuring device must be returned if the wrong device has been ordered or delivered.

As an ISO-certified company and also due to legal regulations, Endress+Hauser is obliged to follow certain procedures when handling any returned products that have been in contact with medium. To ensure swift, safe and professional device returns, please read the return procedures and conditions on the Endress+Hauser website at www.services.endress.com/return-material

12.3 Disposal

When disposing, separate and recycle the device components based on the materials.

13 Overview of the operating menu



Depending on the parameter configuration, not all submenus and parameters are available. Information on this can be found in the parameter description under "Prerequisite".

IO-Link	Level 1	Level 2	Level 3	Details
Identification	Extended Ordercode			→ ⓘ 44
	ENP_VERSION			→ ⓘ 44
	Application Specific Tag			→ ⓘ 44
Diagnosis	Actual Diagnostics (STA)			→ ⓘ 44
	Last Diagnostic (LST)			→ ⓘ 44
	Simulation Switch Output (OU1)			→ ⓘ 45
	Simulation Current Output (OU2)			→ ⓘ 45
Parameters	Application	Sensor	Operating Mode (FUNC)	→ ⓘ 33
			Unit changeover (UNI)	→ ⓘ 46
			Zero point configuration (ZRO)	→ ⓘ 27
			Zero point adoption (GTZ)	→ ⓘ 27
			Damping (TAU)	→ ⓘ 48
		Current output	Value for 4 mA (STL)	→ ⓘ 33
			Value for 20 mA (STU)	→ ⓘ 34
			Pressure applied for 4mA (GTL)	→ ⓘ 34
			Pressure applied for 20mA (GTU)	→ ⓘ 34
			Alarm current (FCU)	→ ⓘ 50
		Switch output 1	Switch point value/Upper value for pressure window, output 1 (SP1/FH1)	→ ⓘ 30
			Switchback point value/Lower value for pressure window, output 1 (RP1/FL1)	→ ⓘ 30
			Switching delay time, output 1 (dS1)	→ ⓘ 32
			Switchback delay time, output 1 (dR1)	→ ⓘ 32
			Output 1 (OU1)	→ ⓘ 33
	System	Device Management	HI Max value (maximum indicator)	→ ⓘ 56
			LO Min value (minimum indicator)	→ ⓘ 56
			Revisioncounter (RVC)	→ ⓘ 56
			Reset to factory settings (RES)	→ ⓘ 56
			Device Access Locks.Data Storage Lock	→ ⓘ 57
Observation	Pressure			→ ⓘ 57
	Switch State Output (OU1)			→ ⓘ 57

14 Description of device parameters

14.1 Identification

Extended ordercode	
Navigation	Identification → Extended ordercode
Description	Used to replace the device. Displays the extended order code (max. 60 alphanumeric characters).
Factory setting	As per order specifications

ENP_VERSION	
Navigation	Identification → ENP_VERSION
Description	Displays the ENP version (ENP: electronic name plate)

Application Specific Tag	
Navigation	Identification → Application Specific Tag
Description	Used for unique identification of device in the field. Enter device tag (max. 32 alphanumeric characters).
Factory setting	As per order specifications

14.2 Diagnostics

Actual Diagnostics (STA)	
Navigation	Diagnosis → Actual Diagnostics (STA)
Description	Displays the current device status.

Last Diagnostic (LST)	
Navigation	Diagnosis → Last Diagnostic (LST)
Description	Displays the latest device status (error or warning) that was rectified during operation.

Simulation Switch Output (OU1)

Navigation	Diagnosis → Simulation Switch Output (OU1)
Description	The simulation affects the process data only. It does not affect the physical switch output. If a simulation is active, a warning to this effect is displayed so that it is obvious to the user that the device is in the simulation mode. A warning is communicated via IO-Link (C485 - simulation active). The simulation must be ended actively via the menu. If the device is disconnected from the power supply during the simulation and power is then resupplied, the simulation mode is not resumed, and instead the device continues operation in the measuring mode.
Options	■ OFF ■ OU1 = low (OPN) ■ OU1 = high (CLS)

Simulation Current Output (OU2)

Navigation	Diagnosis → Simulation Current Output (OU2)
Description	Simulation affects the process data and the physical current output. If a simulation is active, a warning to this effect is displayed so that it is obvious to the user that the device is in the simulation mode. A warning is communicated via IO-Link (C485 - simulation active). The simulation must be ended actively via the menu. If the device is disconnected from the power supply during the simulation and then power is resupplied afterwards, the simulation mode is not resumed, and instead the device continues operation in the measuring mode.
Options	■ OFF ■ 3.5 mA ■ 4 mA ■ 8 mA ■ 12 mA ■ 16 mA ■ 20 mA ■ 21.95 mA

14.3 Parameters

14.3.1 Application

Sensor

Operating Mode (FUNC)

Navigation	Parameter → Application → Sensor → Operating Mode (FUNC)
Description	Enables the desired behavior of output 2 (not IO-Link output)
Options	Options: ■ OFF ■ 4-20 mA (I)

Unit changeover (UNI)

Navigation	Parameter → Application → Sensor → Unit changeover (UNI)
Description	Select the pressure engineering unit. If a new pressure engineering unit is selected, all pressure-specific parameters are converted.
Switch on value	Depends on order specifications.
Options	■ bar ■ kPa ■ Mpa ■ psi
Factory setting	Depends on order specifications.

Zero point configuration (ZRO)

Navigation	Parameter → Application → Sensor → Zero point configuration (ZRO)
Description	(Typically absolute pressure sensor) A pressure shift resulting from the orientation of the device can be corrected by the position adjustment. The pressure difference between zero (set point) and the measured pressure must be known.

Prerequisite	An offset is possible (parallel shifting of the sensor characteristic) to correct the orientation and any zero point drift. The set value of the parameter is subtracted from the "raw measured value". The requirement to be able to perform a zero point shift without changing the span is met with the offset function. Maximum offset value = $\pm 20\%$ of the sensor nominal range. If an offset value is entered that shifts the span beyond the physical limits of the sensor, the value is admitted but a warning message is generated and displayed via IO-Link. The warning message only disappears when the span is within the sensor limits, taking the offset value currently configured into consideration. The sensor can ■ be operated in a physically unfavorable range, i.e. outside its specifications, or ■ be operated by making appropriate corrections to the offset or span. Raw measured value – (manual offset) = display value (measured value)
Example	■ Measured value = 0.002 bar (0.029 psi) ■ Set the manual offset to 0.002. ■ Display value (measured value) after position adjustment = 0 bar (0 psi) ■ The current value is also corrected.
Note	Setting in increments of 0.001. As the value is entered numerically, the increment depends on the measuring range
Options	No selection. The user is free to edit the values.
Factory setting	0

Zero point adoption (GTZ)

Navigation	Parameter → Application → Sensor → Zero point adoption (GTZ)
Description	(Typically gauge pressure sensor) A pressure shift resulting from the orientation of the device can be corrected by the position adjustment. The pressure difference between zero (set point) and the measured pressure need not be known.
Prerequisite	The pressure value present is automatically adopted as the zero point. An offset is possible (parallel shifting of the sensor characteristic) to correct the orientation and any zero point drift. The accepted value of the parameter is subtracted from the "raw measured value". The requirement to be able to perform a zero point shift without changing the span is met with the offset function. Maximum offset value = $\pm 20\%$ of the sensor nominal range. If an offset value is entered that shifts the span beyond the physical limits of the sensor, the value is admitted but a warning message is generated and displayed via IO-Link. The warning message only disappears when the span is within the sensor limits, taking the offset value currently configured into consideration. The sensor can ■ be operated in a physically unfavorable range, i.e. outside its specifications, or ■ be operated by making appropriate corrections to the offset or span. Raw measured value – (manual offset) = display value (measured value)

Example 1

- Measured value = 0.002 bar (0.029 psi)
- Use the **Zero point adoption (GTZ)** parameter to correct the measured value with the value, e.g. 0.002 bar (0.029 psi). This means that you are assigning the value 0 bar (0 psi) to the pressure present.
- Display value (measured value) after position adjustment = 0 bar (0 psi)
- The current value is also corrected.
- Where applicable, check and correct switch points and span settings.

Example 2

- Sensor measuring range: -0.4 to +0.4 bar (-6 to +6 psi) (SP1 = 0.4 bar (6 psi); STU = 0.4 bar (6 psi))
- Measured value = 0.08 bar (1.2 psi)
 - Use the **Zero point adoption (GTZ)** parameter to correct the measured value with the value, e.g. 0.08 bar (1.2 psi). This means that you are assigning the value 0 mbar (0 psi) to the pressure present.
 - Display value (measured value) after position adjustment = 0 bar (0 psi)
 - The current value is also corrected.
 - Warnings C431 or C432 appear because the value 0 bar (0 psi) was assigned to the real value of 0.08 bar (1.2 psi) present and the sensor measuring range was thus exceeded by $\pm 20\%$.
SP1 and STU values must be readjusted downwards by 0.08 bar (1.2 psi).

Damping (TAU)

Navigation	Parameter → Application → Sensor → Damping (TAU)
Description	The damping affects the speed at which the measured value reacts to changes in pressure.
Input range	0.0 to 999.9 seconds in increments of 0.1 seconds
Factory setting	2 seconds

Current output

Value for 4 mA (STL)

Navigation	Parameter → Application → Current output → Value for 4 mA (STL)
Description	Assignment of the pressure value which should correspond to the 4 mA value. It is possible to invert the current output. To do so, assign the pressure upper range value to the lower measuring current.
Note	Enter the value for 4 mA in the selected pressure unit anywhere within the measuring range. The value can be entered in increments of 0.1 (increment depends on the measuring range).
Options	No selection. The user is free to edit the values.
Factory setting	0.0 or as per order specifications

Value for 20 mA (STU)

Navigation	Parameter → Application → Current output → Value for 20 mA (STU)
Description	Assignment of the pressure value which should correspond to the 20 mA value. It is possible to invert the current output. To do so, assign the pressure lower range value to the upper measuring current.
Note	Enter the value for 20 mA in the selected pressure unit anywhere within the measuring range. The value can be entered in increments of 0.1 (increment depends on the measuring range).
Options	No selection. The user is free to edit the values.
Factory setting	Upper measuring limit or as per order specifications.

Pressure applied for 4mA (GTL)

Navigation	Parameter → Application → Current output → Pressure applied for 4mA (GTL)
-------------------	---

Description

The pressure value present is automatically adopted for the 4 mA current signal. Parameter for which the current range can be assigned to any section of the nominal range. This occurs by assigning the pressure lower range value to the lower measuring current and the pressure upper range value to the upper measuring current. The pressure lower range value and upper range value can be configured independently of one another so the pressure measuring span does not remain constant. The LRV and URV pressure measuring span can be edited over the entire sensor range. An invalid TD value is indicated by diagnostic message S510. An invalid position offset is indicated by diagnostic message C431. The editing operation cannot result in the device being operated outside the minimum and maximum sensor limits.

Incorrect entries are declined as indicated by the following messages, and the last valid value prior to the change is used again:

- Parameter value above limit (0x8031)
- Parameter value below limit (0x8032)

The measured value currently present is accepted as the value for 4mA anywhere within the measuring range. The sensor characteristic curve is shifted such that the pressure present becomes the zero value.

Pressure applied for 20mA (GTU)

Navigation

Parameter → Application → Current output → Pressure applied for 20mA (GTU)

Description

The pressure value present is automatically adopted for the 20 mA current signal. Parameter for which the current range can be assigned to any section of the nominal range. This occurs by assigning the pressure lower range value to the lower measuring current and the pressure upper range value to the upper measuring current. The pressure lower range value and upper range value can be configured independently of one another so the pressure measuring span does not remain constant. The LRV and URV pressure measuring span can be edited over the entire sensor range. An invalid TD value is indicated by diagnostic message S510. An invalid position offset is indicated by diagnostic message C431. The editing operation cannot result in the device being operated outside the minimum and maximum sensor limits. Incorrect entries are declined, and the last valid value prior to the change is used again. The measured value currently present is accepted as the value for 20 mA anywhere within the measuring range. There is a parallel shift of the sensor characteristic so that the pressure present becomes the max value.

Alarm current (FCU)

Navigation

Parameter → Application → Current output → Alarm current (FCU)

Description

The device displays warnings and faults. This is done via IO-Link using the diagnostic message stored in the device. The purpose of all device diagnostics is solely to provide information to the user; they do not have a safety function. The errors diagnosed by the device are displayed via IO-Link in accordance with NE107. In accordance with the diagnostic message, the device behaves as per a warning or fault condition:

Warning (S971, S140, C485, C431, C432):

With this type of error, the device continues to measure. The output signal does not adopt its fault state (value in the event of an error). The main measured value and the state in the form of the letter plus a defined number are displayed alternately (0.5 Hz) via IO-Link. The switch outputs remain in the state defined by the switch points.

Fault (F437, S803, F270, S510, C469, F804):

With this type of error, the device does not continue to measure. The output signal adopts its fault state (value in the event of an error). The fault state is displayed via IO-Link in the form of the letter plus a defined number. The switch output changes to the defined state (open). For the analog output option, an error is also signaled and transmitted via the 4 to 20mA signal. In NE43, NAMUR defines a current ≤ 3.6 mA and ≥ 21 mA as a device failure. A corresponding diagnostic message is displayed. Current levels available for selection: The selected alarm current is used for all errors. Diagnostic messages are displayed with numbers and letter via IO-Link. It is not possible to acknowledge all the diagnostic messages. The relevant message disappears if the event is no longer pending.

The messages are displayed in order of priority:

- Highest priority = first message displayed
- Lowest priority = last message displayed

Options

- Min: Lower alarm current (≤ 3.6 mA)
- Max: Upper alarm current (≥ 21 mA)

Factory setting

Max or as per order specifications

Switch output 1

Behavior of switch output

Switch point value/Upper value for pressure window, output 1 (SP1/FH1)
Switchback point value/Lower value for pressure window, output 1 (RP1/FL1)

Navigation

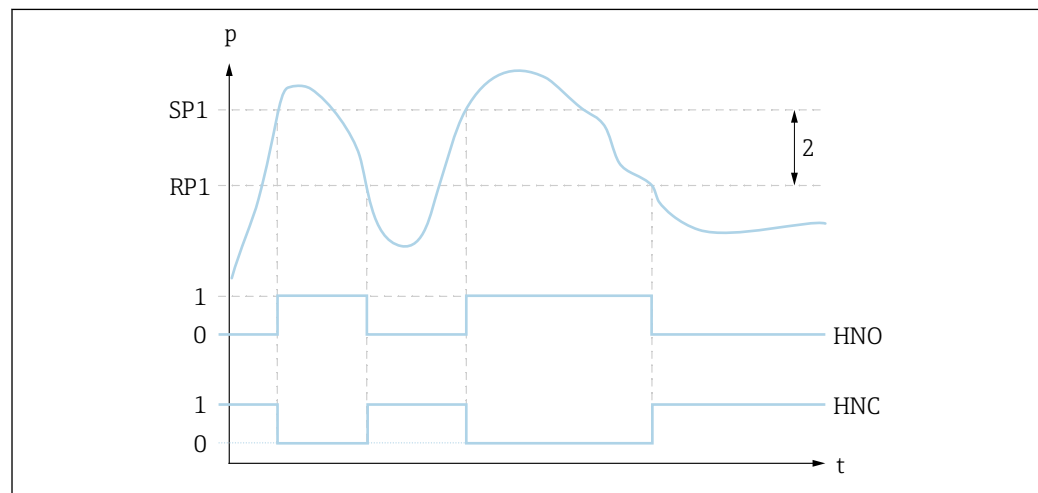
Parameter → Application → Switch output 1 → Switch point value.../Switchback point value...

Prerequisite

The following functions are available only if a hysteresis function has been configured for the switch output (output 1 (Ou1)).

Description of behavior of SP1/RP1

The hysteresis is implemented using the **SP1** and **RP1** parameters. Since the parameter settings depend on one another, the parameters are described all together. The switch point "SP1" and switchback point "RP1" can be defined with these functions (e.g. for pump control). When the set switch point "SP1" is reached (with increasing pressure), an electrical signal change takes place at the switch output. When the set switchback point "RP1" is reached (with decreasing pressure), an electrical signal change takes place at the switch output. The difference between the value of switch point "SP1" and the value of switchback point "RP1" is known as the hysteresis. The configured value for the switch point "SP1" must be greater than the switchback point "RP1". A diagnostic message is displayed if a switch point "SP1" is entered that is $\leq$ the switchback point "RP1". While it is possible to make this entry, it does not take effect in the device. The entry must be corrected!



A0034025

- 0 0-signal. Output open in quiescent state
- 1 1-signal. Output closed in quiescent state
- 2 Hysteresis
- SP1 Switch point
- RP1 Switchback point
- HNO NO contact
- HNC NC contact

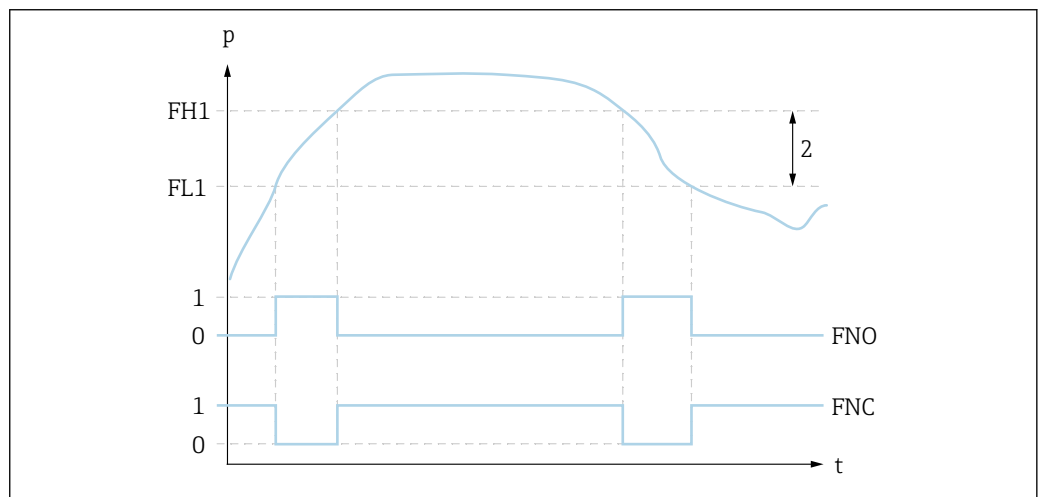
i To prevent switch-on and switch-off if values are around the switch point "SP1" or switchback point "RP1", a delay can be set for the relevant points. In this regard, see the **Switching delay time, output 1 (dS1)** and **Switchback delay time, output 1 (dR1)** parameter descriptions.

Prerequisite

The following functions are available only if a window function has been configured for the switch output (output 1 (Ou1)).

Description of behavior of FH1/FL1

The window function is implemented using the **FH1** and **FL1** parameters. Since the parameter settings depend on one another, the parameters are described all together. The upper value of the pressure window "FH1" and the lower value of the pressure window "FL1" can be defined with these functions (e.g., for monitoring a certain pressure range). When the lower value of the pressure window "FL1" is reached (with increasing or decreasing pressure), an electrical signal change takes place at the switch output. When the upper value of the pressure window "FH1" is reached (with increasing or decreasing pressure), an electrical signal change takes place at the switch output. The difference between the upper value of the pressure window "FH1" and the lower value of the pressure window "FL1" is known as the pressure window. The upper value of the pressure window "FH1" must be greater than the lower value of the pressure window "FL1"! A diagnostic message is displayed if the upper value entered for the pressure window "FH1" is less than the lower value of the pressure window "FL1". While it is possible to make this entry, it does not take effect in the device. The entry must be corrected!



A0034026

0 0-signal. Output open in quiescent state

1 1-signal. Output closed in quiescent state

2 Pressure window (difference between the value of the high window "FH1" and the low window "FL1")

FNO NO contact

FNC NC contact

FH1 Upper value of the pressure window

FL1 Lower value of the pressure window

Options

No selection. The user is free to edit the values.

Factory setting

Factory setting (if no customer-specific setting is ordered):

Switch point SP1/FH1: 90%; switchback point RP1/FL1: 10%

Switching delay

Switching delay time, output 1 (dS1) Switchback delay time, output 1 (dR1)

Note

The switching delay time/switchback delay time function is implemented using the **dS1** and **dR1** parameters. Since the parameter settings depend on one another, the parameters are described all together.

- dS1 = switching delay time, output 1
- dR1 = switchback delay time, output 1

Navigation

Parameter → Application → Switch output 1 → Switching delay.../Switchback delay...

Description

To prevent switch-on and switch-off if values are around the switch point "SP1" or the switchback point "RP1", a delay in a range of 0 – 50 seconds, to two decimal places, can be set for the individual points.

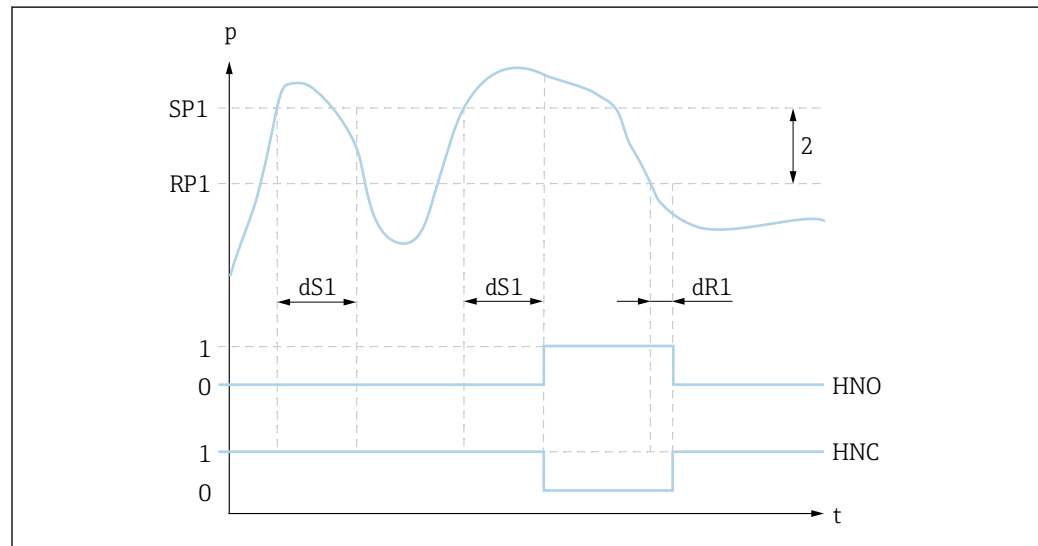
If the measured value leaves the switching range during the delay time, the delay time starts again.

Example

- SP1 = 2 bar (29 psi)
- RP1 = 1 bar (14.5 psi)
- dS1 = 5 seconds
- dR1 = 2 seconds

dS1/: ≥ 2 bar (29 psi) must be present for at least 5 seconds for SP1 to become active.

dR1/: ≥ 1 bar (14.5 psi) must be present for at least 2 seconds for RP1 to become active.



A0034027

0 0-signal. Output open in quiescent state

1 1-signal. Output closed in quiescent state

2 Hysteresis (difference between the value of the switch point "SP1" and the value of the switchback point "RP1")

HNO NO contact

HNC NC contact

SP1 Switch point 1

RP1 Switchback point 1

dS1 Set time for which the specific switch point must be reached continuously without interruption until an electrical signal change takes place

dR1 Set time for which the specific switchback point must be reached continuously without interruption until an electrical signal change takes place

Input range 0.00 - 50.00 seconds

Factory setting 0

Output 1 (OU1)

Navigation Parameter → Application → Switch output 1 → Output 1 (OU1)

Description

- Hysteresis normally open (HNO):
The switch output is specified as a NO contact with hysteresis properties.
- Hysteresis normally closed (HNC):
The switch output is specified as an NC contact with hysteresis properties.
- Window normally open (FNO):
The switch output is specified as a NO contact with window properties.
- Window normally closed (FNC):
The switch output is specified as an NC contact with window properties.

Options

- Hysteresis normally open (HNO)
- Hysteresis normally closed (HNC)
- Window normally open (FNO)
- Window normally closed (FNC)

Factory setting Hysteresis normally open (HNO) or as per order specifications

14.3.2 System

HI Max value (maximum indicator)

Navigation Parameter → System → Device Management → HI Max value (maximum indicator)

Description This parameter is used as the maximum indicator and makes it possible to call up retroactively the highest value ever measured for pressure.
A pressure that is present for at least 2.5 ms is logged to the maximum indicator.
The maximum indicators cannot be reset.

LO Min value (minimum indicator)

Navigation Parameter → System → Device Management → LO Min value (minimum indicator)

Description This parameter is used as the maximum indicator and makes it possible to call up retroactively the lowest value ever measured for pressure.
A pressure that is present for at least 2.5 ms is logged to the maximum indicator.
The maximum indicators cannot be reset.

Reset to factory settings (RES)

Navigation Parameter → System → Device Management → Reset to factory settings (RES)

Description  **WARNING**
"Reset to factory settings" causes an immediate reset to the factory settings of the order configuration (as-delivered state).
If the factory settings have been changed, downstream processes might be affected following a reset (the behavior of the switch output or current output might be changed).
► Make sure that downstream processes are not started unintentionally.

The reset is not subject to additional locking, such as in the form of device locking. The reset also depends on the device status.

Any customer-specific configuration carried out at the factory is not affected by a reset (customer-specific configuration remains).

The following parameters are **not** reset when a reset is performed:

- LO Min value (minimum indicator)
- HI Max value (maximum indicator)
- Last Diagnostic (LST)
- Revisioncounter (RVC)

Note The last error is not reset in a reset.

Revisioncounter (RVC)

Navigation Parameter → System → Device Management → Revisioncounter (RVC)

Description Counter that indicates the number of parameter changes.

Device Access Locks.Data Storage Lock ¹⁾ Activation/deactivation of data storage

- 1) The "Device Access Locks.Data Storage Lock" parameter is an IO-Link standard parameter. The name of the parameter may be available in the language configured in the IO-Link operating tool that is used. The display depends on the particular operating tool.

Navigation Parameter → System → Device Management → Device Access Locks.Data Storage Lock

Description The device supports data storage. If a device is being replaced, this allows the configuration of the old device to be written to the new device. If, when a device is being replaced, the original configuration of the new device is to be retained, the **Device Access Locks.Data Storage Lock** parameter can be used to prevent the parameters from being overwritten. If this parameter is set to "true", the new device does not adopt the data stored in the master's data storage.

Options

- false
- true

14.4 Observation

The process data →  21 are transmitted acyclically.

15 Accessories

15.1 Weld-in adapter

Various weld-in adapters are available for installation in vessels or pipes.

Device	Description	Option ¹⁾	Order number
PMP23	Weld-in adapter M24, d=65, 316L	PM	71041381
PMP23	Weld-in adapter M24, d=65, 316L 3.1 EN10204-3.1 material, inspection certificate	PN	71041383
PMP23	Weld-in adapter G1, 316L, conical metal joint	QE	52005087
PMP23	Weld-in adapter G1, 316L, 3.1, conical metal joint, EN10204-3.1 material, inspection certificate	QF	52010171
PMP23	Weld-in tool adapter G1, brass	QG	52005272
PMP23	Weld-in adapter G1, 316L, silicone O-ring seal	QJ	52001051
PMP23	Weld-in adapter G1, 316L, 3.1, silicone O-ring seal, EN10204-3.1 material, inspection certificate	QK	52011896
PMP23	Weld-in adapter Uni D65, 316L	QL	214880-0002
PMP23	Weld-in adapter Uni D65, 316L 3.1 EN10204-3.1 material, inspection certificate	QM	52010174
PMP23	Weld-in tool adapter Uni D65/D85, brass	QN	71114210
PMP23	Weld-in adapter Uni D85, 316L	QP	52006262
PMP23	Weld-in adapter Uni D85, 316L 3.1 EN10204-3.1 material, inspection certificate	QR	52010173

1) Product Configurator, order code for "Enclosed accessories"

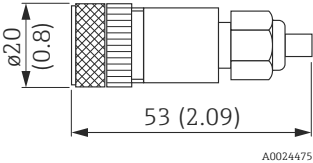
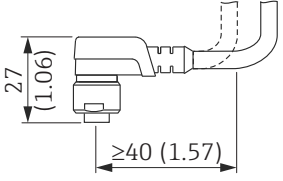
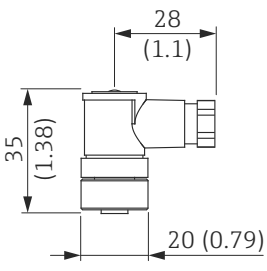
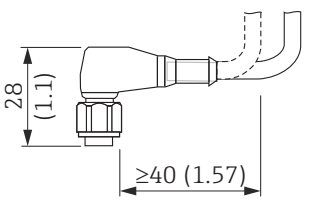
If installed horizontally and weld-in adapters with a leakage hole are used, ensure that the leakage hole is pointing down. This allows leaks to be detected as quickly as possible.

15.2 Process adapter M24

The following process adapters can be ordered for the process connections with order option X2J and X3J:

Device	Description	Order number	Order number with inspection certificate 3.1 EN10204
PMP23	Varivent F DN32 PN40	52023996	52024003
PMP23	Varivent N DN50 PN40	52023997	52024004
PMP23	DIN11851 DN40	52023999	52024006
PMP23	DIN11851 DN50	52023998	52024005
PMP23	SMS 1½"	52026997	52026999
PMP23	Clamp 1½"	52023994	52024001
PMP23	Clamp 2"	52023995	52024002

15.3 M12 plug connectors

Connector	Degree of protection	Material	Option ¹⁾	Order number
M12 (self-terminated connection at M12 plug) 	IP67	- Union nut: Cu Sn/Ni - Body: PBT - Seal: NBR	R1	52006263
M12 90 degrees with 5m (16 ft) cable 	IP67	- Union nut: GD Zn/Ni - Body: PUR - Cable: PVC Cable colors 1 = BN = brown 2 = WT = white 3 = BU = blue 4 = BK = black	RZ	52010285
M12 90 degrees (self-terminated connection at M12 plug) 	IP67	- Union nut: GD Zn/Ni - Body: PBT - Seal: NBR	RM	71114212
M12 90 degrees with 5m (16 ft) cable (terminated at one end) 	IP69 ²⁾	- Union nut: 316L (1.4435) - Body and cable: PVC and PUR	RW	52024216

1) Product Configurator, order code for "Enclosed accessories"

2) Designation of the IP protection class according to DIN EN 60529. Previous designation "IP69K" according to DIN 40050 Part 9 is no longer valid (standard withdrawn on November 1, 2012). The tests required by both standards are identical.

16 Technical data

16.1 Input

16.1.1 Measured variable

Measured process variable

Gauge pressure or absolute pressure

Calculated process variable

Pressure

16.1.2 Measuring range

Metal process isolating diaphragm

Sensor	Device	Maximum Sensor measuring range		Lowest calibratable span ¹⁾	MWP	OPL	Factory settings ²⁾	Option ³⁾
		lower (LRL)	upper (URL)					
		[bar (psi)]	[bar (psi)]					
Devices for gauge pressure measurement								
400 mbar (6 psi) ⁴⁾	PMP23	-0.4 (-6)	+0.4 (+6)	0.4 (6)	1 (15)	1.6 (24)	0 to 400 mbar (0 to 6 psi)	1F
1 bar (15 psi) ⁴⁾	PMP23	-1 (-15)	+1 (+15)	0.4 (6)	2.7 (40.5)	4 (60)	0 to 1 bar (0 to 15 psi)	1H
2 bar (30 psi) ⁴⁾	PMP23	-1 (-15)	+2 (+30)	0.4 (6)	6.7 (100.5)	10 (150)	0 to 2 bar (0 to 30 psi)	1K
4 bar (60 psi) ⁴⁾	PMP23	-1 (-15)	+4 (+60)	0.8 (12)	10.7 (160.5)	16 (240)	0 to 4 bar (0 to 60 psi)	1M
6 bar (90 psi) ⁴⁾	PMP23	-1 (-15)	+6 (+90)	2.4 (36)	16 (240)	24 (360)	0 to 6 bar (0 to 90 psi)	1N
10 bar (150 psi) ⁴⁾	PMP23	-1 (-15)	+10 (+150)	2 (30)	25 (375)	40 (600)	0 to 10 bar (0 to 150 psi)	1P
16 bar (240 psi) ⁴⁾	PMP23	-1 (-15)	+16 (+240)	5 (75)	25 (375)	64 (960)	0 to 16 bar (0 to 240 psi)	1Q
25 bar (375 psi) ⁴⁾	PMP23	-1 (-15)	+25 (+375)	5 (75)	25 (375)	100 (1500)	0 to 25 bar (0 to 375 psi)	1R
40 bar (600 psi) ⁴⁾	PMP23	-1 (-15)	+40 (+600)	8 (120)	100 (1500)	160 (2400)	0 to 40 bar (0 to 600 psi)	1S
Devices for absolute pressure measurement								
400 mbar (6 psi) ⁴⁾	PMP23	0 (0)	0.4 (+6)	0.4 (6)	1 (15)	1.6 (24)	0 to 400 mbar (0 to 6 psi)	2F
1 bar (15 psi) ⁴⁾	PMP23	0 (0)	1 (+15)	0.4 (6)	2.7 (40.5)	4 (60)	0 to 1 bar (0 to 15 psi)	2H
2 bar (30 psi) ⁴⁾	PMP23	0 (0)	2 (+30)	0.4 (6)	6.7 (100.5)	10 (150)	0 to 2 bar (0 to 30 psi)	2K
4 bar (60 psi) ⁴⁾	PMP23	0 (0)	4 (+60)	0.8 (12)	10.7 (160.5)	16 (240)	0 to 4 bar (0 to 60 psi)	2M
10 bar (150 psi) ⁴⁾	PMP23	0 (0)	10 (+150)	2 (30)	25 (375)	40 (600)	0 to 10 bar (0 to 150 psi)	2P
40 bar (600 psi) ⁴⁾	PMP23	0 (0)	+40 (+600)	8 (120)	100 (1500)	160 (2400)	0 to 40 bar (0 to 600 psi)	2S

1) Highest turn down that can be set at the factory: 5:1. The turn down is preset and cannot be changed.

2) Other measuring ranges (e.g. -1 to +5 bar (-15 to 75 psi)) can be ordered with customer-specific settings (see the Product Configurator, order code for "Calibration; Unit" option "J"). It is possible to invert the output signal (LRV = 20 mA; URV = 4 mA). Prerequisite: URV < LRV

3) Product Configurator, order code for "Sensor range"

4) Vacuum resistance: 0.01 bar (0.145 psi) abs

Maximum turn down which can be ordered for absolute pressure and gauge pressure sensors

Device	Range	400 mbar (6 psi)	1 bar (15 psi) 6 bar (90 psi) 16 bar (240 psi)	2 bar (30 psi) 4 bar (60 psi) 10 bar (150 psi) 25 to 40 bar (375 to 600 psi)
PMP23	0.3%	TD 1:1	TD 1:1 to TD 2.5:1	TD 1:1 to TD 5:1

16.2 Output

16.2.1 Output signal

Designation	Option ¹⁾
IO-Link 4 to 20 mA (3-wire or 4-wire)	7

1) Product Configurator, order code for "Output"

16.2.2 Switching capacity

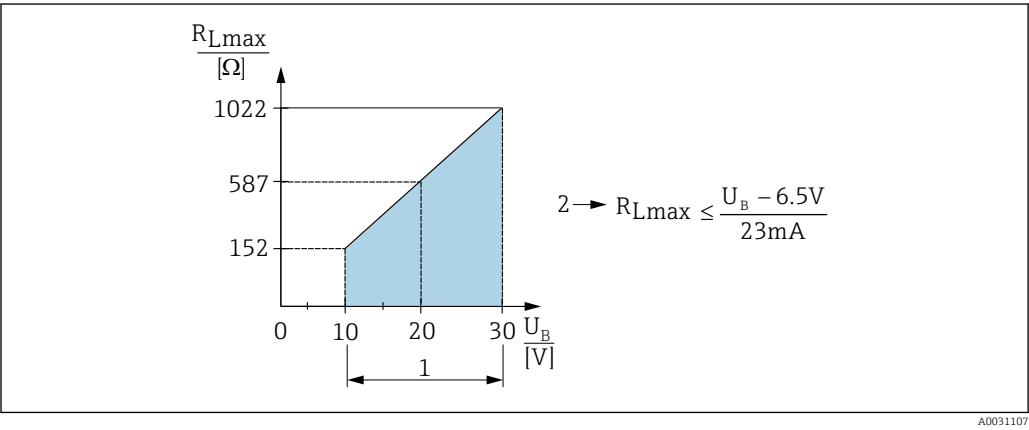
- Switch status ON: $I_a \leq 200\text{ mA}$ ^{3) 4)}; switch status OFF: $I_a \leq 1\text{ mA}$
- Switch cycles: $>10,000,000$
- Voltage drop PNP: $\leq 2\text{ V}$
- Overload protection: Automatic load testing of switching current;
 - Max. capacitive load: $1\text{ }\mu\text{F}$ at max. supply voltage (without resistive load)
 - Max. cycle duration: 0.5 s ; min. t_{on} : $40\text{ }\mu\text{s}$
 - Periodic disconnection from protective circuit in the event of overcurrent ($f = 2\text{ Hz}$) and "F804" displayed

16.2.3 Signal range 4 to 20 mA

3.8 mA to 20.5 mA

16.2.4 Load (for 4 to 20 mA devices)

In order to guarantee sufficient terminal voltage, a maximum load resistance R_L (including line resistance) must not be exceeded depending on the supply voltage U_B of the supply unit.



- 1 Power supply 10 to 30 V DC
2 R_{Lmax} Maximum load resistance
 U_B Supply voltage

- Error current is output and "S803" displayed (output: MIN alarm current)
- Periodic checking to establish if it is possible to quit fault state

3) 100 mA can be guaranteed over the entire temperature range for the switch output 1 x PNP + 4 to 20 mA output. For lower ambient temperatures, higher currents are possible but cannot be guaranteed. Typical value at 20 °C (68 °F) approx. 200 mA. 200 mA can be guaranteed over the entire temperature range for the "1 x PNP" switch output.

4) Larger currents are supported, thus deviating from the IO-Link standard.

16.2.5 Signal on alarm 4 to 20 mA

The response of the output to error is regulated in accordance with NAMUR NE43.
Factory setting MAX alarm: >21 mA

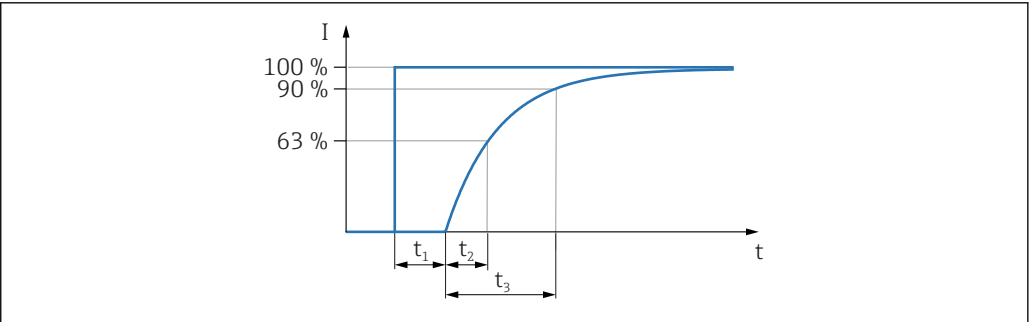
alarm current

Device	Description	Option
PMP23	Adjusted min. alarm current	IA ¹⁾

1) Product Configurator order code for "Service"

16.2.6 Dead time, time constant

Presentation of the dead time and the time constant:



A0019786

16.2.7 Dynamic behavior

Dead time (t_1) [ms]	Time constant (T63), t_2 [ms]	Time constant (T90), t_3 [ms]
7 ms	11 ms	16 ms

16.2.8 Dynamic behavior of switch output

Response time ≤ 20 ms

16.3 Performance characteristics of metal process isolating diaphragm

16.3.1 Reference operating conditions

- As per IEC 60770
- Ambient temperature T_A = constant, in the range: +21 to +33 °C (+70 to +91 °F)
- Humidity φ = constant, in the range: 5 to 80 % rH
- Ambient pressure p_A = constant, in the range: 860 to 1 060 mbar (12.47 to 15.37 psi)
- Position of measuring cell = constant, in the range: horizontal $\pm 1^\circ$ (see also "Influence of the installation position" section →  14)
- Zero based span
- Process isolating diaphragm material: AISI 316L (1.4435)
- Filling oil: synthetic oil polyalphaolefin FDA 21 CFR 178.3620, NSF H1
- Supply voltage: 24 V DC ± 3 V DC
- Load: 320 Ω (at 4 to 20 mA output)

16.3.2 Measuring uncertainty for small absolute pressure measuring ranges

The smallest extended uncertainty of measurement that can be delivered by our standards is:

- in the range 1 to 30 mbar (0.0145 to 0.435 psi): 0.4 % of reading
- in the range < 1 mbar (0.0145 psi): 1 % of reading.

16.3.3 Influence of the installation position

→  14

16.3.4 Resolution

Current output: min. 1.6 μ A

16.3.5 Reference accuracy

The reference accuracy contains the non-linearity [DIN EN 61298-2 3.11] including the pressure hysteresis [DIN EN 61298-23.13] and non-repeatability [DIN EN 61298-2 3.11] in accordance with the limit point method as per [DIN EN 60770].

Device	% of the calibrated span to the maximum turn down		
	Reference accuracy	Non-linearity	Non-repeatability
PMP23	± 0.3	± 0.1	± 0.1

Overview of the turn down ranges →  61

16.3.6 Thermal change of the zero output and the output span

PMP23

Measuring cell	-20 to +85 °C (-4 to +185 °F)	-40 to -20 °C (-40 to -4 °F) +85 to +100 °C (+185 to +212 °F)
	% of the calibrated span for TD 1:1	
<1 bar (15 psi)	<1	<1.2
≥ 1 bar (15 psi)	<0.8	<1

16.3.7 Long-term stability

Device	1 year	5 years	8 years
	% of URL		
IO-Link	±0.2	±0.4	±0.45

16.3.8 Switch-on time

≤2 s

For small measuring ranges, pay attention to the thermal compensation effects.

16.4 Environment

16.4.1 Ambient temperature range

Device	Ambient temperature range ¹⁾
PMP23	–40 to +70 °C (–40 to +158 °F)
PMP23	Devices for hazardous areas: –40 to +70 °C (–40 to +158 °F)

- 1) Exception: the following cable is designed for an ambient temperature range of –25 to +70 °C (–13 to +158 °F): Product Configurator order code for "Enclosed accessories" option "RZ".

16.4.2 Storage temperature range

–40 to +85 °C (–40 to +185 °F)

16.4.3 Climate class

Device	Climate class	Note
PMP23	Class 4K4H	Air temperature: –20 to +55 °C (–4 to +131 °F), relative humidity: 4 to 100 % satisfied according to DIN EN 60721-3-4 (condensation is possible)

16.4.4 Degree of protection

Device	Connection	Degree of protection	Option ¹⁾
PMP23	M12 plug	IP65/67 NEMA type 4X enclosure	M
PMP23	M12 plug made of metal	IP66/69 ²⁾ NEMA type 4X enclosure	N

- 1) Product Configurator order code for "Electrical connection"
 2) Designation of the IP protection class according to DIN EN 60529. Previous designation "IP69K" according to DIN 40050 Part 9 is no longer valid (standard withdrawn on November 1, 2012). The tests required by both standards are identical.

16.4.5 Vibration resistance

Test standard	Vibration resistance
IEC 60068-2-64:2008	Guaranteed for 5 to 2000Hz: 0.05g ² /Hz

16.4.6 Electromagnetic compatibility

- Interference emission as per EN 61326-1 equipment B
- Interference immunity as per EN 61326-1 (industrial environment)
 Devices with IO-Link: For intended use, the switch output can switch to the communication mode for 0.2 s in the event of transient faults (only for devices with IO-Link).
- Maximum deviation: 1.5% with TD 1:1

For more details please refer to the Declaration of Conformity.

16.5 Process

16.5.1 Process temperature range for devices with metallic process isolating diaphragm

Device	Process temperature range
PMP23	-10 to +100 °C (+14 to +212 °F)
PMP23 Sterilization in place (SIP)	At +135°C (+275 °F) for a maximum of one hour (device in operation but not within measuring specification)

Applications with changes in temperature

Frequent extreme changes in temperatures can temporarily cause measuring errors. Internal temperature compensation is faster the smaller the change in temperature and the longer the time interval.

For further information please contact your local Endress+Hauser Sales Center.

16.5.2 Pressure specifications

WARNING

The maximum pressure for the measuring device depends on the lowest-rated element with regard to pressure.

- ▶ For pressure specifications, see the "Measuring range" section and "Mechanical construction" section in the Technical Information.
- ▶ The Pressure Equipment Directive (2014/68/EU) uses the abbreviation "PS". The abbreviation "PS" corresponds to the MWP (maximum working pressure) of the measuring device.
- ▶ MWP (maximum working pressure): The MWP (maximum working pressure) is specified on the nameplate. This value is based on a reference temperature of +20 °C (+68 °F) and may be applied to the device for an unlimited period of time. Observe the temperature dependency of the MWP.
- ▶ OPL (over pressure limit): The test pressure corresponds to the over pressure limit of the sensor and may only be applied temporarily to ensure that the measurement is within the specifications and no permanent damage develops. In the case of sensor range and process connections where the over pressure limit (OPL) of the process connection is smaller than the nominal value of the sensor, the device is set at the factory, at the very maximum, to the OPL value of the process connection. If you want to use the entire sensor range, select a process connection with a higher OPL value.

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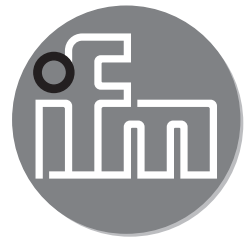
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Operating instructions Binary level sensor

LMTx0x

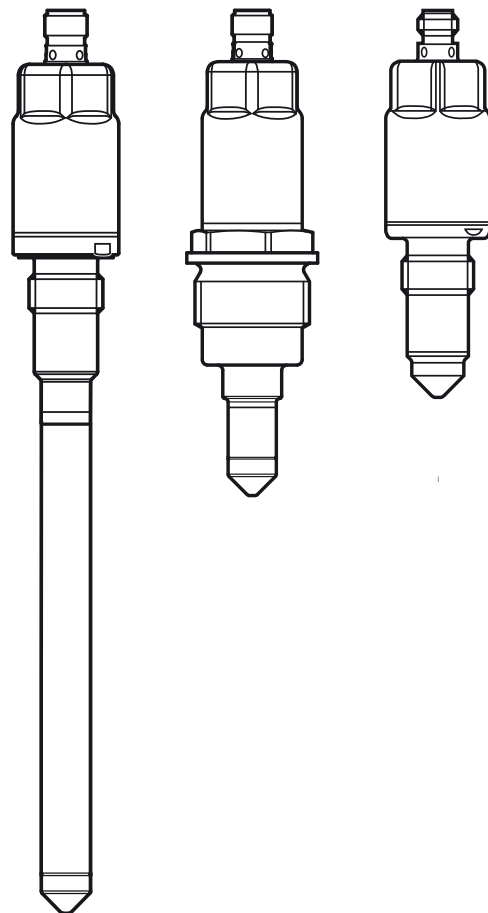
LMTx1x

LMTx2x

LXxxxx

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1 Preliminary note

Technical data, approvals, accessories and further information at www.ifm.com

1.1 Symbols used

- Instructions
- > Reaction or result
- [...] Designation of keys, buttons or indications
- Cross-reference

 Important note
Non-compliance may result in malfunction or interference.

 Information
Supplementary note



CAUTION!

Warning of personal injury.
Slight reversible injuries may result.

2 Safety instructions

- The device described is a subcomponent for integration into a system.
 - The manufacturer is responsible for the safety of the system.
 - The system manufacturer undertakes to perform a risk assessment and to create a documentation in accordance with legal and normative requirements to be provided to the operator and user of the system. This documentation must contain all necessary information and safety instructions for the operator, the user and, if applicable, for any service personnel authorised by the manufacturer of the system.
- Read this document before setting up the product and keep it during the entire service life.
- The product must be suitable for the corresponding applications and environmental conditions without any restrictions.
- Only use the product for its intended purpose (→ Functions and features).
- Only use the product for permissible media (→ Technical data).
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.
- The manufacturer assumes no liability or warranty for any consequences caused by tampering with the product or incorrect use by the operator.
- Installation, electrical connection, set-up, operation and maintenance of the product must be carried out by qualified personnel authorised by the machine operator.
- Protect units and cables against damage.



The sensor is supplied without installation / connection accessories.



► Only use accessories from ifm electronic.

Accessories: www.ifm.com

The optimum function is not ensured when using components from other manufacturers.

3 Functions and features

The unit monitors the level of liquid, viscous and powdery media in tanks and pipes. It can be used for point level detection and run-dry protection. The separate setting of two switching thresholds enables the detection of two different media (can be used, for example, for phase separation or differentiation of media).

3.1 Applications

- Detection of almost all media
- Food and hygienic areas (→ 6) (→ 5.3)
- Available process connections: G1/2, G3/4 and G1
- Different probe lengths for various mounting positions and for temperature decoupling (→ 4.3.2)

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Type	Factory setting ¹⁾	Sensitivity ¹⁾	Probe length ²⁾	Process connection
LMT100	aqueous media	low	11 mm	G 1/2
LMT110	oils, greases, powders	high	11 mm	G 1/2
LMT121	media with low water content	medium	11 mm	G 1/2
LMT102	aqueous media	low	38 mm	G 1/2
LMT104	aqueous media	low	153 mm	G 1/2
LMT105	aqueous media	low	253 mm	G 1/2
LMT202	aqueous media	low	28 mm	G3/4, tuning fork contour
LMT302	aqueous media	low	38 mm	G1, tuning fork contour

¹⁾ Sensitivity adjustable (→ 8 Parameter setting)

²⁾ Probe length measured from conical sealing edge (→ Technical data)



With a suitable unit the presence of certain media can be detected while build-up or foam is suppressed.

In the following table you can find a selection of tested media and the corresponding recommended unit type. A complete list of media is available at www.ifm.com.

Medium	LMTx0x	LMTx1x	LMTx2x
Alcohol (40 % vol.)	●	○	●
Beer	●	○	●
Butter (salted / unsalted)	○	○	●
Ice cream	○	○	●
Fat	○	●	○
Honey	○	○	●
Yoghurt, plain	●	○	○
Non-dairy creamer	○	●	○
Ketchup	●	○	○
Jam	●	○	○
Milk	●	○	●
Remoulade	●	○	○
Olive oil	○	●	○
Cream (30 %)	○	○	●
Chocolate (at approx. 40 °C)	○	○	●
Water (distilled)	●	○	●
Water (tap water)	●	○	●
Sugar (granulated sugar)	○	●	○
●	The medium can be detected without the need to change the factory setting (plug & play).		
○	The medium can be detected by setting the sensitivity (IO-Link required) (→ 8 Parameter setting).		



The above-mentioned details are non-binding reference values. Depending on the composition of the listed media, deviations may occur. Media with a similar composition can be detected using equivalent unit types.

► Check the function by an application test.

3.2 Restriction of the application area

- Not suitable for abrasive media (e.g. quartz sand) and heavy bulk material.
- Not suitable for ozonised water.
- For use in aggressive media (acids and alkali):
 - ▶ Check the compatibility of the product materials beforehand (→ Technical data sheet).
- When used in media which are inhomogeneous, separate from each other thus forming separation layers (e.g. oil layer on water):
 - ▶ Check the function by an application test.
- A large amount of air or gas bubbles may lead to changed switching characteristics. This effect can be used to implement, for example, run-dry protection or pump protection (key word: cavitation).
 - ▶ Check the function by an application test. If required, adapt the sensitivity or set switching delays (→ 8 Parameter setting).
- Do not expose the probe tip to intensive sun radiation (UV radiation).

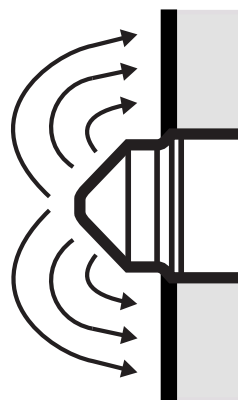
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4 Function

4.1 Measuring principle

The unit operates on the impedance spectroscopy method. It analyses the electrical behaviour of the media to be monitored in the frequency range between 50 and 200 MHz. An electrical field is generated by the probe tip which is influenced by the level. The nature of the medium as well as build-up or foam have different electrical properties that are used for the evaluation.

Fig. 4-1

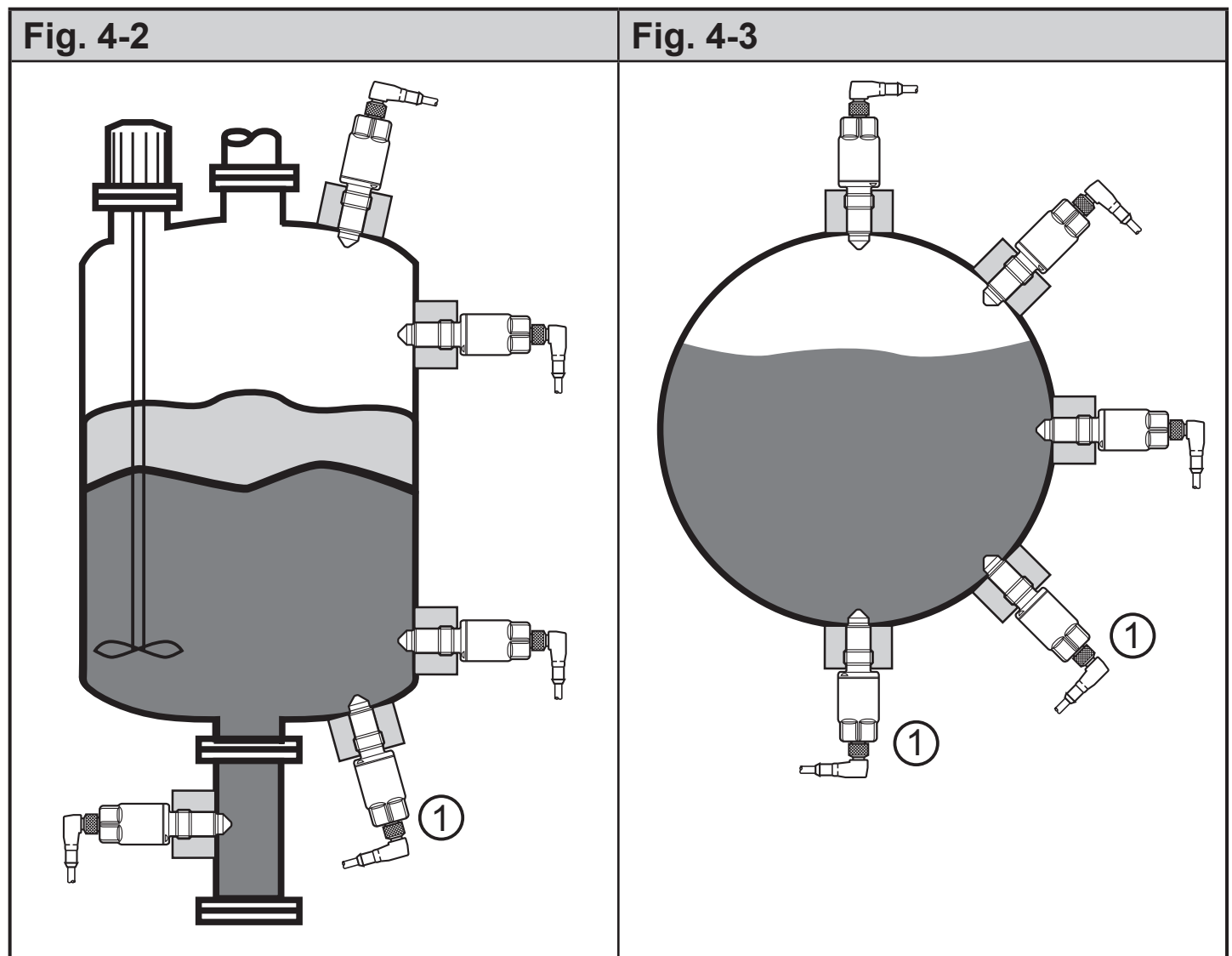


4.2 Other features of the unit

- Streamlined sensor geometry, no blockage of the pipe when unit types with short probe are used, no pressure loss
- Orientation-independent installation possible
- Defined position of the cable entry for angled sockets when ifm welding adapters are used

4.3 Application examples

4.3.1 Application examples for unit types with short probe



1: Installation position only suited to some extent

- Fig. 4-2: Possible installation positions in a tank (e.g. for point level detection or as run-dry protection).
- Fig. 4-3: Fill level monitoring in pipes

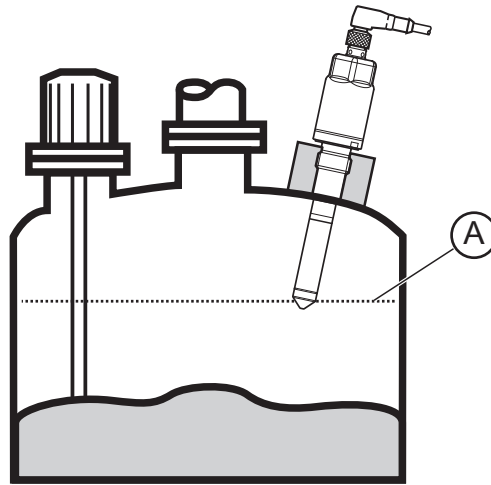


With highly adhesive and viscous media and media prone to sedimentation or build-up the installation positions (1) are only suitable to some extent. Residues might be detected as level.

4.3.2 Application examples for unit types with long probe

Installation from the top:

Fig. 4-4



A: maximum level

Fig. 4-4: For monitoring the maximum level (A) or as overflow prevention. Different probe lengths enable different response levels.

Lateral installation:

Fig. 4-5

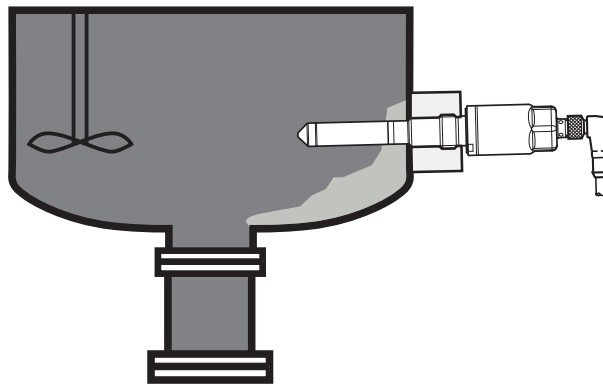


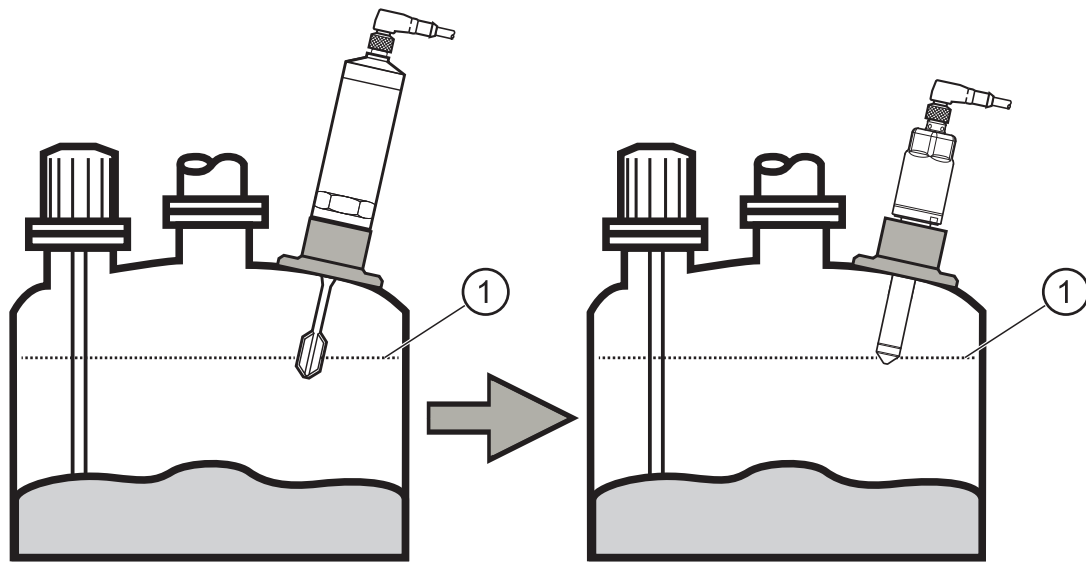
Fig. 4-5: Since the probe tip is installed further into the tank, very adhesive and viscous residues can be suppressed.



The variable clamp fitting (accessory) allows variable installation of the unit types LMT1x4 and LMT1x5 in height/installation depth. This enables, for example, a high-precision adjustment of the response level. Moreover, these types can be uncoupled thermally from the process by means of the variable clamp fitting (recessed installation of the sensor electronics). This also allows applications with higher process temperature and/or with the risk of heat accumulation (e.g. tank insulation).

4.3.3 Application example installation in existing tuning fork adapters

Fig. 4-6



1: Maximum level

Fig. 4-6: Existing tuning fork welding adapters can be used in many cases with the unit types LMT2x2 and LMT3x2 with G3/4 or G1 process connection (→ 3.1 Applications). Typically, the response level (1) is maintained in most cases.

- When process connections from other manufacturers are used:
Adhere to installation location / environment (→ 5.1).

5 Installation



CAUTION!

If the medium temperature is above 50 °C (122 °F) parts of the housing can increase in temperature to over 65 °C (149 °F).

- > Risk of burns
- ▶ Do not touch the unit
- ▶ Protect the housing against contact with flammable substances and unintentional contact.

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Before installing and removing the unit: Make sure that no pressure is applied to the system and there is no medium in the pipe or tank. Also always take into account the potential dangers related to extreme machine and medium temperatures.

5.1 Installation location / environment

- Installation preferably in closed metal tanks or pipes.
- The sensor must be in electrical contact with the metal process connection.



When installed in plastic tanks, there may be deterioration caused by electromagnetic interference.

- ▶ Check the function by an application test.
- ▶ If disturbances occur, take appropriate measures (shielding, grounding, etc.).



A correct fit and function of the unit and ingress resistance of the connection are only ensured using ifm adapters.



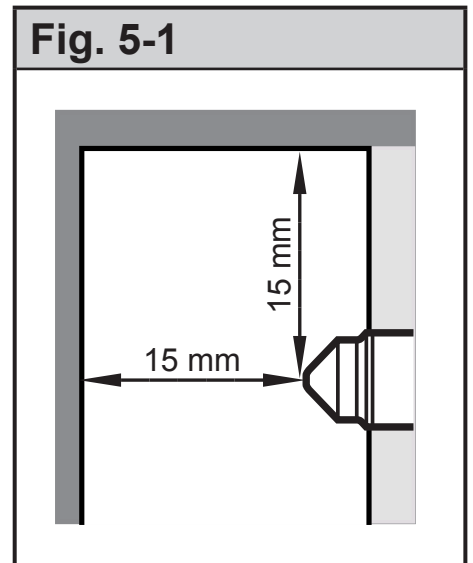
When process connections from other manufacturers are used:

- ▶ Ensure mechanical compatibility.

As a rule, ifm does not assume any responsibility for ingress resistance, hygiene and function, in particular with non-existing compatibility and incorrect installation.

When installed in restricted spaces (e.g. pipes, tank corners, structures) or in agitators and other moving objects:

- ▶ To avoid malfunction and damage on sensor and plant, adhere to a distance of min. 15 mm to neighbouring objects (e.g. pipe/tank walls, structures, other sensors) (fig. 5-1).



5.2 Notes on 3-A compliant installation

- ▶ Make sure that the sensor is integrated into the system according to 3-A.
- ▶ Use only adapters with 3-A certification and marked with the 3-A symbol (→ Accessories).

The process connection must be provided with a leakage port. This is ensured when installed using adapters with 3-A approval.

- ▶ The leakage port must be clearly visible and installed facing downwards for vertical pipes.



For use according to 3-A, special regulations apply for cleaning and maintenance.



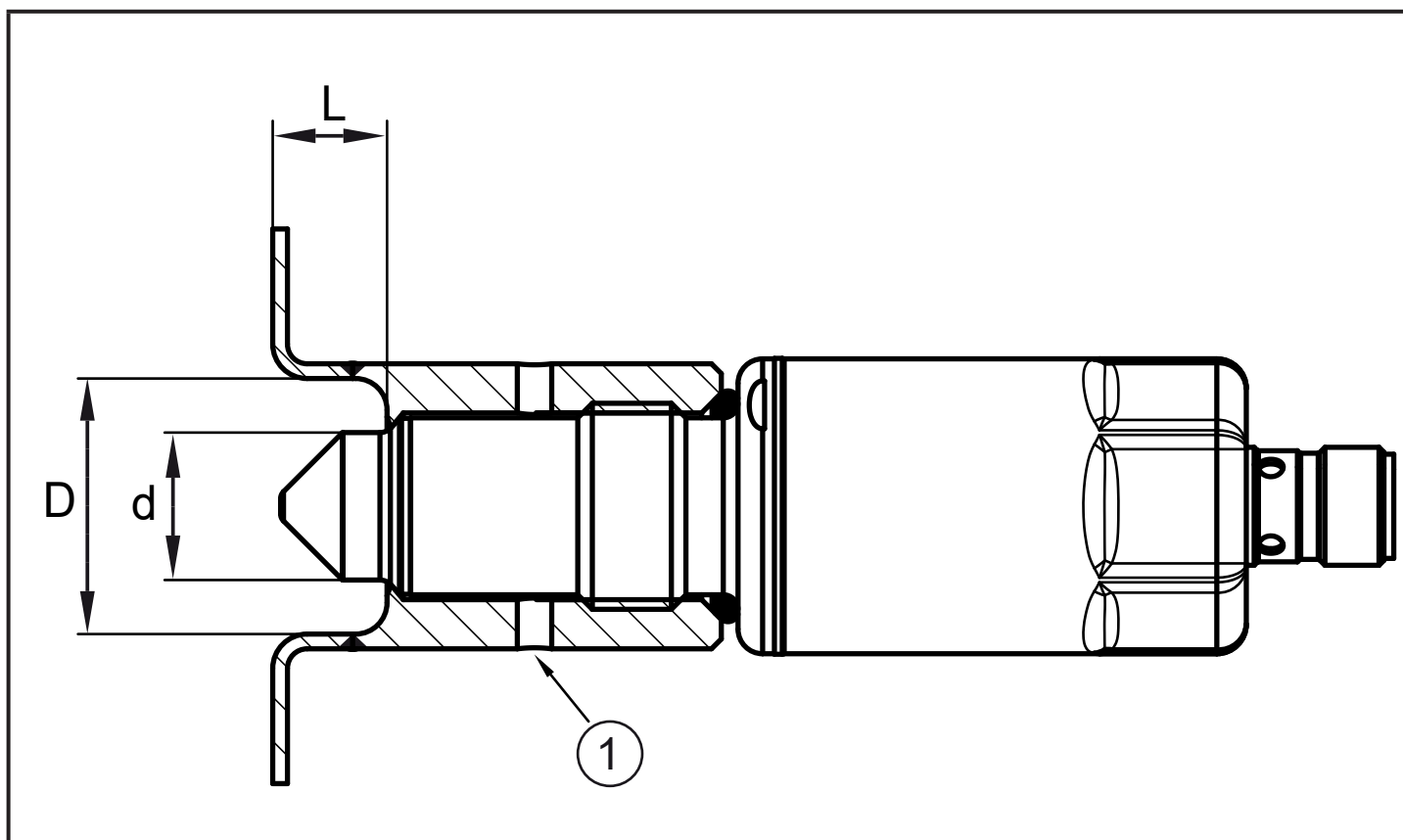
Not suitable for systems that have to meet the criteria of E1.2 / 63-03 of the 3-A standard 63-03.

5.3 Use in hygienic areas to EHEDG



The sensor is suited for CIP (cleaning in place) when installed correctly.

- ▶ Observe the application limits (temperature and material resistance) according to the data sheet.
- ▶ Ensure that the installation of the unit in the system complies with EHEDG guidelines.
- ▶ Adhere to the dimensions $L < (D - d)$ to avoid dead space.



(1) Leakage port

- ▶ Use self-draining installation
- ▶ Only use process adapters permitted according to EHEDG with special seals required by the EHEDG position paper.



The gasket of the system interface must not be in contact with the sealing point of the sensor.

- ▶ In case of structures in a tank, the installation must be flush mount. If not possible then direct water jet cleaning and cleaning of dead spaces must be possible.
- ▶ The leakage port must be clearly visible and installed facing downwards for vertical pipes.

5.4 Installation procedure

The unit is installed by means of an adapter:

- Ensure cleanliness of the sealing areas. Remove protective packaging only just before mounting. In case of damaged sealing areas replace the unit or the adapter.

5.4.1 Installation LMT1x0, LMT1x1 and LMT1x2 (hygiene-compliant)

The seal is formed by the flush front of the PEEK sealing cone (2), fig. 5-2.

- If required: Slide the supplied seal (black O-ring), (1), fig. 5-2, over the thread onto the sensor and/or check for correct position.

It seals the gap on the back between the sensor and the adapter to protect against the ingress of contamination in the thread area.

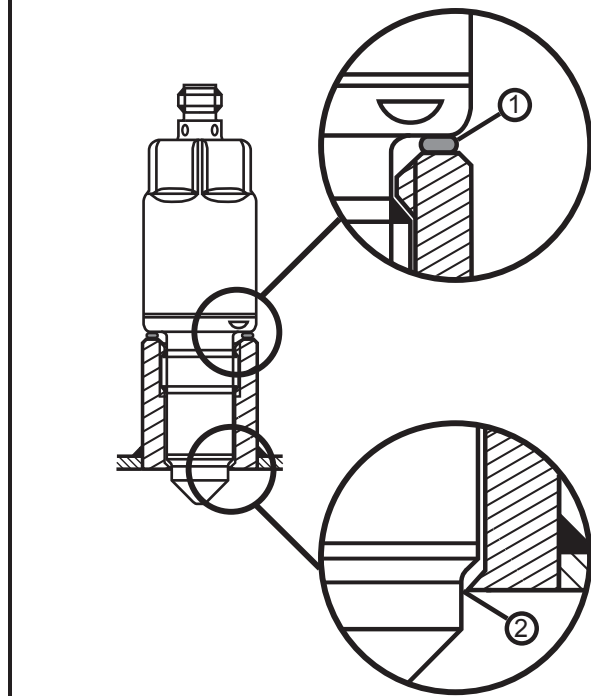


The seal between the housing and the process connection (1) can compensate for variable insertion depths but not for the system pressure.



Use no seals with larger cross sections or several seals at the same time to ensure flush-mount sealing at the PEEK sealing cone!

Fig. 5-2



1: Seal on the back (O-ring, black)

2: Sealing cone / sealing PEEK on metal

- If required: Lightly grease the contact areas using a suitable lubricating paste which has been approved for this application.
- Screw the sensor into the respective process connection and tighten it.
Max. tightening torque: 20...25 Nm
- After installation check the tank / pipe for ingress resistance.

5.4.2 Installation LMT1x4 and LMT1x5

The unit can be adapted via two sealing versions:

1. Flush mount zero-leak using metal-to-metal sealing (fig. 5-3).
2. Flush mount hygienic zero-leak using PEEK gasket (fig. 5-4).



For the hygiene-compliant sealing version a PEEK sealing ring (3), fig. 5-4 is available. It allows use in hygiene-compliant installations to EHEDG. The PEEK sealing ring is not supplied with the unit. It can be ordered separately (E43323).



The PEEK sealing ring has been rated for ifm adapters with end stop towards the medium.

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If the seal between the housing and the process connection is to withstand the system pressure:

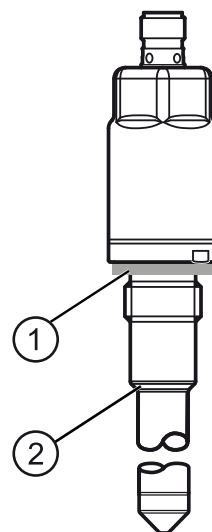


In this case no end stop for the flush mount sealing area exists and the PEEK sealing ring has to be removed.

Flush mount zero-leak using metal-to-metal sealing (2), fig. 5-3

- ▶ Insert the green flat seal (1) and/or check its position.
- ▶ If required: Lightly grease the contact areas using a suitable lubricating paste which has been approved for this application.
- ▶ Screw the sensor into the respective process connection and tighten it. Max. tightening torque: 20...25 Nm.
- ▶ After installation check the tank / pipe for ingress resistance.

Fig. 5-3

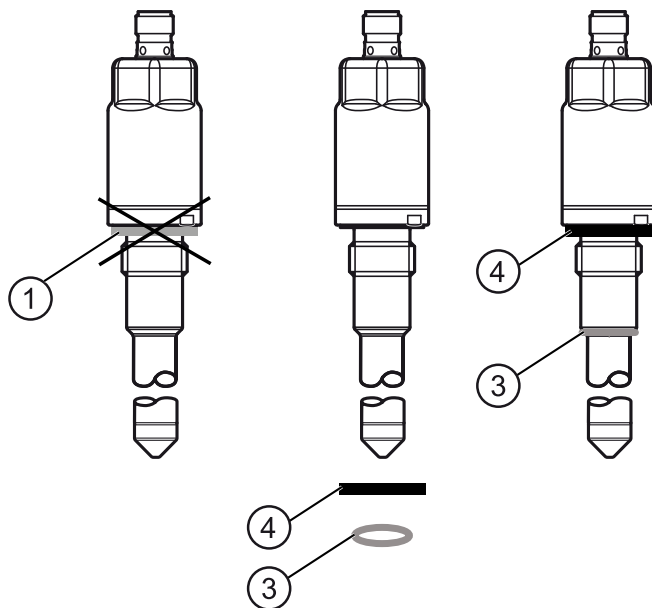


1: green flat seal
2: metal sealing cone

Flush mount hygienic zero-leak using PEEK gasket (3) fig. 5-4

- ▶ If needed, replace green flat seal (1) (on delivery) with black flat seal (4). The flat seal (4) is supplied with the article E43323.
- ▶ Slide the PEEK sealing ring (3) onto the sensor tip until you feel the end stop (cone).
- ▶ If required: Lightly grease the contact areas using a suitable lubricating paste which has been approved for this application.
- ▶ Screw the sensor into the respective process connection and tighten it. Max. tightening torque: 20...25 Nm.
- ▶ After installation check the tank / pipe for ingress resistance.

Fig. 5-4



- 1: green flat seal
3: PEEK sealing ring beige
(accessory E43323)
4: black flat seal (E43323)

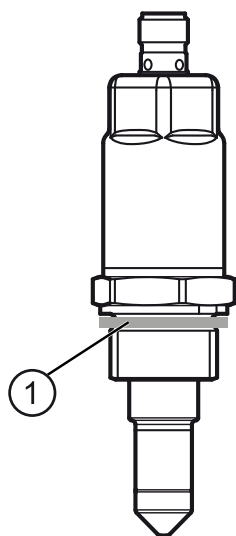
5.4.3 Installation LMT2x2 and LMT3x2 in existing tuning fork adapters

- Observe the installation instructions of the manufacturer of the existing adapter!
- Insert the green flat seal (1), fig. 5-5, and/or check its position. It seals the gap on the back between the sensor and the adapter.
- Slide a suitable, original O-ring and a possibly existing spacing ring of the adapter over the sensor the right way round (G 3/4) and/or check the position of the adapter (G1).
- Check the state and material of the O-ring, replace if necessary.
- Lightly grease the thread of the sensor using a lubricating paste which is suitable and approved for the application.
- Screw the sensor into the adapter and tighten at the hexagonal nut (2), fig. 5-6, until the sensor touches the end stop (3) of the welding adapter.

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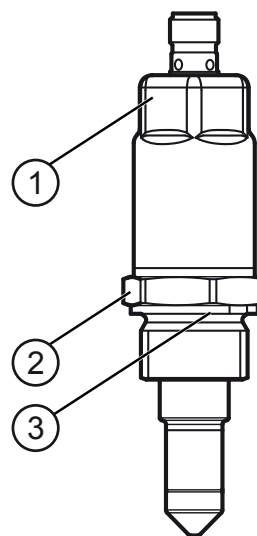
LMT2x2	AF 32	75 Nm
LMT3x2	AF 36	100 Nm

Fig. 5-5



1: green flat seal

Fig. 5-6



1: hexagon AF 27

2: hexagon LMT2x2 AF32 / LMT3x2 AF36

3: end stop



Do not use hexagon (1) (AF 27) because the max. tightening torque is 35 Nm!

- After installation check the tank / pipe for ingress resistance.

6 Electrical connection

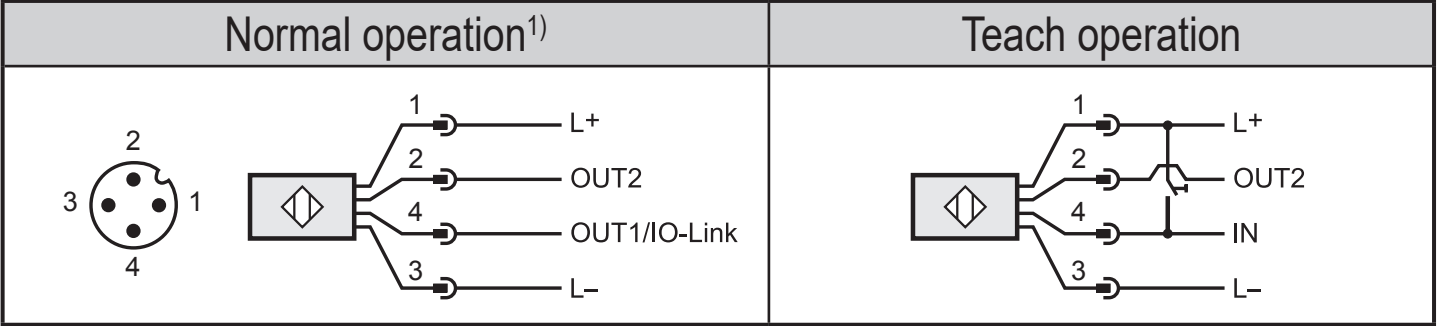


The unit must be connected by a qualified electrician.
The national and international regulations for the installation of electrical equipment must be adhered to.
Voltage supply to EN 50178, SELV, PELV



For marine applications (if approval available for the device), additional surge protection is required.

- ▶ Disconnect power.
- ▶ Connect the unit as follows:



¹⁾ factory setting

Pin	Connection	Core colours for ifm sockets
1	Ub+	brown
3	Ub-	blue
2 (OUT2)	pnP / nPn switching signal	white
4 (OUT1)	• pnp / npn switching signal • IO-Link • input for external teach signal	black



Factory setting OUT1 and OUT2: pnp switching signal

- 
 - In the factory setting, the teach operation is deactivated.
For activation: → 8.1 Parameter setting via PC and IO-Link interface
[ou1] = [tch]
 - Only output OUT2 is available in the teach mode.



The connection accessories are not supplied with the unit. They can be ordered separately.

7 Interfaces

7.1 IO-Link communication interface

The device has an IO-Link communication interface which requires an IO-Link-capable module.

The IO-Link interface allows:

- direct access to process and diagnostic data,
- parameter setting of the unit outside the plant via the IO-Link interface,
- parameter setting of the unit via the IO-Link master during operation.

The IODDs necessary for the configuration of the unit, detailed information about process data structure, diagnostic information, parameter addresses and the necessary information about the required IO-Link hardware and software can be found at www.ifm.com.

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8 Parameter setting



With a suitable unit the presence of certain media can be detected while build-up or foam is suppressed. In many cases the factory setting (→ 3.1 Applications) is absolutely sufficient. For special requirements it is possible to adapt/configure the sensitivity and other functions to the corresponding application. Splashes, wave movements and air bubbles can be suppressed, for example, by setting a switching delay.

The parameters can be set before installation or during operation.



If you change parameters during operation, this will influence the function of the plant.

- ▶ Ensure that there will be no malfunctions in your plant.
- ▶ Note the potential dangers related to extreme plant conditions.

8.1 Parameter setting via PC and IO-Link interface

The interface connects sensors with IO-Link capability to a PC and provides the following options via the IO-Link interface:

- Reading of the current parameter setting
- Parameter setting of the sensor
- Reading of the current measured values and further process values

The interface is not suitable for permanent installation as an automation device.

8.2 Parameter setting via memory plug

Via a memory plug (→ Accessories), a parameter set can be written/transferred to the unit.



The memory plug can also be used to save the current parameter setting of a unit and to transfer it to other units of the same type.

8.3 Parameter setting during operation



Parameter setting during operation requires the connection to a module (master) with IO-Link capability (→ 7.1).

8.4 Parameters

Name	Description
SP1/SP2 rP1/rP2	Set points [SP1] / [SP2] and reset points [rP1] / [rP2].
	 [SPx] must be higher than [rPx]. If [SPx] is set to a value below [rPx], this is rejected by the device software.
	The values for [SPx]/[rPx] are set in per cent of the maximum process value. The process value is defined as follows: Process value in air = 0 %, process value in tap water = 100 % Setting range [SPx]: 4...98 %, step increment: 1 % Setting range [rPx]: 2...96 %, step increment: 1 %, minimum hysteresis: 2 % Reference values:
	Aqueous / water-based media:
	Media with low water content:
ou1 ou2	SPx = 62 %, rPx = 54 % (factory setting LMTx0x)
	SPx = 35 %, rPx = 29 % (factory setting LMTx2x)
	Oils, fats, powders:
	SPx = 8 %, rPx = 5 % (factory setting LMTx1x)
FOU1 / FOU2	[ou1] / [ou2]: output function for OUT1/OUT2 - [Hno] = hysteresis function/normally open - [Hnc] = hysteresis function/normally closed - [Fno] = window function/normally open - [Fnc] = window function/normally closed Parameter [ou1] also provides the option [tch]: - [tch] = configure pin 4 as input for the teach signal (→ 6),(→ 8.8))
	Behaviour of the outputs OUT1 / OUT2 in case of a fault - [OFF] = output opens in case of a fault (factory setting) - [On] = output closes in case of a fault
dFo	Delay time of the outputs in case of a fault Setting range 0...5 s, step increment 0.2 s
dS1*) dS2*)	Switch-on delay for OUT1 or OUT2 Setting range 0...10 s, step increment 0.2 s *) Parameter [dSx] is not available for LMT100, LMT110 and LMT121.
dr1 dr2	Switch-off delay for OUT1 / OUT2 Setting range 0...10 s, step increment 0.2 s
P-n	Output polarity for the outputs (PnP or nPn)

8.5 System commands

tSP1	Teach switch point 1 to medium 1 • Full adjustment to medium 1 to be detected, automatically sets the switching thresholds SP1/rP1 for OUT1.
tSP2	Teach switch point 2 to medium 2 • Full adjustment to medium 2 to be detected, automatically sets the switching thresholds SP2/rP2 for OUT2.
rES	Restore the factory setting

8.6 Unit locking / data storage

The IO-Link master stores all parameters of the connected sensor (data storage) if configured in the master. When a sensor is replaced by a sensor of the same type, the parameters of the old sensor are automatically written to the new sensor if configured in the master and if the sensor allows this.

For safety reasons the data storage can be refused by the sensor. Factory setting: [Open]

Data storage	- [Open] = unit allows parameter download from the master - [Locked] = unit refuses parameter download from the master
--------------	--

8.7 Full adjustment via IO-Link

Full adjustment enables optimum sensitivity of the unit to be set to the medium to be detected (build-up and foam are suppressed):

- ▶ Fill the tank/pipe.
 - > The probe tip must be completely covered with the medium.
- ▶ Execute the system command [tSP1] or [tSP2].
 - > The unit automatically sets the switching thresholds [SPx]/[rPx].
- ▶ Check the function by an application test.

8.8 Parameter setting via the teach input

The teach input must be activated. This requires previous configuration via IO-Link (→ 8.4), parameter [ou2] = [tch].



Output OUT2 must be configured as hysteresis function (Hnc or Hno). If the window function is set, an error during teaching results (→ 8.8.3 Fault during the teach operation).



Only output OUT2 is available in the teach mode. In the teach mode the LEDs indicate the switching status of output OUT2.

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8.8.1 Full adjustment via teach input

- Fill the tank until the probe tip is completely covered.
- Apply Ub+ to pin 4 for $> 2 \dots < 5$ s.



The tool which is available for this process is the teach button (accessory).

- > LEDs are flashing with 2 Hz (▬▬▬▬).
- > After teaching the LEDs are on for 2 s, then the colours change to regular operating mode (table → 8.8.2).

8.8.2 Changing the output function

Output OUT2 can be changed from "NC" (Hnc) to "NO" (Hno) and vice versa.

- Apply Ub+ to pin 4 for $> 5 \dots < 10$ s.
- > LEDs are flashing, first with 2 Hz (▬▬▬▬), after 5 s with a 1 Hz double flashing (▬▬▬▬▬▬).
- > After the change the LEDs are on for 2 s. Then the colours change to regular operating mode (table below).
- > After the successful change, the LEDs are on as follows:

No medium detected	LEDs = yellow (for Hnc)	LEDs = green (for Hno)
Medium detected	LEDs = green (for Hnc)	LEDs = yellow (for Hno)

8.8.3 Fault during the teach operation

The teach operation is cancelled in case of a fault:

- > LEDs are flashing green/yellow with 8 Hz.
- > The unit returns to the operating mode with unchanged settings.

Possible faults:

- Time error (teach time too long / too short)
- Internal sensor signal not clear
- Wrong output function: (→ 8.8 Parameter setting via the teach input)
- Process value too low (< 9 %, e.g. for powders),
SPx/rPx must be set manually (→ 8.1 Parameter setting via PC and IO-Link interface).

9 Operation

After power-on the device is in the operating mode. It carries out its evaluation functions and switches the outputs.

Outputs OUT1 and OUT2 complement each other.



The following table shows the factory settings. In this state OUT1 = Hno and OUT2 = Hnc.

- Check whether the unit operates correctly.

9.1 Switching states and display by LEDs

Operating status	LEDs	OUT1	OUT2
Unit ready for operation, no medium detected	green	OFF	ON
Unit ready for operation, medium detected	yellow	ON	OFF
No operating voltage	OFF	OFF	OFF
Short circuit output 1	flashing yellow	-	1)
Short circuit output 2	flashing yellow	1)	-
Error / failure	-	OFF	OFF
Teach operation	(→ 8.8.1) and (→ 8.8.2)		
Fault during the teach operation	LEDs are flashing green/yellow with 8 Hz		

¹⁾ according to the level



The LEDs always indicate the switching status of output OUT1 (exception: teach mode (→ 8.8)).

9.2 System events IO-Link

Code	Type	Description
20480 d / 50 00 h	Error	Hardware fault in the unit. ► Replace device
25376 d / 63 20 h	Error	Parameter error ► Verify the data sheet and the values
30480 d / 77 10 h	Error	Short circuit ► Verify the installation
36350 d / 8D FE h	Warning	Test event. Event appears if index 2 is set to the value 240, event disappears if index 2 is set to the value 241
36351 d / 8D FF h	Warning	Test event. Event appears if index 2 is set to the value 242, event disappears if index 2 is set to the value 243

UK

10 Maintenance, repair, disposal

- From time to time check the probe tip for build-up and damage. Clean it in case of heavy soiling. In case of damage replace the unit.
- After removal and before reinstallation of the unit carefully clean the probe neck and the installation slot - especially the sealing cone - with appropriate methods to ensure that the unit is resistant to ingress and without dead space.



- If the variable clamp fitting is used (→ 4.3.2):
Check the correct position of the safety chain or the securing wire between the clamp fitting and the sensor from time to time.

- Replace if damaged!



When the medium is changed, it may also be necessary to use another type of unit or adapt the sensitivity (→ 3.1 Applications).

- It is not possible to repair the unit.
- After use dispose of the unit in an environmentally friendly way in accordance with the applicable national regulations.

- In case of returns ensure that the unit is free from soiling, especially from dangerous and toxic substances.

For transport only use appropriate packaging to avoid damage of the unit.

11 Notes on the regulation (EC) 1935/2004

The following components of the product are designed for permanent contact with food according to the regulation (EC) 1935/2004:

- Sensor tip made of PEEK
- Sealing ring made of PEEK (→ 5.4.2)
- Sealing ring made of FKM (LMT104 / LMT105)

12 Factory setting

	LMTx0x	LMTx1x	LMTx2x	User settings
SP1	62 %	8 %	35 %	
rP1	54 %	5 %	29 %	
ou1	Hno	Hno	Hno	
SP2	62 %	8 %	35 %	
rP2	54 %	5 %	29 %	
ou2	Hnc	Hnc	Hnc	
FOU1	OFF	OFF	OFF	
FOU2	OFF	OFF	OFF	
dS1*)	0.0	0.0	0.0	
dS2*)	0.0	0.0	0.0	
dr1	0.0	0.0	0.0	
dr2	0.0	0.0	0.0	
P-n	PnP	PnP	PnP	
dFo	0.0	0.0	0.0	

Percentage values refer to the process value (→ 8 Parameter setting).

*) Parameter is not available for LMT100, LMT110 and LMT121

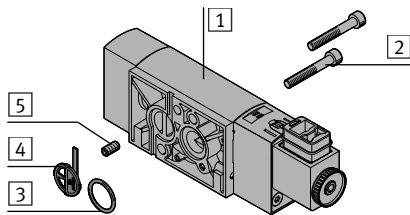
Solenoid valve VSNC-FC-M52-MD-...14-F...

FESTO

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www.festo.com

1. Parts list



- | | | |
|----------|---------------------------------------|------|
| 1 | Solenoid valve, monostable 5/2 or 3/2 | (1x) |
| 2 | Screw | (2x) |
| 3 | O-ring | (1x) |
| 4 | Sheet metal seal | (1x) |
| 5 | Coding pin | (1x) |

2. Intended use

Solenoid valve VSNC-FC-M52-MD-...14-F8 and VSNC-FC-M52-MD-...14-FN:
Attachment to a drive with port pattern as per NAMUR, port pattern in accordance with VDI/VDE 3845 sheet 1: 2010-09.

3. Safety instructions and notes on mounting



Caution

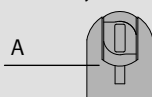
Unexpected movement of components.
Injury due to shock, impact or pinching.

- Switch off power supply before mounting work.
- Switch off compressed air before mounting work.
- Observe the safety instructions (→ Applicable documents).

→ Note

Malfunction due to incorrect assembly.

- Set manual override (A) to **unactuated** prior to mounting.



Unactuated



Actuated

→ Note

Malfunction during outdoor application.

The exhaust ducts 3/5 are plugged, e.g. through frozen condensed water or nesting insects.

- Take on-site environmental conditions into account.
- Perform appropriate safeguarding, e.g.:
 - Use exhaust protection VABD-D3-SN-G14
 - Catch exhaust air.



Information

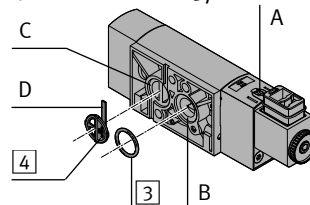
Applicable documents

→ Operating instructions of the drive

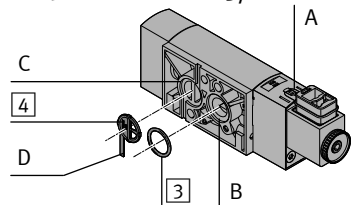
Accessories for VSNC → www.festo.com/catalogue

4. Preassembly

4a. Valve function 5/2



4b. Valve function 3/2



- Press O-ring **3** into the recess (B).
 - Press sheet metal seal **4** into the recess (C).
- Check: Correct orientation of lug (D) according to selected function.

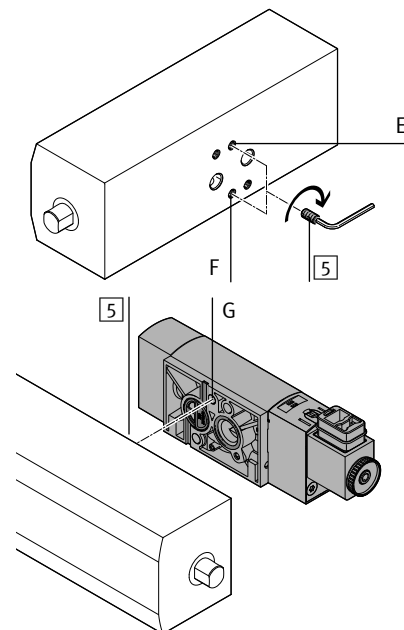
5. Mounting



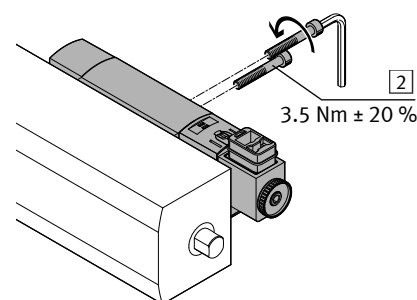
Information

The orientation of the solenoid valve **1** depends on the position of the coding pin **5**.

The coding pin **5** ensures that the solenoid valve **1** is properly mounted and all the valves work properly.



- Position coding pin **5** on the thread (E)/(F) in accordance with the desired direction of movement.
- Screw coding pin **5** into the thread (E)/(F) up to the stop.
- Place coding recess (G) on the coding pin **5**.

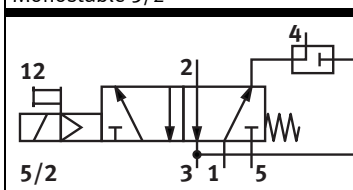


- Tighten screws **2**. Observe tightening torque.

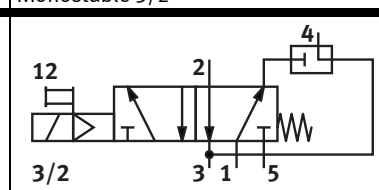
6. Circuit diagrams

VSNC-FC-M52-MD-...14-F...

Monostable 5/2



Monostable 3/2





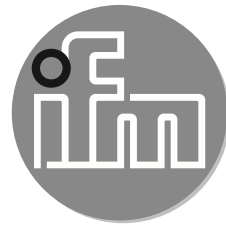
G.C. Evans Sales & Mfg Co Inc.

Section 4-II

Steam / Heat System

Model P-1048SD
Pasteurizer

80269598 / 00 10 / 2017



Operating instructions
Temperature transmitters

TA1xxx
TA2xxx

UK

Contents

1 Remark	2
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4 Function	4
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5.1 Units with G½ sealing cone (type TA25xx)	5
6 Electrical connection.....	6
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6.1.1 General information	6
6.1.2 Device-specific information.....	7
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9 Technical data.....	8
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1 Remark

1.1 Explanation of symbols

- ▶ Instructions
- > Reaction, result
- [...] Designation of keys, buttons or indications
- Cross-reference



Important note

Non-compliance can result in malfunction or interference.

2 Safety instructions

- Please read this document prior to set-up of the unit. Ensure that the product is suitable for your application without any restrictions.
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property can occur.
- Improper or non-intended use may lead to malfunctions of the unit or to unwanted effects in your application. That is why installation, electrical connection, set-up, operation and maintenance of the unit must only be carried out by qualified personnel authorised by the machine operator.
- In order to guarantee the correct condition of the device for the operating time it is necessary to use the device only for media to which the wetted materials are sufficiently resistant (→ Technical data).
- The responsibility whether the measurement devices are suitable for the respective application lies with the operator. The manufacturer assumes no liability for consequences of misuse by the operator. Improper installation and use of the devices results in a loss of the warranty claims.

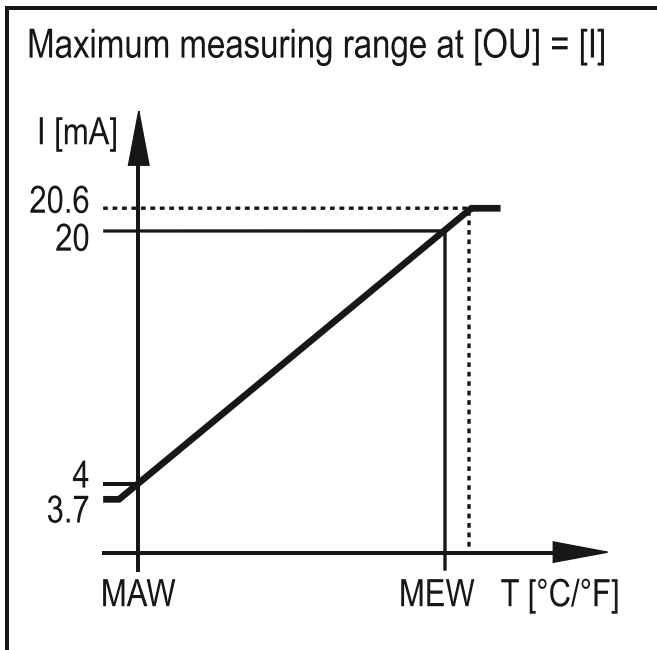
UK

3 Functions and features

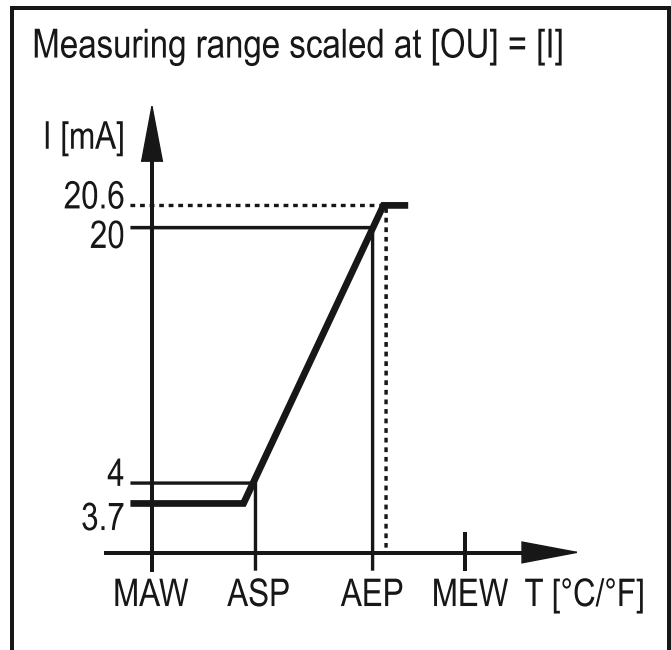
The unit detects the medium temperature and converts it into an analogue output signal (4 ... 20 mA).

4 Function

- The unit supports IO-Link.
- The unit converts the measured signal into a temperature-proportional analogue signal. Depending on the parameter setting ($\rightarrow$ 7) the output signal is at:
4...20 mA with setting [OU] = [I] or
20...4 mA with setting [OU] = [Ineg].
- The analogue signal can be scaled.



MAW = initial value of the measuring range
MEW = final value of the measuring range



ASP = analogue start point
AEP = analogue end point

Within the measuring range the output signal is between 4 and 20 mA. If the temperature value is outside the limits of the measuring range, the following output signal is displayed:

	Output signal at [OU] = [I]	Output signal at [OU] = [Ineg]
Temperature > AEP	20...20.6 mA	4...3.7 mA
Temperature > MEW		
Temperature < ASP	3.7...4 mA	20.6...20 mA
Temperature < MAW		

In case of internal fault, the output signal behaves according to the parameter set in [FOU] (3.5 mA or 21.1 mA) $\rightarrow$ 7 Parameter setting.

5 Installation

- ▶ Horizontal mounting recommended for high medium temperatures.
- ▶ Connect the unit to the process using a fixing element (adapter, clamp).



Information about the available adapters at www.ifm.com.

- ▶ Observe the instructions of the adapter.
- ▶ Use a lubricating paste which is suitable and approved for the application.

Use in hygienic areas to 3A requirements:

- ▶ Make sure that the sensors are integrated into the system in accordance with 3A.
- ▶ Tighten seals to defined torque and ensure seals are centered.

Use in hygienic areas to EHEDG:

- ▶ Make sure that the sensors are integrated into the system in accordance with EHEDG.

5.1 Units with G $\frac{1}{2}$ sealing cone (type TA25xx)



About sensor installation conforming to 3A:

- ▶ Insert PEEK sealing ring E43911.
- ▶ Carry out installation according to separate installation instructions of the sealing ring.

The PEEK sealing ring is not supplied with the unit. It must be ordered separately.
Order no.: E43911.

UK

6 Electrical connection

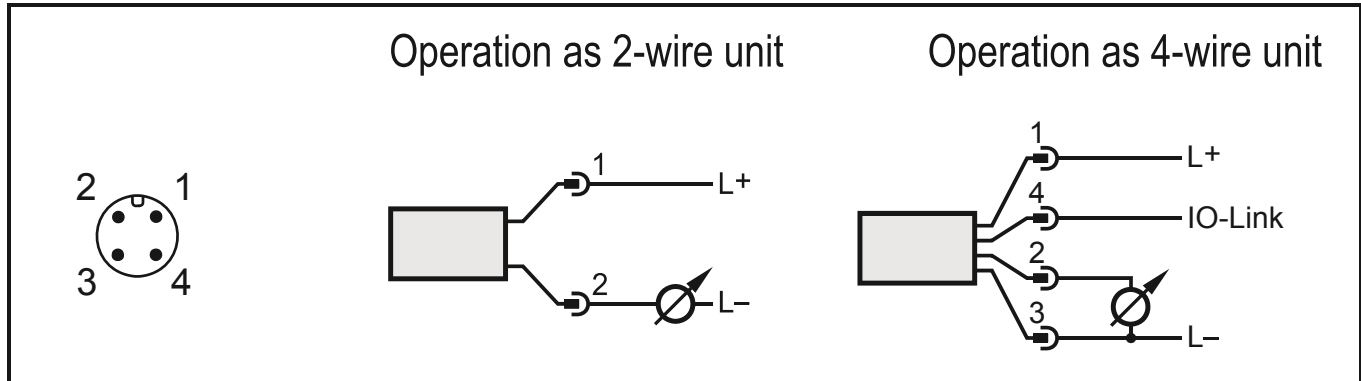


The unit must be connected by a qualified electrician.

The national and international regulations for the installation of electrical equipment must be adhered to.

Voltage supply according to EN 50178, SELV, PELV.

- Disconnect power.
- Connect the unit as follows:



	Operation as 2-wire unit	Operation as 4-wire unit
Pin 1	L+	L+
Pin 2	Analogue signal for temperature	Analogue signal for temperature
Pin 3		L-
Pin 4		IO-Link

6.1 IO-Link

6.1.1 General information

This unit has an IO-Link communication interface which requires an IO-Link-capable module (IO-Link master) for operation.

The IO-Link interface enables direct access to the process and diagnostic data and provides the possibility to set the parameters of the unit during operation.

In addition communication is possible via a point-to-point connection with a USB adapter cable.

You will find more detailed information about IO-Link at www.ifm.com/gb/io-link.

6.1.2 Device-specific information

You will find the IODDs necessary for the configuration of the IO-Link unit and detailed information about process data structure, diagnostic information and parameter addresses at www.ifm.com/gb/io-link.

6.1.3 Parameter setting tools

You will find all necessary information about the required IO-Link hardware and software at www.ifm.com/gb/io-link.

7 Parameter setting

Using an IO-Link capable parameter setting tool, the following options are available:

- Reading current process values.
 - Reading, changing and saving current parameter settings and transmitting them to other units of the same type.
- Connect the unit via the IO-Link interface to a PC or PLC with suitable parameter setting software.

 ifm offers an IO-Link interface for the connection of the sensor via USB port.

7.1 Adjustable parameters

OU	Output function	Analogue output signal: [I]: 4...20 mA [Ineg]: 20...4 mA
ASP	Analogue start point for temperature	With setting [OU] = [I]: Measured value at which the output signal is 4 mA. With setting [OU] = [Ineg]: Measured value at which the output signal is 20 mA.
AEP	Analogue end point for temperature	With setting [OU] = [I]: Measured value at which the output signal is 20 mA. With setting [OU] = [Ineg]: Measured value at which the output signal is 4 mA. Minimum distance between ASP and AEP = 5 °C or 9 °F.
COF	Zero-point calibration	Setting range: ± 10 K in steps of 0.1 K. The internal measured value "0" is shifted by this value.

FOU	Response of the output in case of an internal fault	[On]: The analogue signal goes to the upper end stop value (21.1 mA). [OFF]: The analogue signal goes to the lower end stop value (3.5 mA).
Uni	Unit of measurement for the system temperature	°C or °F

8 Operation

After power on, the unit is in the Run mode (= normal operating mode).

9 Technical data

Technical data and scale drawing at www.ifm.com

10 Factory setting

	Factory setting	User setting
OU	I	
COF	0,0	
FOU	OFF	

Factory setting (ASP and AEP) and the units (Uni)

→ Technical data at www.ifm.com.

More information at www.ifm.com

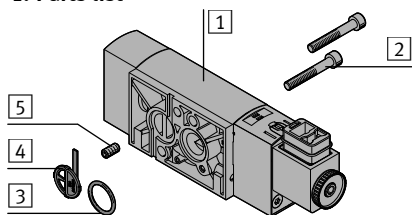
Solenoid valve VSNC-FC-M52-MD-...14-F...

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73726 Esslingen
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www.festo.com

1. Parts list



- | | | |
|---|---------------------------------------|------|
| 1 | Solenoid valve, monostable 5/2 or 3/2 | (1x) |
| 2 | Screw | (2x) |
| 3 | O-ring | (1x) |
| 4 | Sheet metal seal | (1x) |
| 5 | Coding pin | (1x) |

2. Intended use

Solenoid valve VSNC-FC-M52-MD-...14-F8 and VSNC-FC-M52-MD-...14-FN:
Attachment to a drive with port pattern as per NAMUR, port pattern in accordance with VDI/VDE 3845 sheet 1: 2010-09.

3. Safety instructions and notes on mounting



Caution

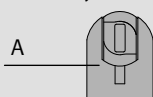
Unexpected movement of components.
Injury due to shock, impact or pinching.

- Switch off power supply before mounting work.
- Switch off compressed air before mounting work.
- Observe the safety instructions (→ Applicable documents).

→ Note

Malfunction due to incorrect assembly.

- Set manual override (A) to **unactuated** prior to mounting.



Unactuated



Actuated

→ Note

Malfunction during outdoor application.

The exhaust ducts 3/5 are plugged, e.g. through frozen condensed water or nesting insects.

- Take on-site environmental conditions into account.
- Perform appropriate safeguarding, e.g.:
 - Use exhaust protection VABD-D3-SN-G14
 - Catch exhaust air.



Information

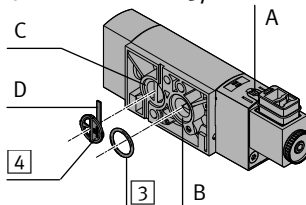
Applicable documents

→ Operating instructions of the drive

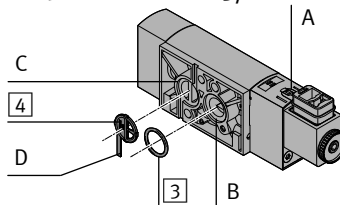
Accessories for VSNC → www.festo.com/catalogue

4. Preassembly

4a. Valve function 5/2



4b. Valve function 3/2



- Press O-ring [3] into the recess (B).
 - Press sheet metal seal [4] into the recess (C).
- Check: Correct orientation of lug (D) according to selected function.

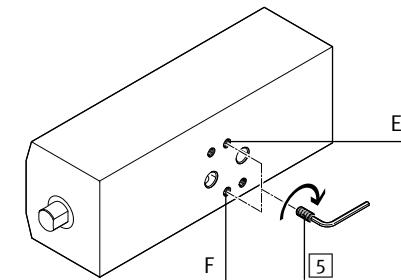
5. Mounting



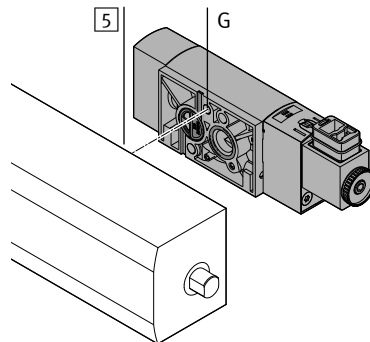
Information

The orientation of the solenoid valve [1] depends on the position of the coding pin [5].

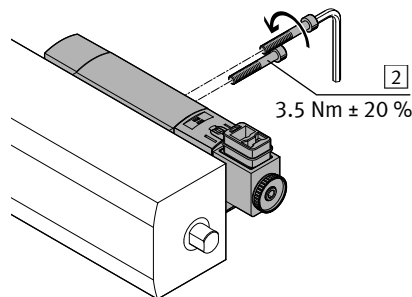
The coding pin [5] ensures that the solenoid valve [1] is properly mounted and all the valves work properly.



- Position coding pin [5] on the thread (E)/(F) in accordance with the desired direction of movement.
- Screw coding pin [5] into the thread (E)/(F) up to the stop.



- Place coding recess (G) on the coding pin [5].

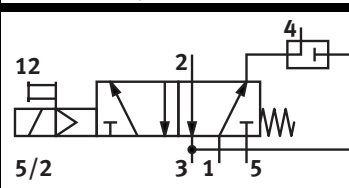


- Tighten screws [2]. Observe tightening torque.

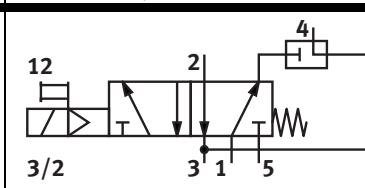
6. Circuit diagrams

VSNC-FC-M52-MD-...14-F...

Monostable 5/2



Monostable 3/2





G.C. Evans Sales & Mfg Co Inc.

Section 4-III

Pasteurizer Conveyor Components

Model P-1040SD
Pasteurizer



ROLLER BEARINGS INSTALLATION & MAINTENANCE

Emerson Power Transmission

P O BOX 1588
AURORA, IL 60507
Phone: 630-898-9620
www.emerson-ept.com

FORM
PS-740-0021
Revised
May, 2002

	⚠ WARNING High voltage and rotating parts may cause serious or fatal injury. Turn off power to install or service. Operate with guards in place. Read and follow all instructions in this manual.	
---	--	---

BORE AND SHAFT TOLERANCES

All SEALMASTER roller bearing races have bore diameters for a sliding or snug fit over the shaft. They are locked to the shaft by means of locking collars with double cup point setscrews. Bearing bore and shaft tolerances are shown in Table 1.

Table 1

RECOMMENDED SHAFT TOLERANCES		
Shaft Diameters (Inches)	Bearing Bore Tolerance	Recommended Shaft Tolerance
1 3/16 - 1 7/16	+ .0010 - .0000	+ .0000 - .0005
1 1/2 - 3	+ .0010 - .0000	+ .0000 - .0010
3 - 3 15/16	+ .0020 - .0000	+ .0000 - .0010
4 - 4 15/16	+ .0020 - .0000	+ .0000 - .0015

MOUNTING INSTRUCTIONS

Prior to securing the unit to the shaft, make certain that shafting is free of burrs. Slide the unit onto the shaft to the point desired for mounting and bolt the unit to the supporting base. To prevent bearing damage avoid hammering on the ends of the inner race. After bolting the unit to the support, tighten the self-locking setscrews securely onto the shaft. Recommended torques for tightening the setscrews are shown in Table 2.

Table 2

RPB LOCKING COLLAR SET SCREW TIGHTENING TORQUE			
Shaft Diameters (Inches)	Set Screw Size	Tightening Torque	
		inch-pounds	foot-pounds
1 3/16 - 1 11/16	5/16 - 24	110 - 140	9 - 11.5
1 3/4 - 2 1/2	3/8 - 24	180 - 230	15 - 19
2 11/16 - 3 1/2	1/2 - 20	400 - 525	33 - 43
3 15/16 - 4	5/8 - 18	875 - 1000	73 - 83
4 7/16 - 4 15/16	3/4 - 16	1450 - 1850	120 - 155

Note: Bearing Design will allow up to 3° misalignment.
Installation at higher than 3° will lead to premature bearing failure

CARTRIDGE INSERT

General: This cartridge is for use in SEALMASTER housing or in SEALMASTER approved OEM applications only. No other use is authorized.

Removal & Replacement: To remove the cartridge from the housing, remove the housing assembly cap bolts and lift off the top housing half so that the shaft plane can be adjusted to allow removal of the cartridge. When replacing the cartridge insert, first check to assure that the rubber grommet is properly seated in the lube hole. Then position the cartridge lock pin so that it lines up with the lock pin slot in the housing. **BE SURE the lock pin is not put in the lube hole.** The shaft can be returned to its normal position and the housing can then be reassembled by tightening the cap bolts. Cap bolt tightening torques are shown in Tables 3, 4, 5, & 6. Locking collars can be reattached to the shaft by tightening the setscrews to the torques shown above. (See Table 2.)



TORQUE VALUES FOR ASSEMBLING HOUSING HALVES

Table 3

PILLOW BLOCK HOUSING		
Shaft Size (Inches)	Tightening Torque	
	(Lbs. Inches)	(Lbs. Feet)
1 3/16 - 1 1/4	204	17
1 3/8 - 2 3/16	372	31
2 1/4 - 3	900	75
3 3/16 - 4 1/2	3192	266
4 15/16 - 5	4728	394

Table 4

FLANGE BEARING HOUSING		
Shaft Size (Inches)	Tightening Torque	
	(Lbs. Inches)	(Lbs. Feet)
1 3/16 - 2	372	31
2 3/16 - 3	900	75
3 7/16 - 3 15/16	1800	150

Table 5

PILOTED FLANGE HOUSING				
Shaft Size (Inches)	Outside Bolts		Inside Bolts	
	(Lbs.-Inches)	(Lbs.-Feet)	(Lbs.-Inches)	(Lbs.-Feet)
1 3/16 - 2	204	17	48	4
2 3/16 - 3	588	49	96	8
3 3/16 - 4	900	75	204	17
4 7/16 - 5	1800	150	900	75

Table 6

EXPANSION PILLOW BLOCKS		
Shaft Size (Inches)	Tightening Torque	
	(Lbs. Inches)	(Lbs. Feet)
1 3/4 - 2 3/16	372	31
2 1/4 - 3	900	75
3 3/16 - 3 1/2	3192	266
3 15/16 - 4 1/2	1800	150
4 15/16 - 5	3192	266

LUBRICATION

All SEALMASTER roller bearings are prelubricated at the factory with a lithium soap grease which is compatible with multi-purpose grease readily available from local suppliers. The factory lubrication conforms to NLGI grade 2 consistency and is suitable for an operating temperature range of -20° F. to 250° F.

Examples:

- Texaco Multifak EP2
- Exxon Lidok EP2
- Mobil Mobilith AW2
- Shell Alvania EP2
- Chevron Dura-lith EP2
- Amoco Amolith 2EP

For extremely dirty or wet applications with shaft speeds below 200 RPM, completely fill the bearing prior to running.

Proper relubrication is important to the life of the bearing. A general relubrication guide is shown in Table 8. This can be used as a starting point for relubrication frequency. Experience will dictate if changes are needed to optimize the relubrication frequency. The bearing should be relubricated while rotating, the grease pumped in slowly until a bead forms around the seals. If necessary to relubricate while idle, refer to relubrication Table 7 for maximum grease capacity for various size bearings.

Table 7

LUBRICATION OF SEALMASTER ROLLER BEARINGS	
Shaft Size (Inches)	Recommended Relube Grease Charge (ozs.)
1 3/16 - 1 1/4	.10
1 3/8 - 1 7/16	.22
1 1/2 - 1 11/16	.32
1 3/4 - 2	.50
2 3/16	.55
2 1/4 - 2 1/2	.65
2 11/16 - 3	.85
3 3/16 - 3 1/2	1.25
3 15/16 - 4	2.50
4 7/16 - 4 1/2	3.10
4 15/16	4.75

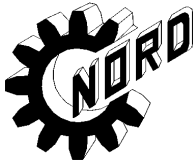
Table 8

RECOMMENDED RELUBRICATION FREQUENCY			
Speed	Temperature	Cleanliness	Greasing Interval
100 RPM	Up to 125° F.	Clean	6 months
500 RPM	Up to 150° F.	Clean	2 months
1000 RPM	Up to 210° F.	Clean	2 weeks
1500 RPM	Up to 210° F.	Clean	Weekly
Any Speed	Up to 150° F.	Dirty	1 wk. to 1 mo.
Any Speed	Up to 150° F.	Dirty	Daily to 1 wk.
Any Speed	Any Temperature	Very Dirty	Daily to 1 wk.
Any Speed	Any Temperature	Extreme conditions	Daily to 1 wk.



WARNING

Disconnect all power before adjusting units



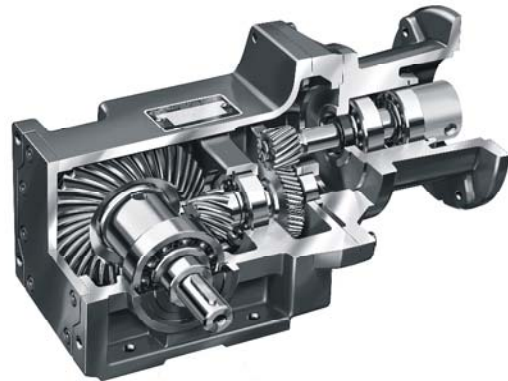
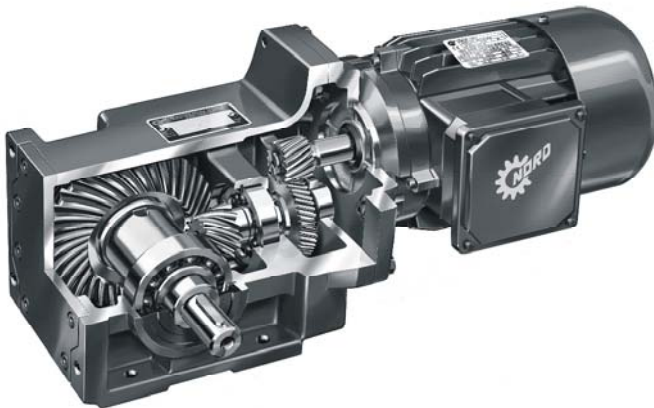
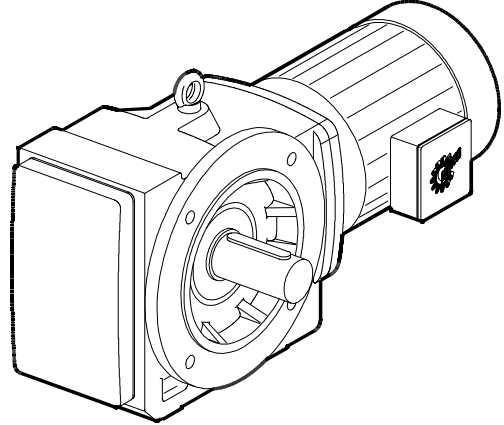
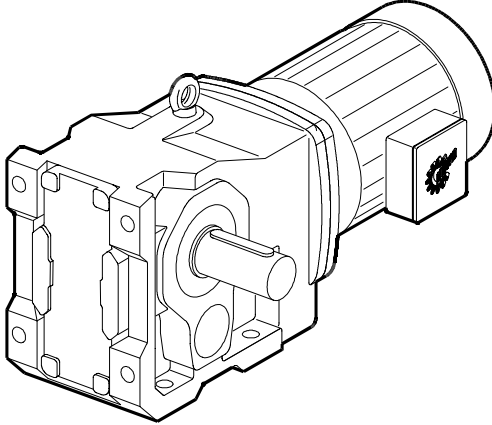
UNICASE[®] 90.1 & 92 Series Helical Bevel Gearboxes Installation and Maintenance Instructions

Retain These Safety Instructions For Future Use

BIM 1040

USA

CDN



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)

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

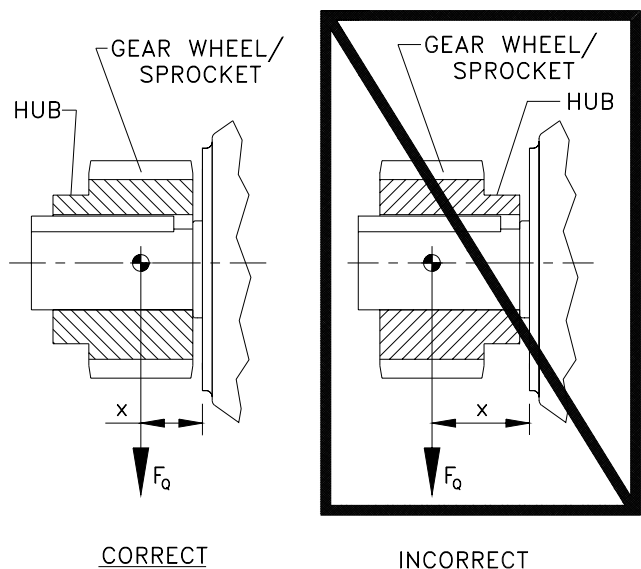
Inch

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

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:

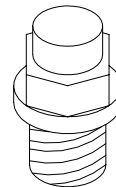
LOCK OUT POWER before any maintenance is performed. Make absolutely sure that no voltage is applied while work is being done on the gearbox.

START-UP

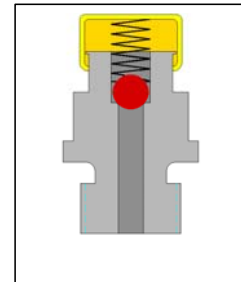
1. Ensure that switches, alarms, heaters, coolers and other safety and protection devices are installed and operational for their intended purpose.
2. Verify that the installed mounting position is the same as the nametag mounting position. If not, adjust the oil level accordingly and relocate the vent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



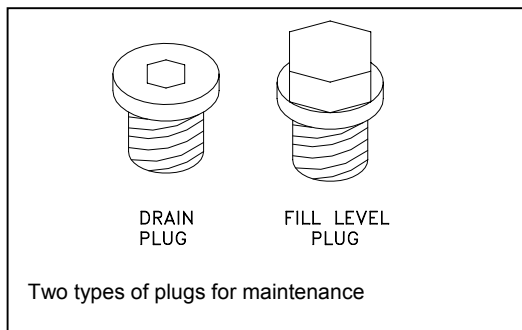
AUTOVENT
PLUG



The Autovent releases built-up air pressure from inside the gearbox (Max. pressure 2 psi).

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 $\frac{1}{2}$ inch of the bottom of the fill plug threads.

OPERATION AND MAINTENANCE CHECKLIST

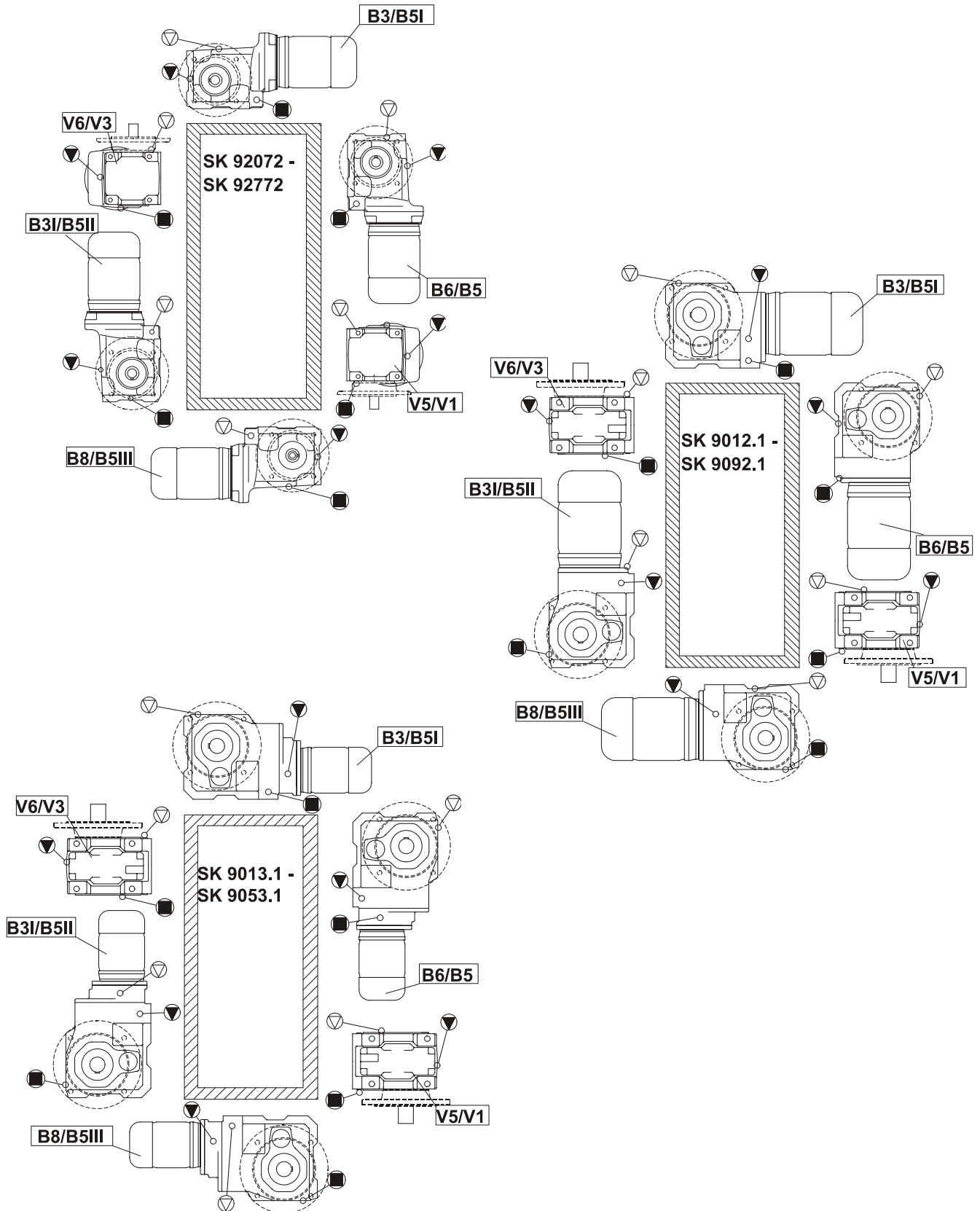
1. Operate the equipment as it was intended to be operated
2. Do not overload.
3. Run at correct speed.
4. Maintain lubricant in good condition and at proper level.
5. Dispose of used lubricant in accordance with applicable laws and regulations.
6. Apply proper maintenance to attached equipment at prescribed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

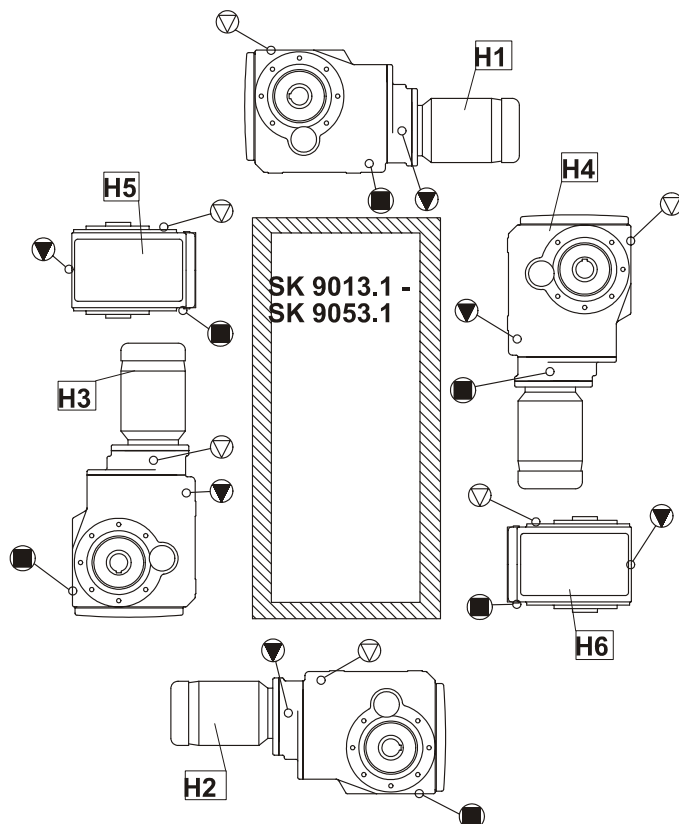
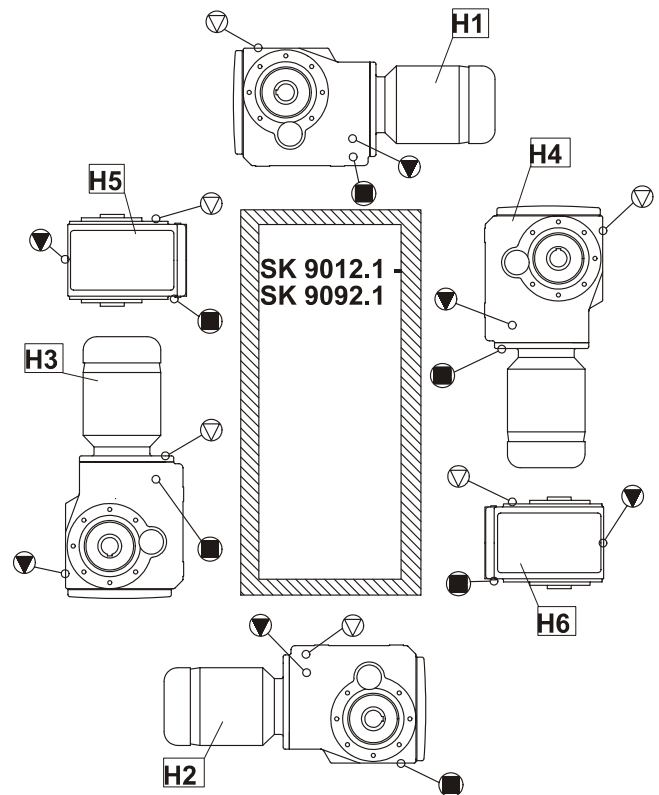
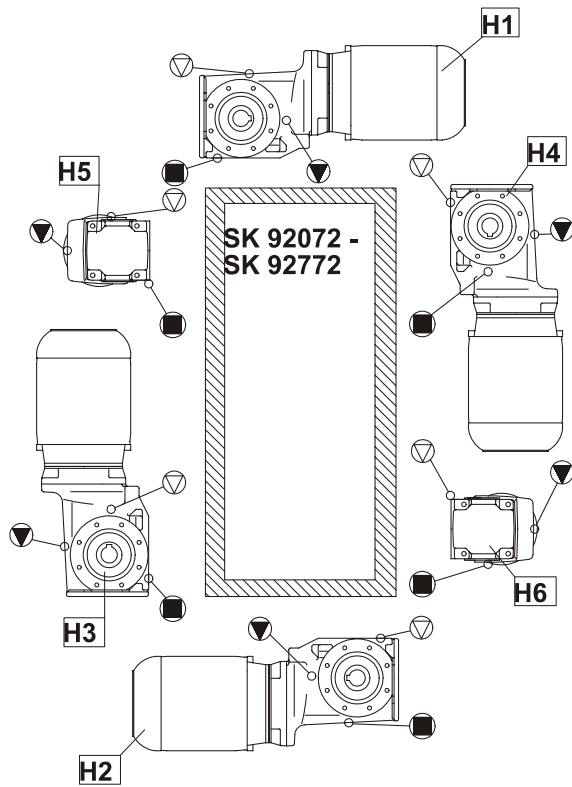
NOTES

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.

The 92 Series Helical Bevel gearbox sizes SK92072, SK92172 & SK92372 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.

**The 92 Series Helical Bevel gearbox sizes SK92072, SK92172 & SK92372 have no vent or drain plugs.
They are filled with synthetic oil so the units are “Lubed for Life”.**

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 68°F 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 ½ inch of the bottom of the fill plug threads.

LUBRICATION CAPACITY – 90.1 SERIES HELICAL BEVEL GEARBOXES																	
Mounting position		Foot mounting															
		triple reduction									quadruple reduction						
		9012.1	9016.1	9022.1	9032.1	9042.1	9052.1	9062.1	9082.1	9086.1	9092.1	9013.1	9017.1	9023.1	9033.1	9043.1	9053.1
B 3	quarts	0.74	0.74	1.37	1.80	4.64	6.87	10.57	17.96	27.47	38.04	1.27	1.27	2.54	3.49	4.86	10.57
	liters	0.70	0.70	1.30	1.70	4.39	6.50	10.00	17.00	26.00	36.00	1.20	1.20	2.40	3.30	4.60	10.00
B 3 I	quarts	2.54	2.54	4.44	7.08	10.36	22.72	38.04	75.55	107.78	181.75	3.17	3.17	5.60	8.24	13.52	25.57
	liters	2.40	2.40	4.20	6.70	9.80	21.50	36.00	71.50	102.00	172.00	3.00	3.00	5.30	7.80	12.79	24.20
B 6	quarts	1.69	1.69	2.74	5.07	9.19	16.91	29.06	54.42	77.14	165.90	2.11	2.11	3.17	6.97	10.87	17.69
	liters	1.60	1.60	2.59	4.80	8.70	16.00	27.50	51.50	73.00	157.00	2.00	2.00	3.00	6.60	10.29	16.74
B 6 I	quarts	0.74	0.74	1.37	1.79	4.65	6.87	10.57	17.96	27.47	38.04	1.27	1.27	2.54	3.49	4.86	10.57
	liters	0.70	0.70	1.30	1.69	4.40	6.50	10.00	17.00	26.00	36.00	1.20	1.20	2.40	3.30	4.60	10.00
B 6 II	quarts	2.54	2.54	4.44	7.08	10.36	22.72	38.04	75.55	107.78	181.75	3.17	3.17	5.60	8.24	13.52	25.57
	liters	2.40	2.40	4.20	6.70	9.80	21.50	36.00	71.50	102.00	172.00	3.00	3.00	5.30	7.80	12.79	24.20
B 8	quarts	2.01	2.01	3.70	6.76	10.57	20.08	33.81	66.04	89.82	179.64	2.32	2.32	4.02	7.40	11.31	21.13
	liters	1.90	1.90	3.50	6.40	10.00	19.00	32.00	62.50	85.00	170.00	2.20	2.20	3.80	7.00	10.70	20.00
B 8 I	quarts	1.69	1.69	2.74	5.07	9.19	16.91	29.06	54.42	77.14	165.90	2.11	2.11	3.17	6.97	10.78	17.69
	liters	1.60	1.60	2.59	4.80	8.70	16.00	27.50	51.50	73.00	157.00	2.00	2.00	3.00	6.60	10.20	16.74
V 5	quarts	1.27	1.27	2.11	4.33	7.18	11.62	19.02	34.87	50.72	84.54	1.48	1.48	2.32	4.54	5.49	12.15
	liters	1.20	1.20	2.00	4.10	6.79	11.00	18.00	33.00	48.00	80.00	1.40	1.40	2.20	4.30	5.20	11.50
V 5 I	quarts	1.27	1.27	2.11	4.33	7.18	11.62	19.02	34.87	50.72	84.54	1.48	1.48	2.32	4.54	5.49	12.15
	liters	1.20	1.20	2.00	4.10	6.79	11.00	18.00	33.00	48.00	80.00	1.40	1.40	2.20	4.30	5.20	11.50
V 6	quarts	1.80	1.80	2.96	5.39	7.93	16.38	25.36	49.14	65.51	95.10	2.01	2.01	3.28	5.39	7.08	17.43
	liters	1.70	1.70	2.80	5.10	7.50	15.50	24.00	46.50	62.00	90.00	1.90	1.90	3.10	5.10	6.70	16.49
V 6 I	quarts	1.80	1.80	2.96	5.39	7.93	16.38	25.36	49.14	65.51	95.10	2.01	2.01	3.28	5.39	7.08	17.43
	liters	1.70	1.70	2.80	5.10	7.50	15.50	24.00	46.50	62.00	90.00	1.90	1.90	3.10	5.10	6.70	16.49
Mounting position		Flange mounting															
		triple reduction									quadruple reduction						
		quarts	2.01	2.01	2.75	5.49	10.25	17.44	29.06	57.06	82.42	137.37	2.43	2.43	3.17	6.02	10.78
B 5	liters	1.91	1.91	2.61	5.22	9.74	16.57	27.61	54.21	78.30	130.50	2.31	2.31	3.01	5.72	10.24	18.07
	quarts	0.74	0.74	1.37	2.01	3.80	7.93	12.68	22.19	38.04	42.27	1.27	1.27	2.54	2.85	6.02	13.21
B 5 I	liters	0.70	0.70	1.30	1.91	3.61	7.53	12.05	21.08	36.14	40.16	1.21	1.21	2.41	2.71	5.72	12.55
	quarts	2.54	2.54	4.44	7.71	12.15	24.83	40.68	84.54	124.69	184.92	3.17	3.17	5.60	8.98	15.53	28.00
B 5 II	liters	2.41	2.41	4.22	7.32	11.54	23.59	38.65	80.31	118.46	175.67	3.01	3.01	5.32	8.53	14.75	26.60
	quarts	2.01	2.01	3.70	6.76	12.05	21.13	34.87	69.74	96.16	162.73	2.32	2.32	4.02	7.29	12.04	22.19
B 5 III	liters	1.91	1.91	3.52	6.42	11.45	20.07	33.13	66.25	91.35	154.59	2.20	2.20	3.82	6.93	11.44	21.08
	quarts	1.27	1.27	2.11	3.49	6.87	12.15	20.08	40.15	56.00	86.65	1.47	1.47	2.32	3.80	6.97	13.74
V 1	liters	1.21	1.21	2.00	3.32	6.53	11.54	19.08	38.14	53.20	82.32	1.40	1.40	2.20	3.61	6.62	13.05
	quarts	1.80	1.80	2.96	5.39	8.66	19.02	27.47	54.95	80.31	96.16	2.01	2.01	3.28	5.92	10.41	17.96
V 3	liters	1.71	1.71	2.81	5.12	8.23	18.07	26.10	52.20	76.29	91.35	1.91	1.91	3.12	5.62	9.89	17.06
Mounting position		Shaft mounting															
		triple reduction									quadruple reduction						
		quarts	0.74	0.74	1.37	2.08	3.80	7.93	12.68	22.19	38.04	42.27	1.27	1.27	2.54	2.85	6.02
H 1	liters	0.70	0.70	1.30	1.98	3.61	7.53	12.05	21.08	36.14	40.16	1.21	1.21	2.41	2.71	5.72	12.55
	quarts	2.01	2.01	3.70	6.76	12.05	21.13	34.87	69.74	96.16	162.73	2.32	2.32	4.02	7.29	12.05	22.19
H 2	liters	1.91	1.91	3.52	6.42	11.45	20.07	33.13	66.25	91.35	154.59	2.20	2.20	3.82	6.93	11.45	21.08
	quarts	2.54	2.54	4.44	7.71	12.15	24.83	40.68	84.54	124.69	184.92	3.17	3.17	5.60	8.98	15.53	28.00
H 3	liters	2.41	2.41	4.22	7.32	11.54	23.59	38.65	80.31	118.46	175.67	3.01	3.01	5.32	8.53	14.75	26.60
	quarts	2.01	2.01	2.74	5.49	10.25	17.43	29.05	57.06	82.42	137.37	2.43	2.43	3.17	6.02	10.77	19.02
H 4	liters	1.91	1.91	2.60	5.22	9.74	16.56	27.60	54.21	78.30	130.50	2.31	2.31	3.01	5.72	10.23	18.07
	quarts	1.27	1.27	2.11	3.49	6.87	12.15	20.08	40.15	56.01	86.65	1.48	1.48	2.32	3.80	6.97	13.74
H 5	liters	1.21	1.21	2.00	3.32	6.53	11.54	19.08	38.14	53.21	82.32	1.41	1.41	2.20	3.61	6.62	13.05
	quarts	1.80	1.80	2.96	5.39	8.66	19.02	27.47	54.95	80.31	96.16	2.01	2.01	3.28	5.92	10.14	17.96
H 6	liters	1.71	1.71	2.81	5.12	8.23	18.07	26.10	52.20	76.29	91.35	1.91	1.91	3.12	5.62	9.63	17.06
Standard lubricant for the gearboxes is mineral oil. Synthetic oil is available at a surcharge.																	
Note: Filling quantities are approximate figures. Oil level must be checked according to oil level plug.																	
For mounting angles not shown, consult factory.																	

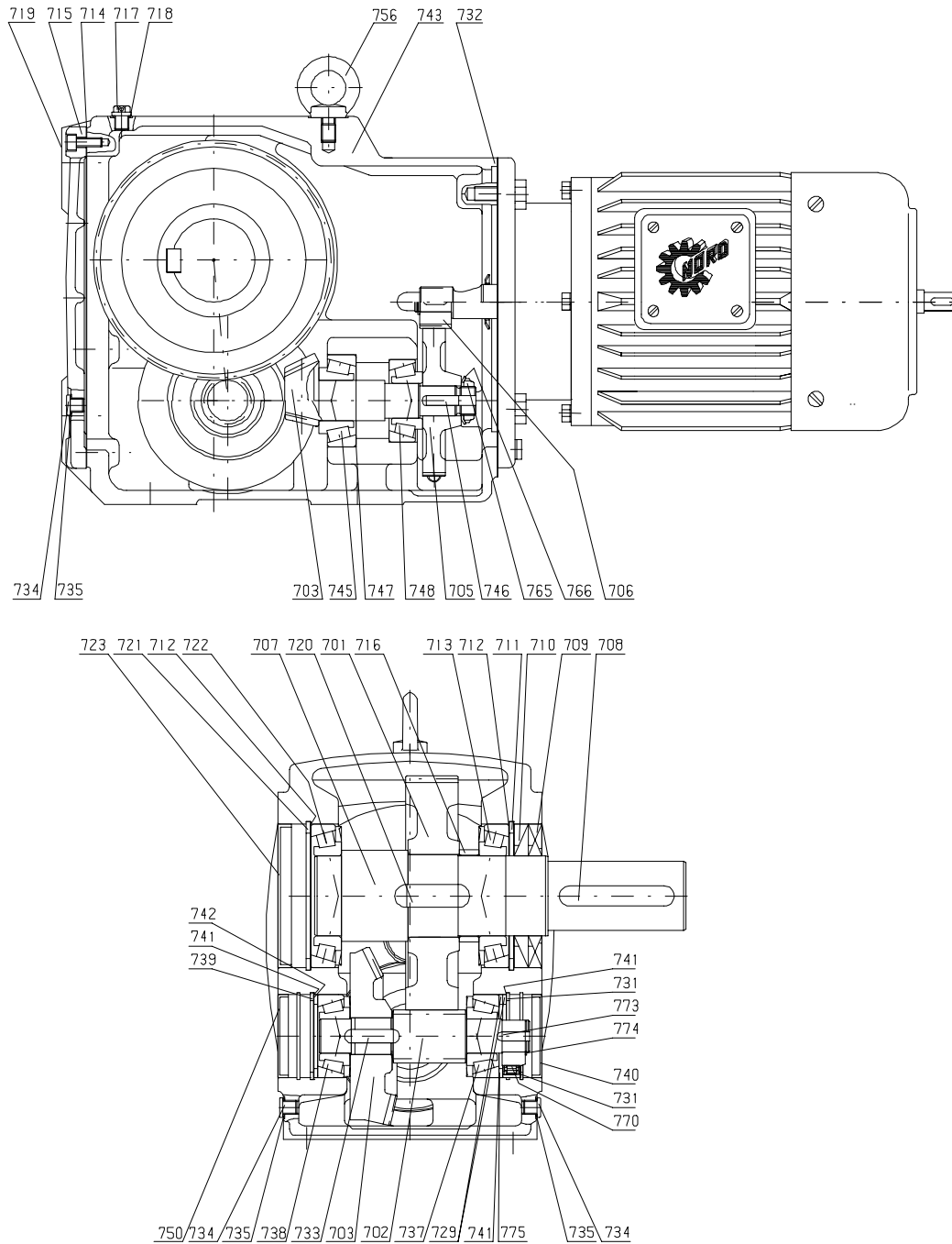
LUBRICATION CAPACITY – 92 SERIES HELICAL BEVEL GEARBOXES										
Mounting Position	Model Size									
	SK92072		SK92172		SK92372		SK92672		SK92772	
	[Quarts]	[Liters]	[Quarts]	[Liters]	[Quarts]	[Liters]	[Quarts]	[Liters]	[Quarts]	[Liters]
B3	0.42	0.40	0.63	0.60	0.95	0.90	1.90	1.80	2.43	2.30
B3I	0.85	0.80	1.06	1.00	1.69	1.60	3.59	3.40	5.60	5.30
B6	0.74	0.70	0.95	0.90	1.37	1.30	3.70	3.50	4.76	4.50
B6I	0.42	0.40	0.63	0.60	0.95	0.90	1.90	1.80	2.43	2.30
B6II	0.85	0.80	1.06	1.00	1.69	1.60	3.59	3.40	5.60	5.30
B8	0.63	0.60	1.16	1.10	1.53	1.45	3.38	3.20	4.86	4.60
B8I	0.74	0.70	0.95	0.90	1.37	1.30	3.70	3.50	4.76	4.50
V5	0.63	0.60	0.79	0.75	1.27	1.20	2.75	2.60	4.33	4.10
V5I	0.63	0.60	0.79	0.75	1.27	1.20	2.75	2.60	4.33	4.10
V6	0.63	0.60	0.79	0.75	1.27	1.20	2.75	2.60	4.33	4.10
V6I	0.63	0.60	0.79	0.75	1.27	1.20	2.75	2.60	4.33	4.10
B5	0.74	0.70	1.06	1.00	1.59	1.50	2.96	2.80	4.65	4.40
B5I	0.42	0.40	0.63	0.60	1.22	1.15	1.64	1.55	2.91	2.75
B5II	0.85	0.80	1.16	1.10	1.80	1.70	3.49	3.30	5.71	5.40
B5III	0.63	0.60	1.00	0.95	1.27	1.20	2.64	2.50	4.33	4.10
V1	0.63	0.60	0.79	0.75	1.22	1.15	2.54	2.40	3.70	3.50
V3	0.63	0.60	0.79	0.75	1.22	1.15	2.54	2.40	3.70	3.50
H1	0.42	0.40	0.63	0.60	1.22	1.15	1.64	1.55	3.17	3.00
H2	0.63	0.60	1.00	0.95	1.27	1.20	2.64	2.50	4.76	4.50
H3	0.85	0.80	1.16	1.10	1.80	1.70	3.49	3.30	5.81	5.50
H4	0.74	0.70	1.06	1.00	1.59	1.50	2.96	2.80	4.54	4.30
H5	0.63	0.60	0.79	0.75	1.22	1.15	2.54	2.40	3.80	3.60
H6	0.63	0.60	0.79	0.75	1.22	1.15	2.54	2.40	3.17	3.00

The 92 Series Helical Bevel gearbox sizes SK92072, SK92172 & SK92372 have no vent or drain plugs. They are filled with synthetic oil so the units are “Lubed for Life”.

PARTS LIST

SK9012 - SK9092

Foot mounted



701	Output gear
702	Output pinion shaft
703	Bevel gearset
705	Input gear
706	Input pinion
707	Output shaft
708	Key
709	Shaft seal
710	Shaft seal
711	O-ring
712	Shim
713	Taper roller bearing
714	Gasket
715	Gear case cover
716	Spacer
717	Vent screw
718	Seal
719	Socket head screw
720	Key
721	O-ring
722	Taper roller bearing
723	Sealing plug
729	Supporting disc
731	O-ring
732	Gasket
733	Key
734	Drain plug
735	Seal
737	Taper roller bearing
738	Taper roller bearing
739	O-ring
740	Sealing plug
741	Shim
742	Supporting disc
743	Gear case
745	Taper roller bearing
746	Key
747	Shim
748	Taper roller bearing
750	Sealing plug
756	Flanged eye bolt
765	Slotted round nut
766	Tab washer
770	Backstop
773	Key
774	O-ring
775	Supporting disc

RECOMMENDED SPARE PARTS

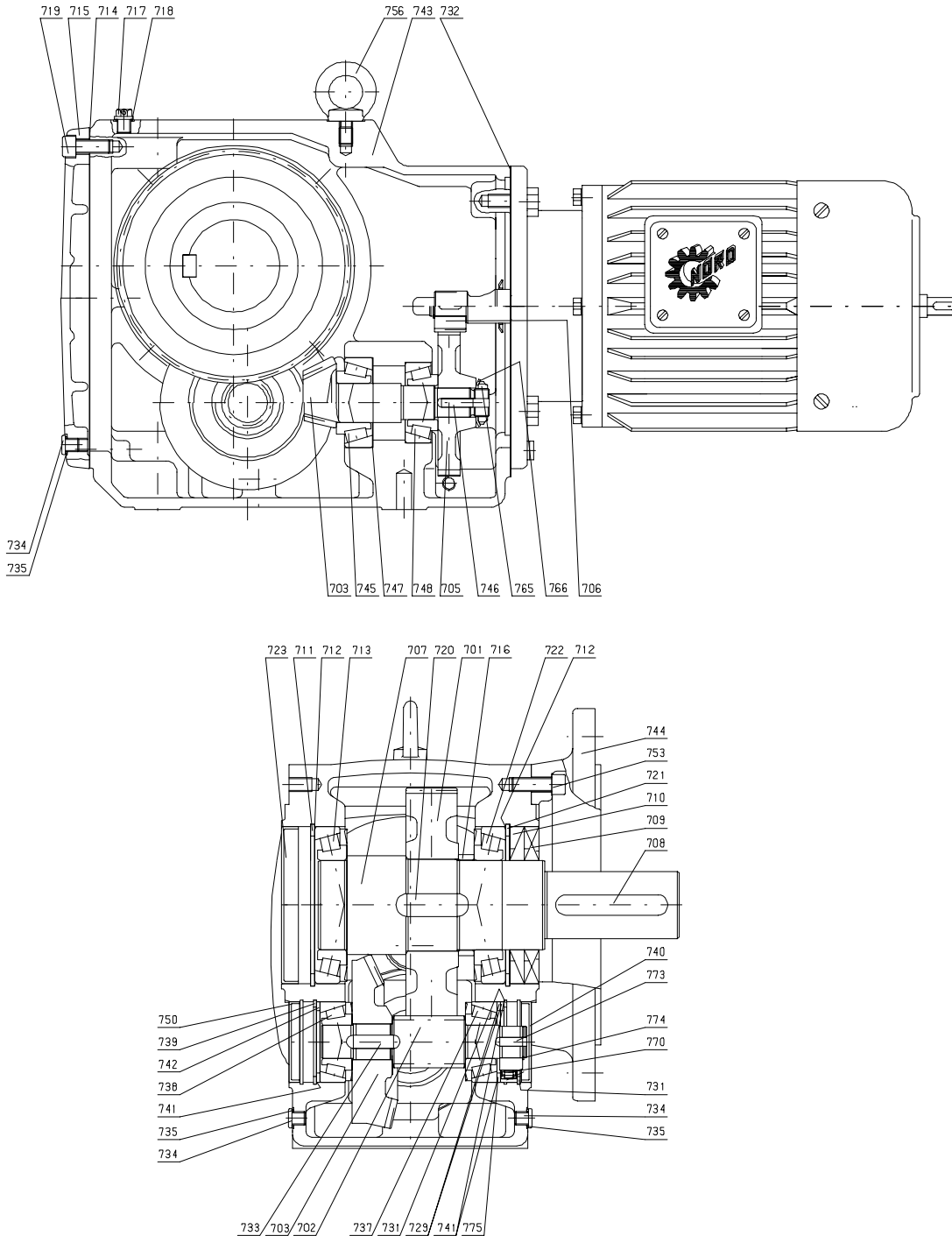
Bearings – *all* Gaskets – *all* Shims – *all*
 Seals – *all* Seal Plugs – *all*

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

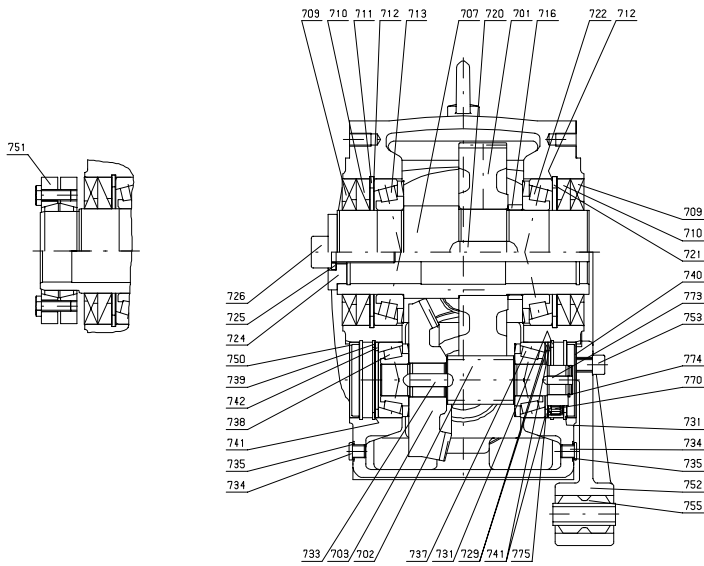
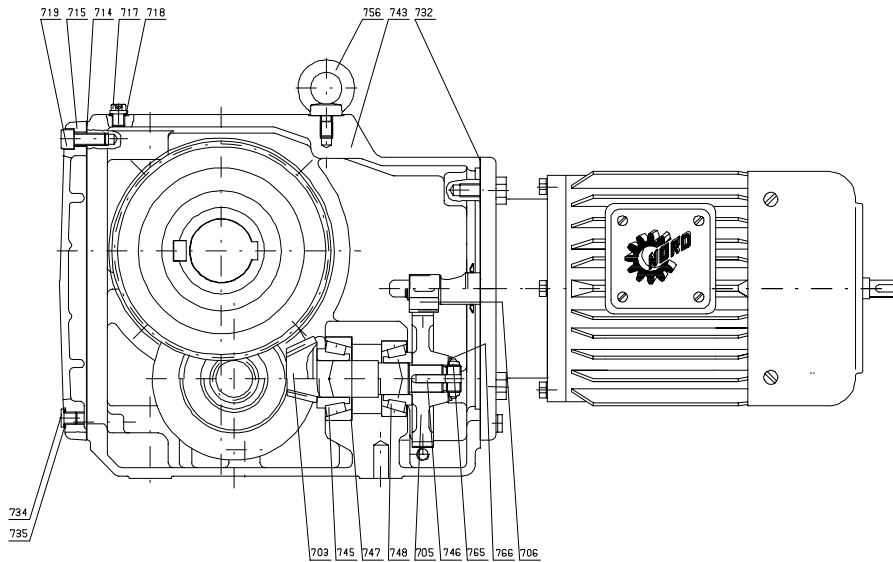
SK 9012 - SK 9092 VF
Flange mounted



- 701 Output gear
- 702 Output pinion shaft
- 703 Bevel gearset
- 705 Input gear
- 706 Input pinion
- 707 Output shaft
- 708 Key
- 709 Shaft seal
- 710 Shaft seal
- 711 Circlip
- 712 Shim
- 713 Taper roller bearing
- 714 Gasket
- 715 Gear case cover
- 716 Spacer
- 717 Vent screw
- 718 Seal
- 719 Socket head screw
- 720 Key
- 721 Circlip
- 722 Taper roller bearing
- 723 Sealing plug
- 729 Supporting disc
- 731 Circlip
- 732 Gasket
- 733 Key
- 734 Drain plug
- 735 Seal
- 737 Taper roller bearing
- 738 Taper roller bearing
- 739 Circlip
- 740 Sealing plug
- 741 Shim
- 742 Supporting disc
- 743 Gear case
- 744 Flange
- 745 Taper roller bearing
- 746 Key
- 747 Shim
- 748 Taper roller bearing
- 750 Sealing plug
- 753 Socket head screw
- 756 Flanged eye bolt
- 765 Slotted round nut
- 766 Tab washer
- 770 Backstop
- 773 Key
- 774 Circlip
- 775 Supporting disc

PARTS LIST

SK9012 - SK9092 AZ
Shaft mounted

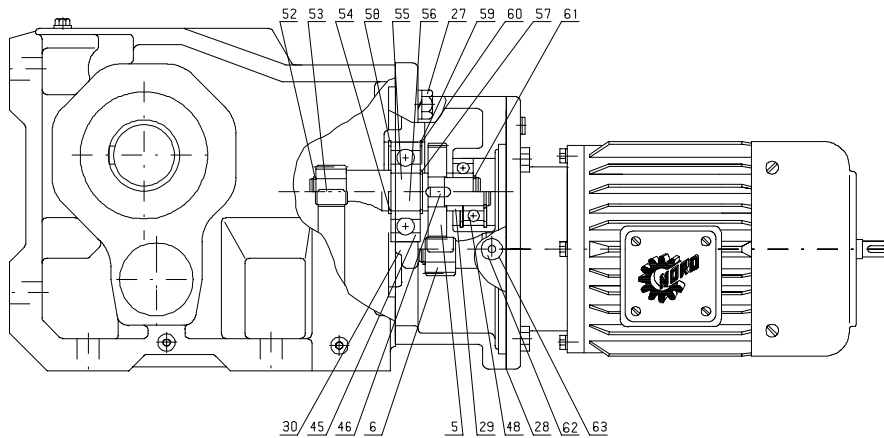


- 701 Output gear
- 702 Output pinion shaft
- 703 Bevel gearset
- 705 Driving gear
- 706 Driving pinion
- 707 Hollow shaft
- 709 Shaft seal
- 710 Shaft seal
- 711 Circlip
- 712 Shim
- 713 Taper roller bearing
- 714 Gasket
- 715 Gear case cover
- 716 Spacer
- 717 Vent screw
- 718 Seal
- 719 Socket head screw
- 720 Key
- 721 Circlip
- 722 Taper roller bearing
- 724 Washer
- 725 Spring washer
- 726 Socket head screw
- 729 Supporting disc
- 731 Circlip
- 732 Gasket
- 733 Key
- 734 Drain plug
- 737 Taper roller bearing
- 738 Taper roller bearing
- 739 Circlip
- 740 Sealing plug
- 741 Shim
- 742 Supporting disc
- 743 Gear case
- 745 Taper roller bearing
- 746 Key
- 747 Shim
- 748 Taper roller bearing
- 750 Sealing plug
- 751 Shrink disc connector
- 752 Torque arm
- 753 Socket head screw
- 755 Rubber buffer
- 756 Flanged eye bolt
- 765 Slotted round nut
- 766 Tab washer
- 770 Backstop

PARTS LIST

SK 9013 - SK 9053

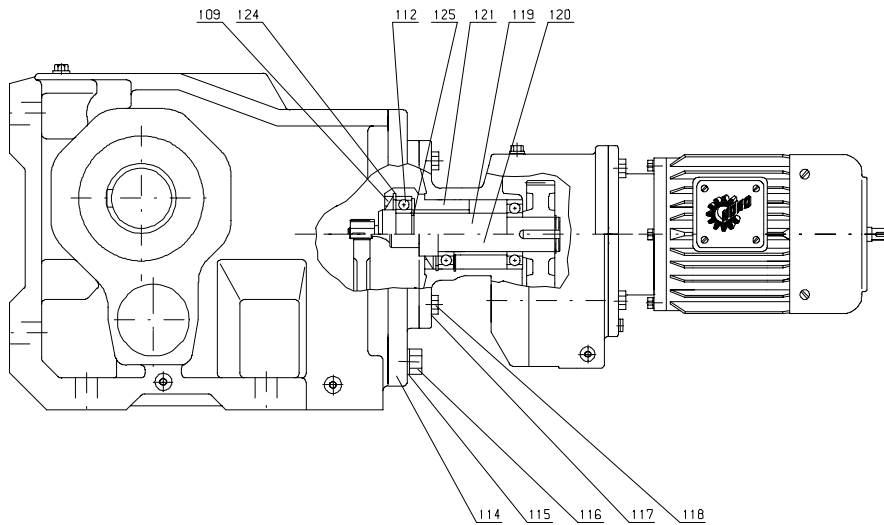
Foot mounted
Flange mounted VF
Shaft mounted AZ



- 5 Input gear
- 6 Input pinion
- 27 Bolt
- 28 Gasket
- 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 Intermediate shaft, gearcut
- 58 Circlip
- 59 Shim
- 60 Circlip
- 61 Circlip
- 62 Plug
- 63 Seal
- 109 Shaft seal
- 112 Ball bearing
- 114 Intermediate flange
- 115 Spring washer
- 116 Bolt
- 117 Spring washer
- 118 Bolt
- 119 Intermediate shaft, plain
- 119 Intermediate shaft, gearcut
- 121 Bearing sleeve
- 124 Circlip
- 125 Circlip

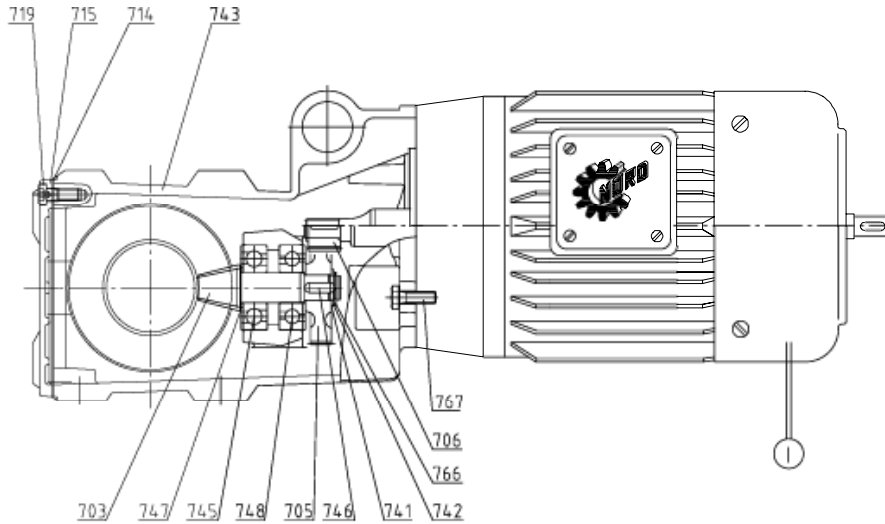
SK 9062/32 - SK 9092/52

Foot mounted
Flange mounted VF
Shaft mounted AZ

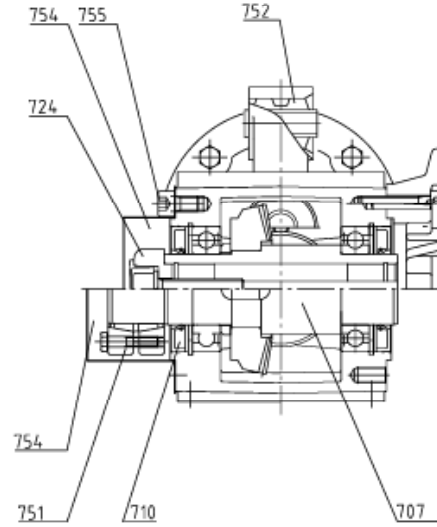
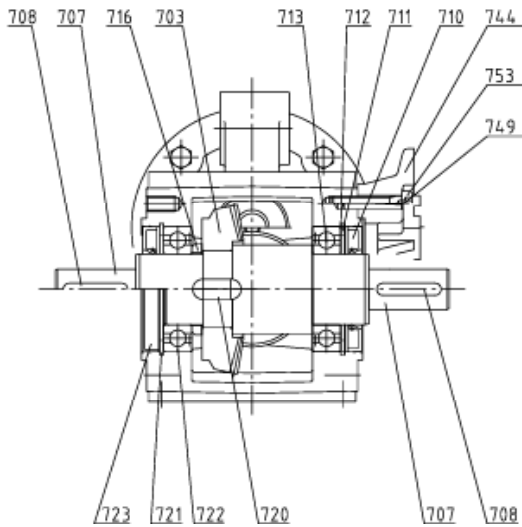


PARTS LIST

SK92072



- 703 Bevel gearset
- 705 Input gear
- 706 Input pinion
- 707 Output shaft
- 708 Key
- 710 Shaft seal
- 711 Circlip
- 712 Shim
- 713 Taper roller bearing
- 714 Gasket
- 715 Gear case cover
- 716 Spacer
- 719 Socket head screw
- 720 Key
- 721 Circlip
- 722 Taper roller bearing
- 723 Sealing plug
- 724 Fixing element
- 741 Shim
- 742 Supporting disc
- 743 Gear case
- 744 Flange
- 745 Taper roller bearing
- 746 Key
- 747 Shim
- 748 Taper roller bearing
- 749 Grooved pin
- 751 Shrink disc connector
- 752 Rubber buffer
- 753 Socket head screw
- 754 Cover
- 755 Socket head screw
- 766 Circlip
- 767 Hexagon screw



RECOMMENDED SPARE PARTS

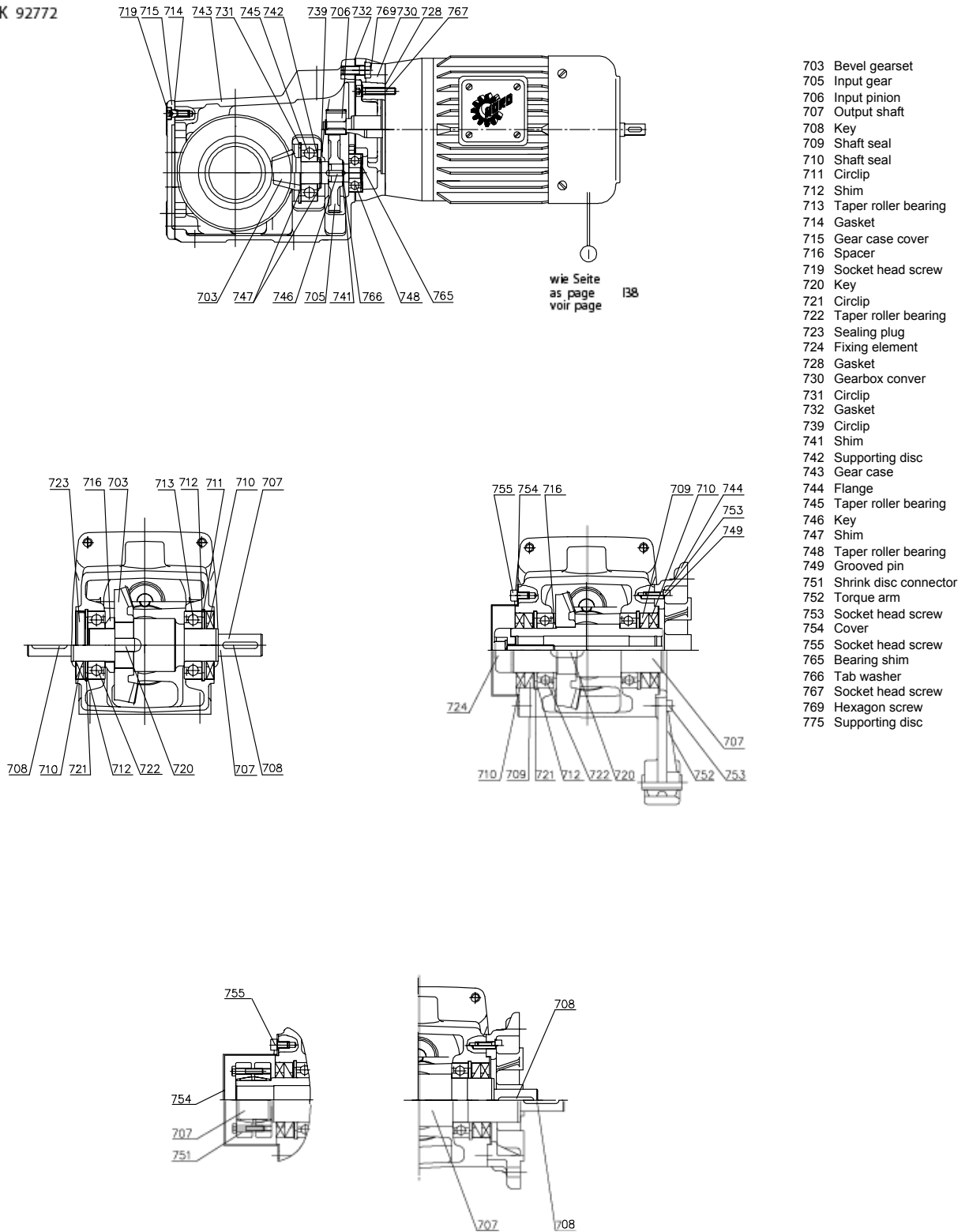
Bearings – *all* Gaskets – *all* Shims – *all*
 Seals – *all* Seal Plugs – *all*

IMPORTANT!

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PARTS LIST

SK 92172 - SK 92772



NORD Gear Corporation

National Customer Service Toll Free 888-314-6673

www.nord.com

NORD Gear Limited

Toll Free in Canada 800-668-4378

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Corona, CA 92882
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Fax 888-408-6673

MIDWEST

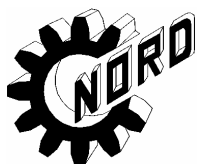
PO Box 367
800 Nord Drive
Waunakee, WI 53597
Phone 608-849-7300
Fax 800-373-6673

SOUTH

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

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



MINICASE[®] Worm Gearboxes

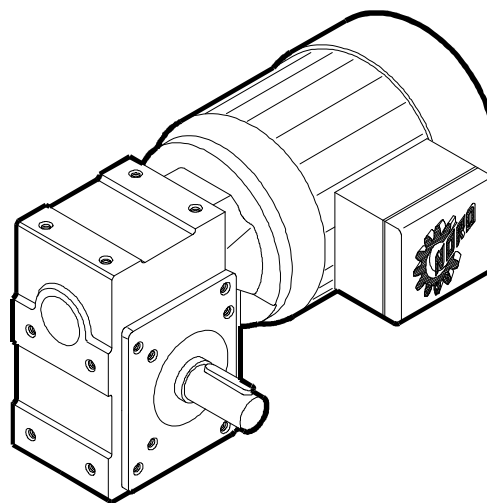
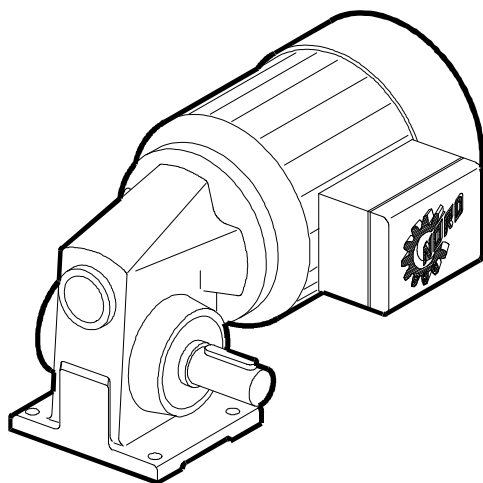
Installation and Maintenance Instructions

Retain These Safety Instructions For Future Use

BIM 1031

USA

CDN



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.

It is presumed that system design, as well as all work with regard to transport, assembly, installation, starting-up, maintenance and repair, is performed by qualified personnel or supervised by skilled labor taking overall responsibility.

Preparing and performing installation

- lifting devices on the drive are designed to carry the drive weight
- foundation (base) should be of adequate size and vibration-proof
- install gear unit or geared motor rigid and braceless
- ensure sufficient ventilation for cooling
- make use of tapped hole for fastening to the shaft end
- when installing shaft connections, avoid shocks on shafts which can cause bearing damage
- preferably use flexible coupling between output shaft and driven machine
- fit output elements to shaft end or secure feather key before starting the motor
- it is the owner's responsibility to properly guard all moving parts of the machine

Efficiencies

A new wormgear reducer will have slightly lower efficiency than when the gear set is broken in. This effect increases with higher ratios. Efficiencies shown in the catalog are after a break in period of 25 hours at full load.

Maintenance

NORD Gear MINICASE[®] drives are maintenance free.

The MINICASE[®] series of worm gear reducers are filled with polyglycol synthetic lubricant/bearing-grease. This ensures proper operation throughout the *full lifetime* of the units. No breather plugs are required because of synthetic lubricant used. The MINICASE[®] drives are completely sealed.



CAUTION:

Any change in normal operation (excessive noise, increased temperature or power consumption) may indicate a problem with the application.

Notify qualified maintenance personnel to inspect equipment; otherwise physical injury or damage to the machine may occur.

**IN CASE OF DOUBT,
DISCONNECT THE MACHINE IMMEDIATELY!**

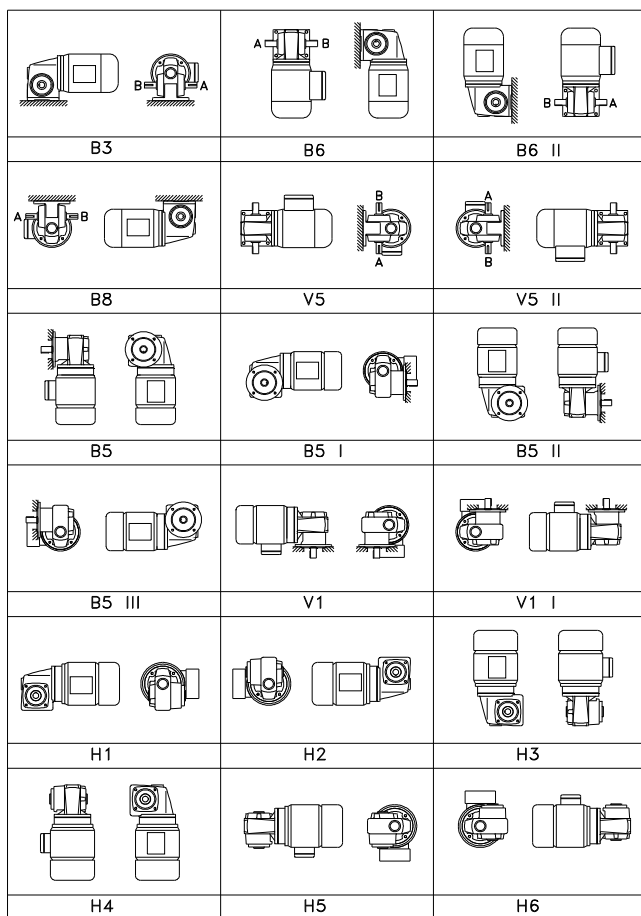


WARNING:

Exposed moving parts can cause severe injury. It is the responsibility of the system designer to install adequate guards.

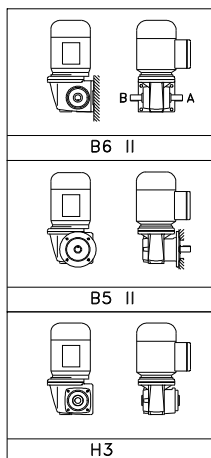
Mounting Positions

SINGLE STAGE MINICASE®



TWO STAGE MINICASE®

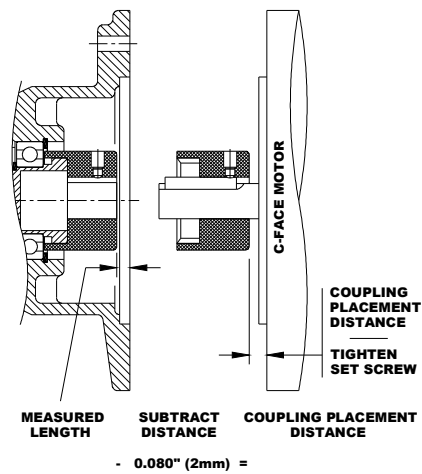
NORD DOUBLE REDUCTION HOUSINGS (2S STYLE) ARE FILLED AT THE FACTORY WITH OIL TO SUIT ALL MOUNTING POSITIONS EXCEPT FOR THE ONES SHOWN BELOW.



NEMA C-face Motor Installation Instructions

1. Put the coupling onto the splined input shaft until it is firmly seated.
2. Measure the distance from the face of the input adapter to the face of the coupling and record that measurement.
3. Subtract 0.08" (~2mm) from the distance. **This needs to be done so that the coupling will not be preloaded after installation!**
4. Use that measurement to locate the coupling from the face of the motor onto the shaft.

Once in place, tighten the setscrew to lock the coupling in place. It is also recommended that the shaft key be staked or bonded (Loctite) in place to prohibit the key from vibrating out.



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FLATTOP

SAFETY CONSIDERATIONS

PRODUCT SAFETY: Products designed and manufactured by Rexnord are capable of being used in a safe manner; but Rexnord cannot warrant their safety under all circumstances.

PURCHASER MUST INSTALL AND USE THE PRODUCTS IN SAFE AND LAWFUL MANNER IN COMPLIANCE WITH APPLICABLE HEALTH AND SAFETY REGULATIONS AND LAWS AND GENERAL STANDARDS OF REASONABLE CARE; AND IF PURCHASER FAILS TO DO SO, PURCHASER SHALL INDEMNIFY REXNORD FROM ANY LOSS, COST OR EXPENSE RESULTING DIRECTLY OR INDIRECTLY FROM SUCH FAILURE.

SAFETY DEVICES: Products are provided with only safety devices identified herein. **IT IS THE RESPONSIBILITY OF PURCHASER TO FURNISH APPROPRIATE GUARDS FOR MACHINERY PARTS** in compliance with **MSHA** or **OSHA** Standards, as well as any other safety devices desired by Purchaser and/or required by law; and **IF PURCHASER FAILS TO DO SO, PURCHASER SHALL INDEMNIFY REXNORD FROM ANY LOSS, COST OR EXPENSE RESULTING DIRECTLY OR INDIRECTLY FROM SUCH FAILURE.**

General Safety Precautions:

- To avoid personal injury, all machinery must be turned off and locked out, prior to chain installation, inspection, maintenance and removal
- Always use safety glasses to protect eyes. Wear protective clothing, gloves and safety shoes
- Support the chain to prevent uncontrolled movement of the chain and parts
- Maintain tools in proper condition and assure their proper use. Use of chain assembly tools is recommended when applicable
- Do not attempt to connect or disconnect chain unless chain construction is clearly known and understood
- Do not reuse any sections of damaged chain because they may have been overloaded and weakened

If any flame cutting, welding, etc. is to occur in the conveyor vicinity, take adequate precautions to insure that no burning of any chain or other components occurs. If adequate protection cannot be provided, remove the chain and other plastic components from the conveyor and store in a safe location. Thermoplastic and similar materials can burn and give off toxic fumes.

DO NOT INSTALL, OPERATE OR PERFORM MAINTENANCE ON THESE PRODUCTS UNTIL YOU READ AND UNDERSTAND THE INSTRUCTIONS CONTAINED IN THIS MANUAL.

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4	Introduction
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11	Conveyor Design Recommendations
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	Chain Center Guidance with Posittrack™ Tracking Guides
	Return Way
	Catenary Sag
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	Sprocket Locations
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	Equipment / Material Listing
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INTRODUCTION

Many beverage and food products are processed inside their containers after filling. The most common method is a wide chain-style tunnel, where the containers are carried through the machine on a wide chain. Within these tunnels, controlled temperature water sprays or showers are used to process the product. In some machines, the containers are lowered into a water bath. These Tunnel Machines can be Pasteurizers, Warmers or Coolers, depending on the product requirements. Higher speed production lines may require two wide conveyors side-by-side or even two decks.

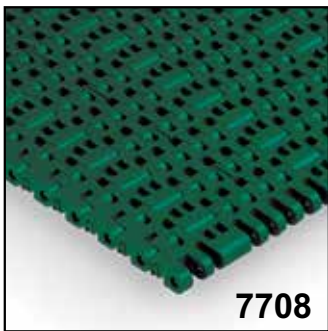
Much of the information contained in this manual can also be found in general Rexnord® FlatTop Product Catalogs and Engineering Manuals. This manual combines all the specific product information and recommendations related directly to the chain selection, construction, installation and maintenance of the conveyor portion of Pasteurizers, Warmers and Coolers.

PASTEURIZERS, WARMERS & COOLERS

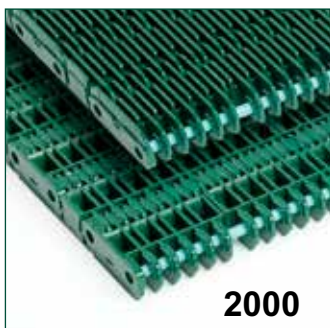
Tunnel Pasteurizers, Warmers and Coolers are very demanding product handling applications due to the high temperature range, high load and chemicals used to treat the water and clean these machines. In addition, modern containers can be unstable and production speeds are quite fast.

Rexnord® has developed a number of MatTop® Chain/Transfer Solutions for these tough applications:

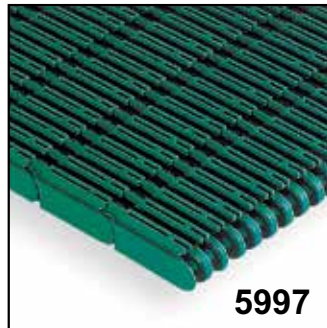
- Rexnord 2000 and 5997 Thermoplastic Raised Rib MatTop Chains
- Rexnord Fortrex™ 9200 Series Stainless Steel Raised Rib MatTop Chains
- Rexnord 7708 Thermoplastic Open Area MatTop Chains



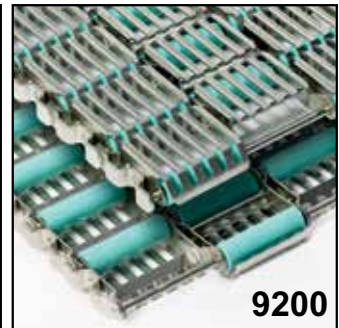
7708



2000



5997



9200

The Rexnord Transfer Methods mentioned above include:

- **Conventional Transfer Combs (2000, 5997 & 9200)** – These combs “rake” the containers on and off of the raised rib MatTop Chains. Various styles are available. While they do provide good transfer and eliminate trip points, they create dead spaces, resulting in stranding containers at the infeed end and discharge end of the tunnel
- **DTS®-C Transfers (2000, 5997 & 9200)** – Using special transfer combs, these are used with raised rib MatTop Chains to combine the features of the transfer combs with our patented DTS transfer chains to provide totally self-clearing transfers
- **DTS® (7708)** – These transfers require no transfer combs or dead plates. The containers convey directly between the tunnel open area Rexnord MatTop Chain and the DTS infeed and discharge chains. However, there are constraints on the size of the tunnels these open area MatTop Chains and DTS transfers may be used on

INTRODUCTION

This manual will guide you to the optimal Rexnord® MatTop® Chain and transfer solution for your particular tunnel application. This manual also contains:

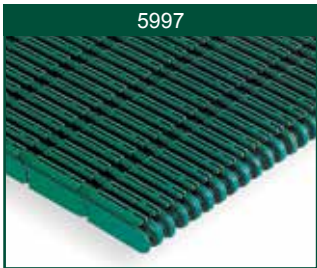
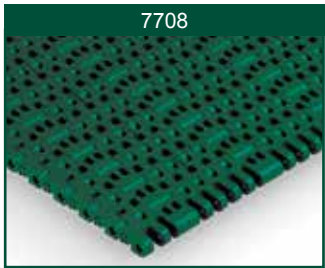
- Recommendations for the proper design of the conveyor portion of the tunnel to insure that you get the most productivity, efficiency and life out of your Rexnord solution
- Detailed installation and maintenance recommendations

✓ Rexnord's expertise is limited to the chains, sprockets, comb transfers and basic conveyor recommendations. For mechanical structural, thermal, hydraulic, electrical requirements, etc. consult with the tunnel equipment manufacturer.

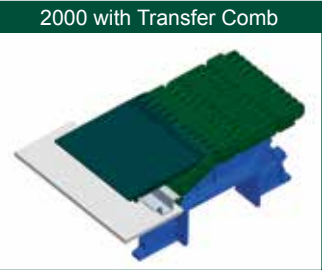
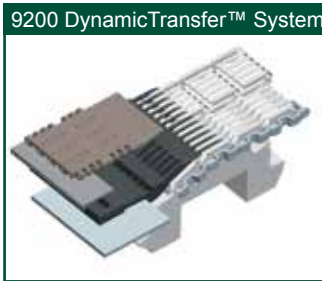
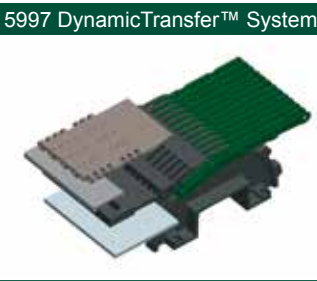
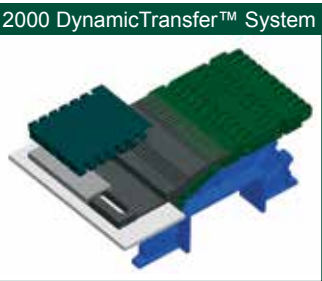
INTRODUCTION

REXNORD® CHAINS FOR THE PASTEURIZER INDUSTRY

Tunnel Chains



Infeed / Outfeed Systems



INTRODUCTION

Pasteurizer Rexnord Chain Series	Nominal Chain Widths								Positrack™ Tracking Guide Option (see page 17)
	Minimum Chain Width		Maximum Chain Width		Standard (Uncut)		Non-Standard (Cut)		
	in	mm	in	mm	in	mm	in	mm	
7708	36	914	216	5486	3	76.2	0.5	12.7	No
RR2000	9	229	216	5486	3	76.2	1.50	38.1	Yes
RRHD2000	9	229	216	5486	3	76.2	1.50	38.1	Yes
SR2000	9	229	216	5486	3	76.2	1.50	38.1	Yes
5997	36	914	216	5486	3	76.2	0.5	12.7	No
9217, 9227	36	914	216	5486	3	76.2	NA*	NA*	Yes
Infeed / Discharge Rexnord Chain Series	Available Widths								Positrack™ Tracking Guide Option
	in				mm				
1005 DTS PT	3.3				85.0				Yes
7705 DTS PT	4-1/2				114.3				Yes
7705 DTS-R PT	4-1/2				114.3				Yes

* NA = Not Applicable. 9200 Series modules can not be cut. Actual chain width is 0.75 in (19.0 mm) larger than the nominal width.

Chain Information				
Chain Series	7708	2000	5997	9200
Surface Style	Open Area	Raised Rib (RR), Raised Rib Heavy Duty (RRHD) Super Rib (SR)	Raised Rib	Raised Rib
Link Material / Construction	USP Material	USP Material	USP Material	Stainless Steel / Rollers
Chain Pitch	1.00 in (25.4 mm)	2.00 in (50.8 mm)	2.25 in (57.2 mm)	2.25 in (57.2 mm)
Chain Thickness	0.50 in (12.7 mm)	0.95 in (24.1 mm)	0.97 in (24.6 mm)	1.06 in (27.0 mm)
Open Area	20%	27%	22%	50%
Chain Strength	1800 lbs/ft (26262 N/m)	2000 lbs/ft (29781 N/m)	2400 lbs/ft (35016 N/m)	Contact Application Eng.
Pin Retention	Rexnord® TwistLock® plug	Clips	Blind Eye/Plug	Rivet Clip
PosiTrack™ Tracking Guides Options	No	Yes	No	Yes
Transfer Options				
Static Transfer Combs	No	Yes	Yes	Yes
DTS-C	No	Yes	Yes	Yes
DTS Only	Yes	No	No	Yes
Applications				
Pasteurizer	No	Yes	Yes	Yes
Warmers / Coolers	Yes	Yes	Yes	Yes

GENERAL CHAIN SELECTION GUIDELINES

How to use this Chain Selection Guide for Pasteurizer, Warmer, Cooler Applications.

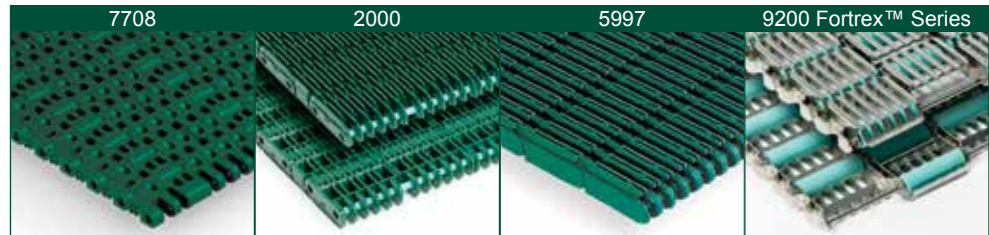
It is important to select the Rexnord® conveying chain most suitable for your specific pasteurizer, warmer, cooler application and container type. To use the chain selection guide provided below:

- First, select the chain series that contains the characteristics required for your specific application such as surface style, link material, chain pitch, chain strength and transfer technologies for each of the four chains available from Rexnord
- Second, find the container type to be processed in the product conveyed selection grid for either beverage or food applications
- Select the chain series that suits your specific application based on the above criteria



Rexnord 5990 Series MatTop® chain is available in North America.

Rexnord 2000 Series MatTop chain is available in Europe and countries outside of North America.



Rexnord MatTop Chain Options							
Chain Series		USP7708	RR2000	RRHD2000	SR2000	USP5997	9200
Chain Construction		Open Area	Raised Rib	Raised Rib Heavy Duty	Solid Rib Heavy Duty	Raised Rib	Open Rib
Link Material		HT / USP	XP	USP	USP	HT / USP	SS
Beverage Applications - General Guidelines Only							
Container							
Bottle	Petaloid Bottom PET/PEN	●	NR	NR	●	NR	NR
	Returnable Glass	NR	NR	NR	●	NR	●
	Non-Returnable Glass	NR	NR	●	●	●	●
	Ring Bottom PET/ PEN	●	●	●	●	●	NR
	Aluminum	●	●	●	●	●	●
Can	Aluminum or Steel	●	●	●	●	●	●
Food Applications - General Guidelines Only							
Glass Jars					●		●
PET/PEN Jars		●	●	●	●	●	
Aluminum or Steel Cans		●	●	●	●	●	

● Preferred

● Second Choice

NR = Generally Not Recommended

CHAIN AND SPROCKET NOMENCLATURE

Chain Nomenclature

HT7708K113

CHAIN MATERIAL:	CHAIN SERIES:	CHAIN WIDTH:
HT	7708	113 IN

USP5997K159

CHAIN MATERIAL:	CHAIN SERIES:	CHAIN WIDTH:
USP	5997	159 IN

RRHDP2000USP 159

CHAIN STYLE:	CHAIN SERIES:	CHAIN MATERIAL:	CHAIN WIDTH:
RAISED RIB HEAVY DUTY WITH POSITRACK™ TRACKING GUIDES	2000	USP	159 IN

FORTREX™ 9227K159 PT

CHAIN SERIES:	CHAIN WIDTH:	WITH POSITRACK™ TRACKING GUIDES
FORTREX 9227	159	

9217 = ROLLERS EVERY LINK
9227 = ROLLERS EVERY OTHER LINK

Sprocket Nomenclature

KUS5996T14 3-1/2 IN SQUARE BORE

SPROCKET STYLE:	SPROCKET SERIES:	NUMBER OF TEETH:	BORE TYPE:
KUS - MACHINED SPLIT DRIVE SPROCKET	SUITABLE FOR 5990 CHAIN SERIES	14	3-1/2 IN SQUARE BORE
KU - MACHINED SPLIT IDLER SPROCKET			R90 MM - ROUND BORE OF 90 MM
KSXT - MACHINED SPLIT IDLER DRUM			3-7/16 IN OVERBORE WITH DOUBLE KEYWAY - CLEARANCE FIT
NS- MOLDED SPLIT DRIVE SPROCKET			ROUND BORE OF 3-7/16 IN WITH 2 STANDARD KEYWAYS AT 180 DEGREES
SS - MOLDED SPLIT DRIVE SPROCKET			

NOTES

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CONVEYOR DESIGN RECOMMENDATIONS

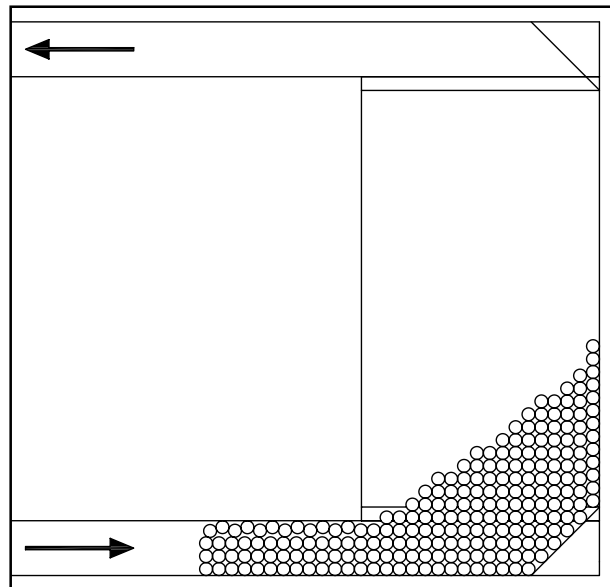
Conveyor Layout

The layout of the Tunnel in the production line and the interfaces with infeed conveyor and discharge conveyor can affect:

- The performance/longevity of the tunnel chain and shafting
- The tunnel container handling efficiency

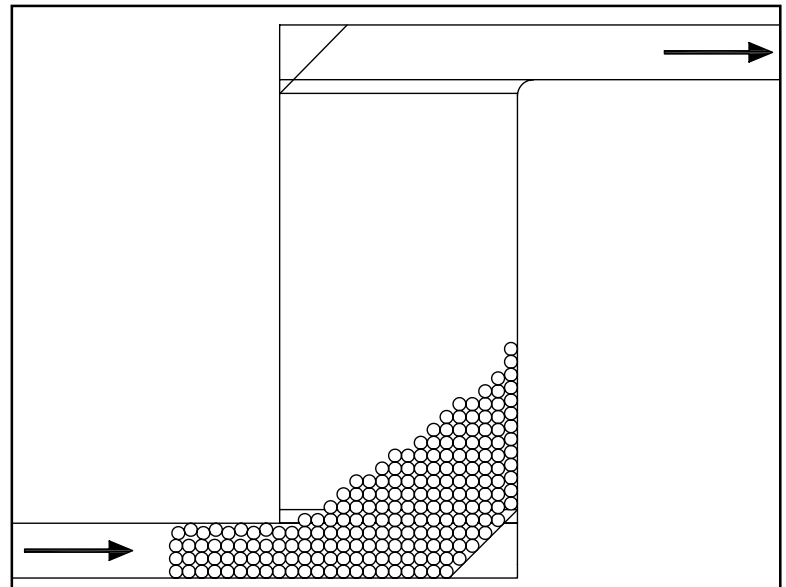
Tunnel Layout

The position of the tunnel in the production line will dictate either a C-Shaped or a Z-Shaped layout as shown below.



C-Shaped Layout

With a C-Shaped layout, the containers must traverse across the end of the chain at the discharge end. If the tunnel is not fully packed, this can cause the containers to tip and jam at the discharge end.



Z-Shaped Layout

With a Z-Shaped layout, the containers move away from the tunnel in the same direction as they entered, without having to traverse all the way across the discharge end of the chain. Therefore, there is less chance of container tippage in a Z-Shaped layout.

Tunnel Chain & Shaft Loading

With either layout, the containers will first fill the “far side” of the tunnel, as shown above. This causes one side of the tunnel chain to be fully loaded while the other side is empty or only partially loaded. This uneven chain loading can cause issues as discussed on page 12.

Container Handling Efficiency

This uneven loading can also lead to container tippage. Other infeed and outfeed factors can also affect container handling, such as:

- Conveyor speeds
- Guide rail configurations
- Types of Rexnord® transfer methods include: transfer combs, DTS® or DTS®-C

CONVEYOR DESIGN RECOMMENDATIONS

The three factors; conveyor speed, guiderail configuration and type of transfer method, can be configured and combined in different ways to maximize chain life, shaft life and container handling efficiency.



Uneven chain loading can lead to premature chain failure and/or drive shaft failure. Several solutions, such as guiderail configurations, to minimize this uneven loading are available. Contact Application Engineering for information.



It is ALWAYS recommended that the intermediate discharge chain run at approximately half the speed of the main take-away conveyor. The best solution is to use a separate variable speed drive that can be adjusted for each style container and line speed. Sometimes this intermediate discharge conveyor does not run during normal production and is only operated at the end of each product run to clear out the machine.

Double Deck Machine Considerations

Enough height between decks must be provided to allow for the necessary chain sag and to prevent the upper return chain from interfering with the containers or spray systems on the bottom deck. Refer to the Catenary Sag section on page 20 for more details. This requires sufficient horizontal length of the infeed and discharge conveyors in order to keep the infeed and decline angles at recommended angles as shown below.

Incline / Decline Considerations

The maximum possible angle is dependent on several factors such as: coefficient of friction between chain and product, speed, product stability, lubrication and dirt or debris. The table below shows a general recommendation of maximum angles determined by chain friction. These values are only general guidelines and if more specific information is required contact Application Engineering.

Chain Type	Maximum Angle (Incline/Decline)	
	Lubricated	Dry Running
Steel Chains	4°	8°
Plastic Chains	2.5°	4.5°

Chain Pin Access

Provide sufficient access openings in the sidewalls of the machine so the pins of the Rexnord® MatTop® Chain in each deck can be inserted and removed. The production line layout must also provide sufficient space on either side of the machine for this purpose.



Rexnord HT5997 MatTop chain pins can only be inserted and removed from one side. There is a preferred direction of travel with this chain as shown on page 26. When traveling in this direction, the pins can only be accessed from the right side when looking in the direction of travel.



Rexnord 9200 Fortrex™ pins can be inserted and removed from both sides. The pins are made of stainless steel and are not as flexible as plastic pins, therefore allow extra room for pin access and removal.

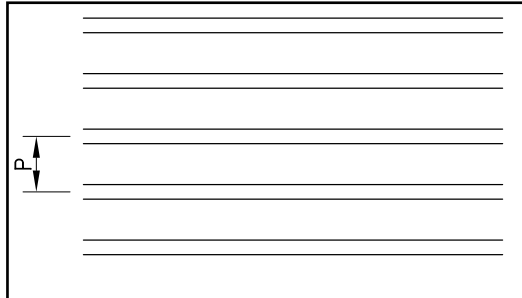
CONVEYOR DESIGN RECOMMENDATIONS

Carry Way

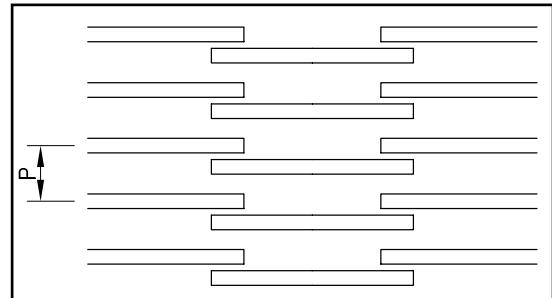
The entire tunnel structure, supports and shafting must be strong and rigid enough to handle the high loads. The carry way support structure should be constructed of C-Channel or square tube cross members, spaced approximately 2 to 3 ft. or **600 to 900 mm** apart. All supporting members need to be robust, rigid and level. This structure must be able to support the weight of the wearstrips, chain and full containers without deflecting or twisting.

The top level of the finished carry way wearstrips (including chain) should be level with the top of the infeed and discharge chains. For more detailed information see the Sprocket Location section on pages 25-28.

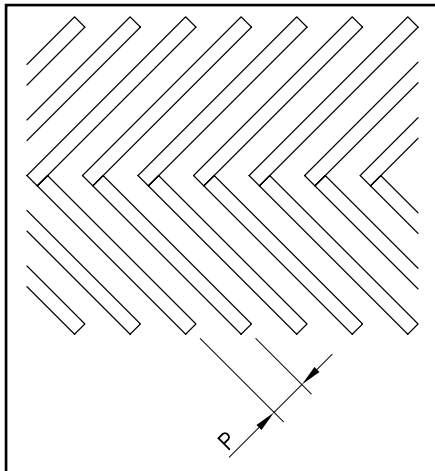
The chain carry way wearstrips should be as shown below:



In-Line Wearstrip Pattern



Offset Wearstrip Pattern



Chevron Wearstrip Pattern



For chevron style, the chevrons should point toward the discharge end in order to help track the chain. The center of the V-pattern should be open and/or staggered, as shown, so debris can pass through at the ends.

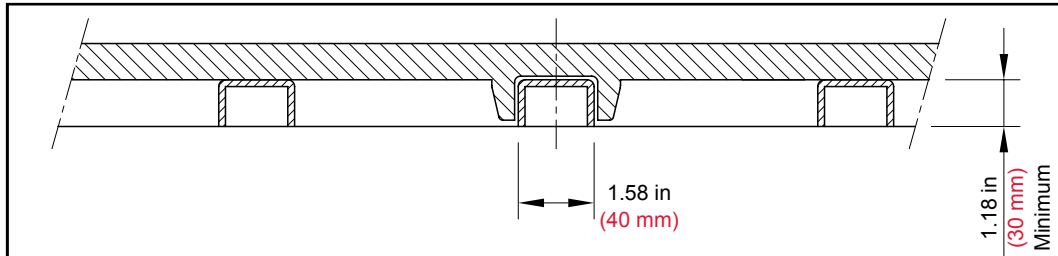
Chain	Recommended Wearstrip Spacing					
	Wearstrip Style					
	Parallel				P Dimension / Chevron	
	P Dimension / In-Line		P Dimension / Offset			
	(in)	(mm)	(in)	(mm)	(in)	(mm)
7708	6	152.4	6	152.4	6	152.4
2000	6	152.4	6	152.4	6	152.4
5997	6	152.4	6	152.4	6	152.4
9217	3	76.2	NR	NR	6	152.4
9227	6	152.4	NR	NR	NA	NR

Recommended wearstrip width for all = 1.5 to 2.0 in (**35 to 50 mm**)

CONVEYOR DESIGN RECOMMENDATIONS

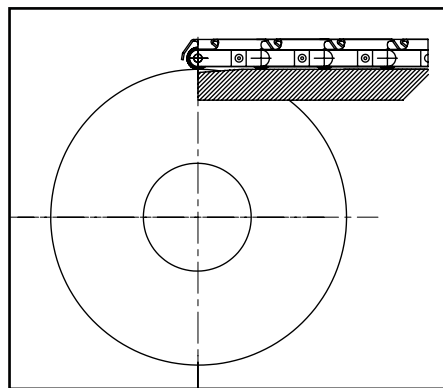
Carry Way

If Rexnord® MatTop® chains with Positrack™ Tracking Guides are utilized, the carry way wearstrip pattern must allow for the guides as shown below. The following chains are available with PosiTrack Tracking Guides: RRP2000, RRHDP2000, SRP2000, 9217PT and 9227PT MatTop chains. The PosiTrack can be located in the center of the chain or 1.50 (38.1 mm) offset depending on the width of the chain. For more detailed information see page 17.

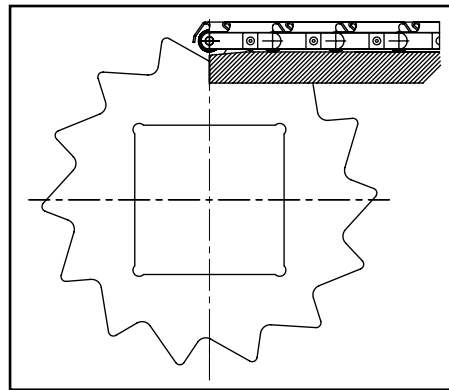


PosiTrack™ Tracking Guide

Rexnord 9217 requires the ends of the wearstrips need to be positioned in between the sprockets or idler wheels as shown below. See Sprocket Location section on pages 25-28.

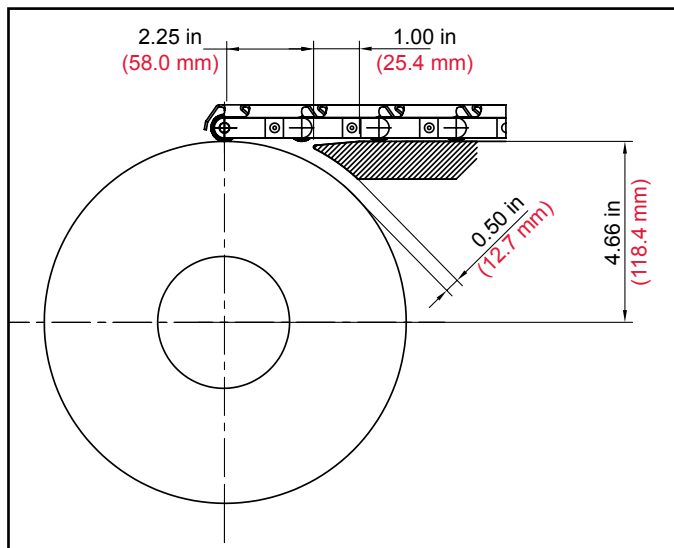


Wearstrip Location - Idler Wheel

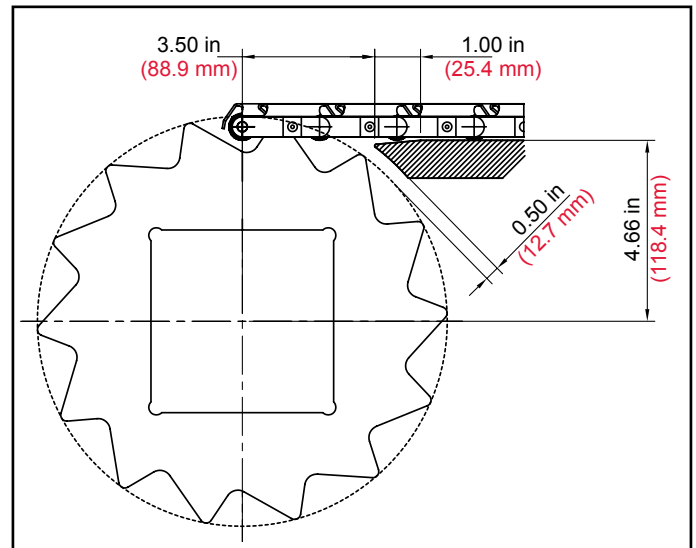


Wearstrip Location - Drive Sprocket

Rexnord 9227 MatTop chains require a special design for wearstrip ends at the drive sprocket and idler locations as shown below.



Idler Sprocket Wearstrip Location - 9227 Series



Drive Sprocket Wearstrip Location - 9227 Series

CONVEYOR DESIGN RECOMMENDATIONS

Carry Way Wearstrip Materials

Chain	Recommended Wearstrip Materials For Tunnel Applications			
	Container Type			
	One-Way Glass	Returnable Glass	Cans	PET/PEN
7708	SS	SS	UHMWPE or SS	UHMWPE or SS
2000	SS	SS	SS	SS
5997	SS	SS	SS	SS
9200	SS	SS	SS	SS

SS = Stainless Steel

UHMWPE = Ultra High Molecular Weight Polyethylene

Stainless Steel Wearstrips

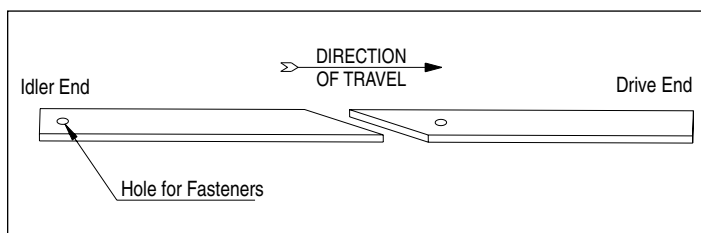
- Recommended for corrosive, abrasive or high temperature applications. Especially critical for handling glass containers in high breakage areas
- A cold-rolled austenitic grade is recommended which offers the best corrosion resistant properties
- Recommended one quarter hard temper (25 – 35Rc)
- Softer annealed grades of austenitic stainless steel are NOT RECOMMENDED
- Martensitic stainless steel can also be used when heat treated (25 to 35 Rc), however it is not as corrosion resistant as austenitic
- Hardness is more critical than grade for better wear resistance
- Wearstrip surface finish is a critical aspect for overall chain life. A surface finish of 32 μ -in Ra (0.8 μ -m) is recommended

UHMWPE (Ultra High Molecular Weight Polyethylene) Wearstrips

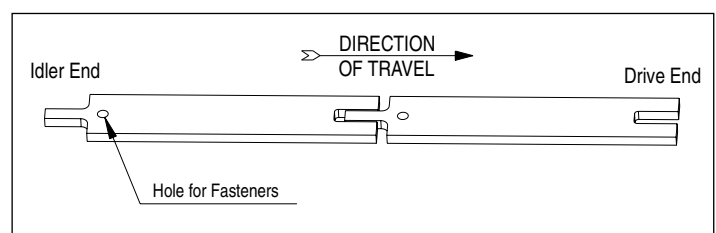
- Provide lower coefficient of friction than stainless steel
- Not recommended for abrasive conditions where particles may imbed in the surface and wear the chain
- Not affected by moisture and more resistance to chemicals than nylon
- UHMWPE wearstrips must be solidly supported
- Wearstrips will contract and expand due to environmental conditions. Suggested methods to accommodate this are shown below
- Wearstrip surface finish is a critical aspect for overall chain life. A surface finish of 125 μ -in Ra (3.175 μ -m) is recommended



Wearstrips will contract and expand due to environmental conditions. Suggested methods to accommodate this are shown below.



UHMWPE Thermal Expansion



UHMWPE Thermal Expansion

CONVEYOR DESIGN RECOMMENDATIONS

Guide Clearance

For elevated temperature applications, the actual width increases by an amount that is dependent upon temperature, chain width and the plastic coefficient of thermal expansion. Use the guide clearance formulas below or contact Rexnord® for assistance.

Guide Clearance (GC) = Chain width at room temperature (W) + expansion due to temperature + standard clearance (A)

- If the chain width is known, then $GC = W + (W \times CTE \times \Delta T) + A$
- If the guide clearance is known, then $Maximum\ W = (GC - A) / (1 + CTE \times \Delta T)$

GC = Chain guide clearance (or track width) in inches or mm

W = Actual chain width in inches or mm

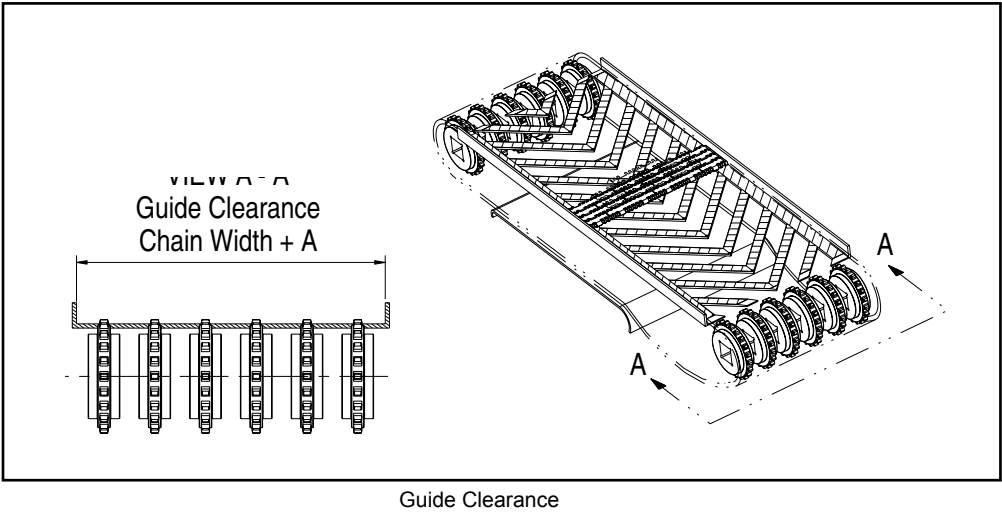
CTE = Chain coefficient of thermal expansion, as shown in table below

ΔT = Temperature range in machine in °F or °C

A = Recommended extra clearance based on machine length, as shown in table below

Coefficients of Thermal Expansion (CTE)		
Link Material	inches / inch / °F	mm / mm / °C
HT / USP	0.00083	0.00015

Chain - Edge Guide Clearance			
Conveyor Length		Dimension A	
Feet	Meters	inches	mm
30 to 50	9 to 15	0.63	16
Over 50	Over 15	0.75	19.1



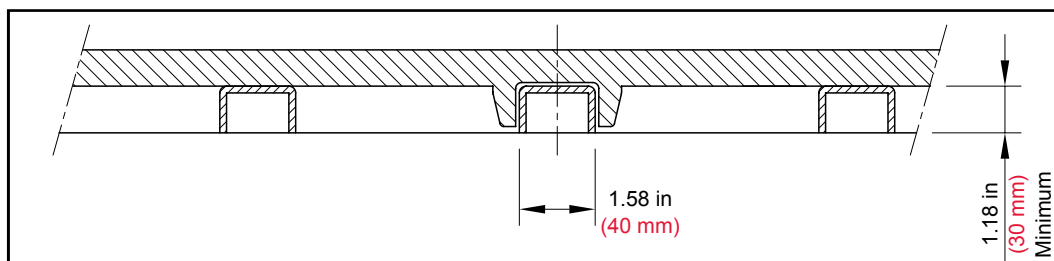
✓ These outer chain edge guides help track conventional MatTop® Chains without PosiTrack® though the tunnel. They can be full-length rails along both sides of the chain or short guide blocks spaced every 5 ft. (1.5 m) along the length of the machine. Whatever method is used, it must prevent the chain from interfering with tunnel support members, etc. where it can catch and break.

✓ Fortrex 9200 chain clearance should be 0.25 in. (6.35 mm) on both sides of the chain. Fortrex 9200 PT chain clearance should be 1.50 in. (38.1 mm) minimum on both sides of the chain. The 9200 actual chain width is 0.75 in. (19.0 mm) larger than the nominal width. It is critical to order the correct chain width to fit within the tunnel equipment. Actual Chain Width = Nominal Chain Width + 0.75 in. (19.0 mm).

CONVEYOR DESIGN RECOMMENDATIONS

Chain Center Guidance with PosiTrack™ Tracking Guides

The chain within a tunnel can be guided using Positrack Tracking Guides in the center part of the chain. The Positrack Tracking Guides are located in the center of the chain or offset 1.5 in. (38.1 mm) from the center of the chain, depending on the width. The following chains are available with PosiTrack Tracking Guides: RRP2000, RRHDP2000, SRP2000, 9217PT and 9227PT MatTop® chains.



PosiTrack™ Tracking Guide

Rexnord® Chains with PosiTrack Tracking Guide	PosiTrack Tracking Guide Locations			
	Chain Width Increments *			
	3 in (76.2 mm) (i.e. 3, 9, 15 in, etc.)		6 in (152.4 mm) (i.e. 6, 12, 18 in, etc.)	
	Dimension from Center of Carry Way Bed			
	(in)	(mm)	(in)	(mm)
RRP2000	0	0	1.5	38.1
RRHDP2000	0	0	1.5	38.1
SRP2000	0	0	1.5	38.1
9217PT *	0	0	1.5	38.1
9227PT *	0	0	1.5	38.1



* The 9200 actual chain width is 0.75 in. (19.0 mm) larger than the nominal width. It is critical to order the correct chain width to fit within the tunnel equipment. Actual Chain Width = Nominal Width + 0.75 in. (19.0 mm)



Product guide rail profiles and spacing must prevent containers from falling over the outer edges of the tunnel chain and getting trapped in the return chain. If that happens, containers or broken pieces can get caught in the tail sprockets, causing chain and sprocket breakage.



PosiTrack Tracking Guide should be chamfered at Idler side.



Additional glass shields minimize glass debris build-up on the return chain.

CONVEYOR DESIGN RECOMMENDATIONS

Return Way

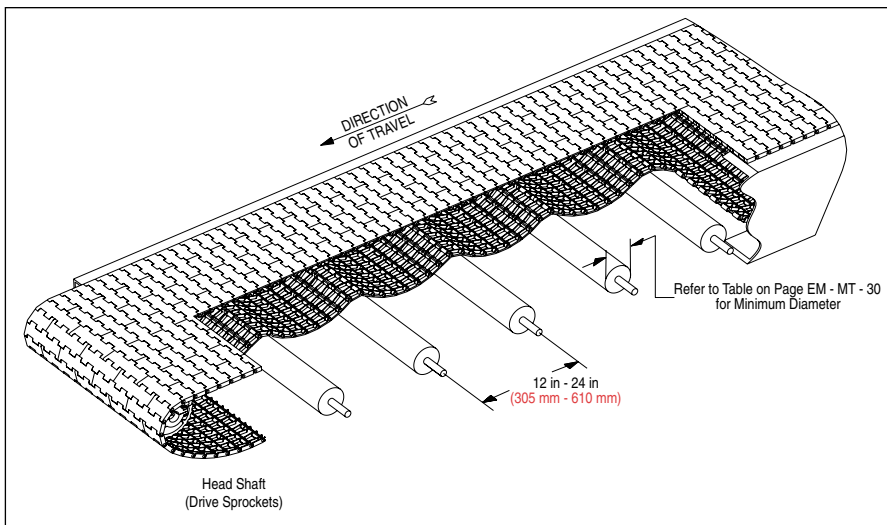
Internal Chain Returns

Internal chain return ways, where the chain is guided back inside the tank, are typical. It is recommended that the height of the water in the tanks be well below the return chain catenary sags or the return chain can float, which can lead to sprocket interaction problems. For double deck units, see notes on page 12.

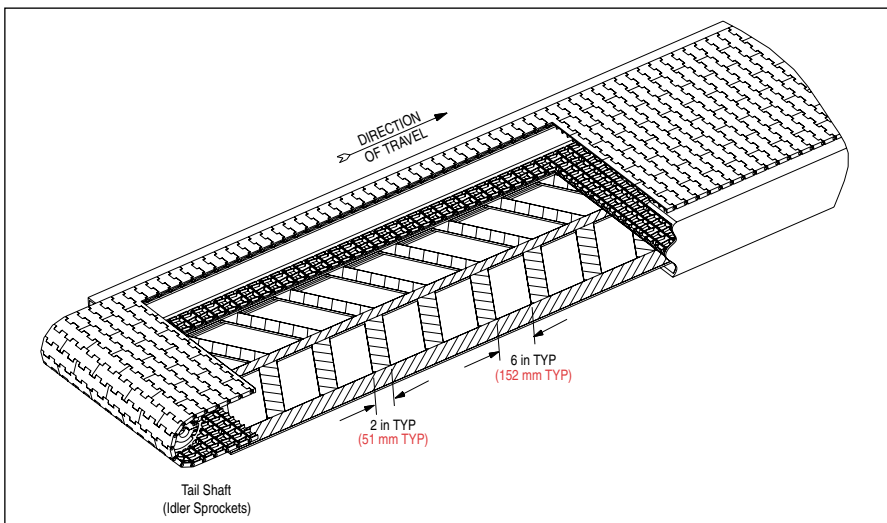
External Chain Returns

External chain returns are less demanding since the chain is not inside the hot, caustic environment for half of the time. However, care must be taken so that the return chain does not drag on the floor or catch on the bottom of the tank. It is recommended to inspect the catenary sag on a regular maintenance schedule as discussed on page 63.

 Ensure the proper guide clearance is maintained as shown on page 16. Provide side guide shoes in the return so the return chain cannot catch on side support members.



Roller Return Pattern

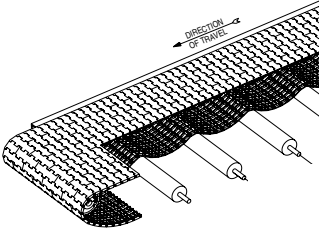
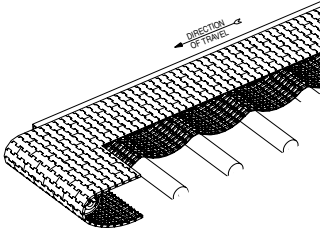
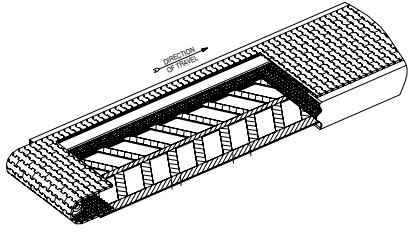


Chevron Return Pattern

- 
- Rotating rollers, static tubes or static half-round shoes are typically used for chain returns in tunnel machines
 - Rotating rollers result in less drag on the return chain due to rolling friction vs. sliding friction. This can have an equalizing effect on the vertical chain sags
 - Static tubes or shoes will cause more chain drag, but do not need any maintenance
 - Chevron style sliding returns are also used
 - Some returns use a combination of several return types in order to control the chain sags

CONVEYOR DESIGN RECOMMENDATIONS

Return Way

RECOMMENDED RETURN TYPES & MINIMUM SIZES						
Rexnord Chain	Rotating Roller or Static Tubes		Static Half-Round Shoes		Sliding	
						
	Diameter		Radius		Wearstrip Width	
Series	(in)	(mm)	(in)	(mm)	(in)	(mm)
7708	2	50	1	25	1.5	35
2000	6	150	3	75	1.5	35
5997	6	150	3	75	1.5	35
9200	6	150	3	75	NR	NR

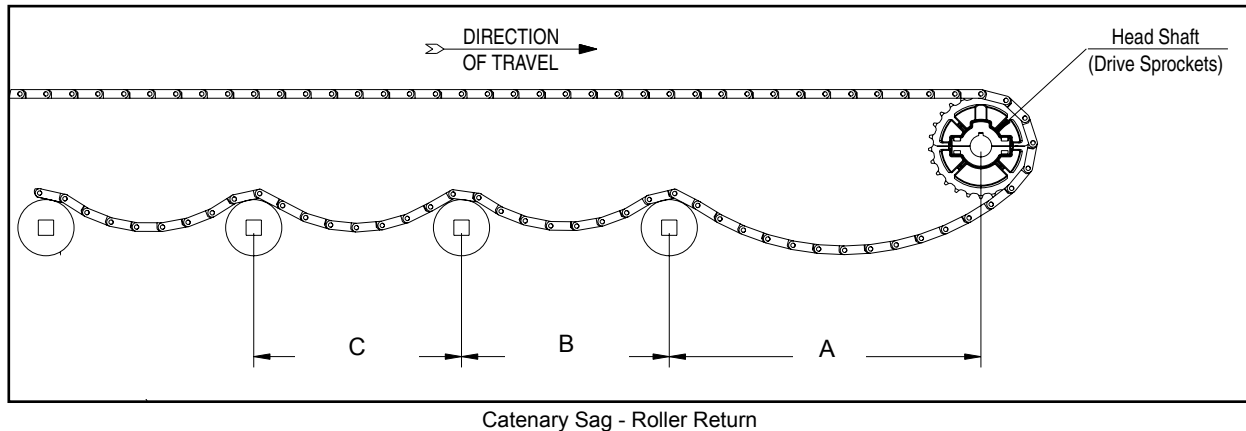


- The spacing in the return way is dependent on many factors specific to each tunnel. Therefore contact Application Engineering for recommended spacings between rotating rollers, static tubes or shoes.
- Return rollers require bearings that are free-turning in a wet, caustic environment. The rollers should be straight and true and constructed of cold rolled stainless steel
- Return tubes or shoes should be straight and true as well as constructed of cold rolled stainless steel (32 μ -in Ra finish). UHMWPE or PVC coverings are acceptable in non-abrasive applications, such as can and plastic container machines. UHMWPE or PVC can be applied to reduce sliding friction in the return
- All return rollers and shoes must be level and perpendicular to chain direction of travel
- The tops of return rollers or shoes are usually located at approximately the same height as the bottoms of the sprockets or slightly higher

CONVEYOR DESIGN RECOMMENDATIONS

Catenary Sag

The function of the catenary is to allow a place for excess chain to accumulate. This is extremely critical in tunnel machines utilizing plastic chains, where the very long chains can elongate due to a combination of high tension loads and high temperatures. This excess chain length will cause the chain to sag down in between the return rollers, tubes or shoes. The chain elongation and resultant sag is dynamic, changing with changes in loading and temperature. Proper return roller or shoe spacing is critical. Snubber rollers may be required to maintain proper wrap around the drive sprockets.



The catenary sag calculations required to determine proper return roller or shoe spacing in tunnel machines are complex and it is recommended to consult with Rexnord® Application Engineer for specific A, B and C dimension recommendations.



Return roller and shoe spacing recommendations must take into account locations of walls between water tanks and any other obstructions.



Provide plenty of clearance above and below the return chain to avoid chain interference. The return chain will sag in between rollers or shoes as described above, but can also pull tight, as load and temperature conditions change.

CONVEYOR DESIGN RECOMMENDATIONS

Head and Tail Shaft Requirements

The two preferred shaft styles are either square with turned down ends or round with double keyway. Although a square or round shaft is typical for both the head and tail shaft, other options may be chosen for tail shafts. For ease of chain installation and maintenance, consider adding extensions to tail shafts so they can be manually rotated from outside the tunnel. Select proper head and tail shaft sizes using the Rexnord Chain Calculation Program that will fit the available sprocket bore sizes for the chosen chain as listed in the Product Introduction section.

For best performance use cold-rolled solid stainless steel shafting with:

- Suggested Hardness: 25 to 30 Rc
- Suggested Surface Finish: 63 μ -in Ra (1.6 μ m)
- Straightness Tolerance: Within 1/32 in. (0.8 mm) over the shaft length
- Twist Tolerance: Maximum of 1/8 degree/ft (0.4 degree/m) of shaft length
- TIR Tolerance (Total Indicator Run-out): Maximum of 1/32 in. (0.8 mm)
- Corner Chamfer (or corner radius) for Square Shafts: Maximum of 1/8 in. (3.2 mm)



Standard mill quality steel may not meet these requirements. Therefore, additional straightening and/or machining may be required.



The shaft sizes calculated by the Rexnord® Chain Calculation Program are for solid round, double-keyed shafts or solid square shafts, made of stainless steel ONLY. These sizes are guidelines only and the final design and sizing are the responsibility of the machinery builder and/or end user, especially if other materials or styles of shaft are used.



Round shafting with 2 or 4 angles welded on to simulate square shafting is NOT recommended due to dimensional inaccuracy and possible shaft distortion during fabrication.



If round double-keyed shafting is used, the two full length keys must extend along the full chain width (except at bearing locations), so that all sprockets are engaged. Lock these keys in place on both head and tail shafts.



If using dual drives, the shafts should be connected in the middle by a rigid coupling (with no back-lash) and both shafts must be in time with each other (square corners or keys in line). The dual drives must be accurately synchronized.



Another option for the dual shaft/two-drive system is to use two “half-width” chains side-by-side in place of the one wide chain. In this case, it is best if both the drive shafts and the tail shafts are NOT coupled together in the middle.

CONVEYOR DESIGN RECOMMENDATIONS

Head and Tail Shaft Requirements - Bearings

It is recommended to use the proper number of shaft bearings as indicated by the Rexnord® Chain Calculation Program.

The outboard bearings are usually ball bearings, either flange style mounted to the side of the tunnel or pillow blocks mounted to the ends of the tunnel. Pillow blocks are preferred for DTS® and DTS®-C transfers.

The internal bearings are typically split pillow block sleeve type and must be severe wash-down duty. Mount internal bearings to robust structural cross member in order to prevent horizontal shaft bending due to chain loading.

For proper shaft and bearing mounting dimensions refer to the Sprocket Location section on pages 25-28.

CONVEYOR DESIGN RECOMMENDATIONS

Sprockets

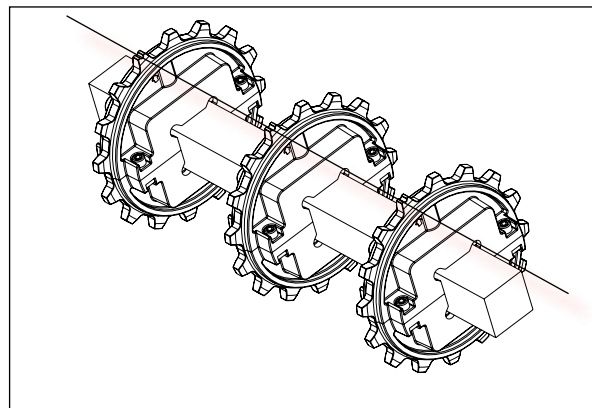
Split sprockets are usually preferred due to ease of installation and maintenance. Select the sprocket style that is available with the selected bore style (i.e. square, round double-keyed, etc.) and large enough to fit the required shaft size, as determined in the Rexnord® Chain Calculation Program.

✓ Always specify bore style and size for each selection. For round bore sprockets that must slide axially on shaft, always specify as “Idler Bore”. See Chain and Sprocket Nomenclature section on page 9 for details on ordering.

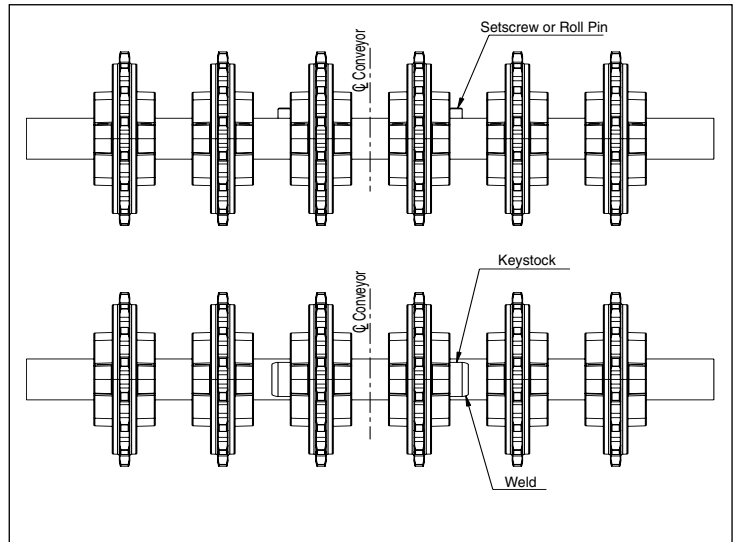
✓ For tunnel applications, Rexnord recommends using the maximum number of sprockets (i.e. using all available chain sprocket pockets) on both head and tail (drive and idler) ends. This assures optimum product transfer at both ends of the machine. When installing the sprockets, make sure that all sprocket faces are positioned the same way on the shaft as shown below. For more detailed information on sprocket installation see pages 48-49.

Sprockets should be fixed on the shaft or floating depending on the chain series as shown in the table below. Fixed sprockets can be locked in place using set screws, roll pins, welded blocks or shaft collars as shown below. Make sure that the locking method cannot come loose over time. The other sprockets should float axially to allow for thermal expansion and contraction of the tunnel chain and will be held in place by the chain sprocket pockets

Drive and Idler Sprocket Mounting Recommendations			
Rexnord Chains	2 center sprockets are fixed All others float	All float	Fix all
7708	X		
RR2000, RRHD2000, SR2000	X		
RRP2000, RRHDP2000, SRP2000		X	
5997	X		
9217, 9217PT, 9227, 9227PT			X



Square Bore Sprockets Displaying Timing Mark



Two Center Sprockets Fixed on the Shaft

CAUTION It is critical to never mix sprockets with different materials or different styles (split vs solid) on the same shaft because teeth will not be properly aligned.

CONVEYOR DESIGN RECOMMENDATIONS

Sprockets

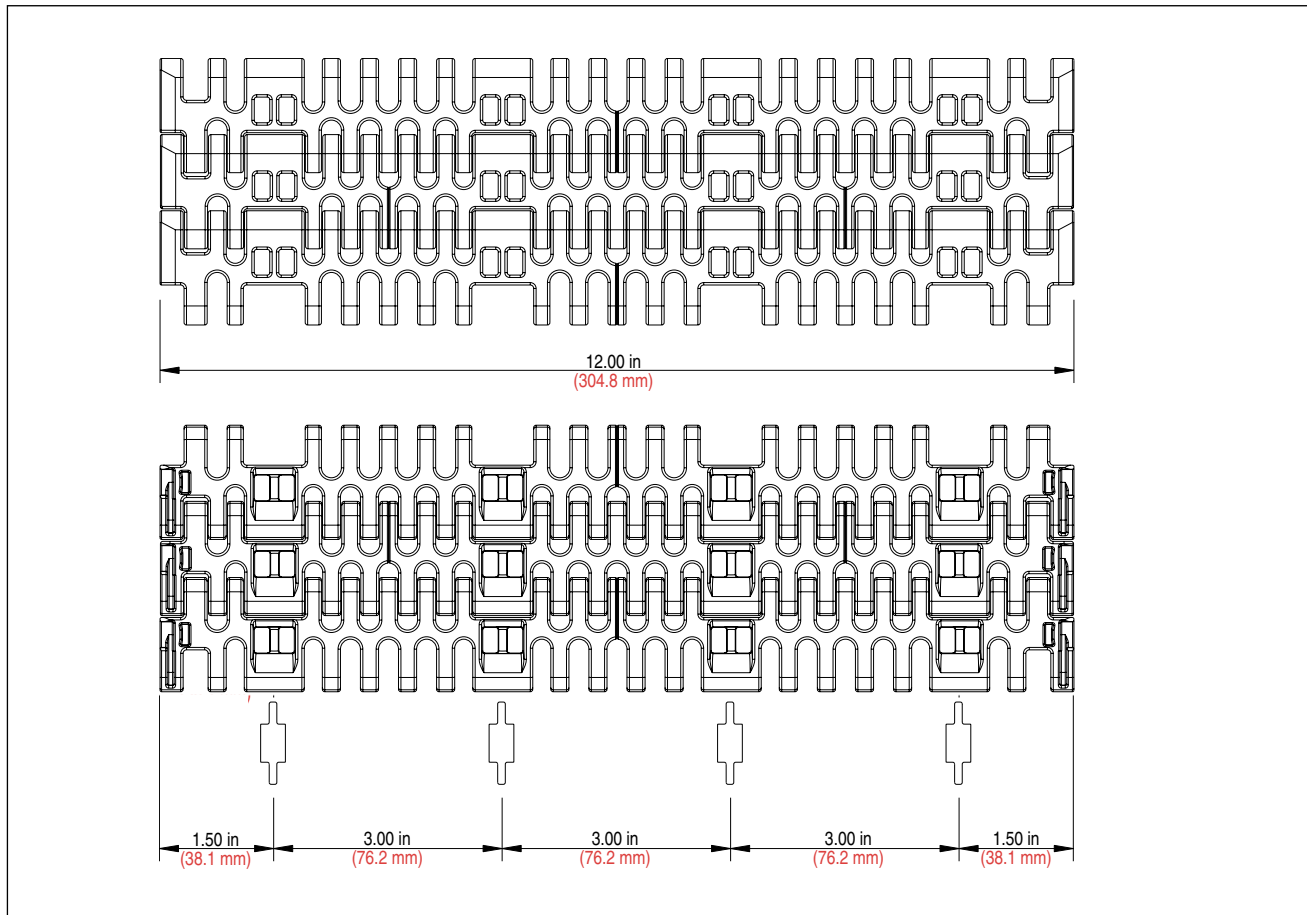


- Where internal shaft bearings or shaft couplings are required, they may interfere with the proper sprocket locations. This will usually require that one or more sprockets be left out. In this case, provide other means of supporting chain at this location to keep chain from sagging in-between sprockets. This can be accomplished with an idler sprocket or machined UHWMPE drum
- If dual drives are utilized, it is critical to ensure that each pair is accurately synchronized and in phase
- For sprocket pocket locations see Sprocket Location section on pages 25-28.

CONVEYOR DESIGN RECOMMENDATIONS

Sprocket Locations - 7708

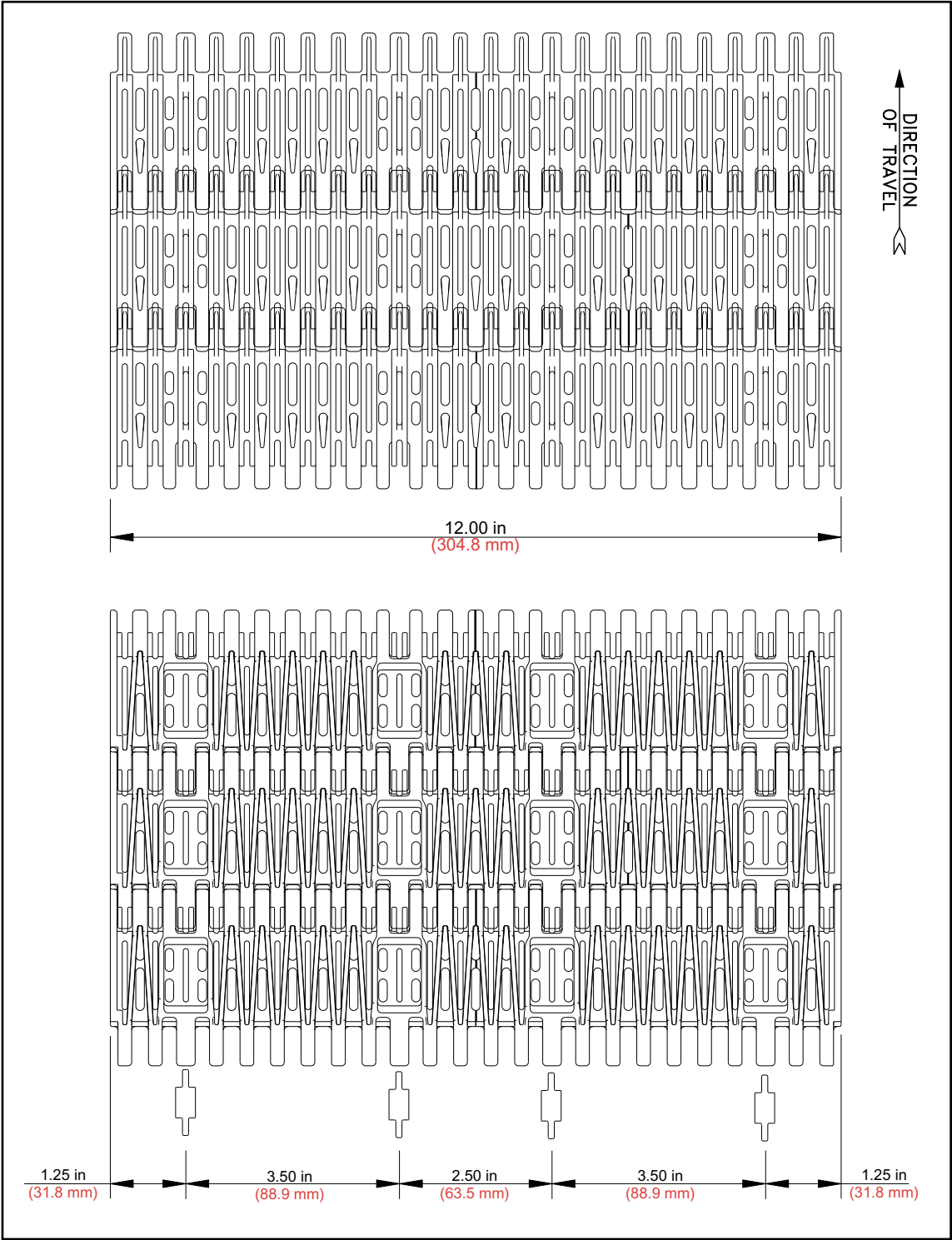
Sprockets must be positioning axially along shafts so teeth fit into corresponding sprocket pockets in chain. For sprocket locations for each MatTop Chain Series see pages 25-28.



Sprocket Locations - 7708 MatTop Chain Series

CONVEYOR DESIGN RECOMMENDATIONS

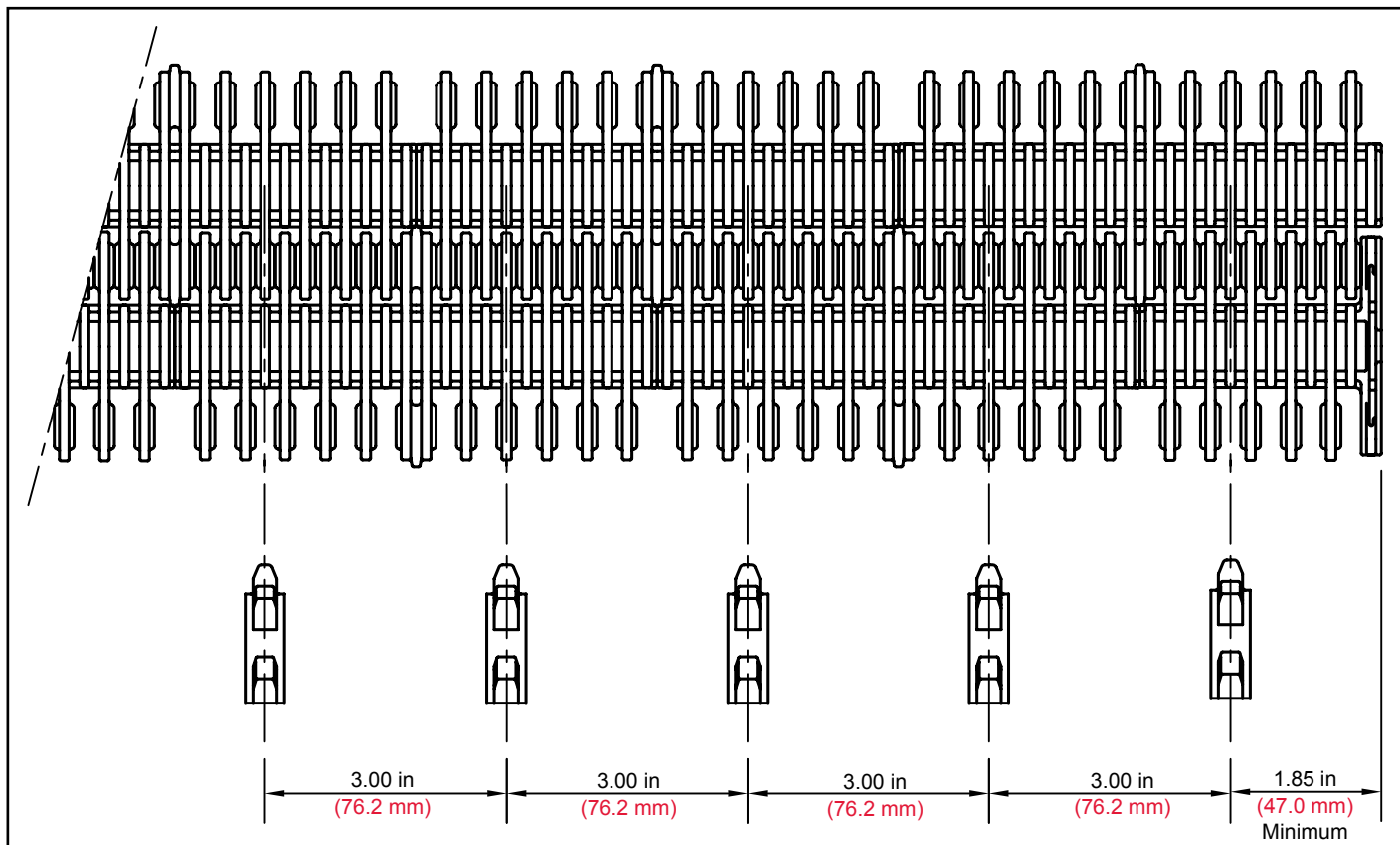
Sprocket Locations - 5997



Sprocket Locations - 5997 MatTop Chain Series

CONVEYOR DESIGN RECOMMENDATIONS

Sprocket Locations - 2000



Sprocket Locations - 2000 MatTop Chain Series



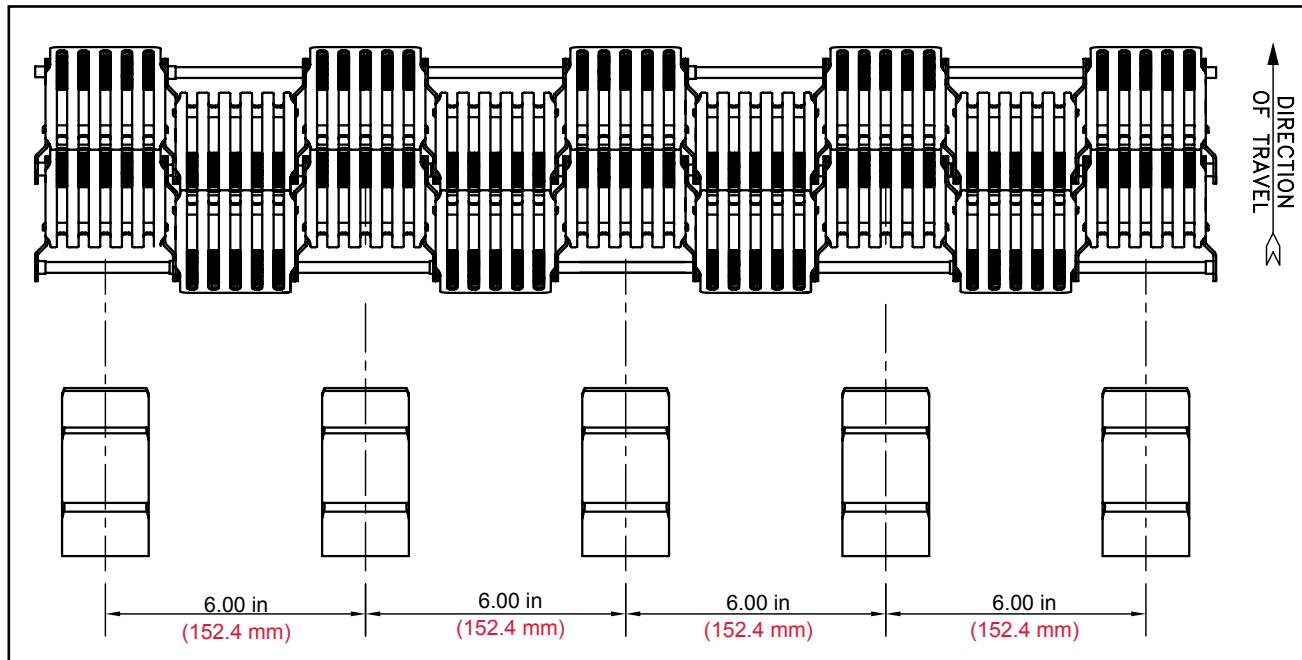
Use the same sprocket location for 2000 chain series with PositTrack™ Tracking Guides, however, the sprocket can not be placed in the position of the PositTrack Tracking Guides.



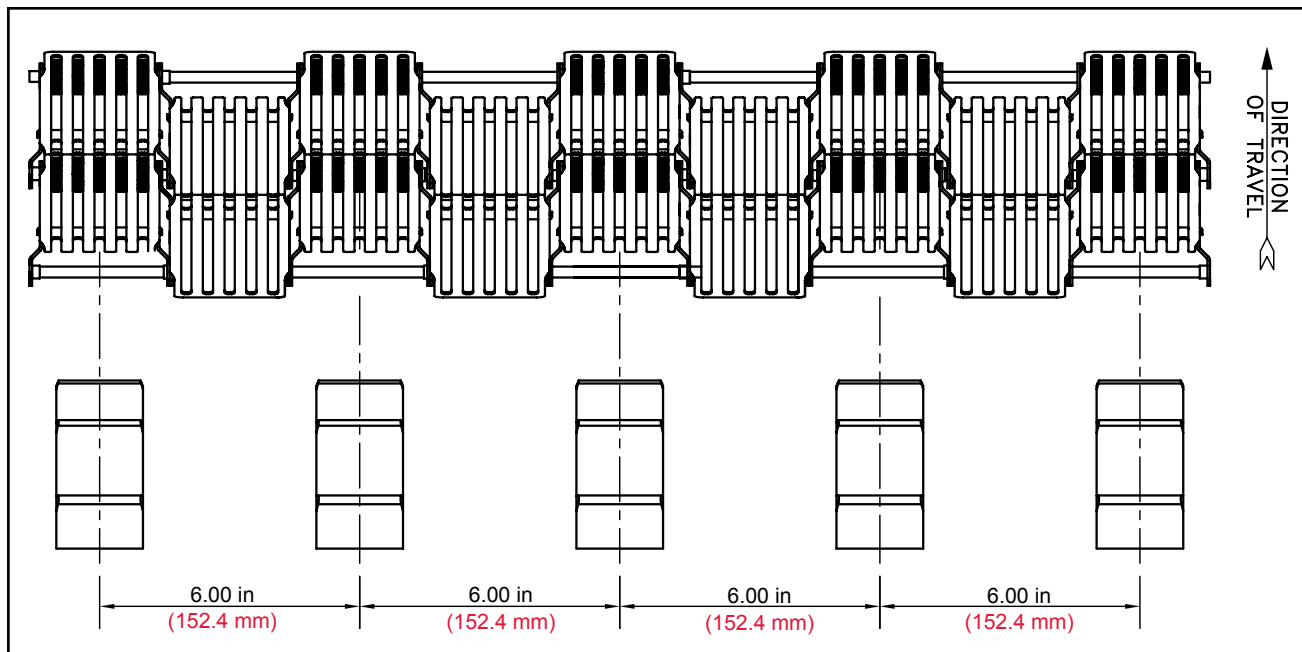
The three outer sprocket pockets should not be used.

CONVEYOR DESIGN RECOMMENDATIONS

Sprocket Locations - 9200



Sprocket Locations - Fortrex™ 9217 MatTop Chain Series



Sprocket Locations - Fortrex™ 9227 MatTop Chain Series



Use the same sprocket location for 9200 chain series with PositTrack™ Tracking Guides, however, the sprocket can not be placed in the position of the PositTrack Tracking Guides.

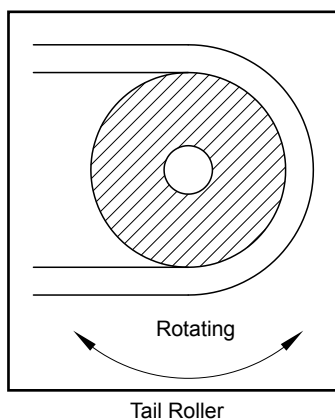
CONVEYOR DESIGN RECOMMENDATIONS

Idler Wheels

Idler wheels or pulleys are suitable alternatives to sprockets for tunnel tail ends. These methods must turn freely and the chain must be guided so it can not move laterally.

✓ For chains without PosiTrack™ Tracking Guides, the use of one or two sprockets locked down in the middle of the tail shaft accomplishes both requirements.

✓ Rexnord® 9200 Series MatTop® Chains are recommended to run on rotating idler drums or idler wheels. Locations for the PosiTrack™ Tracking Guide groove position are shown on page 17.

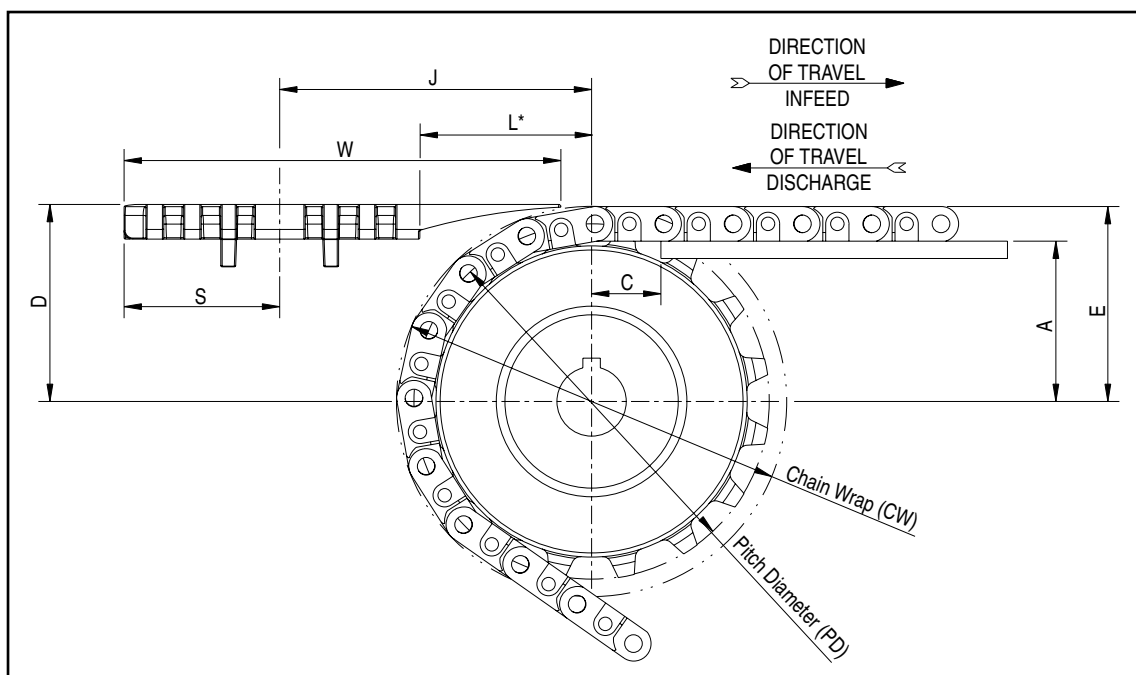


CONVEYOR DESIGN RECOMMENDATIONS

Sprocket Location - 7708

Proper shaft mounting location, carry wearstrip positioning and comb transfer plate dimensions are inter-related and are determined by the type of chain, sprocket size and type of transfer. For sprocket location or shaft drop information for each MatTop Chain Series see pages 30-37.

Rexnord® DTS® (Dynamic Transfer System) – Used with 7708 MatTop® Chain



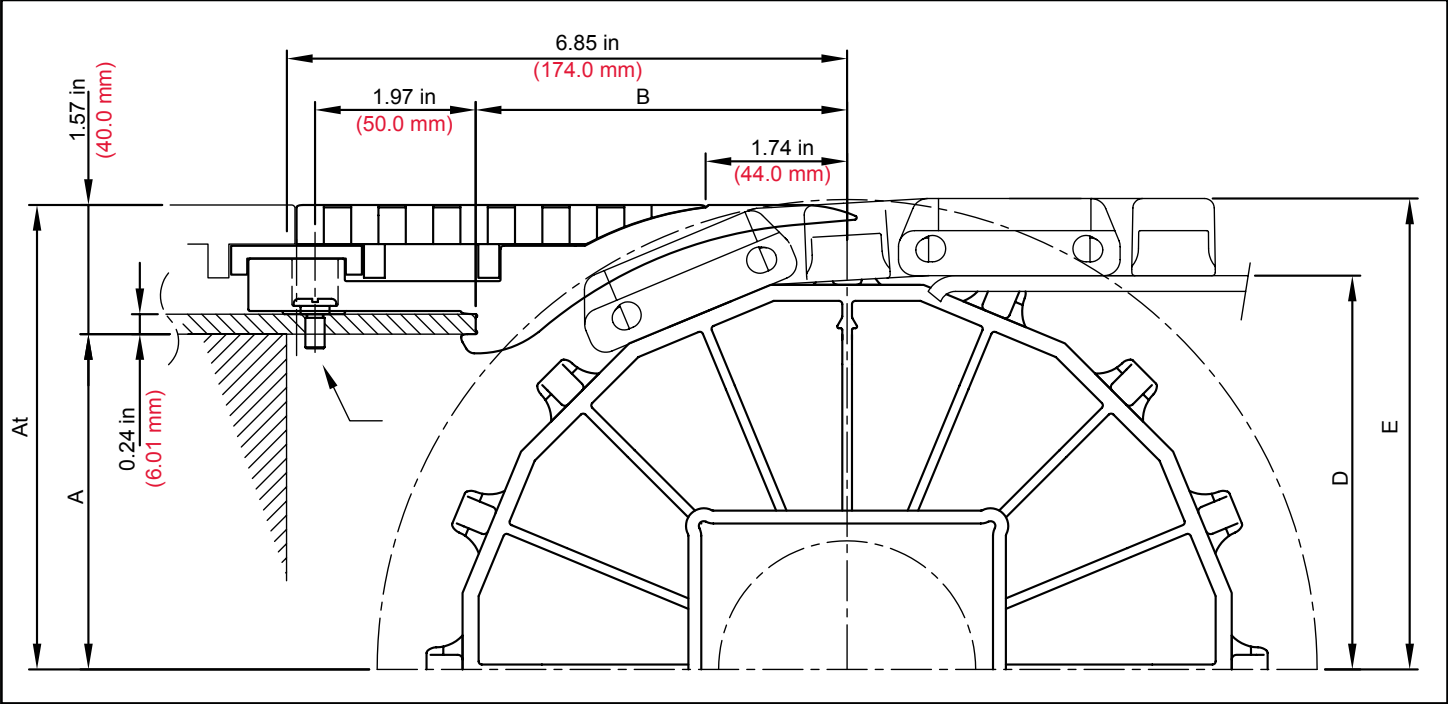
Shaft Drop with 7705 DTS® 4.50 in (114.3 mm) and 7708 Chain

7708 MatTop Chain with 7705 DTS® 4.50 in													
Chain Number	No. of Spkt. Teeth	Pitch Diameter (PD)	A	C	Chain Wrap (CW)	D		E	J		L	S	W
						Infeed	Discharge		Infeed	Discharge			
		in (mm)											
7708	16T	5.126 (130.2)	2.31 (58.7)	1.00 (25.4)	5.63 (143.0)	2.84 (72.1)	2.78 (70.6)	2.81 (71.4)	4.58 (116.3)	4.84 (122.9)	2.46 (62.5)	2.25 (57.2)	4.50 (114.3)
	18T	5.759 (146.3)	2.63 (66.8)		6.26 (159.0)	3.16 (80.3)	3.10 (78.7)	3.13 (79.5)	4.61 (117.1)	4.88 (124.0)			
	21T	6.710 (170.4)	3.11 (79.0)		7.21 (183.1)	3.64 (92.5)	3.58 (90.9)	3.61 (91.7)	4.65 (118.1)	4.94 (125.5)			
	31T	9.885 (251.1)	4.69 (119.1)		10.39 (263.9)	5.22 (132.6)	5.16 (131.1)	5.19 (131.8)	4.77 (121.2)	5.12 (130.0)			

CONVEYOR DESIGN RECOMMENDATIONS

Sprocket Location - 2000

Rexnord® DTS®-C (Dynamic Transfer System) – Used with 2000 MatTop® Chains



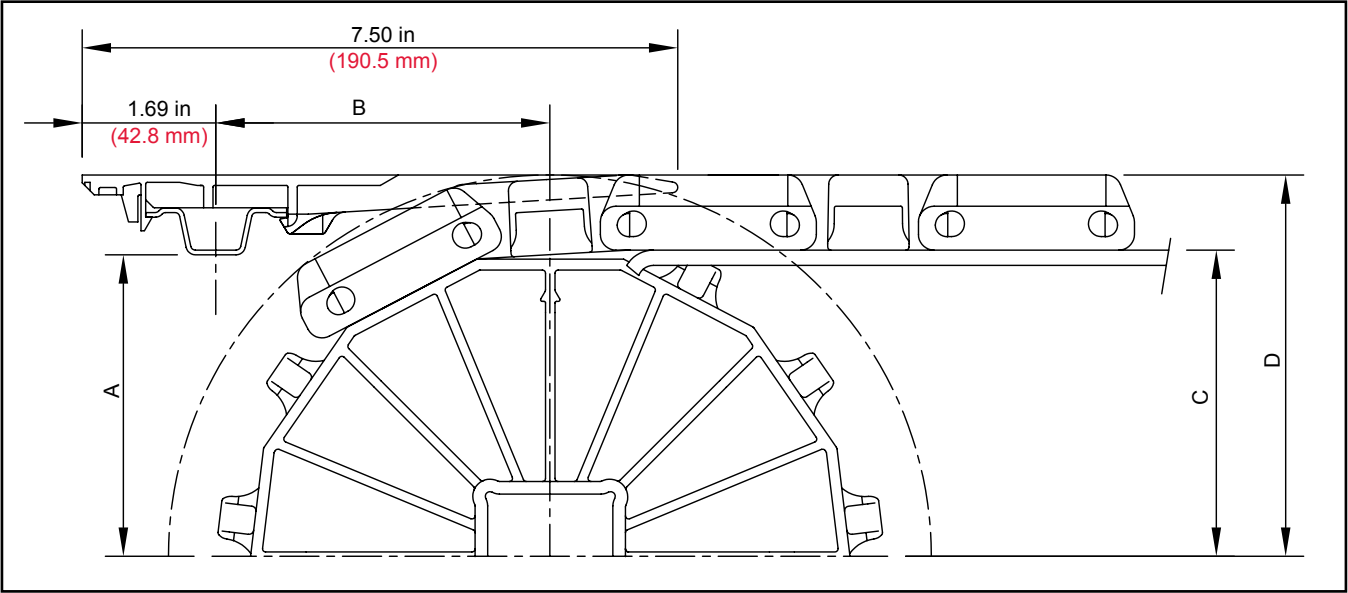
Shaft Drop with 2000 MatTop Chain Series and Transfer Comb

RR2000, RRHD200 and SR2000 Series MatTop Chain with DTS-C														
	Sprocket				Dimensions									
Chain Number	No. of Spkt. Teeth	Eff. No. of Teeth	Pitch Diameter (PD)		A		At		B		D		E	
			in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
2000	10	10	6.46	164.0	2.20	56.0	2.20	56.0	4.57 - 4.69	116 - 119	2.91	74.0	3.86	98.0
	12	12	7.72	196.0	2.83	72.0	2.83	72.0			3.54	90.0	4.49	114.0
	13	13	8.35	212.0	3.15	80.0	4.72	120.0			3.86	98.0	4.80	122.0
	16	16	10.24	260.0	4.09	104.0	5.677	144.0			4.80	122.0	5.75	146.0

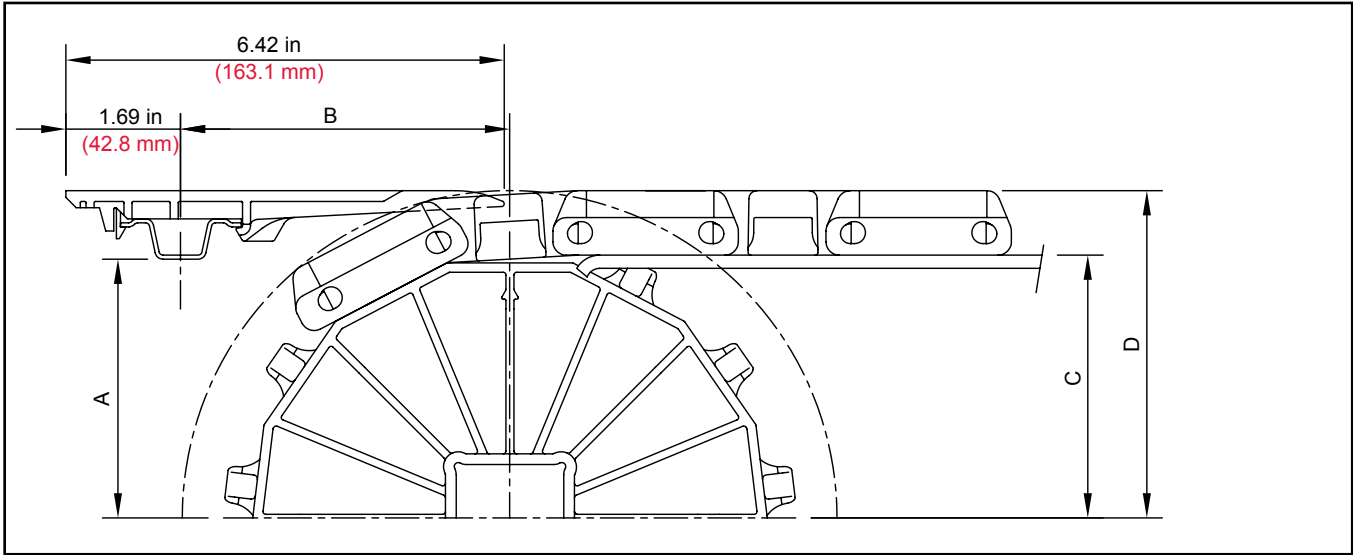
CONVEYOR DESIGN RECOMMENDATIONS

Sprocket Location - 2000

Rexnord® Transfer Combs – Used with 2000 MatTop® Chains



Shaft Drop with 2000 MatTop Chain Series and Transfer Comb



Shaft Drop with 2000 MatTop Chain Series and Transfer Comb (for Glass Handling Applications)

CONVEYOR DESIGN RECOMMENDATIONS

Sprocket Location - 2000

Rexnord® Transfer Combs – Used with 2000 MatTop® Chains

2000 RR & RRHD* Series MatTop Chain General Conveying						
Chain Number	No. of Spkt. Teeth	Pitch Diameter (PD)	A	B	C	D
		in (mm)				
2000 RR & 2000 RRHD	10T	6.47 (164.4)	2.85 (72.3)	4.33 (110.0)	2.90 (73.7)	3.85 (97.7)
	12T	7.73 (196.4)	3.48 (88.4)	4.49 (114.0)	3.54 (89.8)	4.48 (113.8)
	13T	8.35 (212.2)	3.80 (96.5)	4.57 (116.0)	3.85 (97.9)	4.80 (121.9)
	16T	10.25 (260.4)	4.75 (120.6)	4.80 (122.0)	4.80 (122.0)	5.75 (146.0)

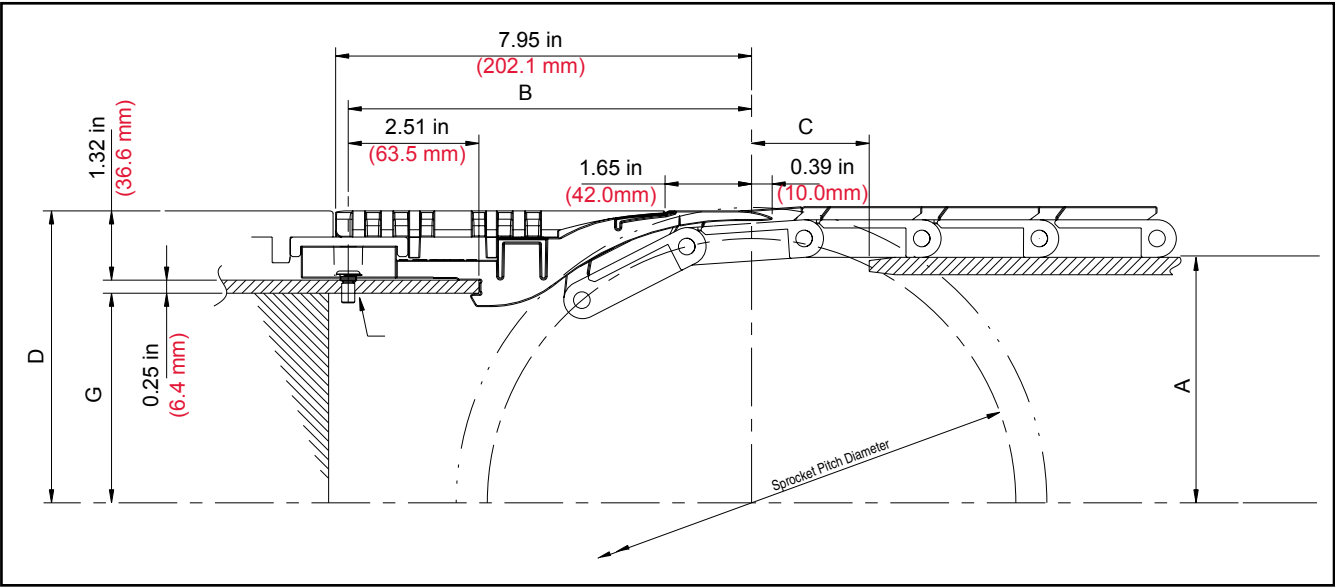
2000 RR & RRHD* Series MatTop Chain Glass Handling Applications						
Chain Number	No. of Spkt. Teeth	Pitch Diameter (PD)	A	B	C	D
		in (mm)				
2000 RR & 2000 RRHD	10T	6.47 (164.4)	2.85 (72.3)	4.80 (122.0)	2.90 (73.7)	3.85 (97.7)
	12T	7.73 (196.4)	3.48 (88.4)		3.54 (89.8)	4.48 (113.8)
	13T	8.35 (212.2)	3.80 (96.5)		3.85 (97.9)	4.80 (121.9)
	16T	10.25 (260.4)	4.75 (120.6)		4.80 (122.0)	5.75 (146.0)

2000 Series MatTop Chain General and Glass Handling Applications						
Chain Number	No. of Spkt. Teeth	Pitch Diameter (PD)	A	B	C	D
		in (mm)				
SR2000	10T	6.47 (164.4)	2.85 (72.3)	4.80 (122.0)	2.90 (73.7)	3.85 (97.7)
	12T	7.73 (196.4)	3.48 (88.4)		3.54 (89.8)	4.48 (113.8)
	13T	8.35 (212.2)	3.80 (96.5)		3.85 (97.9)	4.80 (121.9)
	16T	10.26 (260.4)	4.75 (120.6)		4.80 (122.0)	5.75 (146.0)

CONVEYOR DESIGN RECOMMENDATIONS

Sprocket Location - 5997

Rexnord® DTS®-C (Dynamic Transfer System) – Used with 5997 MatTop® Chains



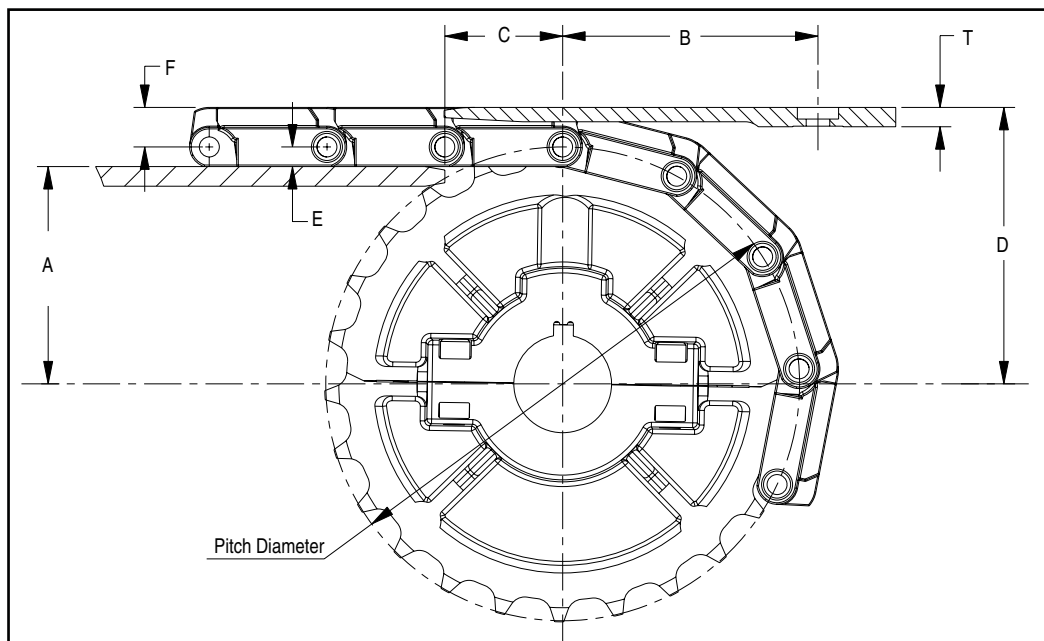
Shaft Drop with 5997 MatTop Chain Series and DTS-C

5997 MatTop Chain with DTS-C														
Sprocket				Dimensions										
Chain Number	No. of Spkt. Teeth	Eff. No. of Teeth	Pitch Diameter (PD)		A		B		C		D		G	
			in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
5997	9	9	6.57	166.9	2.93	74.4	7.717	196.0	2.25	57.2	3.84	97.5	2.26	57.5
	12	12	8.69	220.7	3.99	101.3					4.90	124.3	3.32	84.3
	14	14	10.11	256.8	4.69	119.1					5.60	142.3	4.03	102.3

CONVEYOR DESIGN RECOMMENDATIONS

Sprocket Location - 5997

Rexnord® Transfer Combs – Used with 5997 MatTop® Chains



Shaft Drop with 5997 MatTop Chain Series and Transfer Comb

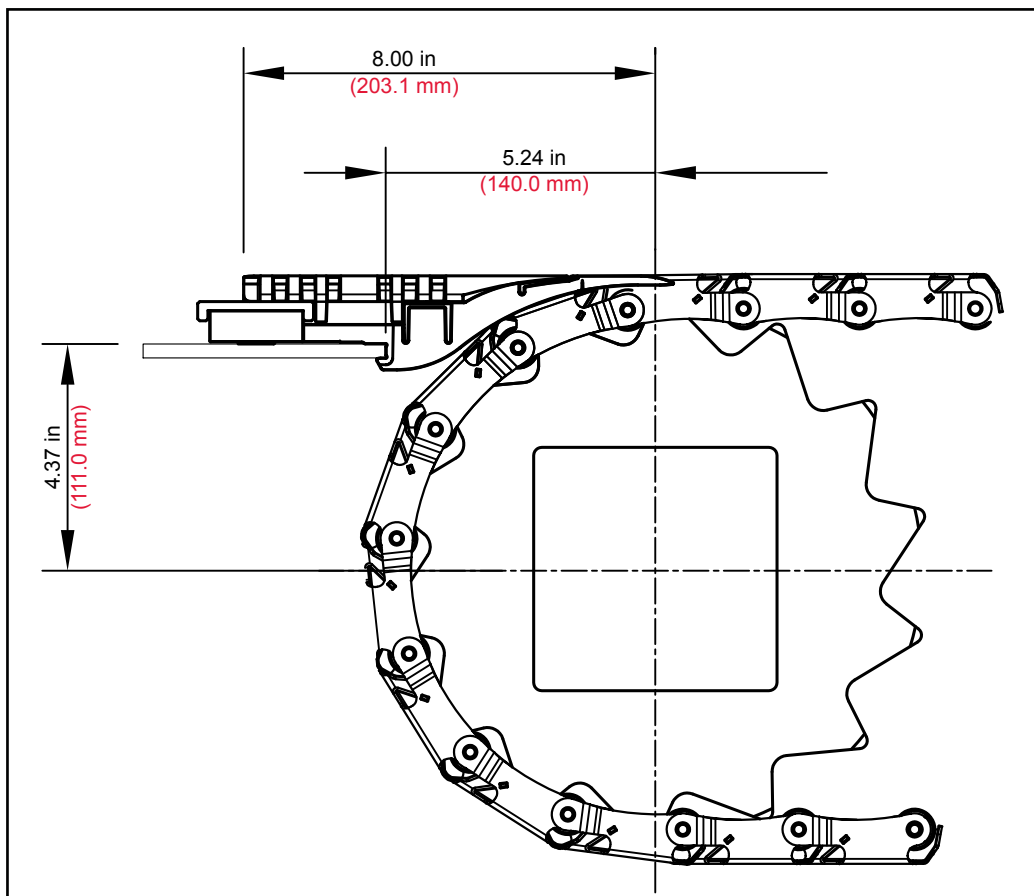
5997 MatTop Chain with Standard Transfer Comb														
Chain Number	Sprocket			Dimensions										
	No. of Spkt. Teeth	Pitch Diameter (PD)		A		B*				C		D		
						114-222-1		114-683-1* 114-1010-1*						
		in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	
5997	9	6.57	166.9	2.93	74.4	2.24 - 4.00	56.9 - 101.6	2.50 - 5.75	63.5 - 146.1	2.25	56.7	3.90	99.1	
	12	8.69	220.7	3.99	101.3	2.99 - 4.00	75.9 - 101.6	3.25 - 5.75	82.8 - 146.1			4.96	125.9	
	14	10.11	256.8	4.69	119.1	3.29 - 4.00	83.6 - 101.6	3.55 - 5.75	90.2 - 146.1			5.67	143.9	
	5997 MatTop Chain with Heavy Duty Transfer Comb													
	No. of Spkt. Teeth	Pitch Diameter (PD)		A		B*				C		D		
						I5997/607052		I5997/631183 114-6275-1						
		9	6.57	166.9	2.93	74.4	3.18 - 4.93	80.8 - 125.2	3.18 - 6.20	111.8 - 157.5	2.25	56.7	3.90	99.1
	12	8.69	220.7	3.99	101.3	3.93 - 4.93	99.8 - 125.2	3.93 - 6.20	130.8 - 157.5	4.96			125.9	
	14	10.11	256.8	4.69	119.1	4.23 - 4.93	107.4 - 125.2	4.23 - 6.20	138.4 - 157.5	5.67			143.9	
	5997 MatTop Chain with Retrofit Transfer Comb													
	No. of Spkt. Teeth	Pitch Diameter (PD)		A		B*				C		D		
						114-5200-1*		114-5201-1*						
		9	6.57	166.9	2.93	74.4	2.57 - 3.62	65.3 - 91.9	2.62 - 4.87	66.5 - 123.7	2.25	56.7	3.90	99.1
	12	8.69	220.7	3.99	101.3	3.32 - 3.62	84.2 - 91.9	3.37 - 4.87	85.6 - 123.7	4.96			125.9	
	14	10.11	256.8	4.69	119.1	3.62	91.9	3.67 - 4.87	93.2 - 123.7	5.67			143.9	

* The B-Dimension is flexible and contains a range. The comb fingers must extend beyond the sprocket centerline to avoid transfer problems and cannot be too close as to cause interference between the combs and the chain.

CONVEYOR DESIGN RECOMMENDATIONS

Sprocket Location - 9200

Rexnord® DTS®-C (Dynamic Transfer System) – Used with 9200 MatTop® Chains

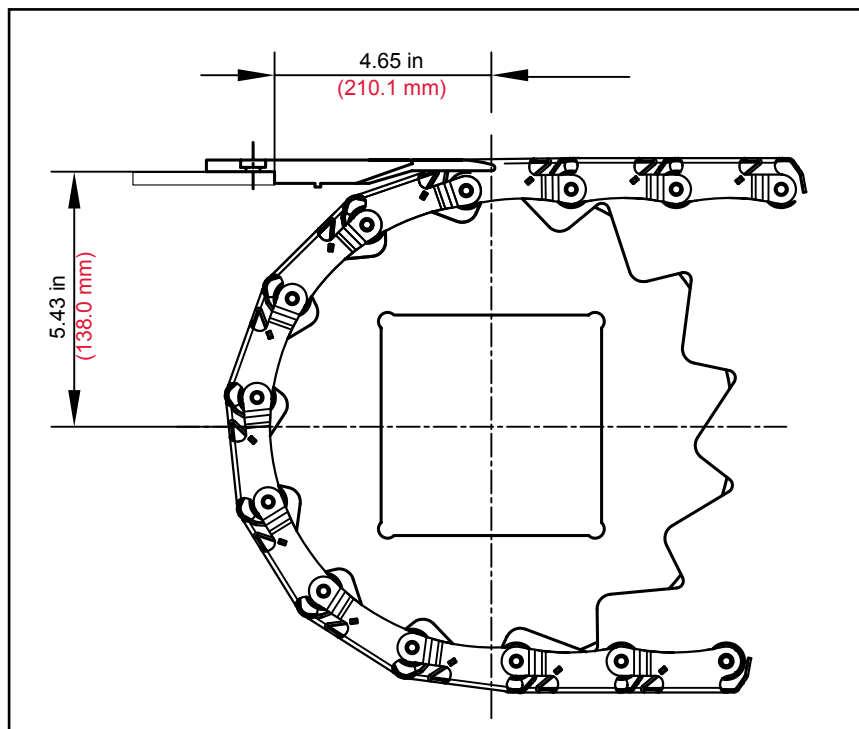


Shaft Drop with 9200 MatTop Chain Series and DTS-C® System

CONVEYOR DESIGN RECOMMENDATIONS

Sprocket Location - 9200

Rexnord® Transfer Combs – Used with 9200 MatTop® Chains



Shaft Drop with 9200 MatTop Chain Series and Transfer Comb

CONVEYOR DESIGN RECOMMENDATIONS

Sprocket Location

- ✓ Tunnel Shafts must be level and perpendicular to chain direction of travel.
- ✓ The infeed conveyor and discharge conveyor sections should be mounted to the tunnel frame with adjustable mounting brackets for final adjustment in the field (up & down and in & out).
- ✓ Wearstrip ends must be positioned in between sprockets in order to provide sufficient support as shown on pages 14 and 30-37.
- ✓ For mounting of combs, rigid angles (vs. flat plates) are preferred and they should be firmly attached to the sides of the infeed and discharge conveyors. Make sure that tunnel chain can rotate freely on sprockets without interfering with combs and mounting profile.

CONVEYOR DESIGN RECOMMENDATIONS

Comb Mounting

All combs (both conventional style and DTS®-C) are approx. 5.93 in. wide (150 mm) and are mounted on approximately 6 in. (152.4 mm) centers. Each conventional style comb is supplied with two shoulder bolts and two caps. The shoulder bolts allow for thermal expansion and contraction and the caps cover the mounting holes to provide smooth transfer. Rexnord® DTS-C Combs are supplied also with two shoulder bolts. After all of the DTS-C plates are installed, a long UHMWPE wearstrip is installed over the mounting area.

- See pages 58-60 for details on transfer comb installation information for each MatTop® Chain Series



- All conventional transfer combs and DTS-C Combs should be mounted level
- The stainless steel mounting plates or angles (angles preferred) should be level and straight
- The flatness and straightness of the mounting profiles is critical to overall system performance
- All combs must be mounted with the supplied shoulder bolts and be able to float axially to allow for thermal expansion and contraction of the raised rib tunnel chain
- The combs must be positioned so the fingers are located in between the ribs

CONVEYOR DESIGN RECOMMENDATIONS

Conveyor Drives

Main Tunnel Drives

- If the machine is a double deck, one drive is required for each level
- If the machine is long and wide, each level may require one drive on each side due to shaft size requirements
- It is common for a long, wide double deck machine to have four separate drives



Dual drives need to be accurately synchronized together.



If the transfers are DTS® or DTS®-C, the tunnel structure, tunnel shafts, bearings and drives must be designed so as to prevent interference with the DTS chains in the carry way and return way.

Infeed and Discharge Conveyor Drives

Refer to general discussion/considerations section regarding infeed and discharge conveyor drives and speeds on page 12. For special options, consult Rexnord Application Engineering.

Retrofits

For retrofits from different types of conveyor chains or chains or from other conveying methods, consult Rexnord Application Engineering for specific recommendations on changes required to the:

- Carry and Return Beds
- Shafts & Shaft Mounting
- Transfers and Mounting
- Drives

NOTES

[illegible]

INSTALLATION

Pre-Installation

It is recommended to review the Conveyor Design section of this manual to ensure that the new or retrofit equipment is properly designed.

Chain Width

The chain width must be ordered to fit into a new or existing equipment. It is recommended to refer to page 16 of the Design Conveyor section to determine the guide clearance required for each chain series.



Fortrex 9200 chain clearance should be 0.25 in. (6.35 mm) maximum on both sides. Fortrex 9200 PT chain clearance should be 1.50 in. (38.1 mm) minimum on both sides of the chain. The 9200 actual chain width is 0.75 in. (19.0 mm) larger than the nominal width. It is critical to order the correct chain width to fit within the tunnel equipment. Actual Chain Width = Nominal Chain Width + 0.75 in. (19.0 mm).

Comb Mounting Plate

Some general preparation is required prior to chain installation. These items are especially critical on retrofit applications. The following provide general guidelines.

- Determine if the existing hole locations in the mounting plate can be used as discussed on pages 58-60
- For retrofit applications, the combs may have to be modified to fit into the existing hole locations or new holes can be drilled and tapped as required
- If new holes cannot be drilled and tapped a new mounting plate may be required. If a new mounting plate is required it is essential to have it fabricated and on-site prior to installation

INSTALLATION

To ensure optimum performance on any tunnel equipment, it is recommended to follow the proper installation and maintenance procedures. This manual provides general recommendations and guidelines for chain installation and maintenance on a Pasteurizer, Warmer or Cooler tunnel.

Chain Packaging & Initial Inspection

All Rexnord® tunnel equipment chains are delivered in wooden crates. The chains are packaged in layers within the crates in 3 ft. (1 m) wide sections. Although high quality packaging is used, the risk of damage during transportation can never be fully eliminated. Therefore, prior to beginning the installation it is recommended to:

- Inspect the chain, sprockets and transfer combs visually for any damage
- Ensure the correct quantity of chain, sprockets and transfer combs are on-site
- Ensure all the necessary tools and equipment for the installation are on-site as listed on page 45

Working Area Preparation

Each tunnel is unique and poses different installation recommendations depending on the size of the tunnel, space limitations, etc. The following provides general guidelines.

- If space is available, it is recommended to make a temporary working area in front of the pasteurizer to assemble chain
- The working area should be wider than the chain and the length must be longer than two chain sections (approximately 6 ft. or 2 m)
- A fork-lift is recommended to move and raise the wood crates up to the desired level, as required
- The wood crates can be opened on the side so that chain can be pulled out easily, layer by layer
- It is recommended to make a rigid chain pulling fixture that can be connected to the first section of chain

There are several methods of accomplishing this. Two of the methods are listed as follows:

- 1) Use a chain pin or metal pin within the chain to connect to a rigid pulling fixture
- 2) Use a rigid metal rod or pipe and interlace wire, ties or links into the leading section of the chain
- 3) For a retrofit, it is possible to use the existing chain to pull the new chain through the conveyor.

One example of how the two chains can be connected is shown on page 44

- Make a temporary return support by using several flat straps draped over the return shoes or rollers and pulled tight as shown on page 44

INSTALLATION

Working Area Preparation



Example of Rigid Chain Pulling Fixture Using Existing Chain



Example of Temporary Return Support



Example of Temporary Return Support

INSTALLATION

Equipment / Material Listing

The following is a list of tools required for chain, sprocket and transfer comb installation:

CHAIN ASSEMBLY TOOL	Chain assembly tools are available for the MatTop® Chain Series as shown below
SCREWDRIVERS	Flat head screwdriver for chain assembly and disassembly
PIN PULLERS	Contact Rexnord to obtain a pin puller (Part 4004) or use a similar threaded tool
RATCHETS AND SOCKETS	Sized for the chain assembly tool (or utilize an electric impact hammer drill and socket)
ELECTRIC HAND DRILL AND GEARBOX DRILL BIT ADAPTER	Used to drive the motor
EXTENSION CORDS	As required
STRING LEVELS	A transit or laser level can also be utilized to insure the wearstrips and shafts are level and aligned
FLAT STRAPS	Long enough to pull the chain through the entire length of the tunnel
ROPE AND WINCH	Used for pulling the chain through the tunnel
SPARE WEARSTRIPS	Only recommended for retrofit applications. Have spare wearstrips on-hand during the installation in the event that damaged wearstrip sections need to be replaced
WORK GLOVES	Heavy protective gloves are recommended
RIVET TOOL	Only required for Fortrex™ 9200 chain installations (details shown on page 56)
STAINLESS STEEL RIVETS	Only required for Fortrex 9200 chain installations. Supplied by Rexnord® (Part Number 820.00.09)

Chain Assembly Tools



2000 Chain Assembly Tool
Part #800.00.04



5997 Chain Assembly Tool
Contact Application Engineering
for recommendations



9200 Chain Assembly Tool
Part #820.00.18 (for 9217)
Part #820.10.15 (for 9227)

Rexnord Chains	7708	2000	5997	9200
Amount of Assembly Tools Required	Not available	1 tool for every 3 ft (1.0 m) of chain width	Contact Application Engineering for recommendations	1 tool for every 3 ft (1.0 m) of chain width

INSTALLATION

Handling Instructions

For safety and handling instructions please refer to the CAUTION sheet which is shown below. This CAUTION sheet is also included in the chain shipment (laminated sheet within the crate).

CAUTION

- Be careful when handling MatTop shipping crates and chain sections due to heavy weight. Wide crates & chain sections **must be supported in the middle** to prevent bending and/or breakage.
- When handling belt sections, **be careful to avoid injury** to fingers and hands, such as pinching, cutting or crushing of fingers or hands.



When removing or installing MatTop Chain:

- Always wear protective clothing: safety glasses, work gloves, steel toed safety shoes, ear protection and protective head gear.
- Always lock out/tag out all power switches to equipment and adjacent conveyors and **follow proper safety procedures** before entering or working around equipment.
- Secure and Support the chain to **prevent uncontrolled movement** of chain and parts.
- Tools should be in good condition and used properly.

Do not attempt to connect or disconnect chain until you understand chain construction, including **the correct direction for pin removal/insertion** and **proper Chain Direction of Travel**.

For these and other Installation and Maintenance instructions, refer to Rexnord FlatTop Chain Engineering Manual and Installation /Maintenance Manuals. Or contact the Application Engineering Department.

INSTALLATION

Removal of Existing Chain and Components

If this is a retrofit, first remove the used chain, sprockets, transfer combs and product guiderails. It is recommended to remove all of the existing chain first to allow for inspection of the wearstrips, shaft, bearings and couplings. In some situations, the used chain is attached to the new chain and assists to pull the chain through the tunnel (see page 44).

Inspection Prior to Installation

Inspection - Carry Way

Prior to installation inspect the existing carry way and ensure the following:

- Carry way wearstrips are level using a string level, transit or laser level in all directions
- Wearstrips have rounded lead in edges, are the same height, and contain no sharp edges
- Wearstrip surfaces are smooth per recommendations on page 15
- Chain guide clearance are set per recommendations on page 16
- Positrack guides are flat on top and sides to ensure proper fit (i.e. no weld lines)

Replace, adjust or repair wearstrips as required

The following notes only pertain to the 9200 Fortrex™ chains:

- In-line wearstrips are required for 9227 chains
- Chevron or in-line pattern wearstrips can be used for 9217 chains

Inspection - Return Way

Prior to installation inspect the existing return way and ensure the following:

- Return shoes or rollers are not damaged
- All return shoes or rollers are level and positioned properly (i.e. parallel and square to the direction of chain travel)
- Return shoes or rollers are smooth per recommendations on page 19
- Chain guide clearance are set per recommendations on page 16
- Return rollers spin freely

Replace, adjust or repair as required

Inspection - Shaft, Bearing and Coupling

Prior to installation inspect the shaft, bearings and couplings and ensure the following:

- Condition of the shafts, bearings and couplings is satisfactory per manufacturer recommendations
- Shafts are level and positioned correctly
- Shafts are aligned correctly
- Center support bearings are aligned and positioned correctly
- If dual shafts are utilized, shaft couplings are used correctly (i.e. couplings should be rigid with no back-lash and both halves of square or keyed shafts are in time with each other)

Replace, adjust or repair as required

INSTALLATION

Sprocket Installation

Step 1: Install the sprockets onto the shaft making sure that they all face the same way so that all the teeth are in line. Square shaft sprockets contain a timing mark to help ensure proper positioning as shown on page 23

Step 2: Sprockets should be fixed on the shaft or floating depending on the chain series as shown on page 23. Fixed sprockets can be locked in place using set screws, roll pins, welded blocks or shaft collars as shown on page 23. Make sure that the locking method cannot come loose over time. The other sprockets should float axially to allow for thermal expansion and contraction of the tunnel chain and will be held in place by the chain sprocket pockets

Step 3: Locate sprockets laterally along shafts to ensure that the sprockets line up with the proper sprocket pocket locations. This is accomplished easily by using a short section of chain laying over the ends of the carry wearstrips at the shaft ends

Step 4: Tighten all the sprocket capscrews and keyway setscrews as recommended below

Capscrews			
	Bolt Size	Hex Size	Recommended Torque
English	1/4 in	3/16 in	50 in-lb
	3/8 in	5/16 in	75 in-lb
Metric	M6	M5	5.7 N-m
	M10	M8	8.5 N-m

Keyway Setscrew	
Hex Size	Recommended Torque
1/8 in	40 in-lb
1/16 in	40 in-lb

INSTALLATION

Sprocket Installation



It is critical to never mix split and solid sprockets on the same shaft because teeth will not be aligned.



- Where internal shaft bearings or shaft couplings are required, they may interfere with the proper sprocket locations. This will usually require that one or more sprockets be left out. In this case, provide other means of supporting chain at this location to keep chain from sagging in-between sprockets. This can be accomplished with an idler sprocket or machined UHWMPE drum
- If dual drives are utilized, it is critical to ensure that each pair is accurately synchronized and in phase
- For sprocket pocket locations see Sprocket Location section on pages 25-28

INSTALLATION

Sprocket and Wearstrip Location

See pages 30-37 for details on sprocket and wearstrip locations for each MatTop® Chain Series. The following are general guidelines when installing shafts, sprockets, wearstrips and combs.

- The distance from the end of the wearstrip to the sprocket shaft centerline should equal the “C” Dimension for plastic MatTop Chains. If this is not followed the wearstrip will interfere with the free articulation of the chain as it enters the sprocket. However, in applications where temperature fluctuations affect the width of the chain the “C” dimension should be increased so the wearstrips do not interfere with the outer diameter of the sprocket.
- The leading edges of the wearstrips should be beveled.
- Mounting sprockets in line with wearstrips is not recommended for chains using transfer combs.
- The following formula and dimensions used in conjunction with the figure will give the proper shaft and wearstrip positioning.

A = Shaft Drop = Distance from centerline of sprocket to top of wearstrip = $(\text{Pitch diameter}/2) + E$

B = Distance from centerline of the sprocket to the transfer comb mounting location

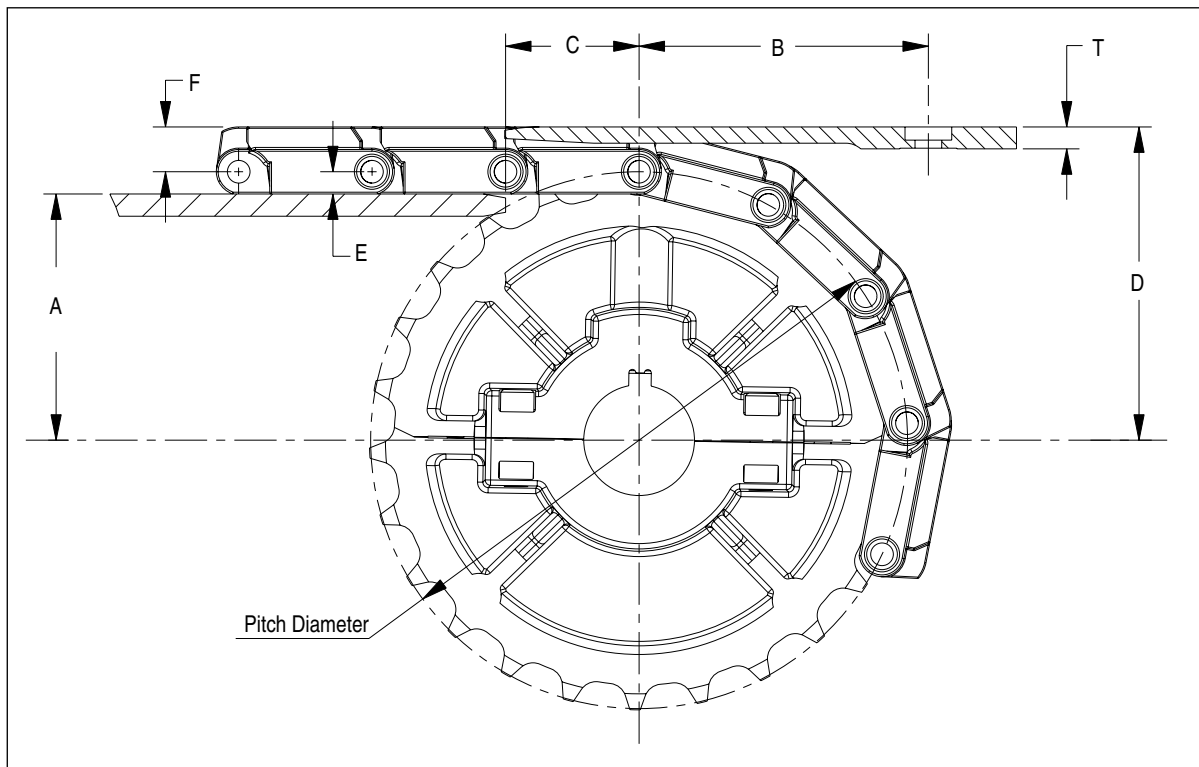
C = One chain pitch (for plastic MatTop Chains)

D = Distance from centerline of sprocket to top of transfer comb = $(\text{Pitch diameter}/2) + F$

E = Distance from centerline of chain pin to top of wearstrip

F = Distance from centerline of chain pin to top of chain surface

T = Transfer comb thickness



Shaft Drop Drawing - See pages 30-37 for details and dimensions for each MatTop® Chain Series



For more details and dimensions on the shaft and sprocket locations for each MatTop Chain Series see pages 30-37

INSTALLATION

Chain Installation

All of the chain instructions assume that the chain is installed on the idler end of the conveyor. If the chain is to be installed on the drive end, the opposite tunnel directions should be followed.

Step 1: Pull flat straps all the way through the tunnel from the idler end to the drive end and attach them in several places across the length of the rigid fixture as shown on page 44

Step 2: Remove the chain from the shipping crates at the idler end on the temporary working area. The chain is shipped in 3 ft. (1 m) sections with pins inserted in one end of the chain. Extra plugs and pins (7708, 2000 & 5997) and extra pins, clips and rivets (9200) are included in each crate

Step 3: First pull one section of chain through the machine making sure that the chain can move freely



Install the chain in the recommended direction of travel as shown in the Product Catalog. 9217 chains are bi-directional, however, the preferred direction of travel depends on the axial drive and idler sprocket locations. 9227 chains are uni-directional.



If you can not slide the chain directly into the tunnel it is critical to roll the chain in coils. To prevent damage when picking up the chain it must be supported in the center as shown to the right and on page 46.



Prior to installing the chain, pull one section of chain through the entire tunnel ensuring that there are no tight spots or obstructions. The chain should be able to move freely through the entire machine.



Chain is Coiled and Properly Supported

Step 4: Using the temporary work area, connect two sections of chain together by pulling out the extra pin in the end row and reassembling the two sections using the same pin and insert the plug retention. See pages 52-56 for more details on assembling the chain

Step 5: Use a winch to index the chain in 3 ft. (1 m) sections all the way through the tunnel to the drive end. Repeat this step with each new 3 ft. (1 m) section of chain

Step 6: Wrap the chain over the drive sprockets, making sure that the teeth of all the sprockets are properly engaged in the respective sprocket pockets



Ensure that there is a sprocket engaged in every available sprocket pocket both on the drive and idler end.



If using 9200 chain with PosiTrack™ ensure that it is properly tracking on the channel.

INSTALLATION

Chain Installation

Step 7: Pull the chain through the return way section by using the temporary return support. Use a winch or electric hand drill to index the chain in 3 ft. (1 m) sections through the return to the idler end of the tunnel

Step 8: Wrap the chain over the idler sprockets, making sure that the teeth of all the sprockets are properly engaged in the respective sprocket pockets of the chain

Step 9: Tighten the chain using the chain assembly tool to pull the two ends together. Remove as many rows of links as possible by tightening the chain assembly tool until there is nearly zero sag in the catenary. Insert the last pin into the chain and assemble the pin retention

NOTE: Preheating the chain is not required prior to tightening the chain

Rexnord® Chains	2000	5997	7708	9200
Pin Retention Method	Clip / Clip	Blind / Plug	TwistLock	Rivet clip / Rivet clip
# of Pitches to Remove	2	1	1	1
Pin Access	Both sides	One side (plug side only)	Both sides	Both sides

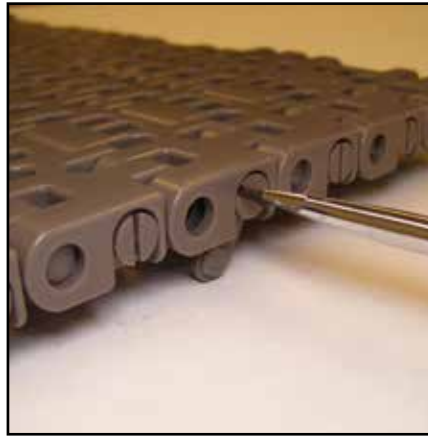
INSTALLATION

Chain Installation

Rexnord® 7708 MatTop® Chain



STEP
1 Chain with correctly closed pin retention



STEP
2 Place flat screwdriver in Rexnord TwistLock® plug and turn counter clockwise to open



STEP
3 When TwistLock plug is open, the rod can be pulled or pushed out

INSTALLATION

Chain Installation

Rexnord® RR2000 and RRHD200 MatTop® Chain



STEP

1

Chain with correctly closed pin retention



STEP

2

Place flat screwdriver in square hole of the clip and move clip upwards to open



STEP

3

When clip is removed, the rod can be pulled or pushed out

Rexnord SR2000 MatTop Chain



STEP

1

Chain with correctly closed pin retention



STEP

2

Place flat screwdriver in square hole of the clip and move clip downwards to open



STEP

3

When clip is removed, the rod can be pulled or pushed out

INSTALLATION

Chain Installation

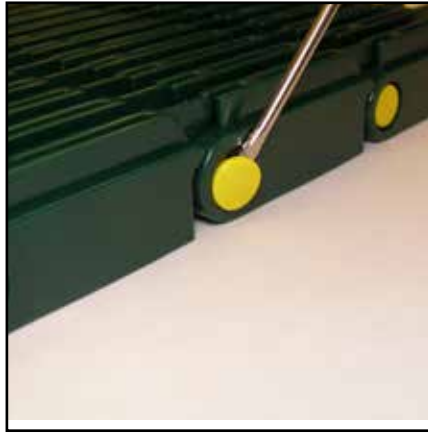
Rexnord® 5997 MatTop® Chain



STEP

1

Chain with correctly closed pin retention



STEP

2

Place flat screwdriver in-between chain and plugs and push plug outwards to open



STEP

3

When plug is removed, the rod can be pulled out



The 5997 chain pins can only be accessed on the plug side of the chain. Therefore, it is critical to have access holes on the side where the plugs are located. A pin puller can be used for easy removal.

INSTALLATION

Chain Installation

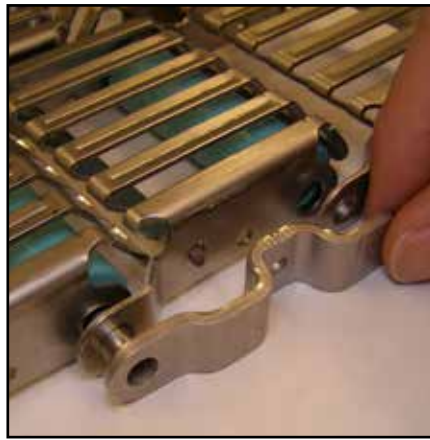
Rexnord® Fortrex™ 9200 MatTop® Chain



STEP

1

Chain without pin retention. To remove the pin retention drill the pin rivets out



STEP

2

Pin retention should slide over the rod and be pop-riveted in place. Make sure stainless steel rivets are used and the pin retention clips are tightly fitted to the module



STEP

3

Chain with correctly closed pin retention



The 9200 chain uses a special stainless steel clip that is pop-riveted to the chain on both sides using a hand or powered pop rivet gun as shown below. The pins can be accessed from either side of the chain.



Stainless steel rivets 0.1575 in. (4.0 mm) must be used (Part 820.00.09)



9200 Chain Rivet Tool, Clip and Stainless Steel Rivet

INSTALLATION

Catenary Adjustment

Rexnord® MatTop® chains are designed to run with a catenary and therefore no take-ups or tensioning devices are required. The chains should be connected in ambient temperature.

The size of the catenary is critical and the following general guidelines should be followed. For more details on the catenary arrangement refer to page 20.

Rexnord Chains	2000	5997	7708	9200
Vertical sag when running	4 to 12 in (100 to 300 mm)	4 to 6 in (100 to 150 mm)		4 to 10 in (100 to 250 mm)
Horizontal span	40 to 80 in (1000 to 2000 mm)	48 to 60 in (1219 to 1524 mm)		40 to 80 in (1000 to 2000 mm)

-  After initial chain installation run the chain until the equipment reaches operating temperature conditions for the catenary sag to settle in the correct position. After this time period it is recommended to check the catenary to insure the proper sag is obtained. Adjust by adding or removing links as required.
-  Check the water temperature first to avoid injury when inspection the chain in a hot zone.
-  The mechanical and thermal properties may differ depending on the MatTop chain series and material resulting in different chain sag characteristics. In some retrofit situations, this may require moving or adding return shoes or rollers to minimize the amount of vertical sag.
-  For double deck units, it is critical to ensure that the catenary sag of the top unit does not affect product handling in the bottom unit (i.e. the catenary should not contact the product).
-  It is critical to ensure that the catenary sag does not get caught into the tanks of the tunnel equipment.

DTS® Chain or DTS®-C Installation (not available for 7708 MatTop Chain Series)

All of the Rexnord chains can be used in conjunction with either a DTS chain or DTS-C transfer comb. For specific recommendations using these products refer to Rexnord's Engineering manual (8rxEM-en) or the DTS-C design manual (8rxDTS-C-en).

INSTALLATION

Transfer Comb Installation - High Temperature Application (2000)

Rexnord offers two styles of transfer combs for 2000 Series pasteurizer chains. Both are click-fitted on an omega style profile. For more details on the specific product offering refer to the Product Catalog.

Step 1: Ensure that the omega profile is mounted properly to the pasteurizer support construction

Step 2: Mount the transfer combs onto the omega profile making sure all the transfer comb fingers are engaged between the chain ribs and along the entire width of the chain

Step 3: Test the transfers to ensure they are mounted properly so they are allowed to slide from side-to-side

Step 4: Test the level of the transfer combs with all the products conveyed within the tunnel. Adjust the height and level of the infeed and discharge conveyors and comb support brackets as required to assure smooth container transfer. The tops of the transfer combs should be even with the top of the chain. The transfer combs should be mounted level from front to back



For DTS®-C combs it is recommended to make the height position of the comb support adjustable to achieve optimum performance of the DTS-C system

INSTALLATION

Transfer Comb Installation - High Temperature Application (5997)

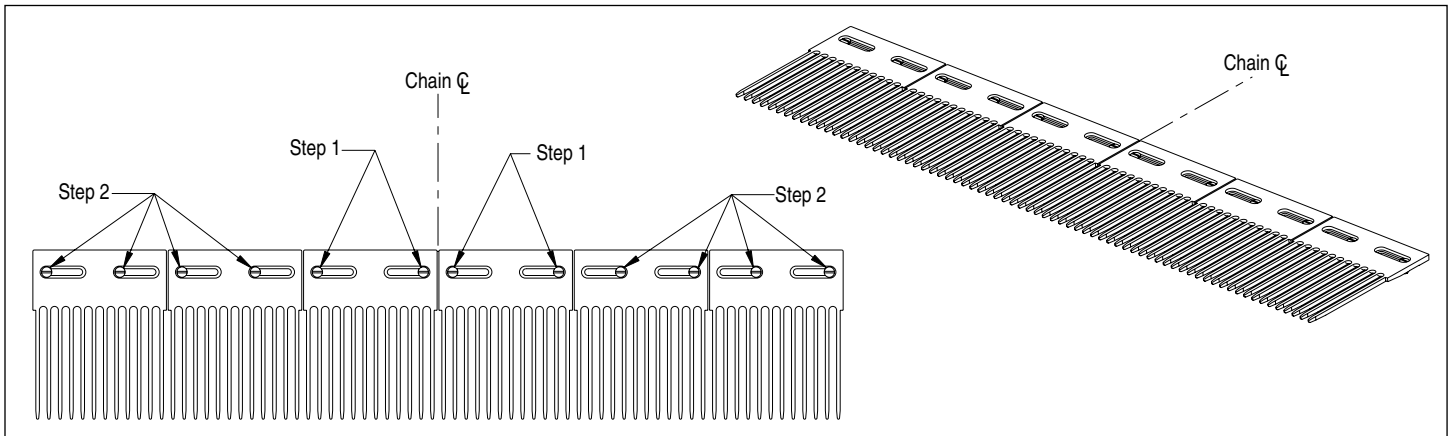
Rexnord offers several different styles of transfer combs for each unique application and mounting arrangement. For more details on the specific product offering refer to the Product Catalog.

Step 1: Ensure that the mounting holes are located properly per the recommendations shown below. If this is a retrofit application, new holes may need to be drilled and tapped for proper comb positioning or the combs may need to be modified

Step 2: Mount the transfer combs onto the mounting plates making sure that all the transfer comb fingers are engaged between chain ribs and along the entire width of the chain

Step 3: Secure the two center most transfer plates to track the chain as shown below

Step 4: Position the fasteners in the remaining transfer plates to the corresponding right side or left side of the slots to allow for expansion at high temperatures as shown below



Screw Locations for High Temperature Application

Step 5: Test the transfer combs to ensure they are mounted properly so they are allowed to slide slightly from side to side. After mounting there will be approximately 1/16 in. (1.5 mm) gap between the edges of the transfer combs

Step 6 (Critical): Test the level of the transfer combs with all the products conveyed within the tunnel. Adjust height and level of the infeed and discharge conveyors and comb support brackets as required to assure smooth container transfer. The tops of the transfer combs should be even with the top of the chain or approximately 1/16 in. (1.5 mm) above the tops of the chain ribs. The transfer combs should be mounted level from front to back

 It is critical to use the hardware provided in the the transfer plate kits. The hardware contains a special shoulder screw that allows the combs to float axially.

 This arrangement will allow these transfer plates to move as required to accommodate changes in the chain width up to 1.50 in. (38.1 mm)

INSTALLATION

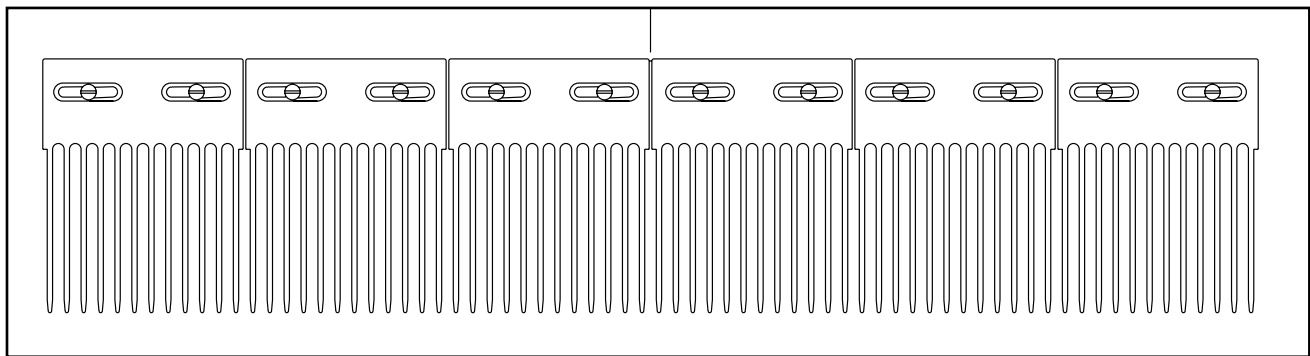
Transfer Comb Installation - High Temperature Application (Fortrex™ 9200)

Rexnord® offers one style of classic transfer combs for Fortrex 9200 chain and one style of DTS®-C comb suitable for the Fortrex 9200 chain. For more details on the specific product offering refer to the Product Catalog.

Step 1: Ensure that the mounting holes are located properly per the recommendations shown below. If this is a retrofit application, new holes may need to be drilled and tapped for proper comb positioning or the combs may need to be modified

Step 2: Mount the transfer comb onto the mounting plates making sure all the transfer comb fingers are engaged between chain ribs and along the entire width of the chain

Step 3: Position the fasteners in the center of the slots as shown below



Screw Locations for High Temperature Application

Step 4: Test the transfer combs to ensure they are mounted properly so they are allowed to slide slightly from side to side.

Step 5 (Critical): Test the level of the transfer combs with all the products conveyed within the tunnel. Adjust height and level of the infeed and discharge conveyors and comb support brackets as required to assure smooth container transfer. The tops of the transfer combs should be even with the top of the chain. The transfer combs should be mounted level from front to back



It is critical to use the hardware provided in the transfer plate kits. The hardware contains a special shoulder screw that allows the combs to float axially.

INSTALLATION

Guiderail Installation

The guiderails that were removed prior to the chain installation must be reinstalled into the conveyor.

Step 1: Install the guiderails in the tunnel conveyor. Make sure that the guiderails within the tunnel are positioned properly to prevent containers from falling over the edge of the chain and getting caught in the return way



A general recommendation is to maintain the guiderail positioning to be narrower on the infeed than the outfeed. As a general rule of thumb the infeed guiderail is more narrow by one product diameter (i.e. Infeed guiderail spacing = Outfeed guiderail spacing - 1 product diameter).

Step 2: Install the guiderails on both infeed and discharge conveyors. Make sure that the guiderails are positioned properly to ensure smooth and evenly populated container transfer into and out of the tunnel



It is recommended to position the guiderails even with the chain edge or slightly inward to ensure product does not get caught on the edge of the chain.

INSTALLATION

Start Up

The following are general guidelines to follow prior to production.

Step 1: Remove all tools, loose hardware and debris from the chain in carry and return ways

Step 2: Run the chain **without product** for 2 to 6 hours and check for the following:



For Fortrex 9200 MatTop Chains it is recommended to run the chain **without product** for 24 hours.

- Inspect the chains to ensure all of the sections were properly assembled and the chain was not damaged during the installation process (i.e. plugs have been inserted into the chain, end modules are not damaged, etc.)
- Manually test the transfer comb positioning with containers (while chain is running) as noted on pages 58-60
- Check to ensure transfer combs do not contain debris or particles wedged within the fingers
- Inspect the chain to ensure it is running properly, not hitting any obstructions, and tracking straight within the carry and return way
- Inspect the chain to ensure it is properly driven by the sprockets (i.e. sprockets are in correct locations, there are no high spots, chain is not jumping, etc.)

Step 3: Stop the chain and repair, adjust or correct any problem areas that were found during the inspection process

Step 4: Run the chain **with product (during production run) making sure that the machine is fully loaded** and check for the following:

- Inspect the chain to ensure it is running properly and tracking straight within the carry and return way while under full load
- Review the product at transfer locations and check for any container tippage or instability issues
- Inspect the catenary under full load

Step 5: Inspect the catenary periodically during the chain break-in period (first 2 to 4 weeks). If the sag becomes excessive, remove links during the first available downtime. The recommended catenary sag dimensions are shown below and on page 57

Rexnord® Chains	2000	5997	7708	9200
Vertical sag when running	4 to 12 in (100 to 300 mm)	4 to 6 in (100 to 150 mm)		4 to 10 in (100 to 250 mm)
Horizontal span	40 to 80 in (1000 to 2000 mm)	48 to 60 in (1219 to 1524 mm)		40 to 80 in (1000 to 2000 mm)

Step 6: Note any issues that need to be fine-tuned and adjust or correct during the first available downtime

MAINTENANCE

Maintenance Guidelines

Periodic maintenance is essential to ensure chain reliability and increased lifetime. A general recommended maintenance schedule is shown below that applies to all Rexnord® MatTop® chains in any tunnel equipment. It is always recommended to replace or repair damaged product as soon as it is detected.

Maintenance frequency	Component	Maintenance procedure	Additional notes
Every 2 weeks or during routine cleaning schedule	Infeed chain	Check infeed chain for any visual damage or product handling issues	
Every 2 weeks or during product change outs	Transfer combs	Inspect transfer combs at the infeed and discharge for any damage and ensure proper positioning	Ensure product transfers are smooth
Every 6 months	Pin retention clips or plugs	Check if all the pin retention clips or plugs are in place and in the closed position	Missing clips or plugs could allow the pins to walk and cause a chain failure
	Chain* / Catenary sag	Check the catenary sag while the chain is warm or running. Remove links if the sag becomes excessive	General sag dimension guidelines are shown on page 57 and 62. If links are removed inspect the pins
	Chain*	Inspect the chain for visual damage and discoloration	Contact Application Engineering for information on our free chain evaluation service
Every 6 months after the first 2 years	Chain*	Measure the chain elongation. Chain should be replaced when it measures approximately 3%	Use the chain elongation measurement tool for 5997 chains as shown on page 64
Every 12 months	Positrack™ Tracking Guides (lugs)	Inspect Positrack lugs for any visual damage	
	Chain pins	Ensure pins are not protruding from the chain and have not become dam- aged	
	Drive sprockets	Inspect position of the drive sprockets, tooth damage and alignment	
	Idler wheels	Inspect position of the idler wheels and inspect for any damage	

* Rexnord offers Pasteurizer Chain Evaluation service (see page 64)

MAINTENANCE

Chain Elongation Measuring Tool (5997)

The chain pitch measurement tool was designed to make it easier to measure chain elongation in field applications, especially in hard-to-get-at areas such as pasteurizers, coolers and warmers.



5997 Chain Pitch Measurement Tool (Part 614-522-1)

The tool consists of two identical aluminum blocks as shown above. The four location pegs on the bottom of each block fit into slots in the top of the chain. If more details on using this tool is required contact Rexnord® Application Engineering for the instructional sheet.

Pasteurizer Chain Evaluation Service

Rexnord realizes that the unexpected down time for any product is unacceptable and providing information on the life of a chain is a huge benefit. Rexnord provides a chain life analysis for pasteurizer chains so that installation of new chains can be schedule up front and down time can be avoided. Contact Rexnord Application Engineering for more details on this service.

MAINTENANCE

Water Treatment and Cleaning Procedures

A pasteurizer is one of the harshest environments within a beverage filling plant because of the elevated temperature, constant submersion and chemical additives that are present within this process. Many of the biocides used to control biological growth also attack the plastics used in all conveyor chains, and the elevated temperature hastens this degradation (with every 50° F or 10° C the temperature increases, chemical reactions increase by a factor of 2 to 3!). Additional water properties, such as the pH, Alkalinity and Hardness can also further work together to create an environment where plastic chain life is compromised.

Some chemical treatment is necessary to prevent the biology from overrunning the pasteurizer and fouling the process, but the well-being of the chain needs to be considered by keeping the chemical dosing to a minimum and choosing the right chemicals. The guidelines below should be followed to reduce the amount of damage done to the pasteurizer during normal operation and during boilout/cleaning procedures.

Water treatment & cleaning procedure

1. Do not use peroxides (H_2O_2) or Chlorine Dioxide (ClO_2). At normal concentrations the biocidal effects of peroxide are not great enough to destroy the bacteria within a pasteurizer, and chlorine dioxide is too volatile to control. They both are highly detrimental to polypropylene chains at elevated temperatures.
2. Halogen-based Oxidizing Biocides (such as Chlorine and Bromine) are some of the most commonly used within pasteurizers. However, they could damage polypropylene chains at elevated concentrations. A dosing range between 0.5 – 2.0 ppm is typically sufficient to keep biological growth in check, and reduces the premature aging effect on the chain. The lowest possible concentration that controls the biology should be used (determined through onsite testing), and ideally an online Chlorine Analyzer or Redox Electrode should be used to guarantee the oxidizing agent is properly dosed.
3. Consider using elevated temperatures and biodispersants (surfactants) for boilouts, as opposed to elevated temperature and an increased concentration of biocide. Most bacteria cannot survive in an environment greater than 140°F (60°C) for over one hour.
4. Schedule boilouts as infrequently as possible. Use high-pressure water spray to dislodge large masses of biology once the pasteurizer has been properly sanitized.
5. Ensure proper coverage of spray nozzles within pasteurizers to reduce “dead spots” in corners or areas where no treatment is possible. These areas oftentimes harbor a perfect environment for biology to flourish and will not be affected by increased chemical dosing – no matter how rigorous – since the biocide never actually reaches the mass.
6. If white mineral deposits cause wear on the eyes and pins, the cause could be Hard Water as opposed to chemical attack. A water softener may be needed in the pasteurizer to reduce the amount of calcium carbonate scale on the chain. This can lead to premature chain elongation.

✓ In applications where high chemical dosing is required either by regional regulations or by biological necessity, we recommend considering either our Rexnord® USP material (ultra-stabilized polypropylene) or our Rexnord Fortrex chain to optimize chain life. Contact your local Rexnord Application Engineering representative for additional information.

Rexnord® Pasteurizer, Warmer, Cooler Chain Application Form

• Page 1

Date _____

Customer (Name, Location) _____

Contact (Name, Phone Number, E-Mail Address) _____

End User (Name, Plant Location) _____

Line Number or Description _____

Rexnord Account Executive _____

Fill in all information as completely as possible. For preliminary belt & sprocket selection, fill in page 1. For Detailed Recommendations, also fill in Page 2.

PRODUCTS*

Number	Product	Container	Diameter	Height	Weight	Product Rate	&/OR	Belt Speed
	(Beer, Juice, etc.)	(Can, Glass, PET)	(in)	(in)	(lb)	(Containers / Minute)		(FPM)
1								
2								
3								

*If additional space is required, please provide additional product information on separate sheet.

MACHINE DESCRIPTION

Type of Machine (pasteurizer, warmer or cooler)	
Machine Length (Distance between Shaft Centers (ft))	
Single or Double Deck?	
1 or 2 Drives per Deck?	Horsepower Each (HP):
Outboard Bearing Spacing (in)	
# of Belts per Deck (1 or 2)	
# of Drive Shafts per Deck (1 or 2)	

Belt	Carry Way:		Return Way:	
Conveyor	Wear Strip Material (UHMWP or SS):		Style: Rollers or Shoes:	
Bed			Roller or Shoe Material (UHMWP, PVC or SS):	

TEMPERATURE ZONE

Flow Through Machine	Temperature Zone		
	Zone No.	Length (ft)	Temp. (°F)
Infeed	1		
	2		
	3		
	4		
	5		
	6		
	7		
	8		
	9		
Discharge	10		

Fill in all that apply. If additional space is required, please include on separate sheet.

CHEMICAL USED:

- Provide list of all chemicals used, including material safety data sheet and concentrations
- Provide descriptions of cleaning/boil-out procedure

Belt	(Fill in as much information as possible, especially if for retrofit or replacement**on existing machine)		
	Belt Manufacture (if Known)		Belt Open Area (if known)
	Belt Number (if known)		Belt Pitch (pin to pin) (in)
	Belt Style (Raised Rib or Open Top)		Belt Thickness (in)
	Belt Width		Sprocket Number of Teeth
	Track Width for Belt (in)		OR Sprocket Pitch Diameter (in)

**If retrofit from other than MatTop Chain or Belt (E.G. Walking Beam, Wire Mesh, ect.), Provide any other necessary details.

Rexnord® Pasteurizer, Warmer, Cooler Chain Application Form

• Page 2

Date _____

Customer (Name, Location) _____

Contact (Name, Phone Number, E-Mail Address) _____

End User (Name, Plant Location) _____

Line Number or Description _____

Rexnord Account Executive _____

Fill in all information as completely as possible. For preliminary belt & sprocket selection, fill in page 1. For Detailed Recommendations, also fill in Page 2.

MACHINE DESCRIPTION (Additional details, provide drawings or sketches, if available)

For single deck or lower deck, distance
from bottom of return rollers / shoes to top
of highest water level in tanks _____

If double deck, distance from top of bottom
belt to bottom of upper return rollers or shoes _____

Belt	Carry Way:	Return Way:
Conveyor	Style of track (In-line or Cheveron / Roller Shoe)	If return inside or below the machine?
Bed	Spacing between carryway wearstrips (in)	
	If roller or shoe, radius & spacing (in)	

Return Roller or Shoe Details (if know)

Flow through Machine	Position	Type: Roller or Shoe***	Roller or Shoe Radius (in)	Return Roller or Shoe Spacing (ft)
Infeed	NA	NA	NA	NA
	1			
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	9			
	10			
Discharge	NA	NA	NA	NA

NOTES

- In-line = parallel to belt travel
- Roller or shoes are not normally recommended for carryways due to possible container instability.
Review with Rexnord.

Fill in all that apply. If additional space is required, please include on separate sheet.

***** Some returns use a combination of rollers and shoes.**

Shafting	Infeed End	Discharge End
	Type (square or round)	Type (square or round)
	If round, 1 or 2 keyways for center sprockets	If round, 1 or 2 keyways
	Tail shaft size (square or diameter) (in)	Drive shaft size (square or diameter) (in)
	Total # of bearings on tail end	Total # of bearings on drive end
		If dual drive shaft, are they coupled together in the middle? (Yes or No)
Transfer	Is machine layout "C" shaped or "Z" shaped?	
	Infeed End	Discharge End
	Conveyor chain (SS or Plastic TT, or MT)	Conveyor chain (SS or Plastic TT, or MT)
	Conveyor Chain Number	Conveyor Chain Number
	Number of lanes of chain	Transfers (Finger plates, DTS or DTS-C)
	Transfers (Finger plates, DTS or DTS-C)	Overhead self-clearing mechanism (Yes or No)

If possible, provide detailed sketches or drawings of infeed and discharge areas.



World Class Customer Service

For more than 100 years, the dedicated people of Rexnord have delivered excellence in quality and service to our customers around the globe. Rexnord is a trusted name when it comes to providing skillfully engineered products that improve productivity and efficiency for industrial applications worldwide. We are committed to exceeding customer expectations in every area of our business: product design, application engineering, operations, and customer service.

Because of our customer focus, we are able to thoroughly understand the needs of your business and have the resources available to work closely with you to reduce maintenance costs, eliminate redundant inventories and prevent equipment down time.

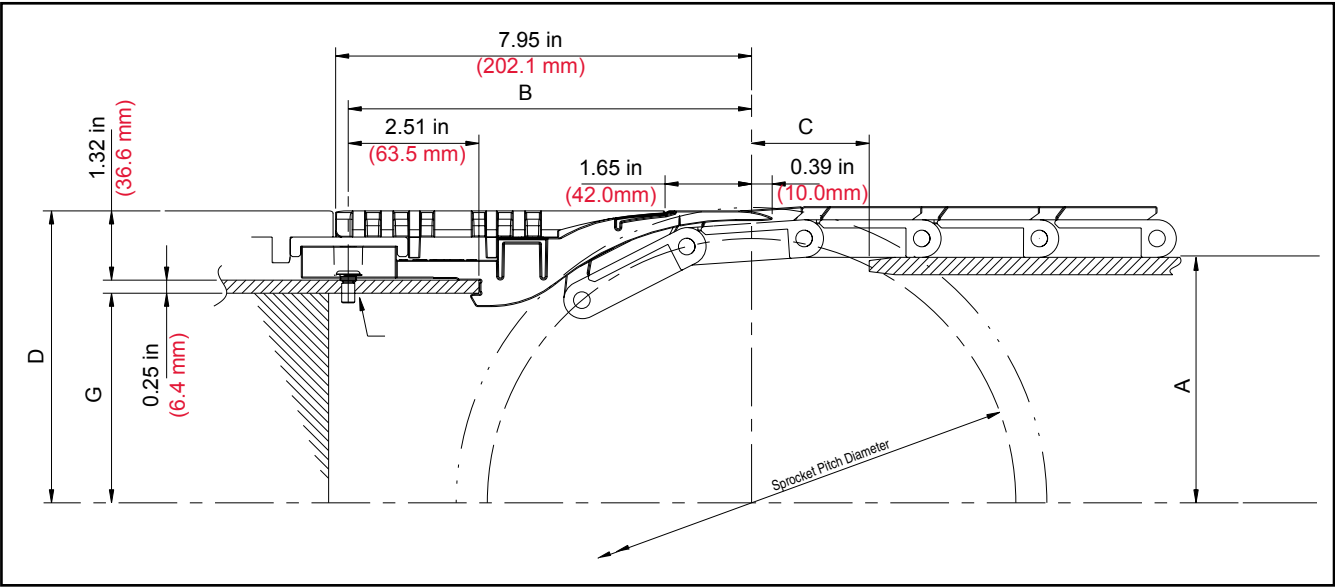
Rexnord represents the most comprehensive portfolio of power transmission and conveying components in the world with the brands you know and trust.



CONVEYOR DESIGN RECOMMENDATIONS

Sprocket Location - 5997

Rexnord® DTS®-C (Dynamic Transfer System) – Used with 5997 MatTop® Chains



Shaft Drop with 5997 MatTop Chain Series and DTS-C

5997 MatTop Chain with DTS-C														
Sprocket				Dimensions										
Chain Number	No. of Spkt. Teeth	Eff. No. of Teeth	Pitch Diameter (PD)		A		B		C		D		G	
			in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
5997	9	9	6.57	166.9	2.93	74.4	7.717	196.0	2.25	57.2	3.84	97.5	2.26	57.5
	12	12	8.69	220.7	3.99	101.3					4.90	124.3	3.32	84.3
	14	14	10.11	256.8	4.69	119.1					5.60	142.3	4.03	102.3

BELT SLACK REMOVAL

Belt slack removal should be done at the discharge end of the machine.

- Remove the guide rails from the “inside” of the tunnel on both sides of the DRIVE END.
- Looking at the sides of the machine on the Drive end, there should be a coupling with a plug. Remove the plug from the coupling on both sides of the machine. You should be able to see the sides of the mat through these openings.
- Remove the fan guard from the main drive. With your fingers rotate the motor fan blade to make the belt travel toward the infeed or discharge end. Do this to ensure that a Belt Lace is lined up directly with the hole.
- Cut two 2 x 4 boards 12” long”. Lay one each on the edge of the belt on each side about 4” back from the coupling opening toward the infeed/idle end. C clamp each board to deck of the machine to ensure the Main Mat cannot move. We would recommend (2) clamps on each board on each side.
- Once clamped, you can pull the lace/pin from the belt out of the coupling on the side. Once the pin/lace is removed, the mat is now open.
- Using the motor fan blade, rotate such that the belt is drawn from the discharge end to the infeed end. Continue to do this until you have enough force to move the C clamps. Continue to rotate the fan and at the same time have someone on each side on the machine to pull the belt toward the infeed end in.
- You will then need to pull the lace out of the slack portion, remove the slack, and then put the lace back in the belt thus splicing the two sections together.
- Remove clamps and boards, install guide rails, plate and fan cover.

Tools needed:

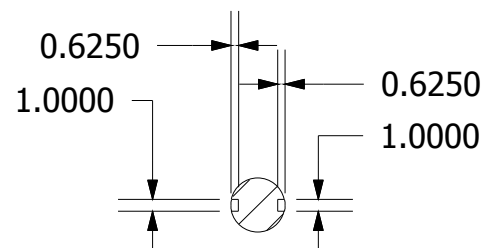
4-C clamps

Socket to remove Fan Motor Cover on Gearbox motor

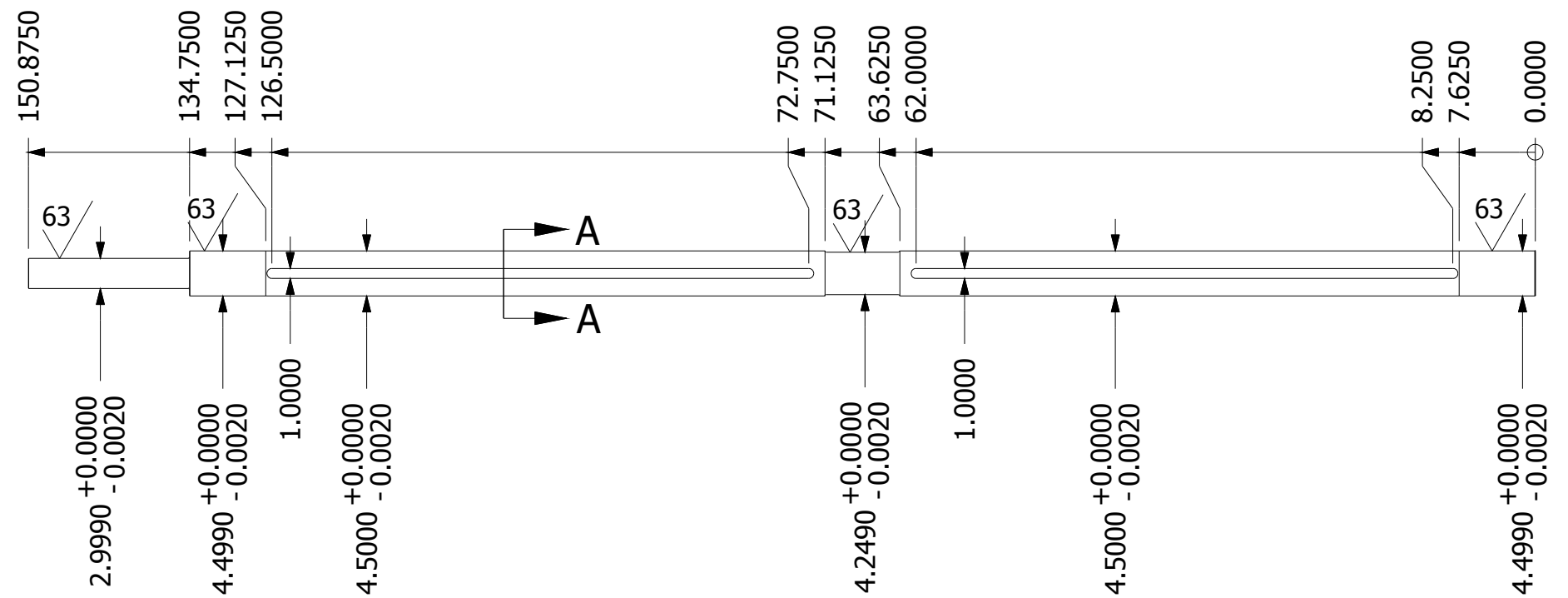
2 wood blocks as described

Needle nose pliers to grab the lace

Wood Screw to screw into the side of the lace to pull

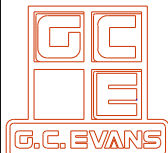


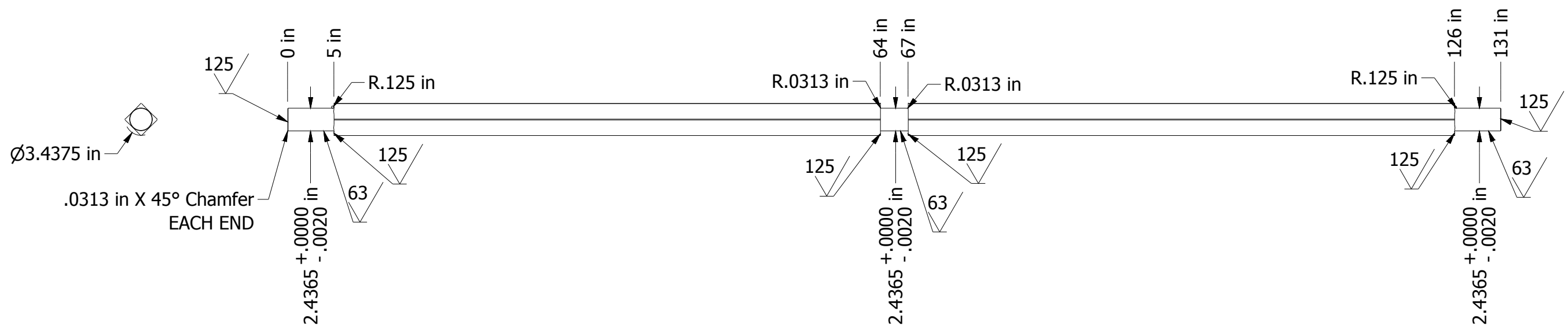
SECTION A-A
SCALE 1/16



SIDE VIEW

MATERIAL: 4 1/2" RND SHAFT MATERIAL

	SCALE: 1/12		DRAWN BY: GPM		TITLE: 4 1/2" RND DIS. SHAFT, SK6382 SEW DRIVE, 10' MACHINE
	DATE:5/29/2019		APP. JDJ		
	MAT'L: Stainless Steel			REV. 0	
	This drawing is the property of G. C. Evans Sales & Mfg. Co.Inc. It is loaned upon the express condition that it shall not be copied or reproduced in any manner, that it shall not be submitted to others for examination without the consent of this company, that it shall not be used in any other way detrimental to the interest of G. C. Evans Sales & Mfg. Co.Inc., and that it shall be returned upon demand.				
	PART NO:				
					PB958376



	SCALE: 1/12	DRAWN BY: GPM		TITLE: INFEEED SHAFT, PASTEURIZER 2 1/2" SQUARE 10'
	DATE:5/24/2019	APP. JDJ		
	MAT'L: Stainless Steel		REV. 0	
	This drawing is the property of G. C. Evans Sales & Mfg. Co.Inc. It is loaned upon the express condition that it shall not be copied or reproduced in any manner, that it shall not be submitted to others for examination without the consent of this company, that it shall not be used in any other way detrimental to the interest of G. C. Evans Sales & Mfg. Co.Inc., and that it shall be returned upon demand.			
				PART NO:



G.C. Evans Sales & Mfg Co Inc.

Section 4-IV

Fans

**Model P-1048SD
Pasteurizer**

OPERATING & MAINTENANCE INSTRUCTIONS AND PARTS LIST

for

PB - Cast Aluminum Pressure Blowers
SPB - Stamped Steel Pressure Blowers
PBS - Fabricated Steel Pressure Blowers
LM - Volume Blowers

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I. General Safety Notes	Page 2
II. Receiving	Page 2
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V. Operation.....	Page 3
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VII. V-belt Drives.....	Pages 4 & 5
VIII. Bearing Maintenance.....	Pages 4 & 5
IX. Warranty.....	Page 5
X. Ordering Replacement Parts	Page 6
XI. Trouble Shooting	Page 6
XII. Assembly Drawings	Pages 7 & 8

NOTICE

If fan will not be put into operation within 30 days, obtain long-term storage instructions from our website (www.cincinnati-fan.com) or your local Cincinnati Fan Sales Office.

⚠ DANGER

ALL FANS AND BLOWERS SHOWN HAVE ROTATING PARTS AND PINCH POINTS. SEVERE PERSONAL INJURY CAN RESULT IF OPERATED WITHOUT GUARDS. STAY AWAY FROM ROTATING EQUIPMENT UNLESS IT IS DISCONNECTED FROM ITS POWER SOURCE AND ALL ROTATING PARTS HAVE STOPPED MOVING.

READ ALL OPERATING INSTRUCTIONS CONTAINED HEREIN
BEFORE INSTALLING EQUIPMENT.

⚠ DANGER

NO GUARANTEE OF ANY LEVEL OF SPARK RESISTANCE IS IMPLIED BY SPARK RESISTANT CONSTRUCTION. IT HAS BEEN DEMONSTRATED THAT ALUMINUM IMPELLERS RUBBING ON RUSTY STEEL MAY CAUSE HIGH INTENSITY SPARKS. AIR STREAM MATERIAL AND DEBRIS OR OTHER SYSTEM FACTORS MAY ALSO CAUSE SPARKS.



PART # 01111W
 CATALOG #PMA-900
 SUPERSEDES: PMA-793

7697 Snider Road, Mason, Ohio 45040-9135

(513) 573-0600

I. GENERAL SAFETY NOTES

1. Rotating parts including shaft and V-belt drives must be properly guarded to prevent personal injury.
2. Electrical wiring must be accomplished by a qualified electrician in accordance with all applicable codes.
3. Care should be taken:
 - Not to run fan above its safe speed
(See Performance Tables in Sales Catalog or call CF sales office).
 - Not to operate in excessive temperatures
(See limitations in Sales Catalog or call CF sales office).
 - Not to operate in dangerous environments.
 - Read all instructions carefully.

II. RECEIVING

Receiving Inspection

When unit is received, inspect immediately for damaged or missing parts. Even though all units are carefully inspected and prepared for shipment at the factory, rough handling en route may cause concealed damage or cause nuts, set screws, bolts or locking collars to work loose. Be certain all fasteners are tightened securely. Rotate wheel by hand to verify that it rotates freely and that there are no obstructions.

Table #1

TORQUE VALUES FOR SPLIT TAPER BUSHINGS	
Bushing Size	MINIMUM RECOMMENDED TORQUE (INCH-LBS)
H	95
B & P	192
Q & R	350

Table #2

SET SCREW TORQUE VALUES		
SET SCREW SIZE		MINIMUM REQUIRED TORQUE (INCH-LBS)
Diameter & No. of Threads/Inch	Hex Size Across Flats (Allen Wrench)	
1/4-20	1/8"	65
5/16-18	5/32"	165
3/8-16	3/16"	228
7/16-14	7/32"	348
1/2-13	1/4"	504
5/8-11	5/16"	1104

NOTE: If wheel set screws are loosened and/or wheel is removed from shaft, set screws *must* be replaced. Set screws cannot be used more than once. Use knurled, cup point set screws with a locking patch.

Inspect all shipments carefully for damage. **The receiver must note any damage on the carrier's bill of lading and file a claim immediately with the freight company in case of damage.** Keep a record of all equipment received, including inspection details and date of receipt because of the possibility of partial shipments.

III. HANDLING

Handle your equipment with care. Some fans are provided with lifting lugs or holes for easy handling. Others must be handled using nylon straps or well-padded chains and cables which protect the fan's coating and housing. Spreader bars should be used when lifting large parts.

Centrifugal fans are best lifted using one strap under the fan's scroll and another strap around the bearing base. **DO NOT LIFT CENTRIFUGAL FANS BY THE FAN SHAFT, WHEEL, FLANGES, INLET SUPPORT OR MOTOR EYE BOLT.**

NOTICE

If fan will not be put into operation within 30 days, obtain long-term storage instructions from our website (www.cincinnati-fan.com) or your local Cincinnati Fan Sales Office.

IV. GENERAL INSTALLATION INSTRUCTIONS

Foundations

Fan foundation must be flat, level and rigid. Where foundation is not completely flat, shims must be placed under fan support at each anchor bolt as required. Bolting fan to an uneven foundation distorts alignment and causes vibration.

Structural steel foundations should be heavily cross-braced for load support.

V. OPERATION

Before Connecting Power

1. Inspect all fasteners and retighten if necessary:
 - a. Foundation bolts.
 - b. Set screws in fan and wheel and V-belt drive (See Tables #1 & #2 on preceding page).
 - c. Housing, bearing and motor mounting.
2. Any inspection doors should be tight and sealed.
3. Bearings should be checked for alignment and lubrication (See Bearing Maintenance, pages 4 & 5).
4. Turn rotating assembly by hand to insure that it does not strike housing. If the wheel strikes the housing, the wheel may have moved on the shaft or the bearings may have shifted in transit. Correction *must* be made prior to start up.
5. Check motor to insure proper speed and electrical characteristics.
6. Check V-belt drive for alignment and correct belt tension.
7. After wiring, energize motor for one second to check for proper rotation.

VI. GENERAL MAINTENANCE

CAUTION

Before any maintenance or service is performed, assure that unit is disconnected or locked out from power source to prevent accidental starting.

The key to good fan maintenance is a regular and systematic inspection of all fan parts. Severity of the application should determine frequency of inspection. The components requiring service are generally the moving parts which include bearings, fan wheel, belts, sheaves and motor.

Cast Aluminum & Metal Parts

Cast aluminum and steel parts usually do not require maintenance during the life of the unit except painted metal surfaces that may require periodic repainting. In a severe, dirty operation, the wheel should be cleaned with a wire brush to prevent an accumulation of foreign matter that could result in fan unbalance. After cleaning wheel, inspect for possible cracks or excessive wear, which can cause unbalance. **DO NOT** operate a wheel that is cracked, chipped, has broken blades or excessive wear. **NOTE:** If wheel set screws are loosened and/or wheel is removed from shaft, set screws *must* be replaced. Set screws cannot be used more than once.

Belts on V-belt drive units require periodic inspection and replacement when worn. For multiple belt drives, belts should be replaced with matched sets.

Motor Maintenance

1. Disconnect or lock out power to motor.
2. Removing dust and dirt: Blow out open type motor windings with low pressure air to remove dust or dirt. Air pressure above 50 P.S.I. should not be used as high pressure may damage insulation and blow dirt under loosened tape. Dust accumulation can cause excessive insulation temperatures.
3. Lubrication: The motor bearings and the fan bearings on the belt drive fans should be greased at regular intervals. Motor manufacturers' greasing instructions and recommendations should be followed closely. Avoid the use of a pressure greasing system which tends to fill the bearing chamber completely. Do not overgrease. Use only 1 or 2 shots with a hand gun in most cases. Maximum hand gun rating 40 P.S.I. Rotate bearings during lubrication where good safety practice permits.
NOTE: On motors with non-regreasable, sealed bearings, no lubrication is required for the life of the bearings.

To prevent rusting of bearing parts, the motor shaft must be rotated at regular intervals (30 days) to assure these parts are well covered with oil or grease.

A WORD OF CAUTION ABOUT MOTORS

Using your hand to test the running temperature of a motor can be a very painful experience:

Normal body temperature	98.6° F
Threshold of pain caused by heat.....	120.0° F
Average temperature of hot tap water.....	140.0° F
Average temperature of hot coffee.....	180.0° F
Normal operating temperature of a fully loaded electric motor open type, 70° F ambient temperature	174.0° F

VII. V-BELT DRIVES

Care should be taken not to overtighten V-belt drive. Excessive belt tension overloads fan and motor bearings. It is much less expensive to replace belts worn from slippage than to replace bearings damaged from excessive loading.

Fans shipped completely assembled have had V-belt drive aligned at the factory. Alignment should be rechecked before operation as a precaution due to handling during shipment.

1. Be sure sheaves are locked in position.

2. Key should be seated firmly in keyway.
3. Place straight edge or taut cord across faces of driving and driven sheaves to check alignment. The motor and fan shafts must be parallel and V-belts must be at right angles to the shafts.
4. Start the fan. Check for proper rotation. Run fan at full speed. A slight bow should appear on slack side of belt. Disconnect power and adjust belt tension by adjusting motor on its sliding base. All belts must have some slack on one side.
5. If belts squeal at start up, they may be too loose.
6. When belts have had time to seat in the sheave grooves, then readjust belt tension (2-3 days).

Table #3 (See Bearing Maintenance, page 5.)

Conditions Around Bearing	Operating Temperature of Fan	**Greasing Intervals
Fairly Clean	up to 120 °F	6-12 months
	120°-160°F	2-3 months
	160°-200°F plus*	1-2 months
Moderate to Extremely Dirty	up to 160°F	1-2 months
	160°-200°F plus*	2-4 weeks
Cold Storage Room		every defrosting period or no more than 4 months
*For fan applications over 200°F: greasing intervals should be from several days to 2 weeks, depending on the temperature.		
**For vertical installations, greasing intervals should be twice as frequent as table values.		

The following greases, or one that is equivalent to the general description, are recommended for the following temperatures or excessive moisture applications.

Operating Conditions	Use Grease Equivalent to these Grades
Temperatures -65°F to 0°F	Esso-Beacon #325 (-65°F) Mobil Grease #28 (-65°F) Shell Oil Aeroshell No. 7 (-100°F)
General Description: Versatile multipurpose microgel thickened synthetic hydrocarbon grease with corrosion inhibitors, anti-oxidant additives, water resistance tendencies and EP characteristics.	

Temperature 0°F to 200°F inclusive (Also use for heavy condensation or direct splash of water)	Mobil Oil - Mobilux EP #2 Shell Oil - Shell Alvania EP #2 Chevron - Chevron SRI #2
General Description: Multipurpose NLGI#2 grease from lithium soap with EP characteristics, rust inhibitors, anti-oxidant additives and good water resistance tendencies.	

Temperatures over 200°F	Dow Corning-DC44 (400°F) (Not compatible with non-silicon based greases)
General Description: Versatile multipurpose microgel thickened synthetic hydrocarbon grease with corrosion inhibitors, anti-oxidant additives, water resistance tendencies and EP characteristics.	

V-belt drive assembly can be mounted as follows:

1. Clean motor and fan shafts. Be sure they are free from corrosive material. Clean bore of sheaves and coat with heavy oil for ease of shaft entry. Remove oil, grease, rust or burrs from sheave grooves.
2. Place fan sheave on fan shaft and motor sheave on its shaft. **Do not pound sheaves** on as this may damage bearings. Tighten sheaves per Table #1 or #2 on page 2.
3. Move motor on slide base so belts can be placed in grooves of both sheaves without forcing. Do not roll belts or use a tool to force belts over the grooves.
4. Align fan and motor shafts so they are parallel. The belts should be at right angles to the shafts. A straight edge or taut cord placed across the face of the sheaves will aid in alignment.
5. Tighten belts by adjusting motor base. Correct tension gives the best drive efficiency. Excessive tension causes undue bearing pressure.
6. Start the fan and run it at full speed. Adjust belt tension until only a slight bow appears on the slack side of the belts. If slippage occurs, a squeal will be heard at start-up. Eliminate this squeal by **disconnecting or locking out motor from power source** and then tightening up the belts.
7. Give belts a few days running time to become seated in sheave grooves, then readjust belt tension.

If the shafts become scratched or marked, carefully remove sharp edges and high spots such as burrs with fine emery cloth or honing stone. Avoid getting emery dust in the bearings.

Do not apply any belt dressing unless it is recommended by the drive manufacturer. V-belts are designed for frictional contact between the grooves and sides of the belts. Dressing will reduce this friction.

Belt tension on an adjustable pitch drive is obtained by moving the motor, not by changing the pitch diameter of the adjustable sheave.

VIII. BEARING MAINTENANCE

Sealed Bearings

Sealed for life bearings are pre-lubricated with the correct amount of manufacturer approved ball bearing grease, and are designed for application where relubrication is not required.

Relubricatable Bearings

The motor bearings and fan bearings on belt drive fans should be greased at regular intervals. Motor manufac-

turers greasing instructions and recommendations should be followed closely. Avoid the use of a pressure greasing system which tends to fill the bearing chamber completely. **Do not over grease.**

NOTE: On motors with non-regreasable, sealed bearings, no lubrication is required for the life of the bearing.

Table #3 (page 4) lists the time intervals between fan greasing to insure proper lubrication in adverse conditions of heat and dust. Use only 1 or 2 shots with a hand gun in most cases. Maximum handgun rating 40 P.S.I.

IX. WARRANTY

Cincinnati Fan & Ventilator Company warrants products of its own manufacture against defects of material and workmanship under normal use and service for a period of eighteen (18) months from date of shipment or twelve (12) months from date of installation, whichever occurs first.

This warranty does not cover ordinary wear and tear, abuse, misuse, overloading, negligence, alteration or systems and/or materials not of Seller's manufacture. Expenses incurred by Buyer(s) in repairing or replacing any defective product will not be allowed except where authorized in writing and signed by an officer of the Seller.

The obligation of Seller under this warranty shall be limited to repairing or replacing F.O.B. Seller's plant, or allowing credit at Seller's option. This warranty is expressly in lieu of all other warranties expressed or implied including the warranties of merchantability and fitness for use and of all other obligations and liabilities of the Seller. The Buyer acknowledges that no other representations were made to him or relied upon him with respect to the quality or function of the products herein sold.

On equipment furnished by the Seller, but manufactured by others, such as motors, Seller extends the same warranty as Seller receives from the manufacturer thereof. Repairs for motors should be obtained from nearest authorized motor service station for the make of motor furnished. All motors used are products of well-known manufacturers with nationwide service facilities. Check the yellow pages of your telephone directory for the location of the nearest service shop.

Cincinnati Fan & Ventilator Company assumes no responsibility for material returned to our plant without our prior written permission.

X. ORDERING REPLACEMENT PARTS

Replacement or spare parts may be ordered through your local Cincinnati Fan representative. (Refer to drawings that begin on page 7.) The following information should accompany parts orders:

1. Motor horsepower, frame size, motor speed, voltage, phase, cycle and enclosure. Motor manufacturer's model number from motor nameplate.
2. Fan Speed (if V-belt driven).
3. Fan serial **and** model numbers from the **fan** nameplate and a complete description of the part.

An adequate stock of repair parts is maintained where possible. **If your fan is vital to production or to plant operation, it is advisable to have all spare parts on hand to minimize downtime.**

XI. TROUBLE SHOOTING

In the event that trouble is experienced in the field, the following are the most common fan difficulties. These points should be checked in order to prevent needless delay and expense.

1. CAPACITY OR PRESSURE BELOW RATING

- a. Incorrect direction of wheel rotation.
- b. Speed too slow.
- c. Dampers not properly adjusted.
- d. Poor fan inlet or outlet conditions (elbows, restrictions).
- e. Air leaks in system.
- f. Damaged wheel.
- g. Total resistance of system higher than anticipated.
- h. Wheel mounted backwards on shaft.
- i. Fan not properly selected for a high temperature and/or high altitude application.

2. VIBRATION AND NOISE

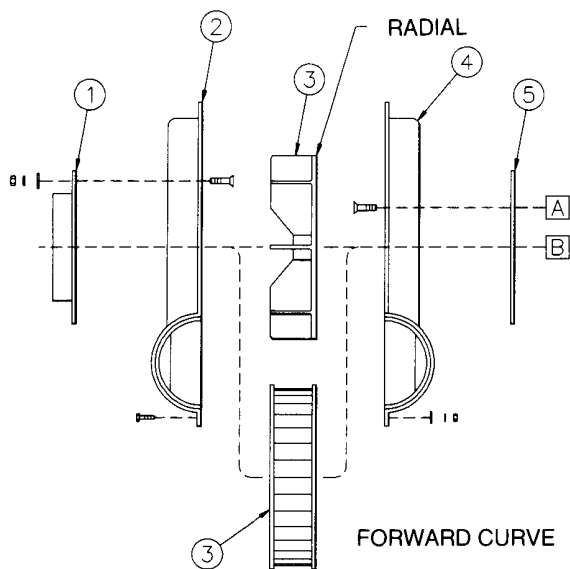
- a. Misalignment of bearings, coupling, wheel or V-belt drive.
- b. Unstable foundation or supports.
- c. Foreign material in fan causing unbalance.
- d. Worn bearings.
- e. Damaged wheel or motor.
- f. Broken or loose bolts and set screws.
- g. Bent shaft.
- h. Worn coupling.
- i. Fan wheel or drive unbalanced.
- j. 120 cycle magnetic hum due to electrical input. Check for high or unbalanced voltage.
- k. Fan delivering more than rated capacity.
- l. Loose dampers.
- m. Speed too high or fan rotating in wrong direction.
- n. Vibration transmitted to fan from some other source.

3. OVERHEATED BEARINGS

- a. Check bearing lubrication.
- b. Poor alignment.
- c. Damaged wheel or drive.
- d. Bent shaft.
- e. Abnormal end thrust.
- f. Dirt in bearings.
- g. Excessive belt tension.

4. OVERLOAD ON MOTOR

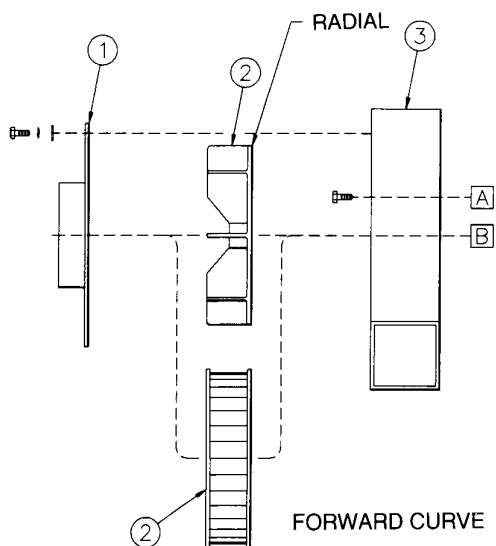
- a. Speed too high.
- b. Fan over capacity due to existing system resistance being lower than original rating.
- c. Specific gravity or density of gas above design value.
- d. Wrong direction of wheel rotation.
- e. Shaft bent.
- f. Poor belt alignment.
- g. Wheel wedging or binding on fan housing.
- h. Bearings improperly lubricated.
- i. Motor improperly wired.
- j. Defective motor. Motor must be tested by motor manufacturer's authorized repair shop.



**MODELS PB, SPB & LM
HOUSING/WHEEL COMPONENTS
All Arrangements**

- *1. Inlet side plate (if required).
- *2. Housing, inlet side.
- *3. Wheel (Radial or Forward Curve).
- 4. Housing, drive side.
- 5. Drive side plate (if required).

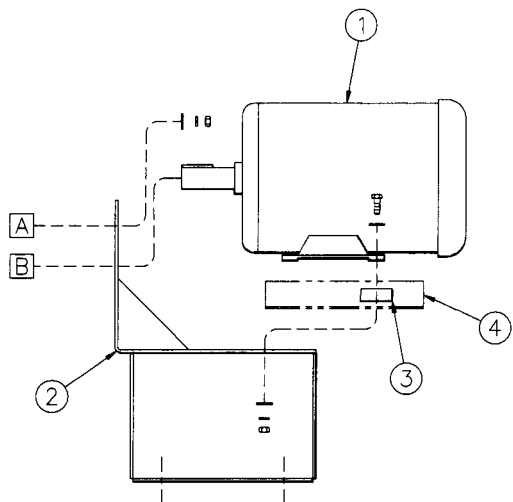
* NOTE: Rotation determined by viewing blower from drive side, not looking into inlet.



**MODELS PBS
FABRICATED HOUSING/WHEEL
COMPONENTS
All Arrangements**

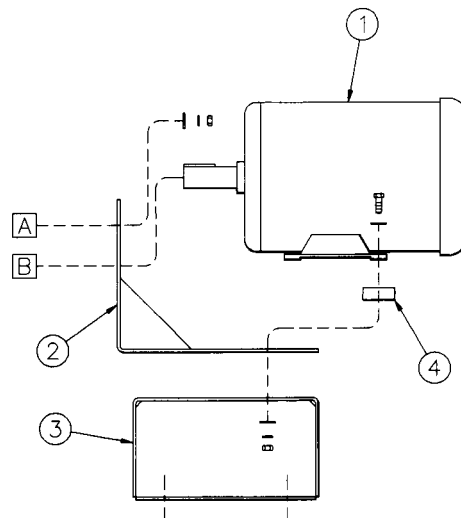
- *1. Inlet side plate.
- *2. Wheel (Radial or Forward Curve).
- 3. Housing, non-reversible (CW or CCW).

* NOTE: Rotation determined by viewing blower from drive side, **not** looking into inlet.



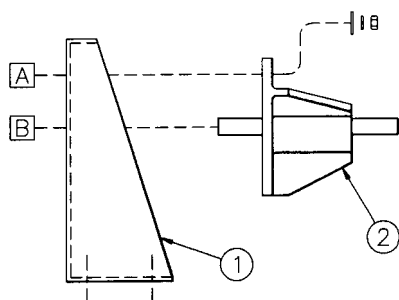
**Arrangement 4 - Type 1
BASE COMPONENTS**

- 1. Motor.
- 2. Combo base.
- 3. Riser blocks (if required).
- 4. Riser base, 1-3/4" (if required).

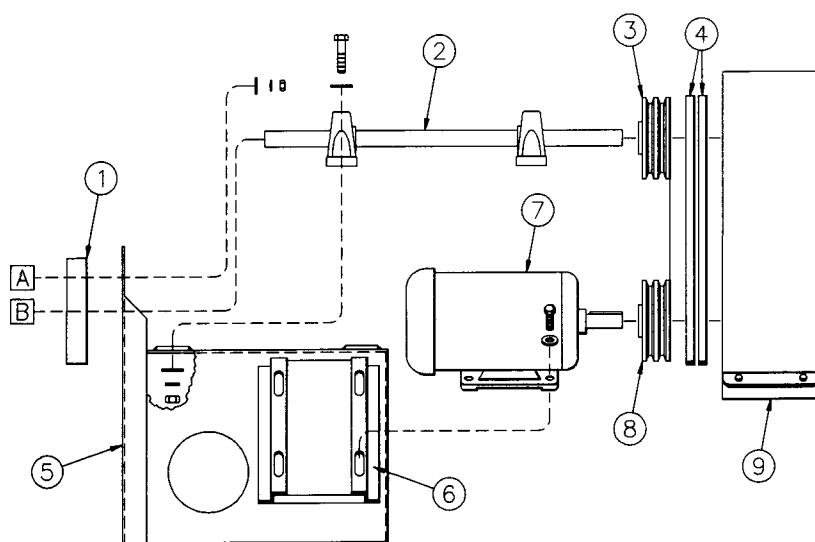


**Arrangement 4 - Type 2
BASE COMPONENTS**

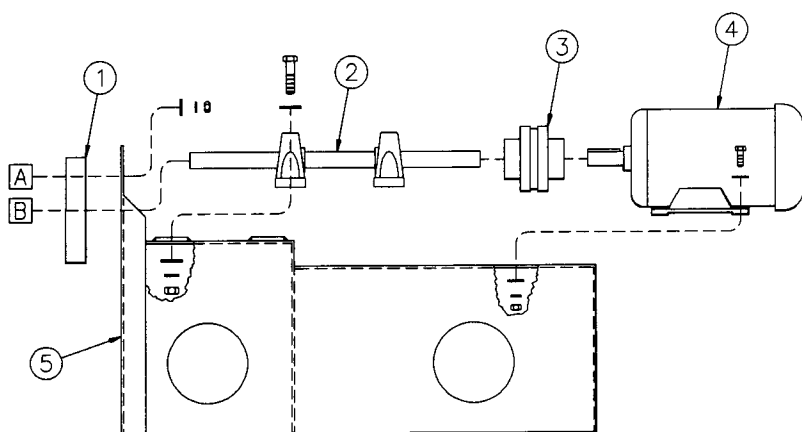
- 1. Motor.
- 2. Angle bracket (if required).
- 3. Bottom base.
- 4. Riser base (if required).

**Arrangement 2****BASE COMPONENTS**

1. Upright base.
2. Shaft/bearing assembly.

**Arrangements 1 & 9****BASE COMPONENTS**

1. Spacer ring (not required for PBS blowers).
2. Shaft/bearing assembly.
3. Fan sheave. (Arr. 9 only).
4. Belt(s). (Arr. 9 only).
5. Bearing base.
6. Motor slide base. (Arr. 9 only)
7. Motor. (Arr. 9 only)
8. Motor sheave. (Arr. 9 only).
9. Belt guard. (Arr. 9 only).

**Arrangement 8****BASE COMPONENTS**

1. Spacer ring (not required for PBS blowers).
2. Shaft/bearing assembly.
3. Shaft coupling.
4. Motor.
5. Base.



Recommended SAFETY PRACTICES

for Users and Installers
of Industrial and Commercial Fans
AMCA Publication 410-96

FOREWORD

i. This publication has been prepared by the Air Movement Division of the Air Movement and Control Association International, Inc. (AMCA International). The information contained in this publication has been derived from many sources. The suggestions made necessarily should be general in their meaning and cannot be applied literally to all specific situations or conditions.

ii. **The safe installation and operation of fans is the responsibility of the system designer, installer, maintainer, and user.** From the initial system design through the life of the equipment, safety should be a foremost consideration. Some areas which require some special attention include system design, layout and construction, fan performance specification, foundation and installation details, storage procedures, start-up and commissioning procedures, operation, maintenance, and repair. Specific safety requirements are mandated by federal, state, and local codes. *Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans* is published by AMCA International for assistance. System designers, installers, maintainers, and users should consult and properly comply with all applicable codes and guidelines.

iii. The safety recommendations contained herein are intended to assist designers, installers, maintainers, or other users of air moving devices in the safe operation and use of the devices mentioned. These recommendations do not represent the only methods, procedures, or devices appropriate for the situations discussed. Caution should be used at all times when working in or around moving parts.

iv. AMCA International disclaims any and all warranties, expressed or implied, regarding the products sold by the manufacturer with which this booklet has been provided. Further, AMCA International recommends that competent personnel be consulted in deciding what is the preferred or recommended safety procedure in a particular instance where the guidelines contained in this booklet are unclear or in any way incomplete.

v. AMCA International has offered the information within this booklet to assist in the safe operation, maintenance, and use of the products sold by members of AMCA International. In so doing, AMCA International does not assume any legal duties of the designer or manufacturer to instruct or warn about their product. AMCA International expressly disclaims liability for any injury or damage arising out of the operation or use of the product or the guidelines contained herein.

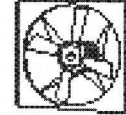
vi. These recommended safety practices were adopted by the AMCA International membership on April 28, 1996.



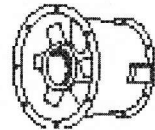
Power Roof
Ventilator



Wall Exhauster



Propeller Fan



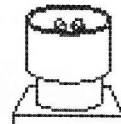
Axial Fan

1. INTRODUCTION

1.1 Fans and other air moving devices are made in a wide variety of types, sizes, and arrangements. This publication addresses the proper use and installation of industrial and commercial fans. It is not intended to address residential and consumer fans.



Centrifugal
Fan



Upblast Roof
Exhauster

1.2 Various "size" factors are important when assessing potential for injury; some factors are: diameter of impeller (wheel, rotor, propeller), rotational inertia, voltage, and current.

1.3 This guide is intended to assist in the safe installation of air moving equipment and to warn operating and maintenance personnel of the commonly recognized hazards associated with this equipment.

1.4 **Handling and installation should always be performed only by experienced and trained personnel who are aware of the hazards associated with rotating equipment. Failure to comply with these practices may result in death or serious bodily injury.** In addition to following the manufacturer's installation instructions, care should be taken to ensure compliance with specific safety requirements mandated by federal, state, and local codes. Industry safety standards and practices published by AMCA International and by other recognized agencies and associations should be consulted and followed where applicable.

2. PERSONNEL SAFETY ACCESSORIES

2.1 GENERAL

2.1.1 Protective devices are incorporated as standard construction on some types of fans but on many fans, these devices are offered as optional accessories. This is done because the need for the devices and the design required will frequently depend upon the type of system, fan location, and operating procedures being employed. Proper protective safety devices; company safety standards; specific safety requirements mandated by federal, state, and local codes; and industry safety standards and practices published by AMCA International and by other recognized agencies and associations should be determined by the user, who should specify and obtain the appropriate devices from the fan manufacturer or others, and should not allow operation of the equipment without them. Examples of available devices include the following:

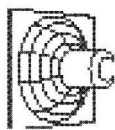
2.2 FAN GUARDS

2.2.1 All fans have moving parts which require guarding in the same way as other moving machinery. Fans located less than seven (7) feet above the floor require special consideration. Specific safety requirements should comply with mandated federal, state, and local codes; and industry safety standards and practices published by AMCA International and by other recognized agencies and associations should be followed.

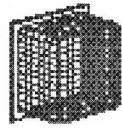
2.2.2 Roof-mounted fans and other fans which are not generally accessible may not require safety guards which might otherwise be appropriate. Where accessibility to these fans is occasional or infrequent, the expense of permanent guarding may be reduced through the use of lockout switches and suitable warnings. In such cases, maintenance personnel



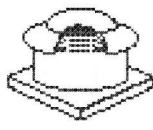
should engage the lockout switch before undertaking any maintenance or repairs. As is the case with other machinery involving moving parts, common sense and caution will preserve personal safety.



Industrial Type Guard
For Propeller Fan



Maximum Safety
Guard for Propeller Fan



Screen on Roof
Ventilator

2.3 INLET AND OUTLET GUARDS

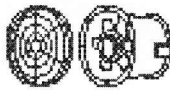
2.3.1 Axial and centrifugal fans are often connected directly to ductwork which will prevent contact with the internal moving parts; when an exposed inlet or outlet represents a hazard, a suitable guard should be installed.



Centrifugal Fan
Protected by Ductwork



Inlet or Outlet Guard
on Centrifugal Fan



Guard for Axial Fan With
Non-Ducted Inlet or Outleg

2.4 DRIVE GUARDS

2.4.1 Fans may be driven directly from the motor shaft or through a belt drive. Where the bearing assembly, rotating shaft, sheaves, or belts are exposed, a suitable guard may need to be provided. Some example guards are shown below.



Drive Coupling
Guard



Heat Slinger Guard
(Shaft and bearing
guard omitted for clarity)



Shaft and Bearing
Guard

2.4.2 Drive guards may be required for tubular centrifugal or axial fans to cover the exposed drive sheave and belts outside the fan housing.



Drive Guard - Axial Fan

2.4.3 A typical centrifugal fan drive guard may vary with the arrangement. Safety guards should be used when drive systems are accessible to personnel. In restricted areas, omission of the back cover may be acceptable.



Drive Guard -
Centrifugal Fan

2.4.4 Dampers and their linkage may operate suddenly without warning at high speeds. Dampers and their linkage contain pinch points which should be identified and guarded.

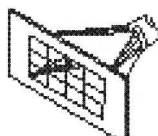
3. HIDDEN DANGERS

3.1 GENERAL

3.1.1 In addition to the obvious hazards associated with the moving parts of rotating machinery, fans present additional potential hazards that are not so obvious and should be considered by the system designer and user for safe operation.

3.2 SUCTION AND AIR PRESSURE

3.2.1 Fans operate by creating suction and air pressure which can be hazardous. Solid objects can be drawn into a fan's inlet and then become dangerous projectiles when they are exhausted through the fan's outlet. **Solid objects can also**



Special Purpose
Intake Screen

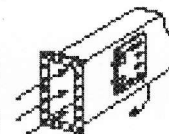
cause fan failure or impeller failure due to imbalance or damage to the impeller blades. Personnel in close proximity to a fan inlet can be overcome by the suction, and drawn into the fan.

3.2.2 Whenever there is a possibility that solid objects can be drawn into a remote intake, the intake should be guarded at all times. Before a guard is removed, the fan should be disconnected and the power supply locked out.

3.2.3 Where fans are installed over an occupied area, safety guards should be provided to prevent dropped objects from entering this area during installation and maintenance.

3.2.4 Access doors to a fan or duct system should never be opened while the fan is operating or coasting to a stop. On the downstream (or pressure) side of the system, releasing the door with the system in operation may result in an explosive opening. On the upstream (or suction) side, the inflow may be sufficient to draw in tools, clothing, and other materials. The power supply should always be locked out prior to accessing a fan or ductwork.

3.2.5 Fan design sometimes requires access doors to be supplied with internal components such as a plug to fill a hole in the fan casing. These doors can often be heavy and difficult to handle. Care should be exercised when opening, removing, and installing these components.



Bolted Access Door in
Duct

3.3 WINDMILLING

3.3.1 Even when the power supply is locked out, fans may cause injury or damage if the impeller is subject to "windmilling" which is the turning of the impeller and drive components due to a draft in the system. To guard against this hazard, the impeller should be secured to physically restrict rotational movement.

3.4 TEMPERATURE

3.4.1 Many fans, fan motors, and fan components run at temperatures that could burn someone who comes in contact with the hot areas, including discharged or leaking gases. If this potential hazard is present, steps should be taken so that personnel working near the fan are aware of the danger and can exercise caution.

3.5 FAN NOISE AND ENVIRONMENT

3.5.1 Some fans can generate sound that could be hazardous to exposed personnel. Sound pressure can be measured in the field, but obtaining accurate data is difficult. The environment in which the fan operates can impact the ability to obtain accurate fan sound readings. Consult the manufacturer for fan sound data. It is the responsibility of the system designer, installer, user, and maintainer to comply with specific safety requirements mandated by federal, state, and local codes; and to follow industry safety standards and practices published by AMCA International and by other recognized agencies and associations, regarding personnel safety from exposure to fan noise associated with use and exposure to equipment.



Hearing Protection

3.6 STROBOSCOPIC EFFECT

3.6.1 The stroboscopic effect of certain lights in combination with certain fan speeds may cause a rotating assembly to appear stopped. In these cases, irregular markings can be placed on the moving parts to prevent this type of effect. Personnel should be warned that the fan may be in motion even if it appears not to be.

3.7 SPECIAL PURPOSE FANS AND SYSTEMS

3.7.1 The hidden dangers associated with Special Purpose Fans used in special systems are covered in Section 6.

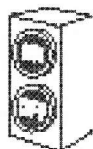
4. POWER ISOLATION

4.1 Every fan should be installed with a suitable device allowing it to be completely disconnected or isolated from the power supply.

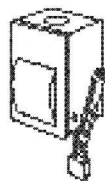
4.2 Many fans are started by remote switches or push-buttons, by interlocks with other equipment, or by automatic controls. Before performing any maintenance, inspection, or other activity which will require removal of guards, ductwork, access doors, etc., or exposure of moving parts, the fan power supply should be locked out and the fan tagged out of service.



4.3 In some installations other equipment, such as gas burners, may be interlocked with the fan so that disconnecting the fan will automatically shut off the burner or other device. Maintenance on systems of this type should be performed only under the supervision of competent engineering personnel and in accordance with applicable codes and standards.



Remote Switch



Disconnect Switch



Lock Carried by
Maintenance Personnel

4.4 In cases where the fan is power driven by a source other than an electric motor, appropriate provisions should be made for the isolation or disengagement of the power supply.

5. START-UP CHECK LIST

5.1 GENERAL

5.1.1 Before putting any fan into initial operation, the manufacturer's instructions should be followed. Transportation, handling, and installation can cause fasteners to loosen, and cause misalignment of fan components. Carefully follow this check list when commissioning equipment.

5.1.2 Lock out the primary and all secondary power sources.

5.1.3 A complete inspection should be made of all of the ductwork and the interior of the fan. Make certain there is no foreign material which can be drawn into or blown through the fan or ductwork. Appropriate protective measures and safety practices should be observed when entering or working within these areas. These measures might include the use of goggles, respirators, or other personal protective devices.

5.1.4 Make sure the foundation or mounting arrangement and the duct connections are adequately designed and installed per drawings and in accordance with recognized acceptable engineering practices and with the fan manufacturer's recommendations.

5.1.5 Check and tighten all bolts, fasteners, and set screws as necessary.

5.1.6 Check the fan assembly and bearings for proper grounding to prevent static electricity discharge.

5.1.7 Ensure power and drive components such as motor starter, variable frequency drive, or hydraulic power unit are properly sized, matched, and connected to the fan.

5.1.8 Check bearings for recommended lubricant and lubrication amount.

5.1.9 Spin the rotating assembly to determine whether it rotates freely, without hitting anything, and is not grossly out of balance.

5.1.10 Inspect impeller for proper rotation for the fan design.

5.1.11 Check alignment of drives and all other components.

5.1.12 Check the belt drive for proper sheave selection and installation and make sure the sheaves are not reversed (excessive speeds could develop).

5.1.13 Check for recommended belt tension.

5.1.14 Properly secure all safety guards.

5.1.15 Assure that all appropriate warnings have been put in place.

5.1.16 Secure all access doors to the fan and ductwork.

5.1.17 Momentarily energize the fan to check the direction of rotation.

Listen as the fan coasts to a stop for any unusual noise, identify the source, and take corrective action as necessary.

5.1.18 Switch on the electrical supply and allow the fan to reach full speed. Check carefully for:

- (1) Excessive vibration
- (2) Unusual noise
- (3) Proper belt alignment
- (4) Proper lubrication
- (5) Proper amperage, voltage, or power values.
- (6) If any problem is indicated, **SWITCH OFF IMMEDIATELY.**

- (7) Lock out the power supply. Secure the fan impeller if there is a potential for windmilling. Check carefully for the cause of the trouble, correct as necessary, and repeat check list procedure.

5.2 Even if the fan appears to be operating satisfactorily, shut down after a brief period, lock out the power supply, and recheck items 5.1.5 through

5.1.17 as the initial start-up may have loosened the bolts, fasteners, and set screws.

5.3 The fan may now be put into operation, but during the first eight hours of running, it should be closely observed and checked for excessive vibration and noise. At this time checks should also be made of motor input current and motor and bearing temperatures to ensure that they do not exceed manufacturer's recommendations.

5.4 After eight hours of operation, the fan should be shut down and the power locked out. Check list items 5.1.5 through 5.1.17 should be inspected and adjusted, if necessary.

5.5 After twenty-four (24) hours of satisfactory operation, the fan should be shut down (locked out) and the drive belt tension should be readjusted to recommended tension.

5.6 After commissioning and start-up, the fan should be operated and maintained in accordance with the manufacturer's and component manufacturer's recommendations. Some basic guidelines for **WARNING SIGNS** and **ROUTINE MAINTENANCE** are included in Sections 7 and 8 of this publication. These sections are meant as a supplement to other publications and are not intended to replace the manufacturer's instructions.

6. SPECIAL PURPOSE FANS

6.1 Most fans are designed to handle clean air at standard temperatures between 32 F and 120 F. These fans should not be placed in systems or used for other than their design intended use. *Special Purpose Fans* are designed for use in systems that may include extreme temperatures, explosive, toxic, or special gases, material handling, corrosive environments, or other special hazards which should be carefully considered. Specific safety requirements should comply with mandated federal, state, and local codes; and industry safety standards and practices published by AMCA International and by other recognized agencies and associations should be followed.

6.2 Where the system will handle explosive or flammable material (i.e., dust, fumes, vapors or gases), fans of spark-resistant construction should be used.

6.3 Fans connected by ductwork or other piping may contain gases other than air which are hazardous. In these cases, procedures should be established to prevent exposure of personnel working on or near the fan, and by maintenance personnel who may need to enter the fan.

Appropriate personal protective equipment as determined by the material safety data sheet, and system operators should be utilized. Appropriate environmental protective measures should also be taken.

6.4 Fan inlet boxes, housings, ductwork, and other system components which are large enough to permit entry should be considered confined spaces. System areas may also serve as low points where heavy gases, liquids, or other substances may accumulate and present explosive, fire, health, or suffocation hazards. Appropriate protective measures and safety practices should be observed when entering or working within these areas.

6.5 Material-handling fans are specially designed to allow the fan to handle a specific type of material without excessive accumulation of material on the fan impeller.

Fans handling corrosive gases or erosive material should be checked periodically. If loss of material is evident, the fan should be shut down, power supply locked out, and tagged out of service. The manufacturer or other qualified personnel should be consulted to determine if the fan is within safety limits for operation. To ensure satisfactory operation it is essential to observe the manufacturer's limitations concerning the type of material to be handled by the fan.

6.6 Fan ratings and maximum speed limits are typically based on the use of air at 70 F. At temperatures above the normal range (specified by the manufacturer), a reduction should be made in the maximum speed limit. Information on this reduction and on other precautions to be taken for high temperature applications should be obtained from the fan manufacturer. Personnel working near high temperature fans should be aware that coming in contact with the fan's housing, ductwork, or handled gases could result in serious burns. Where the danger of burns is not apparent, appropriate warnings should be posted. Appropriate protective apparel should be worn whenever working in close contact with heated housings or ductwork.

6.7 Corrosive contaminants can be formed when moisture combines with an active airborne chemical. Fans subjected to corrosive contaminants will corrode; however, suitable protective coatings or material, if used in



the fan construction, can delay corrosion. Protected fans should be regularly inspected to ensure that the protection remains effective. Personnel working in environments with airborne chemicals may require personal protective apparel equipment.

6.8 Where liquid can accumulate within the fan, provide for the installation of adequately sized drains.

6.9 In those applications where there is a potential for chemical build-up (such as grease, creosote, etc.), periodic cleaning and proper drainage are necessary to avoid a fire hazard.

7. WARNING SIGNS

7.1 GENERAL

7.1.1 A change in the operating characteristics of a fan may indicate the need for maintenance. Sudden changes may indicate severe problems or dangerous conditions developing. Investigate any changes in the operational characteristics or unusual symptoms of the fan. Refer to AMCA Publication 202, *Troubleshooting*, for a more detailed explanation of investigating procedures. Consult your manufacturer or other qualified consultant with questions concerning changes observed.

7.2 EXCESSIVE VIBRATION

7.2.1 Operational vibration levels are one of the best indicators of the condition of the blower. Careful observation and monitoring of vibration levels can detect a minor problem in the early stages of development when correction is less costly and easier. Recommended maximum vibration levels should be obtained from the equipment manufacturer.

7.2.2 If excessive vibration is observed, stop the fan and lock it out until the cause is corrected. Check for material build-up on the impeller. Generally this will show up as material flaking off the fan impeller and causing an imbalance which may lead to catastrophic failure of the fan or its components. Excessive vibration can also be caused by looseness in the drive train, loose fasteners, misalignment or impeller damage. Contact the fan manufacturer or other qualified consultant to determine the maximum vibration level if it is not included in maintenance instructions.

7.3 NOISE

7.3.1 Changes to the sound level may indicate maintenance is needed. Some unusual noises often heard include: bearing noise indicating the bearings need lubricant or replacement; scraping or ticking noise indicating the rotating parts are hitting the stationary parts; squealing indicating the belt drive needs tensioning; repeated changing pitch of the blower indicating operation of the blower at too low a flow. If any of these noises or any other unusual noises are detected, their cause should be determined and corrective action taken as necessary.

7.4 HIGH MOTOR TEMPERATURES

7.4.1 Check that cooling air to the motor has not been diverted or blocked by dirty guards or similar obstacles. Check the input amperage. An increase in amperage may indicate that some major change has occurred in the system.

7.5 HIGH BEARING TEMPERATURES

7.5.1 This condition is usually caused by improper lubrication; this can be either "over," "under," or "unsuitable" lubrication. In every case, if the cause of the trouble is not easily seen, experienced personnel should examine the equipment before it is put back in operation.

7.6 POOR PERFORMANCE

7.6.1 Too much flow or pressure or too little flow or pressure is often a symptom of a change in the operating system. A fan will typically operate at the same performance in a static system some typical causes include: operating of the fan backwards after maintenance procedures; filters dirty or not in place; change or blockage in the ductwork; change in speed of the fan (switching the sheaves); loss or failure of the impeller. All of these causes and many others will affect the flow and pressure produced by the fan.

8. ROUTINE MAINTENANCE

8.1 A preventive maintenance program is an important aspect of an effective safety program. Consult your manufacturer or other qualified consultant with questions concerning changes observed during periodic inspections and routine maintenance.

8.2 The fan manufacturer's operating and maintenance recommendations, as well as the components manufacturer's instructions (such as motor, bearing, drives, etc.) should be strictly followed.

8.3 *Maintenance should always be performed by experienced and trained personnel who are aware of the hazards associated with rotating equipment.* Do not attempt any maintenance on a fan unless the fan power supply has been locked out and tagged out and the impeller has been secured.

8.4 When performing maintenance functions which include disassembly of the fan, careful consideration should be given to the size, weight, center of gravity, and lifting means of the fan components. It should also be noted that the outboard bearing on some fans such as arrangements 1, 8, 9, and 10 is often cap-loaded. Removal of the securing means may result in a sudden change in impeller position.

8.5 Historical data is often the best indicator for determining the operational condition of the fan. Maintenance logs which include relubrication, vibration levels, temperature levels, power requirements, inspection, and other pertinent records should be maintained and consulted as necessary when assessing the condition of the fan.

8.6 Under normal circumstances, handling clean air, the system should require cleaning only once a year. However, the fan and system should be checked at regular intervals to detect any unusual accumulation.

8.7 The fan impeller should be specially checked for build-up of material or dirt which may cause an imbalance with resulting undue wear on bearings and belt drives. A regular maintenance program should be established as needed to prevent material build-up.

8.8 Periodic inspection of the rotating assembly should be made to detect any indication of weakening of the rotor because of corrosion, erosion, or metal fatigue. Where signs of deterioration are found, lock out and tag out the impeller until the unit has been inspected and approved by a qualified consultant.

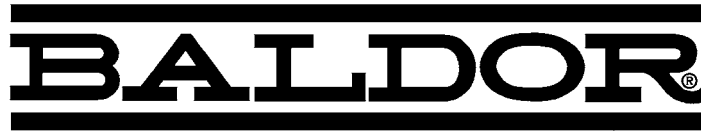


G.C. Evans Sales & Mfg Co Inc.

Section 4-V

Motors

**Model P-1048SD
Pasteurizer**



**Integral Horsepower
AC Induction Motors
ODP, WPI, WP II Enclosure
TEFC Enclosure
Explosion Proof**

Installation & Operating Manual

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Section 1

General Information

Overview

This manual contains general procedures that apply to Baldor Motor products. Be sure to read and understand the Safety Notice statements in this manual. For your protection, do not install, operate or attempt to perform maintenance procedures until you understand the Warning and Caution statements. A Warning statement indicates a possible unsafe condition that can cause harm to personnel. A Caution statement indicates a condition that can cause damage to equipment.

Important:

This instruction manual is not intended to include a comprehensive listing of all details for all procedures required for installation, operation and maintenance. This manual describes general guidelines that apply to most of the motor products shipped by Baldor. If you have a question about a procedure or are uncertain about any detail, Do Not Proceed. Please contact your Baldor distributor for more information or clarification.

Before you install, operate or perform maintenance, become familiar with the following:

- NEMA Publication MG-2, Safety Standard for Construction and guide for Selection, Installation and Use of Electric Motors and Generators.
- The National Electrical Code
- Local codes and Practices

Limited Warranty

1. Most Baldor products are warranted for 18 months from the date of shipment to Baldor's customer from Baldor's district warehouse or, if applicable, from Baldor's factory. Baldor Standard-E® standard efficient motors are warranted for 24 months. Standard-E is limited to three phase, general purpose, 1-200 HP ratings that fall under the Energy Policy Act (EPA). Baldor Super-E® premium efficient motors are warranted for 36 months. Baldor IEEE841 motors are warranted for 60 months. All warranty claims must be submitted to a Baldor Service Center prior to the expiration of the warranty period.
2. Baldor will, at its option repair or replace a motor which fails due to defects in material or workmanship during the warranty period if:
 - a. the purchaser presents the defective motor at or ships it prepaid to, the Baldor plant in Fort Smith, Arkansas or one of the Baldor Authorized Service Centers and
 - b. the purchaser gives written notification concerning the motor and the claimed defect including the date purchased, the task performed by the Baldor motor and the problem encountered.
3. Baldor will not pay the cost of removal of any electric motor from any equipment, the cost of delivery to Fort Smith, Arkansas or a Baldor Authorized Service Center, or the cost of any incidental or consequential damages resulting from the claimed defects. (Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusion may not apply to you.) Any implied warranty given by laws shall be limited to the duration of the warranty period hereunder. (Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.)
4. Baldor Authorized Service Centers, when convinced to their satisfaction that a Baldor motor developed defects in material or workmanship within the warranty period, are authorized to proceed with the required repairs to fulfill Baldor's warranty when the cost of such repairs to be paid by Baldor does not exceed Baldor's warranty repair allowance. Baldor will not pay overtime premium repair charges without prior written authorization.
5. The cost of warranty repairs made by centers other than Baldor Authorized Service Centers **WILL NOT** be paid unless first authorized in writing by Baldor.
6. Claims by a purchaser that a motor is defective even when a failure results within one hour after being placed into service are not always justified. Therefore, Baldor Authorized Service Centers must determine from the condition of the motor as delivered to the center whether or not the motor is defective. If in the opinion of a Baldor Authorized Service Center, a motor did not fail as a result of defects in material or workmanship, the center is to proceed with repairs only if the purchaser agrees to pay for such repairs. If the decision is in dispute, the purchaser should still pay for the repairs and submit the paid invoice and the Authorized Service Center's signed service report to Baldor for further consideration.
7. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Safety Notice:

This equipment contains high voltage! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt installation, operation and maintenance of electrical equipment.

Be sure that you are completely familiar with NEMA publication MG-2, safety standards for construction and guide for selection, installation and use of electric motors and generators, the National Electrical Code and local codes and practices. Unsafe installation or use can cause conditions that lead to serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

- WARNING:** Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.
- WARNING:** Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury. National Electrical Code and Local codes must be carefully followed.
- WARNING:** Avoid extended exposure to machinery with high noise levels. Be sure to wear ear protective devices to reduce harmful effects to your hearing.
- WARNING:** This equipment may be connected to other machinery that has rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt to install operate or maintain this equipment.
- WARNING:** Do not by-pass or disable protective devices or safety guards. Safety features are designed to prevent damage to personnel or equipment. These devices can only provide protection if they remain operative.
- WARNING:** Avoid the use of automatic reset devices if the automatic restarting of equipment can be hazardous to personnel or equipment.
- WARNING:** Be sure the load is properly coupled to the motor shaft before applying power. The shaft key must be fully captive by the load device. Improper coupling can cause harm to personnel or equipment if the load decouples from the shaft during operation.
- WARNING:** Use proper care and procedures that are safe during handling, lifting, installing, operating and maintaining operations. Improper methods may cause muscle strain or other harm.
- WARNING:** Before performing any motor maintenance procedure, be sure that the equipment connected to the motor shaft cannot cause shaft rotation. If the load can cause shaft rotation, disconnect the load from the motor shaft before maintenance is performed. Unexpected mechanical rotation of the motor parts can cause injury or motor damage.
- WARNING:** Disconnect all electrical power from the motor windings and accessory devices before disassembly of the motor. Electrical shock can cause serious or fatal injury.
- WARNING:** Do not use non UL/CSA listed explosion proof motors in the presence of flammable or combustible vapors or dust. These motors are not designed for atmospheric conditions that require explosion proof operation.
-

Safety Notice Continued

WARNING: Motors that are to be used in flammable and/or explosive atmospheres must display the UL label on the nameplate along with CSA listed logo.

Specific service conditions for these motors are defined in NFPA 70 (NEC) Article 500.

WARNING: UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.

Caution: To prevent premature equipment failure or damage, only qualified maintenance personnel should perform maintenance.

Caution: Do not over-lubricate motor as this may cause premature bearing failure.

Caution: Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load from the motor shaft before moving the motor.

Caution: If eye bolts are used for lifting a motor, be sure they are securely tightened. The lifting direction should not exceed a 20° angle from the shank of the eye bolt or lifting lug. Excessive lifting angles can cause damage.

Caution: To prevent equipment damage, be sure that the electrical service is not capable of delivering more than the maximum motor rated amps listed on the rating plate.

Caution: If a HI POT test (High Potential Insulation test) must be performed, follow the precautions and procedure in NEMA MG1 and MG2 standards to avoid equipment damage.

If you have any questions or are uncertain about any statement or procedure, or if you require additional information please contact your Baldor distributor or an Authorized Baldor Service Center.

Receiving

Each Baldor Electric Motor is thoroughly tested at the factory and carefully packaged for shipment. When you receive your motor, there are several things you should do immediately.

1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your motor.
2. Verify that the part number of the motor you received is the same as the part number listed on your purchase order.

Storage

If the motor is not put into service immediately, the motor must be stored in a clean, dry and warm location. Several precautionary steps must be performed to avoid motor damage during storage.

1. Use a "Megger" periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. Immediately investigate any significant drop in insulation resistance.
2. Do not lubricate bearings during storage. Motor bearings are packed with grease at the factory. Excessive grease can damage insulation quality.
3. Rotate motor shaft at least 10 turns every two months during storage (more frequently if possible). This will prevent bearing damage due to storage.
4. If the storage location is damp or humid, the motor windings must be protected from moisture. This can be done by applying power to the motors' space heater (if available) while the motor is in storage.

Unpacking

Each Baldor motor is packaged for ease of handling and to prevent entry of contaminants.

1. To avoid condensation inside the motor, do not unpack until the motor has reached room temperature. (Room temperature is the temperature of the room in which it will be installed). The packing provides insulation from temperature changes during transportation.
2. When the motor has reached room temperature, remove all protective wrapping material from the motor.

Handling

The motor should be lifted using the lifting lugs or eye bolts provided.

1. Use the lugs or eye bolts provided to lift the motor. Never attempt to lift the motor and additional equipment connected to the motor by this method. The lugs or eye bolts provided are designed to lift only the motor. Never lift the motor by the motor shaft or the hood of a WP11 motor.
2. When lifting a WP11 (Weather Proof Type 2) motor, do not lift the motor by inserting lifting lugs into holes on top of the cooling hood. These lugs are to be used for hood removal only. A spreader bar should be used to lift the motor by the cast lifting lugs located on the motor frame.
3. If the motor must be mounted to a plate with the driven equipment such as pump, compressor etc., it may not be possible to lift the motor alone. For this case, the assembly should be lifted by a sling around the mounting base. The entire assembly can be lifted as an assembly for installation. Do not lift using the motor lugs or eye bolts provided.

If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting.

Section 2

Installation & Operation

Overview

Installation should conform to the National Electrical Code as well as local codes and practices. When other devices are coupled to the motor shaft, be sure to install protective devices to prevent future accidents. Some protective devices include, coupling, belt guard, chain guard, shaft covers etc. These protect against accidental contact with moving parts. Machinery that is accessible to personnel should provide further protection in the form of guard rails, screening, warning signs etc.

Location

It is important that motors be installed in locations that are compatible with motor enclosure and ambient conditions. Improper selection of the motor enclosure and ambient conditions can lead to reduced operating life of the motor.

Proper ventilation for the motor must be provided. Obstructed airflow can lead to reduction of motor life.

1. **Open Drip-Proof/WPI** motors are intended for use indoors where atmosphere is relatively clean, dry, well ventilated and non-corrosive.
2. **Totally Enclosed and WPII** motors may be installed where dirt, moisture or dust are present and in outdoor locations.

Severe Duty, IEEE 841 and Washdown Duty enclosed motors are designed for installations with high corrosion or excessive moisture conditions. These motors should not be placed into an environment where there is the presence of flammable or combustible vapors, dust or any combustible material, unless specifically designed for this type of service.

Mounting

The motor must be securely installed to a rigid foundation or mounting surface to minimize vibration and maintain alignment between the motor and shaft load. Failure to provide a proper mounting surface may cause vibration, misalignment and bearing damage.

Foundation caps and sole plates are designed to act as spacers for the equipment they support. If these devices are used, be sure that they are evenly supported by the foundation or mounting surface.

After installation is complete and accurate alignment of the motor and load is accomplished, the base should be grouted to the foundation to maintain this alignment.

The standard motor base is designed for horizontal or vertical mounting. Adjustable or sliding rails are designed for horizontal mounting only. Consult your Baldor distributor or authorized Baldor Service Center for further information.

Alignment

Accurate alignment of the motor with the driven equipment is extremely important.

1. **Direct Coupling**
For direct drive, use flexible couplings if possible. Consult the drive or equipment manufacturer for more information. Mechanical vibration and roughness during operation may indicate poor alignment. Use dial indicators to check alignment. The space between coupling hubs should be maintained as recommended by the coupling manufacturer.
2. **End-Play Adjustment**
The axial position of the motor frame with respect to its load is also extremely important. The motor bearings are not designed for excessive external axial thrust loads. Improper adjustment will cause failure.
3. **Pulley Ratio**
The pulley ratio should not exceed 8:1.
4. **Belt Drive**
Align sheaves carefully to minimize belt wear and axial bearing loads (see End-Play Adjustment). Belt tension should be sufficient to prevent belt slippage at rated speed and load. However, belt slippage may occur during starting.

Caution: Do not over tension belts.

5. Sleeve bearing motors are only suitable for coupled loads.

Doweling & Bolting

After proper alignment is verified, dowel pins should be inserted through the motor feet into the foundation. This will maintain the correct motor position should motor removal be required. (Baldor motors are designed for doweling.)

- 1. Drill dowel holes in diagonally opposite motor feet in the locations provided.
- 2. Drill corresponding holes in the foundation.
- 3. Ream all holes.
- 4. Install proper fitting dowels.
- 5. Mounting bolts must be carefully tightened to prevent changes in alignment. Use a flat washer and lock washer under each nut or bolt head to hold the motor feet secure. Flanged nuts or bolts may be used as an alternative to washers.

Power Connection

Conduit Box

Motor and control wiring, overload protection, disconnects, accessories and grounding should conform to the National Electrical Code and local codes and practices.

For ease of making connections, an oversize conduit box is provided. The box can be rotated 360° in 90° increments. Auxiliary conduit boxes are provided on some motors for accessories such as space heaters, RTD's etc.

AC Power

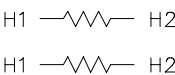
Connect the motor leads as shown on the connection diagram located on the name plate or inside the cover on the conduit box. Be sure the following guidelines are met:

- 1. AC power is within ±10% of rated voltage with rated frequency. (See motor name plate for ratings).
OR
- 2. AC power is within ±5% of rated frequency with rated voltage.
OR
- 3. A combined variation in voltage and frequency of ±10% (sum of absolute values) of rated values, provided the frequency variation does not exceed ±5% of rated frequency.

Performance within these voltage and frequency variations are shown in Figure 2-2.

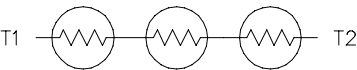
Figure 2-1 Accessory Connections

HEATERS



One heater is installed in each end of motor.
Leads for each heater are labeled H1 & H2.
(Like numbers should be tied together).

THERMISTERS



Three thermistors are installed in windings and tied in series.
Leads are labeled T1 & T2.

WINDING RTDS



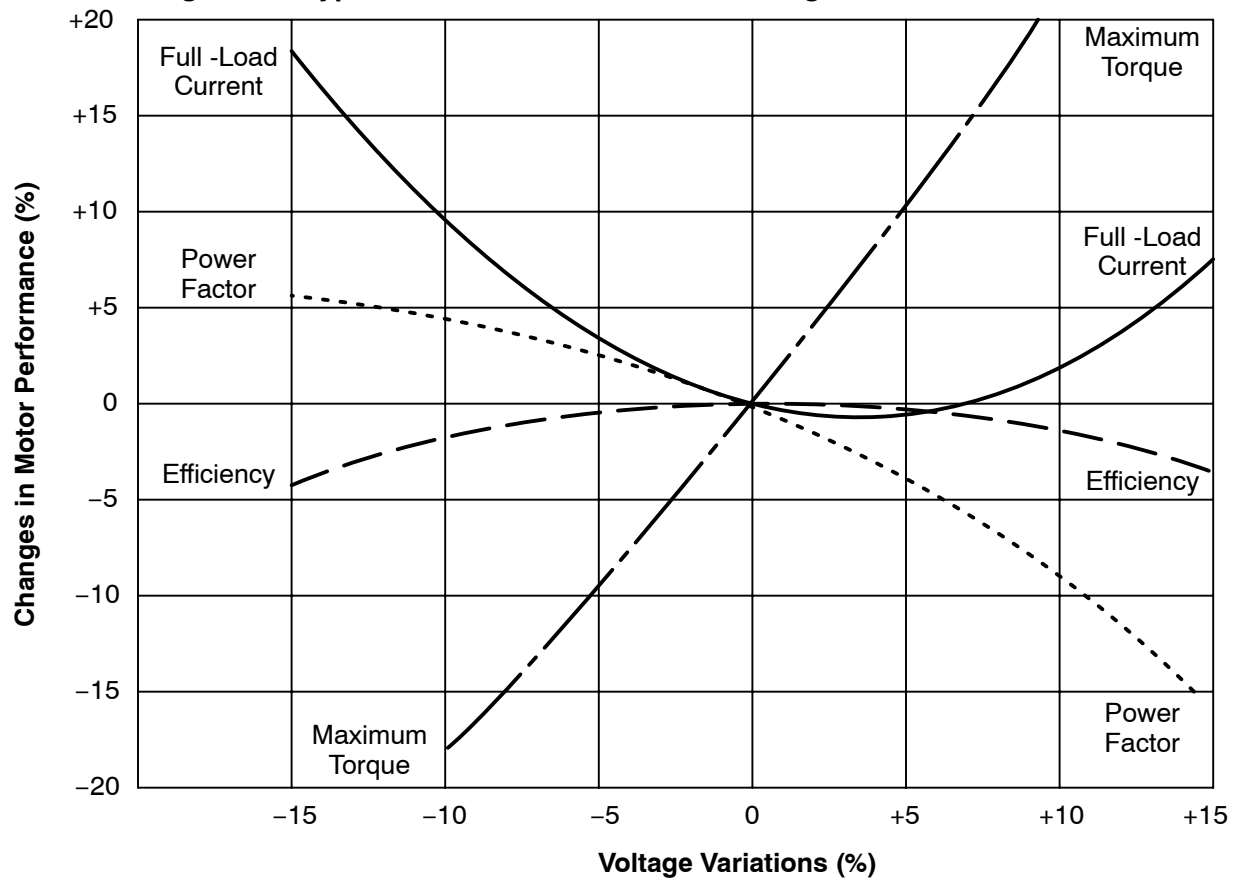
Winding RTDs are installed in windings (2) per phase.
Each set of leads is labeled W1, W2, W3, W4, W5, & W6.

BEARING RTD



- * One bearing RTD is installed in Drive endplate (PUEP), leads are labeled RTDDE.
- * One bearing RTD is installed in Opposite Drive endplate (FREP), leads are labeled RTDODE.
- * Note RTD may have 2-Red/1-White leads; or 2-White/1-Red Lead.

Figure 2-2 Typical Motor Performance VS Voltage Variations



First Time Start Up

Be sure that all power to motor and accessories is off. Be sure the motor shaft is disconnected from the load and will not cause mechanical rotation of the motor shaft.

1. Make sure that the mechanical installation is secure. All bolts and nuts are tightened etc.
2. If motor has been in storage or idle for some time, check winding insulation integrity with a Megger.
3. Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity.
4. Be sure all shipping materials and braces (if used) are removed from motor shaft.
5. Manually rotate the motor shaft to ensure that it rotates freely.
6. Replace all panels and covers that were removed during installation.
7. Momentarily apply power and check the direction of rotation of the motor shaft.
8. If motor rotation is wrong, be sure power is off and change the motor lead connections. Verify rotation direction before you continue.
9. Start the motor and ensure operation is smooth without excessive vibration or noise. If so, run the motor for 1 hour with no load connected.
10. After 1 hour of operation, disconnect power and connect the load to the motor shaft. Verify all coupling guards and protective devices are installed. Ensure motor is properly ventilated.

Coupled Start Up

This procedure assumes a coupled start up. Also, that the first time start up procedure was successful.

1. Check the coupling and ensure that all guards and protective devices are installed.
2. Check that the coupling is properly aligned and not binding.
3. The first coupled start up should be with no load. Apply power and verify that the load is not transmitting excessive vibration back to the motor through the coupling or the foundation. Vibration should be at an acceptable level.
4. Run for approximately 1 hour with the driven equipment in an unloaded condition.

The equipment can now be loaded and operated within specified limits. Do not exceed the name plate ratings for amperes for steady continuous loads.

Jogging and Repeated Starts Repeated starts and/or jogs of induction motors generally reduce the life of the motor winding insulation. A much greater amount of heat is produced by each acceleration or jog than by the same motor under full load. If it is necessary to repeatedly start or jog the motor, it is advisable to check the application with your local Baldor distributor or Baldor Service Center.

Heating - Duty rating and maximum ambient temperature are stated on the motor name plate. Do not exceed these values. If there is any question regarding safe operation, contact your local Baldor distributor or Baldor Service Center.

Section 3

Maintenance & Troubleshooting

WARNING: UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.

General Inspection

Inspect the motor at regular intervals, approximately every 500 hours of operation or every 3 months, whichever occurs first. Keep the motor clean and the ventilation openings clear. The following steps should be performed at each inspection:

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

1. Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water, etc. Oily vapor, paper pulp, textile lint, etc. can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.
2. Use a "Megger" periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. Immediately investigate any significant drop in insulation resistance.
3. Check all electrical connectors to be sure that they are tight.

Relubrication & Bearings

Bearing grease will lose its lubricating ability over time, not suddenly. The lubricating ability of a grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Good results can be obtained if the following recommendations are used in your maintenance program.

Type of Grease

A high grade ball or roller bearing grease should be used. Recommended grease for standard service conditions is Polyrex EM (Exxon Mobil).

Equivalent and compatible greases include:

Texaco Polystar, Rykon Premium #2, Pennzoil Pen 2 Lube and Chevron SRI.

Relubrication Intervals

Recommended relubrication intervals are shown in Table 3-1. It is important to realize that the recommended intervals of Table 3-1 are based on average use.

Refer to additional information contained in Tables 3-2, 3-3 and 3-4.

Table 3-1 Relubrication Intervals *

NEMA / (IEC) Frame Size	Rated Speed - RPM					
	10000	6000	3600	1800	1200	900
Up to 210 incl. (132)	**	2700 Hrs.	5500 Hrs.	12000 Hrs.	18000 Hrs.	22000 Hrs.
Over 210 to 280 incl. (180)		**	3600 Hrs.	9500 Hrs.	15000 Hrs.	18000 Hrs.
Over 280 to 360 incl. (225)		**	* 2200 Hrs.	7400 Hrs.	12000 Hrs.	15000 Hrs.
Over 360 to 5800 incl. (300)		**	*2200 Hrs.	3500 Hrs.	7400 Hrs.	10500 Hrs.

* Relubrication intervals are for ball bearings.

For vertically mounted motors and roller bearings, divide the relubrication interval by 2.

** For motors operating at speeds greater than 3600 RPM, contact Baldor for relubrication recommendations.

Table 3-2 Service Conditions

Severity of Service	Hours per day of Operation	Ambient Temperature Maximum	Atmospheric Contamination
Standard	8	40° C	Clean, Little Corrosion
Severe	16 Plus	50° C	Moderate dirt, Corrosion
Extreme	16 Plus	>50° C* or Class H Insulation	Severe dirt, Abrasive dust, Corrosion, Heavy Shock or Vibration
Low Temperature		<-29° C **	

* Special high temperature grease is recommended (Dow Corning DC44). Note that Dow Corning DC44 grease does not mix with other grease types. Thoroughly clean bearing & cavity before adding grease.

** Special low temperature grease is recommended (Aeroshell 7).

Table 3-3 Relubrication Interval Multiplier

Severity of Service	Multiplier
Standard	1.0
Severe	0.5
Extreme	0.1
Low Temperature	1.0

Some motor designs use different bearings on each motor end. This is normally indicated on the motor nameplate. In this case, the larger bearing is installed on the motor Drive endplate. For best relubrication results, only use the appropriate amount of grease for each bearing size (not the same for both).

Table 3-4 Bearings Sizes and Types

Frame Size NEMA (IEC)	Bearing Description (These are the "Large" bearings (Shaft End) in each frame size)			
	Bearing	Weight of Grease to add * oz (Grams)	Volume of grease to be added	
			in ³	teaspoon
56 to 140 (90)	6203	0.08 (2.4)	0.15	0.5
140 (90)	6205	0.15 (3.9)	0.2	0.8
180 (100-112)	6206	0.19 (5.0)	0.3	1.0
210 (132)	6307	0.30 (8.4)	0.6	2.0
250 (160)	6309	0.47 (12.5)	0.7	2.5
280 (180)	6311	0.61 (17)	1.2	3.9
320 (200)	6312	0.76 (20.1)	1.2	4.0
360 (225)	6313	0.81 (23)	1.5	5.2
400 (250)	6316	1.25 (33)	2.0	6.6
440 (280)	6319	2.12 (60)	4.1	13.4
5000 to 5800 (315-450)	6328	4.70 (130)	9.2	30.0
5000 to 5800 (315-450)	NU328	4.70 (130)	9.2	30.0
360 to 449 (225-280)	NU319	2.12 (60)	4.1	13.4
AC Induction Servo				
76 Frame 180 (112)	6207	0.22 (6.1)	0.44	1.4
77 Frame 210 (132)	6210	0.32 (9.0)	0.64	2.1
80 Frame 250(160)	6213	0.49 (14.0)	0.99	3.3

* Weight in grams = .005 DB of grease to be added

Note: Not all bearing sizes are listed. For intermediate bearing sizes, use the grease volume for the next larger size bearing.

Caution: To avoid damage to motor bearings, grease must be kept free of dirt. For an extremely dirty environment, contact your Baldor distributor or an authorized Baldor Service Center for additional information.

Relubrication Procedure Be sure that the grease you are adding to the motor is compatible with the grease already in the motor. Consult your Baldor distributor or an authorized service center if a grease other than the recommended type is to be used.

Caution: Do not over-lubricate motor as this may cause premature bearing failure.

With Grease Outlet Plug

1. With the motor stopped, clean all grease fittings with a clean cloth.
2. Remove grease outlet plug.

Caution: Over-lubricating can cause excessive bearing temperatures, premature lubrication breakdown and bearing failure.

3. Add the recommended amount of grease.
4. Operate the motor for 15 minutes with grease plug removed. This allows excess grease to purge.
5. Re-install grease outlet plug.

Without Grease Provisions

Note: Only a Baldor authorized and UL or CSA certified service center can disassemble a UL/CSA listed explosion proof motor to maintain it's UL/CSA listing.

1. Disassemble the motor.
2. Add recommended amount of grease to bearing and bearing cavity. (Bearing should be about 1/3 full of grease and outboard bearing cavity should be about 1/2 full of grease.)
3. Assemble the motor.

Sample Relubrication Determination

Assume - NEMA 286T (IEC 180), 1750 RPM motor driving an exhaust fan in an ambient temperature of 43° C and the atmosphere is moderately corrosive.

1. Table 3-1 list 9500 hours for standard conditions.
2. Table 3-2 classifies severity of service as "Severe".
3. Table 3-4 shows that 1.2 in³ or 3.9 teaspoon of grease is to be added.

Note: Smaller bearings in size category may require reduced amounts of grease.

Table 3-5 Troubleshooting Chart

Symptom	Possible Causes	Possible Solutions
Motor will not start	Usually caused by line trouble, such as, single phasing at the starter.	Check source of power. Check overloads, fuses, controls, etc.
Excessive humming	High Voltage.	Check input line connections.
	Eccentric air gap.	Have motor serviced at local Baldor service center.
Motor Over Heating	Overload. Compare actual amps (measured) with nameplate rating.	Locate and remove source of excessive friction in motor or load. Reduce load or replace with motor of greater capacity.
	Single Phasing.	Check current at all phases (should be approximately equal) to isolate and correct the problem.
	Improper ventilation.	Check external cooling fan to be sure air is moving properly across cooling fins. Excessive dirt build-up on motor. Clean motor.
	Unbalanced voltage.	Check voltage at all phases (should be approximately equal) to isolate and correct the problem.
	Rotor rubbing on stator.	Check air gap clearance and bearings.
		Tighten "Thru Bolts".
	Over voltage or under voltage.	Check input voltage at each phase to motor.
	Open stator winding.	Check stator resistance at all three phases for balance.
	Grounded winding.	Perform dielectric test and repair as required.
	Improper connections.	Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity. Refer to motor lead connection diagram.
Bearing Over Heating	Misalignment.	Check and align motor and driven equipment.
	Excessive belt tension.	Reduce belt tension to proper point for load.
	Excessive end thrust.	Reduce the end thrust from driven machine.
	Excessive grease in bearing.	Remove grease until cavity is approximately $\frac{3}{4}$ filled.
	Insufficient grease in bearing.	Add grease until cavity is approximately $\frac{3}{4}$ filled.
	Dirt in bearing.	Clean bearing cavity and bearing. Repack with correct grease until cavity is approximately $\frac{3}{4}$ filled.
Vibration	Misalignment.	Check and align motor and driven equipment.
	Rubbing between rotating parts and stationary parts.	Isolate and eliminate cause of rubbing.
	Rotor out of balance.	Have rotor balance checked and repaired at your Baldor Service Center.
	Resonance.	Tune system or contact your Baldor Service Center for assistance.
Noise	Foreign material in air gap or ventilation openings.	Remove rotor and foreign material. Reinstall rotor. Check insulation integrity. Clean ventilation openings.
Growling or whining	Bad bearing.	Replace bearing. Clean all grease from cavity and new bearing. Repack with correct grease until cavity is approximately $\frac{3}{4}$ filled.

Suggested bearing and winding RTD setting guidelines

Most large frame AC Baldor motors with a 1.15 service factor are designed to operate below a Class B (80°C) temperature rise at rated load and are built with a Class H winding insulation system. Based on this low temperature rise, RTD (Resistance Temperature Detectors) settings for Class B rise should be used as a starting point. Some motors with 1.0 service factor have Class F temperature rise.

The following tables show the suggested alarm and trip settings for RTDs. Proper bearing and winding RTD alarm and trip settings should be selected based on these tables unless otherwise specified for specific applications.

If the driven load is found to operate well below the initial temperature settings under normal conditions, the alarm and trip settings may be reduced so that an abnormal machine load will be identified.

The temperature limits are based on the installation of the winding RTDs imbedded in the winding as specified by NEMA. Bearing RTDs should be installed so they are in contact with the outer race on ball or roller bearings or in direct contact with the sleeve bearing shell.

Winding RTDs – Temperature Limit In °C (40°C Maximum Ambient)

Motor Load	Class B Temp Rise ≤ 80°C (Typical Design)		Class F Temp Rise ≤ 105°C		Class H Temp Rise ≤ 125°C	
	Alarm	Trip	Alarm	Trip	Alarm	Trip
≤ Rated Load	130	140	155	165	175	185
Rated Load to 1.15 S.F.	140	150	160	165	180	185

Note: • Winding RTDs are factory production installed, not from Mod-Express.

• When Class H temperatures are used, consider bearing temperatures and relubrication requirements.

Bearing RTDs – Temperature Limit In °C (40°C Maximum Ambient)

Bearing Type Oil or Grease	Anti-Friction		Sleeve	
	Alarm	Trip	Alarm	Trip
Standard*	95	100	85	95
High Temperature**	110	115	105	110

Note: * Bearing temperature limits are for standard design motors operating at Class B temperature rise.

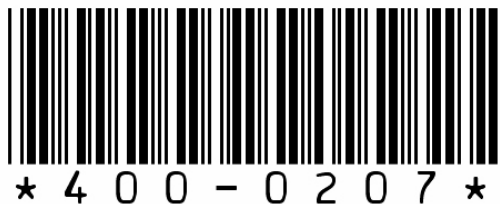
** High temperature lubricants include some special synthetic oils and greases.

Greases that may be substituted that are compatible with Polyrex EM (but considered as "standard" lubricants) include the following:

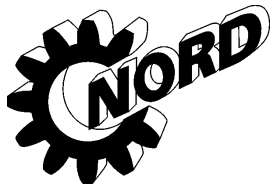
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|--------------------|---------------------------|-----------------------------|
| – Texaco Polystar | – Rykon Premium #2 | – Chevron SRI #2 |
| – Mobilith SHC-100 | – Pennzoil Pennzlube EM-2 | – Chevron Black Pearl |
| – Darmex 707 | – Darmex 711 | – Petro-Canada Peerless LLG |

See the motor nameplate for replacement grease or oil recommendation.

Contact Baldor application engineering for special lubricants or further clarifications.



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BIM 1004

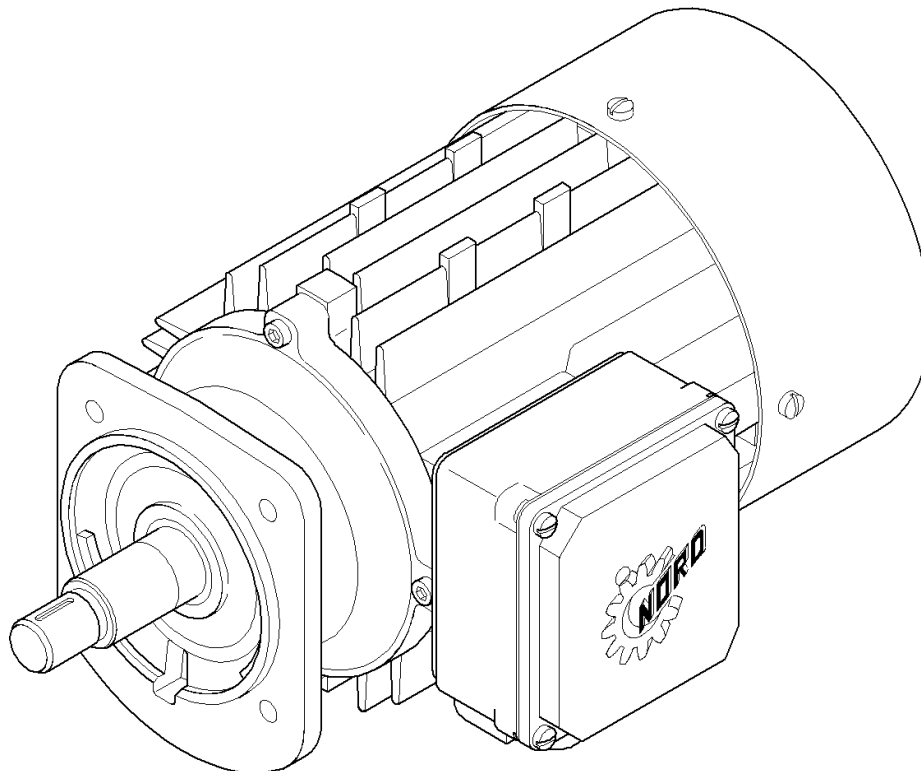
USA

CDN

MOTORS

AC Induction, Single and Polyphase

Installation and Maintenance Instructions



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INTRODUCTION

1. General

This manual includes general motor description and operation, inspection, testing and fault isolation procedures and information, general lubrication instructions and materials, general installation, removal, and handling instructions, and general repair and parts information.

2. Related Publications

The related publications listed in Table 1 provide additional information to support maintenance and fault isolation of the motor and its installation.

Publication Number	Publication Title
BIM 1001	Hollow Shrink Disc Shaft
BIM 1002	Hollow Keyed Shaft and Fixing Element
BIM 1003	Expansion Chambers
BIM 1004	Motors AC Induction, Single Phase and Polyphase
BIM 1009	NORD Gearbox Inputs (Motor Adapters and Couplings)
BIM 1010	UNICASE® Helical Gearboxes
BIM 1011	NORDBLOC® Helical Gearboxes
BIM 1012	Standard Helical Inline Gearboxes
BIM 1020	UNICASE® Shaft Mount Gearboxes
BIM 1030	UNICASE® Helical Worm Gearboxes
BIM 1031	MINICASE® Worm Gearboxes
BIM 1033	SI Design UNIBLOC® Worm Gearboxes
BIM 1040	UNICASE® 90.1 Helical Bevel Gearboxes
BIM 1090	Motor Brakes
BIM 1142	NORDBLOC® 92 Series Helical Bevel Gearboxes
BIM 4010	Titan Mechanical Adjustable Speed Drives
BIM 4020	NORDISC® Friction Disc Mechanical Adjustable Speed Drives

Table 1. Related Publications

DESCRIPTION AND OPERATION

1. General

This manual provides general installation and maintenance information for the NORD family of motors described in this section.

2. Description

The NORD motors covered in this manual are single phase and poly-phase motors (refer to Table 2), can be single speed or two-speed, and may include the options listed in the Motor Options Section. Motor options, electrical requirements, performance characteristics, and motor data are identified on the motor nameplate. The nameplate drawing is provided in Figure 1. Definition of each entry field is provided in Table 2.

3. Operation

The motors described in this manual are alternating current (AC) induction motors, single speed or two-speed, and convection-cooled, fan cooled, or blower cooled. The motors may use single phase or three phase alternating current.

Cooling options include convection cooling (TENV), fan cooling (TEFC), and blower cooling (TEFB). Because the fan is mounted on the motor shaft, the fan speed is identical to the motor speed, and the cooling capacity varies with the motor speed. The blower uses its own motor and a separate power supply to provide a specific airflow and cooling capacity. The blower power data are provided in Table 8.

Type SK	
3 ~ ph.M.	No.
E 191510	EEV: %FL Frame
EN 60034 (H) NEMA	
230/460 V YYY	
kW A	
pf.	60Hz
Amb, 40°C	Encl, TEFC
Brake :	CONT.
MB=	Nm

Type SK	
3 ~ ph.M.	No.
E 191510	EEV: %FL Frame
EN 60034 (H) NEMA	
230/460 V YYY	
kW A	
pf.	60Hz
Amb, 40°C	Encl, TEFC
Brake :	CONT.
MB=	Nm

Type SK	
3 ~ ph.M.	No.
E 191510	EEV: %FL Frame
EN 60034 (H) NEMA	
230/460 V YYY	
kW A	
pf.	60Hz
Amb, 40°C	Encl, TEFC
Brake :	CONT.
MB=	Nm

Figure 1. Motor Nameplates

Field	Definition	Field	Definition
Type	Model Number	DP	Drip Proof
3~ph.M.	Number of Motor Phases	Ins. Cl	Insulation Class
No.	Motor Number	SER. F	Service Factor (allowable horsepower loading)
S	Duty Cycle (i.e. S1, S3-40%)	Encl.	Enclosure Description
Frame	Motor Frame Size	Code	NEMA Code Letter
V	Motor Voltage	EEV	
A	Motor Full-Load Amperage	COS φ	Power Factor
HP	Motor Horsepower	MB=	Motor Brake Force (Newton Meters)
rpm	Motor Speed	AC	Alternating Current
pf.	Power Factor	V~	AC Voltage
Amb	Maximum Ambient Temperature	V=	DC Voltage
Hz	Motor Power Frequency		

Table 2. Nameplate Data

INSPECTION

1. Inspection Interval
Inspect the motor after every 500 operating hours.
2. Inspection Criteria
Inspect the motor according to the criteria in Table 3.

CAUTION: IF IT IS NECESSARY TO CLEAN THE MOTOR EXTERIOR, DO NOT USE SHOP AIR. SHOP AIR CAN FORCE CONTAMINANTS INTO THE MOTOR, AND CAN CAUSE THE BLOWN CONTAMINANTS TO AFFECT OTHER COMPONENTS.

Inspect	Check	Action
Motor exterior	Check the external surfaces for contamination. Accumulation of dirt and fibrous deposits must be removed.	Clean the motor external surfaces using clean, lint-free cloths. Clean deposits from between cooling fins using a vacuum cleaner and a stiff-bristled nylon brush.
	Check the external surfaces for oil film and greasy deposits.	Clean the oil film and greasy deposits from the motor surface using clean, lint-free cloths. If necessary, moisten the cloth with an approved non-flammable, residue-free solvent. Do not pour solvent on the motor.
	Check for evidence of damage or overheating.	If the motor has physical damage, replace the motor.
Motor mountings	Make sure the mounting hardware is secure.	If the mounting hardware is not secure, check the motor/gearbox alignment, and tighten the mounting hardware.
Motor electrical connections	Check that all electrical connections are secure.	If the electrical connections are not secure, tighten them.
	Check the electrical connections for evidence of arcing.	Loose electrical connections can cause arcing, which is evident by discoloration and charring. If you find evidence of arcing, replace the damaged connections.
Insulation resistance	Using an ohmmeter, check and record the resistance of motor winding insulation.	Compare the current resistance reading to previous readings. If the resistance drops significantly, perform an internal inspection for insulation damage or deterioration.
Motor Brake	On motors that have a brake, use a feeler gauge to check the air gap in between the brake pad and the rotor according to NORD Gear Corporation Manual BIM-1090, Motor Brakes Installation and Maintenance Instructions.	If the air gap exceeds the maximum allowed for that brake configuration provided in the manual, adjust the air gap or replace the brake pad according to the instructions in NORD Gear Corporation Manual BIM-1090, Motor Brakes Installation and Maintenance Manual.

Table 3. Motor Inspection Criteria

TESTING AND FAULT ISOLATION

1. General

NOTE: NORD electric motors do not require periodic testing. However, if a motor is removed from its installation, NORD recommends that the motor be checked according to the static and dynamic testing provided below before it is reinstalled. Finding a condition that will require future repair before the motor is reinstalled decreases the overall maintenance time.

This section provides general test information and functional checks for the types of motors covered by this manual. All tests provided below may not apply to all motor types and models. Read and understand the tests and checks before performing them on your motor. Understand how the test or check is to be performed and the pass/fail criteria.

Record and date all measurements taken. Retain the measurements in a file. Comparing current and previous measurements is useful in tracking motor condition and brake wear, if the motor is equipped with a brake.

If the motor fails any of the test procedures provided below, use the fault isolation procedures to determine the motor problem. Refer to the REPAIR section to determine if the failure is a repairable failure.

2. Testing

A. Static Testing

1. The motor can only be static tested if it is disconnected from the component it drives and securely mounted on a fixture or mounting plate. These tests are usually conducted when a motor has been removed for any reason other than failure
2. Turn the motor shaft slowly by hand. Feel and listen for evidence of a failed bearing, which is indicated by a rough feel as the shaft rotates, and by noise.
3. Check for smooth rotation, with no evidence of binding or catching. If the shaft does not rotate smoothly, or binds or catches, the bearings are worn or failing, lack lubrication, or are contaminated.
4. Check the motor shaft for side play by applying pressure at right angles to the shaft in several places around the circumference. If the shaft moves perceptibly, the front bearing is worn.
5. If the motor shaft feels rough as it is turned or makes unusual noise, the motor bearings are failing, lack lubrication, or are contaminated. Replace the motor bearings, or clean and re-lubricate the bearings, as applicable. Refer to the REPAIR section.
6. If the bearing shaft shows play in the bearing, the bearing is worn or failing. Replace the motor bearings according to the REPAIR section.

B. Dynamic Testing

1. Find the motor voltage and rated load current values as listed on the motor nameplate.
2. Using a volt-ohmmeter, verify that the motor power supply is in the correct range.
3. Run the motor with no load. As the motor is operating, listen for unusual motor noise and check for excessive vibration. Vibration and motor noise are indications of bearing contamination, lack of lubrication, damage, or failure.
4. Use an ammeter to measure the no-load current. Record the no-load current for comparison with previous readings, and for reference during future testing.
5. If the motor passes the no-load test, operate the motor at rated load and check and record the current.
6. Check the motor operating temperature at rated load. If the motor operates at a higher than normal temperature, the motor is failing.
7. If the motor has an integral brake, check the brake operating temperature. If the brake operates at a higher than normal temperature, the brake is not releasing completely. Refer to the REPAIR section.

3. Fault Isolation

If the motor has failed or does not meet the requirements of any of the tests described above, use the fault isolation procedures provided in Table 4, Motor Fault Isolation. The table is based on the assumption that the motor has been operating correctly, and that a problem has occurred. If a newly installed motor does not operate correctly, the problem is an installation problem.

Fault	Check	Corrective Action
Motor doesn't operate	Check the circuit breaker.	The breaker has tripped. Reset the breaker. If the breaker trips immediately, the motor windings have shorted. Replace the motor.
	Check the motor and the gearbox separately to determine which has failed.	Replace the motor or the gearbox, as applicable.
	If the breaker has not tripped, check the power circuitry to the motor.	If the power circuitry has opened, repair the power circuitry.
	Check for an open in the motor windings.	If the motor windings have an open circuit, replace the motor.
Motor is noisy	Separate the motor from its gearbox and check the shaft bearings by hand according to the TEST instructions.	If the bearings feel rough, replace the bearings according to the instructions in REPAIR.
Motor thermal protection trips	Check the motor exterior for an excessive accumulation of oil and dirt that can inhibit cooling.	If the motor exterior is excessively dirty, clean the motor surface using clean, lint-free cloths. If the motor has a finned casing, use a vacuum cleaner and a stiff-bristled nylon brush to remove dirt and debris from between the fins.
	If the motor has a vented enclosure, check the vent openings to make sure they are clear.	If necessary, clean the vent openings.
	Visually check for heat-discolored paint, which is evidence of a motor overheat.	If the motor casing shows heat discoloration, the motor is failing. Replace the motor.
	Check the system load.	If the load applied to the system is above rated load, it should be reduced, if possible, to avoid affecting motor life.
Motor slows during operation	Check for increased load.	If the load has increased beyond rated load, correct the overload condition to prevent damage to the motor.
	Check for supply voltage drop.	Supply voltage must be within 10 percent of nominal voltage. If the supply voltage is less than 90 percent of rated voltage, correct the supply voltage to avoid damage to the motor.
	Check the gearbox and the motor bearings for wear and drag that increases as the system temperature rises.	If the gearbox drag increases during operation, repair the gearbox. If the motor bearing drag increases as the motor operates, replace the bearings according to REPAIR.

Table 4. Motor Fault Isolation

LUBRICATION

1. General

NORD motor frame sizes 63 up to and including 225 are prelubricated, therefore require no lubrication during normal operation.

Frame sizes 250 and larger will have grease fittings for regreasing the motor bearings. Relubricate bearings every six months (more often if conditions require) using a polyurea base grease, No. 2 consistency & stabilized against oxidation.

REMOVAL, INSTALLATION, AND HANDLING

1. General

Removing, installing, and handling any NORD electric motor follow the same general procedures. Follow the general procedures provided below. Observe all WARNINGS and CAUTIONS.

If you have any questions about the procedure to use to handle, install, or remove a specific motor, call NORD Gear Corporation. Please read the following WARNINGS & CAUTIONS prior to any work on the motor.

WARNING:



IF THE MOTOR HAS AN INTEGRAL BRAKE, VERIFY THAT THERE IS NO LOAD ON THE GEARBOX BEFORE RELEASING THE BRAKE. THIS WILL PREVENT POSSIBLE INJURY AND POTENTIAL EQUIPMENT DAMAGE FROM A DROPPED LOAD.

WARNING:



THE MOTOR ELECTRICAL POWER HAS DANGEROUS CURRENT LEVELS. TO PREVENT SERIOUS INJURY, SHUT DOWN THE POWER TO THE MOTOR AT ITS CIRCUIT BREAKER OR POWER SWITCH BEFORE REMOVING OR INSTALLING ANY MOTOR. LOCK OUT THE BREAKER OR SWITCH AND POST IT WITH AN "OUT OF SERVICE" PLACARD.

WARNING:



LARGE MOTORS ARE HEAVY, EASY TO UNBALANCE, AND ARE AWKWARD TO LIFT AND MOVE. EVEN SMALLER MOTORS ARE HEAVY. HAVE ASSISTANCE WHEN LIFTING AND MOVING HEAVY MOTORS. IF NECESSARY, USE APPROPRIATE LIFTING DEVICES TO LIFT AND MOVE HEAVY MOTORS.

CAUTION:

TO PREVENT DAMAGE TO THE MOTORSHAFT, BEARINGS, AND THE MATING HUB/SHEAVE IN THE GEARBOX, MAINTAIN SHAFT ALIGNMENT WHILE REMOVING THE MOTOR FROM ITS GEARBOX.

2. Removal

- A. Drain the oil from the mating gearbox, or rotate the motor/gearbox assembly so that the motor is up, to prevent oil from spilling from the gearbox when the motor is removed.
- B. Shut down the power to the motor at the main circuit breaker or power switch. Lock out the breaker or switch and place an "OUT OF SERVICE" placard on the breaker or switch.
- C. Disconnect the wiring to the motor. Tag each wire as it is disconnected.
- D. Prepare the motor for removal by supporting the motor appropriately. For smaller motors, use assistance to steady the motor or support it. For larger motors, use mechanical lifting or support devices to steady and support the motor.
- E. Remove the bolts and washers securing the motor to the its mounting.
- F. Maintain motor shaft alignment, and move the motor away from its mounting pad until the motor shaft clears its mating hub/sheave or gearmesh. If the motor shaft is a keyed shaft, keep the drive key with the motor.
- G. Remove and discard the flange gasket. Clean the gasket material from the flange.

3. Installation with NEMA and IEC Flanges

Refer to NORD Gearbox Inputs Installation and Maintenance Instructions in BIM1009.

- A. Make sure the flanges are clean and free of gasket material. Install a new gasket between the mating flanges, if applicable.
- B. Carefully move the motor to insert the motor shaft and its hub/sheave into the adapter spline, making sure the shaft key enters the mating keyway.
- C. Seat the motor flange against the mating flange. Install the mounting bolts and tighten them securely.
- D. Reconnect the wiring to the motor. Refer to Figure 2 for the motor and options connection diagrams.

4. Removing and Replacing C-Face Motors

- A. Shut off the power to the motor and post the shutoff with an “OUT OF SERVICE” placard. Disconnect the wiring to the motor. Tag each wire as it is disconnected.
- B. Support the motor. Remove four bolts securing the motor to the NEMA or IEC adapter.

NOTE: The bolts securing the motor to the adapter are retained using a medium strength thread locker such as blue Loctite.

- C. Pull the motor straight out from the adapter.
- D. Measure and record the dimension from the coupling to the motor flange. Use this dimension to locate the coupling on the replacement motor.
- E. Install a new drive key in the keyway, staking the key or using Loctite to retain the key in the keyway, according to the following instructions:

- 1) If the drive key is not trapped in the keyway (the keyway is open at both ends), stake and install the drive key as follows:

- a. Make sure the keyway is free of contamination so that the drive key will seat properly.
- b. Add a few drops of an approved lubricant to the keyway.
- c. Place the drive key on an appropriate surface with the shaft side of the drive key up. Stake the key in two places near each long edge to deform the edge outward.

CAUTION: SUPPORT THE MOTOR SHAFT BEFORE STAKING THE KEY TO PREVENT DAMAGE TO THE MOTOR BEARINGS.

- d. Support the motor shaft in V-blocks. Place the key with the staked surface down over the key slot. Place a sheet of copper shimstock, or equivalent, on the drive key and tap it into the keyway using a hammer.
- e. Check the key to make sure it is fully seated and securely retained.

- 2) Install and Loctite the drive key as follows:

- a. Make sure the keyway is clean of old Loctite and is free of oil film.
- b. Apply Loctite primer and medium strength (blue) Loctite to the surface of the key and keyway according to the Loctite instructions.

CAUTION: IF THE DRIVE KEY IS TO BE LOCTITED IN PLACE, CLEAN ALL THE LOCTITE FROM THE SURFACE OF THE DRIVE KEY AND THE MOTOR SHAFT TO PREVENT POSSIBLE BONDING OF THE COUPLING AND SPLINE SHAFT TO THE DRIVE KEY.

- c. Install the drive key and center it in the keyway. Cure the Loctite according to Loctite instructions.

- F. Clean all contamination and corrosion from the mating flanges.
- G. Support the motor and mount it to the adapter.
- H. Apply a medium strength thread locking compound such as blue Loctite to the bolt threads according to the instructions. Install the bolts and tighten them securely.
- I. Reconnect the wiring to the motor. Refer to Figure 2 for the motor and options connection diagrams.

5. Removing and Replacing Integral Motors

- A. Shut off the power to the motor and post the shutoff with OUT OF SERVICE. Disconnect the wiring to the motor. Tag each wire as it is disconnected.
- B. Support the motor and remove the bolts securing the motor to the gearbox.
NOTE: Most integral motor installations have mounting bolts accessible from the motor exterior. If the bolts are not visible, unbolt the input flange from the gearbox. Remove four bolts that mount the motor. Remove and discard the Dubo gaskets from the bolts.
- C. Remove the motor from the gearbox.
- D. Clean the gasket faces on the motor and gearbox, making sure no cleaning debris enters the gearbox.
- E. Check the replacement motor to make sure the motor flange, motor shaft, and motor pinion are identical to the motor that was removed.
- F. Place a new gasket between the gearbox and new motor.
- G. Position the motor on the gearbox, making sure the input pinion meshes with the input gear. Rotate the motor as necessary to align the bolt holes and seat the motor flange. Make sure the gasket remains properly aligned and seated.
- H. Apply a medium strength thread locking compound such as blue Loctite to the bolt threads according to the instructions. Install the bolts and tighten them securely.
NOTE: If the motor/gearbox installation uses an input flange, mount the input flange to the motor using four mounting bolts and new Dubo gasket. Tighten the bolts securely.

CAUTION: DO NOT TO MIX TYPES OF OIL.

- I. Check the gearbox oil level. If necessary fill the gearbox or add oil to bring the gearbox oil to the correct level. Check the installation and maintenance manual for your gearbox to find the correct oil for the gearbox.
- J. Reconnect the wiring to the motor. Refer to Figure 2 for the motor and options connection diagrams.

6. Handling and Lifting

- A. Before lifting any motor, disconnect all electrical connections. Tag each wire as it is disconnected.
- B. Disconnect the motor from the gearbox. Do not lift the motor while it has other equipment attached to it.
- C. If the motor has provisions for a lifting eye, turn in an appropriately sized lifting eye and lock it in place with the locking nut. Lift the motor by the lifting eye using an appropriate lifting device.
- D. If the motor does not have provisions for a lifting eye, seek assistance or use appropriate lifting devices as necessary.

7. Storage

If the motor is not in service, store it according to the following conditions:

- A. Cover the motor and store it in a clean warehouse environment protected from dust and fluids.
- B. If the motor has internal heaters, power the heaters during storage if the storage environment is extremely humid. The heaters will prevent moisture buildup in the motor interior.
- C. Before placing the motor in service, visually inspect the motor exterior for evidence of deterioration during storage. Turn the motor shaft by hand to make sure the shaft turns smoothly and freely.

CONNECTION DIAGRAMS

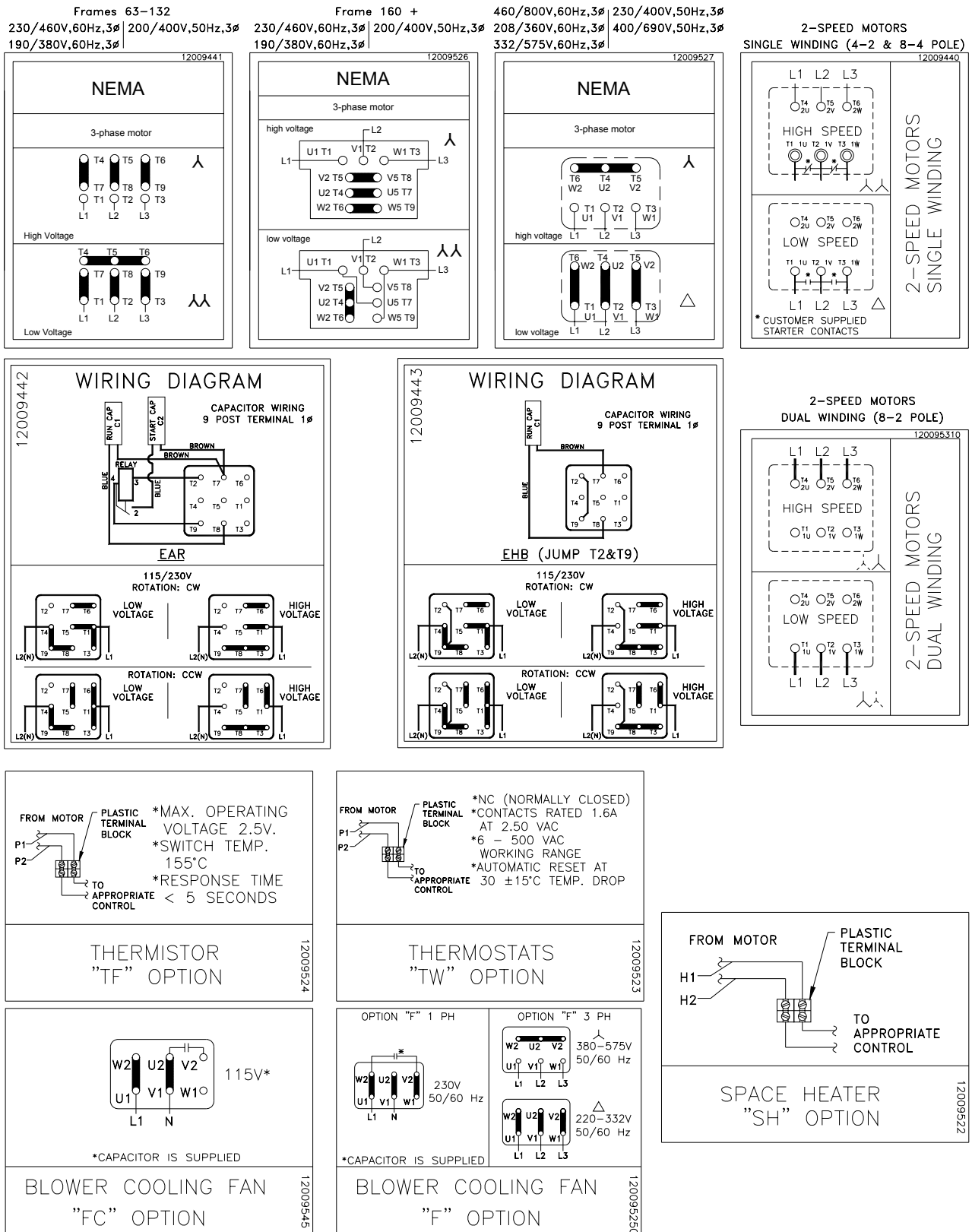


Figure 2. Motor Connection and Wiring Diagrams

REPAIR

1. General

These instructions can be generally applied to NORD motor applications. The exploded view provided in the PARTS INFORMATION section shows the parts orientation for NORD motors.

To procure replacement parts from NORD, contact NORD's customer service department (refer to INTRODUCTION). Provide NORD with the motor part number and serial number, and the item reference number and nomenclature from the parts information figure, which will identify the part for your motor application.

A. The following parts must be replaced if they are removed:

- Oil seal (904), Oil seal (933)
- Gasket (909), Gasket (910), Gasket (921)
- Gasket on plug (961)
- Self-locking screws (907-1, 908-1, 923, 932-1, 940-1)

B. If the following parts are removed, inspect them, and replace them if they are deformed:

- Retaining ring (919), Retaining ring (947), Retaining ring (948)
- Fan clip (952)

C. Disassemble the motor according to the general exploded view in PARTS INFORMATION. Disassemble only as far as necessary to replace the failed parts.

D. Whenever the motor is disassembled, clean all dust and contamination from the motor interior using a vacuum cleaner and a soft-bristled nylon brush.

PARTS LIST

1. General

Refer to Figure 4 for parts information. If you are ordering a part, provide the model and serial number of your motor. This will determine the part number you need.

Part Number	Part Description	Qty per Assembly
900	Rotor Assembly	1
902	A-Endbell	1
904	Oil Seal	1
905	Bearing	1
906	Preload Spring	1
907	T-Box Frame	1
907-1	Screw	4
908	T-Box Cover	1
908-1	Screw	4
909	T-Box Frame Gasket	1
910	T-Box Cover Gasket	1
916	Stator Assembly	1
918	Drive Key	1
919	Retaining Ring	1
920	Oil Plug	1
921	Gasket	1
923	Screw	4
929	Bearing	1
932	B-Endbell	1
932-1	Screw	4
933	Oil Seal	1
939	Fan	1
940	Fan Cowl	1
940-1	Screw	4
947	Retaining Ring	1
948	Retaining Ring	1
952	Fan Clip	1
960	NPT Thread Adapter	1
961	Plug (includes O-ring)	1
***	Spur Drive Gear (alternate to integral bevel gear)	AR
TBLK	Terminal Block	1
TBLK-1	Screw, Terminal Block Mounting	2
ø ø ø	Jumper Bar (not illustrated)	AR

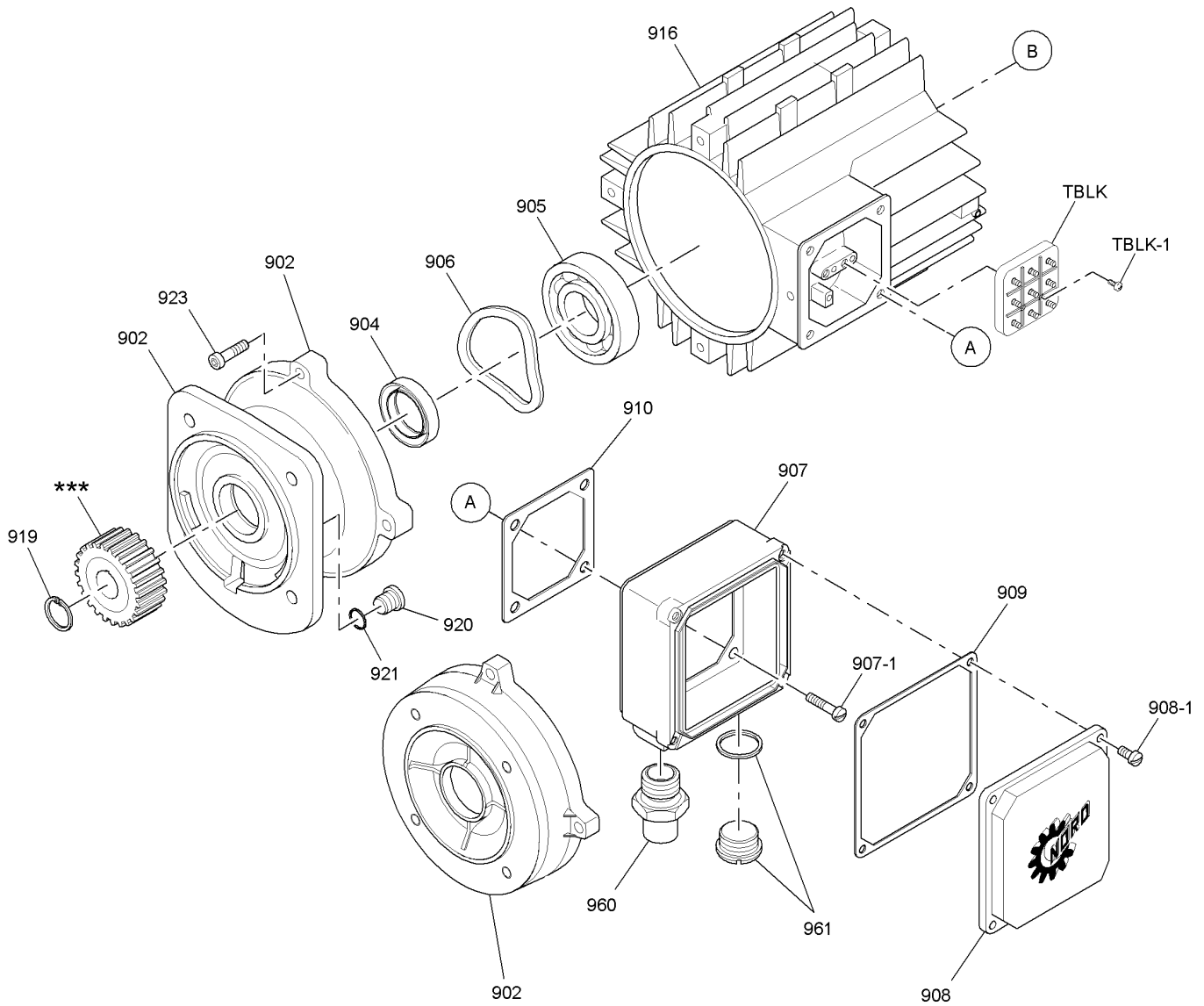


Figure 3. General Motor Exploded View and Generic Parts List (Sheet 1 of 2)

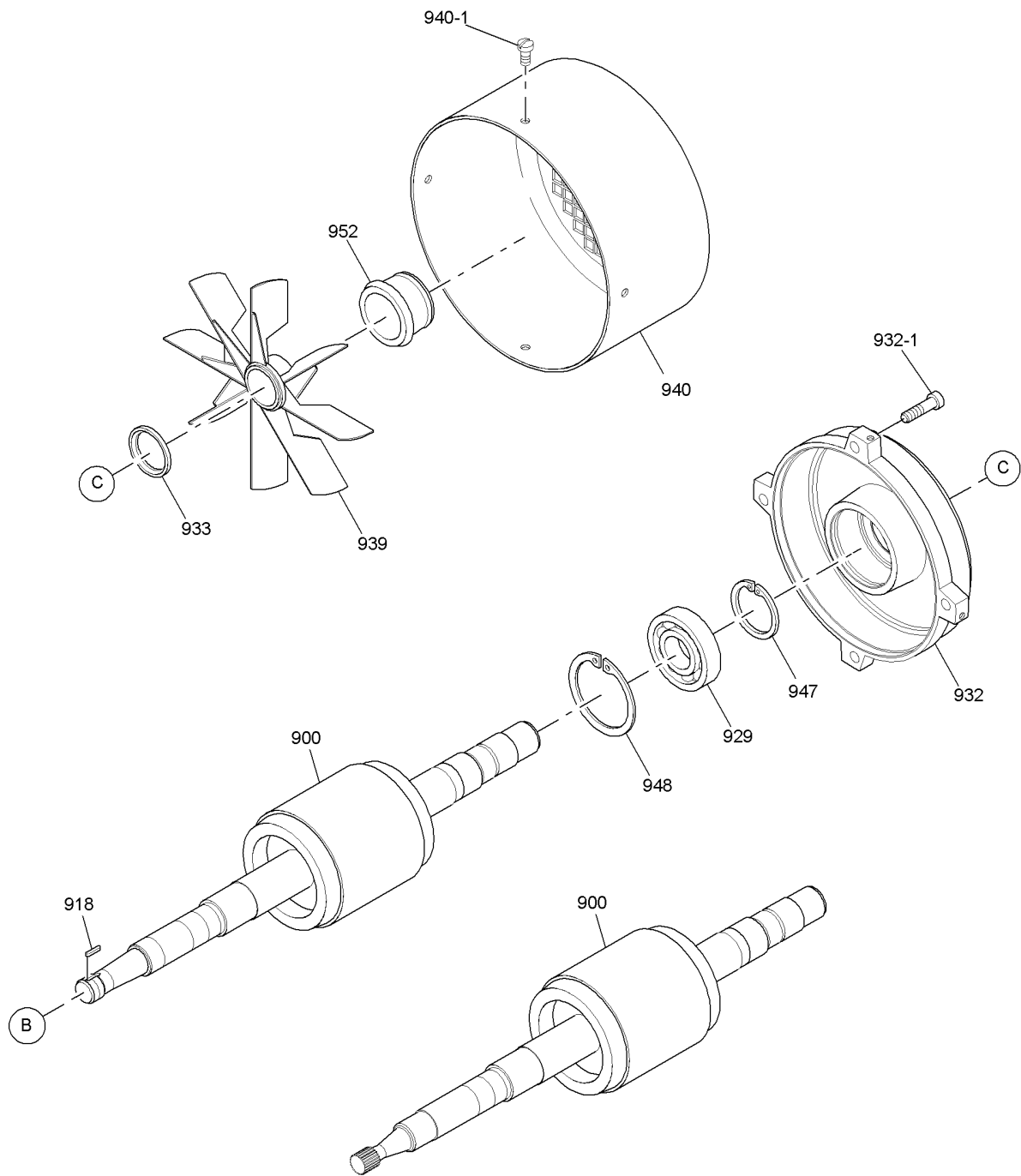


Figure 3. General Motor Exploded View and Generic Parts List (Sheet 2 of 2)

MOTOR OPTIONS & NOMENCLATURE

1. General

NORD offers many options for its motors. The option code will be shown in the motor nomenclature. Below are the available options

Code	Description	Code	Description
BRE	With Brake	OL	TENV Motor – Without Fan
RG	Brake – Corrosion Protected	OL/H	TENV Motor - Without Fan & Cover
SR	Brake – Dust Protected	RD	Canopy Cover
HL	Brake – Manual Hand Release	RDD	Double Canopy Cover
FHL	Brake – Lockable Manual Release	RLS	Backstop
MIK	Brake – Microswitch	SH	Motor Space Heater
IR	Brake – Current Sensing Relay	TF	Thermistor
KD	Condensation Holes	TW	Thermostat
KB	Condensation Holes - Plugged	WE	2 nd Motor Shaft End
MS	Power Plug Connector	WU	High Slip Rotor
NSD+	NORD Severe Duty Plus Protection	Z	High Inertia Motor Ran
EHBU	Single Phase, Run Capacitor	H	Energy Efficient
EARU	Single Phase, Start Cap/Run Cap	IP66	IP66 Environmental Protection
F	Blower Cooling Fan - 3ph & 1ph	ISO H	Class H Insulation
FC	Blower Cooling Fan - 1ph	EP	Epoxy Dipped Windings
IG	Incremental Encoder	FK	Over Running Clutch
VR	5:1 Constant Torque Rated Motor	VN	10:1 Constant Torque Rated Motor
VW	20:1 Constant Torque Rated Motor	VZ-F	1000+:1 Constant Torque Rated Motor

Table 5. Motor Option Codes

Motor Nomenclature					
Motor			Motor Options		
100L	/	4	BRE	40	...
Frame Size		No. of Poles	Brake	Brake size Nm	Other Options

Examples

90SH/4 IG SH

Energy Efficient, 1 Speed, Encoder & Space Heater

100L/4-2 WE RDD

2 speed, 2nd Motor Shaft & Double Canopy Cover

132M/4 BRE100 HL IR TW

Brake, Hand Release, Current Sensor & Thermostat

Technical information follows for THERMISTORS, THERMOSTATS, SPACE HEATERS (Table 6), ENCODERS (Table 7) & BLOWER COOLING FAN (Table 8).

Thermistors (Option TF)

- Connection Diagram shown on Page 12
- Three PTC (Positive Temperature Coefficient) temperature sensitive resistors are wired in series
- One PTC on each phase of the stator winding
- The leads will be labeled P1 and P2 in the terminal box
- This unit must be connected to a Motor Control Protection module such as a Kriwan INT69 or a Variable Frequency Drive with PTC inputs

All wiring must be done by qualified personnel and adhere to all local codes.

WARNING: Thermistors will automatically reset.

Thermistor Ratings:

- Switching temperature 310°F(155°C)
- Maximum operating voltage 2.5 volts
- Resistance at 25°C less than or equal to 300 Ohms
- Response time < 5 seconds

Thermostats (Option TW)

- Connection Diagram shown on Page 12
- Three temperature sensitive, bimetallic switches with normally closed contacts wired in series
- One switch on each phase of the stator winding
- The leads will be labeled P1 and P2 in the terminal box

All wiring must be done by qualified personnel and adhere to all local codes.

WARNING: Thermistors will automatically reset.

Thermostat Ratings:

- Switching temperature 310°F (155°C)
- Switch contacts 1.6A at 250 VAC
- Permissible working 6 to 500 VAC
- Automatically resetting with $30 \pm 15^\circ\text{C}$ drop below switching temperature
- Resistance less than 50 mΩ
- Switch rebound less than 1 millisecond
- 10g shock in all directions
- 2,000 VAC Insulation rating
- 10,000 cycles
- Normally closed

Space Heaters (Option SH)

- Connection Diagram shown on Page 12
- Space Heaters are mounted directly on the motor winding
- The leads are brought into the terminal box and labeled H1 and H2
- They require a separate voltage supply and must not be energized when the motor is energized
- The heaters will keep the winding of the motor approximately 5°C above the surrounding ambient

FRAME SIZE	WATTAGE	VOLTAGES	HEATER P/N	HEATER STRIPS/MTR
63 & 71	18W	110V	18900770	1
		230V	18900780	
		460V	18900790	
80	25W	110V	18900820	1
		230V	18900800	
		460V	18900810	
90 – 112	50W	110V	18900820	2
		230V	18900800	
		460V	18900810	
132-180	100W	110V	18900830	2
		230V	18900840	
		460V	18900850	
200 & 225	120W	110V	18900860	2
		230V	18900870	
		460V	18900880	

Table 6. Space Heater Data

Encoder (Option IG)

- Standard encoder manufacturer is Heidenhain (www.heidenhain.com)
- All encoders will be enclosed inside the fan shroud
- Incremental, Quadrature, Differential, Marker Channel
- IP 64 Protection
- IG1 = 1024PPR, IG2 = 2048PPR, IG4 = 4096PPR
- RS422 & Push/Pull available
- 5V or 10-30V available

Color	Signal		Pin (optional mating plug)	Heidenhain Callouts	Explanation
	Push-pull	RS 422			
Pink	---	$\overline{B}$ (B-)	1	$\overline{U_{a2}}$	Signal line
Blue	---	Sensor (+)	2	U_P	Sense Supply Voltage
Red	R (R+)	R (R+)	3	U_{a0}	Signal line (Marker)
Black	---	R-	4	$\overline{U_{a0}}$	Signal line
Brown	A (A+)	A (A+)	5	U_{a1}	Signal line
Green	---	$\overline{A}$ (A-)	6	U_{a1}	Signal line
Violet	---	Spare	7	$\overline{U_{aS}}$	Spare
Gray	B (B+)	B (B+)	8	U_{a2}	Signal line
Yellow	---	---	9	Shield	Spare
White/ Green	0 V	0 V	10	0 V / U_N	Common
White	0 V	Sensor (-)	11	0 V / Sensor	Sense Common
Brown/ Green	V_S	V_S	12	U_P	Supply Voltage
Table 7. Encoder Wiring Designations					

BLOWER COOLING FAN (Option F & FC)

- Connection Diagram shown on Page 12
- Option FC is 1 phase 115V only
- Option F has capability of 1 phase or 3 phase by connecting a supplied capacitor

		60 Hz Ratings			50 Hz Ratings		
Motor Frame		Voltage [V]	Current [A]	Power [W]	Voltage [V]	Current [A]	Power [W]
Single Phase Connection - 1~Δ	FC63	100-135	0.23	42	100-135	0.30	42
	FC71	100-135	0.23	47	100-135	0.30	44
	FC80	100-135	0.27	57	100-135	0.30	43
	FC90	100-135	0.46	102	100-135	0.57	78
	FC100	100-135	0.53	105	100-135	0.54	78
	FC112	100-135	0.60	115	100-135	0.55	80
Single Phase Connection 1~Δ	F63	230-332	0.11	38	230-277	0.10	27
	F71	230-332	0.12	41	230-277	0.10	28
	F80	230-332	0.13	44	230-277	0.11	29
	F90	230-332	0.25	88	230-277	0.26	72
	F100	230-332	0.28	88	230-277	0.26	70
	F112	230-332	0.31	107	230-277	0.26	73
	F132	230-332	0.27	89	230-277	0.29	82
Three-Phase Low Voltage Connection 3~Δ	F63	230-332	0.08	23	230-290	0.10	27
	F71	230-332	0.08	24	230-290	0.10	28
	F80	230-332	0.08	25	230-290	0.10	29
	F90	230-332	0.21	64	230-290	0.28	86
	F100	230-332	0.21	66	230-290	0.27	86
	F112	230-332	0.23	70	230-290	0.27	85
	F132	230-332	0.25	74	230-290	0.32	96
	F160	230-332	0.49	165	230-290	0.53	155
	F180	230-332	0.49	165	230-290	0.53	155
	F200	230-332	0.49	165	230-290	0.53	155
	F225	230-332	0.49	165	230-290	0.53	155
Three-Phase High Voltage Connection 3~Y	F63	380-575	0.04	23	380-500	0.05	29
	F71	380-575	0.04	25	380-500	0.05	30
	F80	380-575	0.04	26	380-500	0.05	29
	F90	380-575	0.12	62	380-500	0.16	82
	F100	380-575	0.12	66	380-500	0.16	83
	F112	380-575	0.13	70	380-500	0.16	82
	F132	380-575	0.14	75	380-500	0.18	96
	F160	380-575	0.28	165	380-500	0.30	155
	F180	380-575	0.28	165	380-500	0.30	155
	F200	380-575	0.28	165	380-500	0.30	155
	F225	380-575	0.28	165	380-500	0.30	155

Table 8. Blower Cooling Fan Data



G.C. Evans Sales & Mfg Co Inc.

Section 5

Spare Parts / Motor Nameplate Information

Model P-1048SD
Pasteurizer



G.C. Evans Sales & Mfg Co Inc.

Section 5-I

Spare Parts List

Model P-1048SD
Pasteurizer

Blue Marble Productions
Indianapolis, IN
P-1048SD Pasteurizer
Recommended Spare Parts List

Manufacturer	Item	Quantity	Ordering Part #	Cost	Lead Time
Bell & Gossett	e-1531 3AD	1	Impeller - P2000858-6.875	\$1,792.00	6 weeks
<i>Spray Pumps</i>	<i>360 gpm @ 35 tdh</i>	1	Gasket - P57700	\$13.00	1 week
		1	Seal - 186862	\$308.00	1 week
Bell & Gossett	e-1531 3BD	1	Impeller - P2000828-8.125	\$2,562.00	6 weeks
<i>Regen Pumps</i>	<i>360 gpm @ 60 tdh</i>	1	Gasket - P48690	\$27.00	1 week
		1	Seal - 186862	\$308.00	1 week
GC Evans	Bearing - 1 1/2" 2 Bolt Flange	1	CSFLGBRG0013	\$136.00	1 - 2 weeks
GC Evans	Infeed Center Mount Bearing - 2 7/16"	1	G-37338	\$250.00	6 weeks
GC Evans	Discharge Center Mount Bearing - 4 1/4"	2	G-37444	\$400.00	6 weeks
GC Evans	Infeed Center Mount Bearing Housing	1	G-37340	\$350.00	6 weeks
GC Evans	Discharge Center Mount Bearing Housing	2	G-37370	\$450.00	6 weeks
GC Evans	Idle Shaft	1	PB958372	\$4,565.83	2 weeks
GC Evans	Drive Shaft	1	PB958376	\$11,744.00	16 - 20 weeks
IFM Efector	RTD	1	TA2313	\$137.20	1 week
IFM Efector	Level Sensor	1	LMT102	\$283.36	1 week
Rexnord	Main Belt	50'	USP5997 - 120"	\$210.83/ft	4 weeks
Rexnord	Drive Sprocket	10	NS5996-14T 4-1/2 Round	\$70.53	4 weeks
Rexnord	Idle Sprocket	10	NS5996 - 14T 2 1/2" Square	\$70.53	4 weeks
Rexnord	Conveyor Chain - HP7705 15"	20'	HP7705-15	\$47.38/ft	2 weeks
Rexnord	Conveyor Chain - HP7705 18"	20'	HP7705-18	\$40.64/ft	
Rexnord	DTS Belt - HP7705 4.5" DTS LH	20'	HP7705-4.5-DTS-LH	\$26.66/ft	2 weeks
Rexnord	DTS-C Finger Transfer Plate	5	614-448-1	\$30.38	2 weeks
SealMaster	Infeed Main Bearing - 2 7/16"	2	RPB207-C2CR	\$1,166.91	8 weeks
SealMaster	Discharge Main Bearing - 4 1/2"	2	RPB408-C4CR	\$6,501.15	8 weeks
Nord	Main Drive	1	SK6382/22AZMHG-80S/4 CUS IP66	\$5,945.87	12 weeks
Spraying Systems	Main Spray Nozzle	50	D3/4HH-PVDF7010	\$52.00	4 weeks

*******Items highlighted in red are considered CRITICAL SPARES needed for normal startup.*******

Quoted pricing is good for 30 days.



G.C. Evans Sales & Mfg Co Inc.

Section 5-II

Motor Nameplate Information

Model P-1048SD
Pasteurizer

Blue Marble Productions
Indianapolis, IN
P-1048SD Pasteurizer
Motor Nameplate Information

Main Drive Gearbox

Manufacturer	Nord Gear
Horsepower	0.33
Volts	230/460
RPM	1710
Type	71 S/4 CUS IP66
In	1710
Out	0.5
Torque (lb-in)	41970
Mounting Pos	M5
Ratio	3450.76

Infeed Gearbox

Manufacturer	Nord
Horsepower	0.33
Volts	230/460
RPM	1710
Type	71 L/4 CUS IP66
In	1720
Out	6
Torque (lb-in)	5454
Mounting Pos	M4
Ratio	297.67

DTS Gearbox

Manufacturer	Nord
Horsepower	0.25
Volts	230/460
RPM	1680
Type	63 L/4 CUS IP66
In	1680
Out	8.4
Torque (lb-in)	1058
Mounting Pos	M4
Ratio	200.00

Discharge Blower Motor

Manufacturer	Baldor
Horsepower	5
RPM	3450
Frame	184T
Volts	230/460
Catalog #	EM3613T

Pump Motor (Spray)

Manufacturer	Baldor
Horsepower	5
RPM	1800
Frame	184JM
Volts	230/460
Catalog #	EJMM3615T

Pump Motor (Regen)

Manufacturer	Baldor
Horsepower	10
RPM	1800
Frame	215JM
Volts	230/460
Catalog #	EJMM3714T