Western Water Constructors, Inc.
license no. 188068

Submittal Cover

Job no. 16-05

CONTRACT NAME:	Manteca WQCF Digester Improvements	**SUB #:**	204
SPEC SECTION:	11386 Packaged Digester Gas Treatment System	**REV #:**	0
SUBMITTAL TITLE:	Packaged Digester Gas Treatment System – O&M	**CODE:**	11386-02
FILE NAME:	204-R0_11386-02_Packaged Digester Gas Treatment System-OM	**DATE:**	11/10/2017

WWC REVIEW/COMMENTS: ☒ **NO EXCEPTIONS** ☐ **EXCEPTIONS / DEVIATIONS AS NOTED**

REVIEWED BY: ST **SIGNED:**

WWC HAS REVIEWED THIS SUBMITTAL FOR CONFORMANCE WITH THE PROJECT PLANS & SPECIFICATIONS.

OWNER REVIEW:

ITEM	DESCRIPTION	REVIEW STATUS				
		A	B	C	D	E
1	Packaged Digester Gas Treatment System O&M	☐	☐	☐	☐	☐
2		☐	☐	☐	☐	☐
3		☐	☐	☐	☐	☐
4		☐	☐	☐	☐	☐
5		☐	☐	☐	☐	☐

LEGEND: **A =** No Exceptions Taken **B =** Make Correction Noted **C =** Correct & Resubmit
D = Rejected **E** = Accepted for Record

OWNER COMMENTS:

REVIEWER'S NAME:

REVIEWER'S SIGNATURE: **DATE:**

707 Aviation Blvd
Santa Rosa, CA 95403

www.westernwater.com
general engineering contractors

p 707.540.9640
f 707.540.9641

EQUIPMENT SUMMARY FORM

1. EQUIPMENT ITEM Packaged Digester Gas Treatment System

2. MANUFACTURER Unison Solutions

3. EQUIPMENT IDENTIFICATION NUMBER(S) BIOG-TNK-07-610/611, BIOG-FLT-07-612
(maps equipment number)

4. LOCATION OF EQUIPMENT Gas treatment area

5. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS) SulfaTreat tank operating weight 47,006 lbs. Inlet filter weight 500 lbs.

6. NAMEPLATE DATA - Horsepower NA
   Amperage NA
   Voltage NA
   Service Factor (S.F.) NA
   Speed NA
   ENC Type NA
   Capacity NA
   Other NA

7. MANUFACTURER'S LOCAL REPRESENTATIVE

   Name NA

   Address NA

   Telephone Number 563-585-0967

8. MAINTENANCE REQUIREMENTS See O&M manual

9. LUBRICANT LIST NA

10. SPARE PARTS (recommendations) See O&M manual

11. COMMENTS

CITY OF MANTECA WASTEWATER QUALITY CONTROL FACILITY

Packaged Gas Treatment System

OPERATION AND MAINTENANCE INSTRUCTIONS

5451 Chavenelle Rd.
Dubuque, IA 52002

Phone: 563-585-0967
Fax: 563-585-0970

www.unisonsolutions.com

CITY OF MANTECA WASTEWATER QUALITY CONTROL FACILITY

Packaged Gas Treatment System

OPERATION AND MAINTENANCE INSTRUCTIONS

Unison Solutions, Inc.
5451 Chavenelle Rd
Dubuque IA 52002
(563) 585-0967
www.unisonsolutions.com

Title Sheet

Title:	**OPERATION AND MAINTENANCE INSTRUCTIONS**
Project Title:	**City of Manteca Wastewater Quality Control Facility**
Equipment:	**Packaged Gas Treatment System**
General Contractor:	**Western Water Constructors, Inc.** **707 Aviation Blvd.** **Santa Rosa, Ca. 95403** **Phone: (707) 540-9640** **Fax: (707) 540-9641**
Engineer:	**HERWIT Engineering** **6200 Center Street, Suite 310** **Clayton, CA 94517** **(925) 672-6599**
Manufacturer:	**Unison Solutions, Inc.** **Project No.: 251** **Contact: Nathan Huebner** **5451 Chavenelle Rd.** **Dubuque, Iowa 52002** **Telephone: (563) 585-0967** **E-mail: Nathan.Huebner@unisonsolutions.com** **Fax: (563) 585-0970**
Parts & Service:	**Unison Solutions, Inc.** **Telephone: (563) 585-0967**

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TABLE OF CONTENTS

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UNISON
SOLUTIONS

WARRANTY STATEMENT

Unison Solutions, Inc. (Unison) is committed to providing quality products and services to its customers. As a demonstration of this commitment, Unison offers the following warranty on its products.

Grant of Warranty: Unison provides this warranty for its equipment under the terms and conditions which are detailed herein. This warranty is granted to the person, corporation, organization, or legal entity (Owner), which owns the equipment on date of start-up. This warranty applies to the owner during the warranty period, and is not transferable.

Warranty Coverage: Equipment that is determined by Unison to have malfunctioned during the warranty period under normal use solely as a result of defects in manufacturing workmanship or materials shall be repaired or replaced at Unison's option. Unison's liability under this warranty to the Owner shall be limited to Unison's decision to repair or replace, at its factory or in the field, items deemed defective after inspection at the factory or in the field.

Warranty Exclusions: All equipment, parts and work not manufactured or performed by Unison carry their own manufacturer's warranty and are not covered by this warranty. Unison's warranty does not override, extend, displace or limit those warranties. Unison's only obligation regarding equipment, parts and work manufactured or performed by others shall be to assign to the Owner whatever warranty Unison receives from the original manufacturer. Unison does not warrant its products from malfunction or failure due to shipping or storage damage, deterioration due to exposure to the elements, vandalism, accidents, power disturbances, or acts of nature or God. This warranty does not cover damage due to misapplication, abuse, neglect, misuse, improper installation, or lack of proper service and/or maintenance, nor does it cover normal wear and tear. This warranty does not apply to modifications not specifically authorized in writing by Unison or to parts and labor for repairs not made by Unison or an authorized warranty service provider. This warranty does not cover incidental or consequential damages or expenses incurred by the Owner or any other party resulting from the order, and/or use of its equipment, whether arising from breach of warranty, non-conformity to order specifications, delay in delivery, or any loss sustained by the Owner. No agent or employee of Unison has any authority to make verbal representations or warranties of any goods manufactured and sold by Unison without the written authorization signed by an authorized officer of Unison. Unison warrants the equipment designed and fabricated to perform in accordance with the specifications as stated in the proposal for the equipment and while the equipment is properly operated within the site specific design limits for that equipment. Any alterations or repair of Unison's equipment by personnel other than those directly employed by, or authorized by Unison shall void the warranty unless otherwise stated under specific written guidelines issued by Unison to the Owner. This warranty does not cover corrosion or premature wear or failure of components resulting from the effects caused by siloxanes, hydrogen sulfide or volatile organic compounds in excess of the design limits. All media must be purchased through Unison Solutions or approved in writing by Unison Solutions during warranty period. Media purchased though alternate sources and not approved in writing by Unison shall void the warranty. The design limit is based on site specific gas data provided by the Owner prior to the proposal for the equipment. Owner shall be responsible for all maintenance service, including, but not limited to, lubricating and cleaning the equipment, replacing expendable parts, media, making minor adjustments and performing operating checks, all in accordance with the procedures outlined in Unison's maintenance literature. Unison does not warrant the future availability of expendable maintenance items.

Warranty Period: This Unison warranty is valid for 30 months from the time the equipment is shipped from Unison's factory or 24 months from the date of startup, whichever occurs first.

Repairs During Warranty Period: All warranty claim requests must be initiated with a Return Material Authorization (RMA) number for processing and tracking purposes. The RMA number shall be issued to the Owner upon claim approval and/or field inspection. When field service is deemed necessary in order to determine a warranty claim, the costs associated with travel, lodging, etc. shall be the responsibility of the Owner except under prior agreement for a field inspection. This warranty does not include reimbursement of any costs for shipping the equipment or parts to Unison or an authorized service establishment, or for labor and/or materials required for removal or reinstallation of equipment or parts in connection with a warranty repair. This warranty covers only those repairs that have been conducted by Unison or by a Unison authorized warranty service provider, or by someone specifically authorized by Unison to perform a particular repair or service activity. All component parts replaced under the terms of this warranty shall become the property of Unison.

UNISON ASSUMES NO OTHER WARRANTY FOR ITS EQUIPMENT, EITHER EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR NONINFRINGEMENT, OR LIABILITY FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGE.

5451 Chavenelle Road, Dubuque, Iowa 52002 ■ [O] 563.585.0967 [F] 563.585.0970 ■ www.unisonsolutions.com

SYSTEM SAFETY

This guideline is intended to be an aid for owners and operators of biogas conditioning systems in developing safety programs. A facility owner, manager, or supervisor with appropriate training and applicable knowledge in biogas conditioning systems should develop a safety program adhering to the applicable federal, state, and local codes and agencies.

It is recommended that all personnel that may be exposed to the hazards associated with biogas conditioning systems be properly trained. Only trained, authorized personnel should perform maintenance or operate the system. Training should be documented and kept on file for future reference. The training material should be reviewed whenever a site condition changes or as often as the facility owner, manager or supervisor deems appropriate.

It is the sole responsibility of the system owner to comply with all applicable codes and agencies. Unison Solutions, Inc. assumes no responsibility for the unsafe operation and service of the system. The information provided herein may help identify hazards and develop safe work procedures when operating and servicing the gas conditioning system. Refer to the system O&M Manual provided for specific manufacturer recommendations. Safety labels may also be applied throughout the system to warn of potential hazards.

Possible Hazards:

A. High Voltage
B. Hot Surfaces
C. Pressurized gases and liquids
D. Poisonous gases
E. Explosive gases
F. Harmful chemicals
G. Combustible solids
H. Rotating parts
I. Confined spaces
J. Falling objects
K. Asphyxiating gases

General Safety Guidelines:

A. Do NOT operate system without guards, doors, and covers in place.
B. Do NOT remove, bypass, or modify safety devices.

C. Do NOT operate system if it is not in proper working condition.
D. Do NOT allow open flames in the vicinity of the system.
E. Do NOT allow unauthorized personnel to operate or service the system.
F. Do NOT climb in or on the system during operation.

System Maintenance:

Only trained, authorized personnel should perform maintenance on the gas conditioning system. Always follow an approved Lockout/Tagout program to ensure safety. Components within the system can energize and move at any time, so all sources of energy need to be identified and have the ability to be isolated for maintenance. Also, please note that components utilizing a yellow wire within the gas conditioning system control panel are energized from a source other than the panel disconnect.

Pressurized Vessels/Piping:

Vessels and piping will remain pressurized even after the system is shutdown and power is removed from the panel and peripheral components. Observe multiple pressure instruments before attempting to service the equipment. When opening a valve or removing a pipe component, do not stand directly in line with the component or valve. Open the valve or remove the pipe component slowly. Never modify vessels or piping without authorization from the manufacturer as doing so will void the system warranty. NEVER make modifications to or weld onto a pressure vessel. A pressure vessel is defined as a closed container designed to hold gases or liquids at a pressure substantially different from the ambient pressure.

Hydrogen Sulfide:

Hydrogen Sulfide, commonly referred to as H_2S, is an extremely hazardous and toxic compound found in biogas. It is a colorless, flammable gas that can be identified in relatively low concentrations by its characteristic rotten egg odor. H_2S has a very low odor threshold, with its smell being easily perceptible at concentrations well below 1ppm in air. The odor increases as the gas becomes more concentrated, with the strong rotten egg smell recognizable

up to 30ppm. Above this level, the gas is reported to have a sickeningly sweet odor up to around 100ppm. However, at concentrations above 100ppm, a person's ability to detect the gas is affected by rapid temporary paralysis of the olfactory nerves in the nose, leading to a loss of the sense of smell**.** This means that the gas can be present at dangerously high concentrations with no perceivable odor. Prolonged exposure to lower concentrations can also result in similar effects of olfactory fatigue. This unusual property of H_2S makes it extremely dangerous to rely totally on the sense of smell to warn of the presence of the gas.

Volatile Organic Compounds:

Volatile Organic Compounds, commonly referred to as VOCs, are present in biogas in varying concentrations. Exposure to VOCs can cause acute and chronic health disorders. Filtering biogas captures and concentrates VOCs. Proper PPE should be used when removing and replacing biogas filter media. Personnel trained to remove and replace the filter media should also be properly trained on the required PPE.

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SYSTEM OVERVIEW

The Unison Solutions, model HSR-300-251-H, gas conditioning system is designed to process up to 300 scfm of digester gas. Process gas first enters the inlet moisture/particulate filter (FLT-301), which is designed to remove 99% of any moisture/particulate 3 micron and larger. The process gas then passes through two H_2S removal vessels (FLT-302 and FLT-303) piped in lead/lag configuration. The vessels are filled with a passive bed of media that is designed to removal hydrogen sulfide. The lead/lag configuration allows for either vessel to be put in the lead or lag position, or one vessel can be bypassed.

SYSTEM MANUAL VALVE LISTING

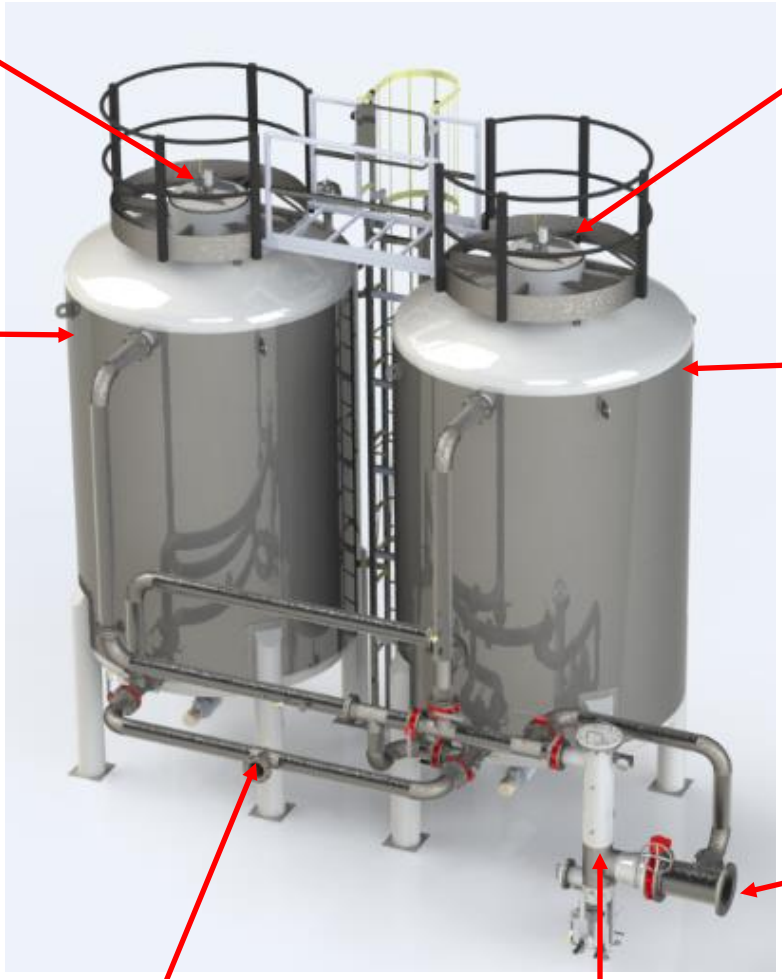
Valve #	Normal operating position	Function
	Biogas Lines	
VB 301	Closed	Open to vent FLT-302
VB 302	Closed	Open to utilize overflow vent for FLT-302
VB 303	Closed	Open to vent FLT-303
VB 304	Closed	Open to utilize overflow vent for FLT-303
VY 301	Open	Close to isolate FLT-301
VY 302	Open	Close to isolate FLT-301
VY 303	Closed	Open to bypass FLT-301
	Condensate Lines	
VB 701	Open	Close to isolate STR-701 and FD-701
VB 702	Closed	Open to manually drain FLT-301
VB 703	Open	Close to isolate FD-701
VB 704	Closed	Open to flush FLT-302
VB 705	Open	Close to isolate STR-702 and TK-702
VB 706	Closed	Open to flush FLT-303
VB 707	Open	Close to isolate STR-703 and TK-703
	Instrument Valves	
VI 3001	Closed	Open to take gas sample at inlet
VI 3002	Open	Close to isolate PDI 301
VI 3003	Closed	Open to calibrate PDI 301
VI 3004	Open	Close to isolate PDI 301
VI 3005	Closed	Open to calibrate PDI 301
VI 3006	Closed	Open to take gas sample before FLT-302
VI 3007	Closed	Open to take gas sample after FLT-302
VI 3008	Closed	Open to purge FLT-302
VI 3009	Closed	Open to take gas sample before FLT-303
VI 3010	Closed	Open to take gas sample after FLT-303
VI 3011	Closed	Open to purge FLT-303
VI 3012	Closed	Open to take gas sample at discharge

H2S removal vessels can be operated in parallel or lead/lag series operation. The following table shows positions of valves for each mode of operation.

- Mode 1: FLT 302 / FLT 303 parallel operation
- Mode 2: FLT 302 Lead / FLT 303 Lag series operation
- Mode 3: FLT 303 Lead / FLT 302 Lag series operation

Valve #	Mode 1	Mode 2	Mode 3
VY 304	Open	Open	Closed
VY 305	Open	Closed	Open
VY 306	Open	Closed	Open
VY 307	Open	Open	Closed
VY 308	Closed	Open	Closed
VY 309	Closed	Closed	Open

UNDERSTANDING THE SYSTEM



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SYSTEM SUMMARY

Inlet Conditions		Discharge Conditions	
Design Flow	300 scfm	Design Flow	300 scfm
Design Pressure	12” W.C.	Design Pressure	NA
Design Temperature	100°F	Design Temperature	NA
Design R.H.	100%	Design R.H.	NA
Inlet Process Connection		12” Class 150 pattern Lug Valve	
Discharge Process Connection		6” Class 150 pattern Lug Valve	

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MAINTENANCE OVERVIEW

The Unison Solutions gas conditioning system is designed to run unattended. However, a daily and weekly inspection should be completed by a trained operator. An inspection log has been included in this section. Make copies and keep a history of this log. Special attention should be paid to any reading on this log which is inconsistent with previous days.

In addition to daily and weekly checks, there are also maintenance procedures required to keep the gas conditioning system running smoothly. The Maintenance Schedule outlines these procedures. Specific work instructions are not included for cleaning strainers, replacing panel light bulbs, greasing bearings, etc. Contact Unison Solutions or trained maintenance personnel if guidance is needed with these procedures.

Pressure relief valves fall into a special maintenance category. Due to the key safety function they perform, it is recommended that each relief valve be inspected according to the manufacturer's documentation. Please refer to specific intervals called out in the individual valve IOM's. This includes relief valves on the gas and oil piping. Refer to the P&ID drawing 3G-251-X-01 to locate all of the valves labeled PSV.

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RECOMMENDED TOOLS AND EQUIPMENT

- Volt meter with milliamp feature
- Handheld digital manometer
- Laser thermometer
- Standard hand tools
    - Grease gun and grease cartridge
    - Screw drivers
        - Set of flat head and Philips of various sizes
        - Very small flat head and Philips for terminal blocks
    - Wrenches
        - Set of standard size wrenches from 5/16” through 1-1/8”
        - Set of metric wrenches from 8 mm through 19 mm
    - Sockets
        - Set of standard size sockets from 5/16” through 1-1/8”
        - Set of metric sockets from 8 mm through 19 mm
    - Allen wrenches
        - Set of standard size Allen wrenches from 1/16” through 3/8”
        - Set of metric Allen wrenches from 1.5 mm through 10 mm
    - 12” Crescent wrench
    - 18” Crescent wrench
    - 12” Pipe wrench
    - 18” Pipe wrench
    - Channel lock pliers

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RECOMMENDED SPARE PARTS

General

Qty	Unison Part Number	Cost Per Unit	Description
1	GASKET-1013	$15	10”, gasket for FLT 301
4	GASKET-5710	$115	24”, gasket for FLT 302/303
1	PDI-1000	$521	0-10” WC, differential pressure gauge
1	FD-1000	$411	Float drain
1	LS-1009	$737	Level switch
1	TI-1006	$43	0 to 250 F, 2.5” stem, rear mount temperature gauge
1	ADT-XXXX	$TBD	Automatic Drip Trap

Pricing to be confirmed at time of order

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MAINTENANCE SCHEDULE

Unison Solutions, Inc.

HSR-300-251-H – H_2S Removal System

Maintenance Item	Reference Section	Frequency
General System Checks; Services if Required		
Record data points in a daily log noting current operating conditions	Sec. 2; Daily Log Sheet	Daily
If PDI 301 exceeds 6 inWC, clean particulate filter	Sec. 3D; Cleaning Procedure	As needed
Verify calibration of PDI 301	Sec 3E; Capsuhelic IOM	Annually
Removal Media Service		
Take periodic gas samples and test for H_2S	Sec. 3A; Media Monitoring	Varies
When necessary change H_2S removal media	Sec. 3C; Change out Procedure	Varies
Condensate Removal Service		
Check STR 701, STR 702, and STR 703; clean as needed	No reference	Quarterly

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DAILY LOG

Unison Solutions, Inc.: Gas Conditioning System

HSR-300-251-H

	Date & Time							
	Initials							
LOCATED ON SYSTEM (RCMD DAILY)	Normal Readings	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
GAS PIPING								
TI 301: FLT 302 INLET GAS TEMPERATURE	80 to 100°F	°F	°F	°F	°F	°F	°F	°F
TI 302: FLT 302 DISCHARGE GAS TEMPERATURE	80 to 100°F	°F	°F	°F	°F	°F	°F	°F
TI 303: FLT 303 INLET GAS TEMPERATURE	80 to 100°F	°F	°F	°F	°F	°F	°F	°F
TI 304: FLT 303 DISCHARGE GAS TEMPERATURE	80 to 100°F	°F	°F	°F	°F	°F	°F	°F
PDI 301: INLET FILTER DIFFERENTIAL PRESSURE	0 to 6 inWC	inWC	inWC	inWC	inWC	inWC	inWC	inWC

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251 - MANTECA WQCF

H2S REMOVAL

MECHANICAL DRAWINGS

DRAWING LIST	DRAWING NO.
TITLE SHEET	1T-251-01
MECHANICAL ABBREVIATIONS & SYMBOLS	1M-251-01
PROCESS & INSTRUMENTATION DIAGRAM	3G-251-H2S-3-01
H2S REMOVAL SYSTEM LAYOUT	6L-251-3-01

UNISON
SOLUTIONS

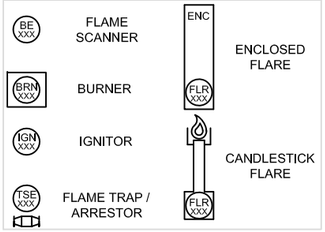
UNISON SOLUTIONS INC.
5451 CHAVENELLE ROAD
DUBUQUE, IA 52002

PHONE: 563-585-0967
FAX: 563-585-0970

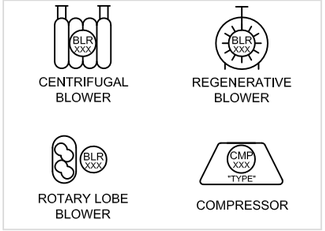
MECHANICAL SYMBOLS & COMPONENT ABBREVIATIONS

THESE SYMBOLS & ABBREVIATIONS COMPRISE A STANDARD LIST; NOT ALL MAY APPEAR ON THIS PROJECT

COMBUSTION



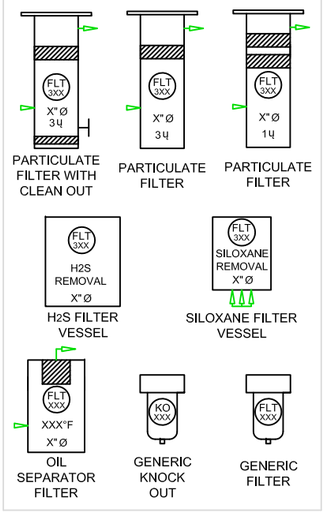
COMPRESSION



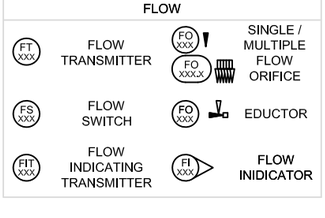
COUPLING DRIVES

FLOAT DRAINS

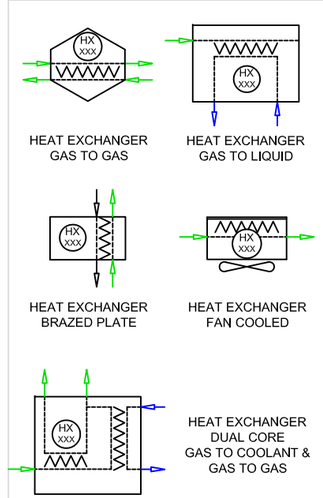
FILTERS



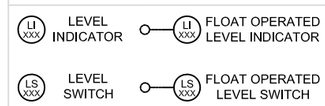
FLOW



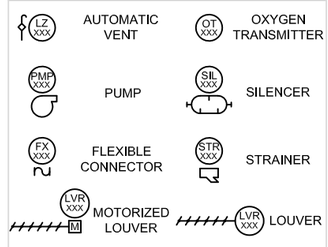
HEAT EXCHANGE



LEVEL



MISCELLANEOUS



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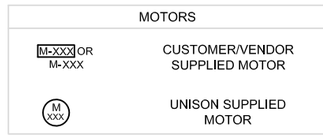
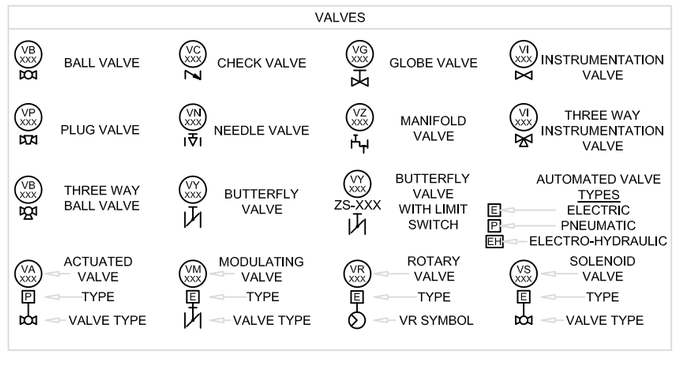
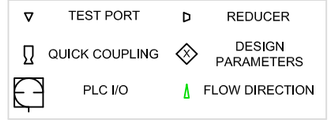


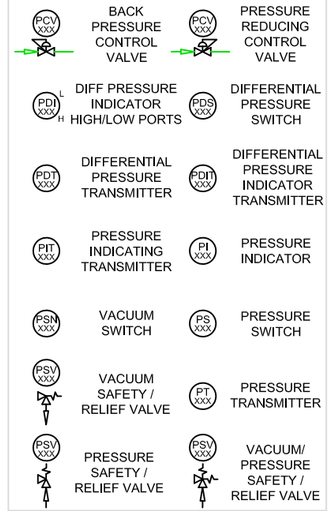
VALVES



NON-DESIGNATED SYMBOLS

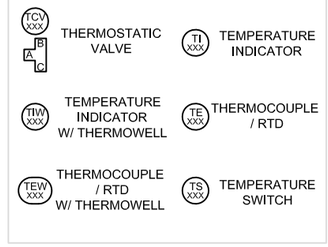


PRESSURE



TANKS

TEMPERATURE



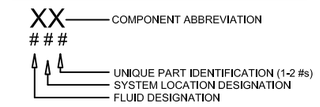
MECHANICAL ABBREVIATIONS

THESE ABBREVIATIONS COMPRISE A STANDARD LIST; NOT ALL ABBREVIATIONS MAY APPEAR ON THIS PROJECT

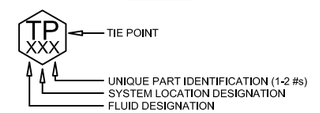
ACFM	ACTUAL CUBIC FEET PER MINUTE
APPROX	APPROXIMATELY
BTU	BRITISH THERMAL UNIT
BTU/H	BRITISH THERMAL UNIT PER HOUR
C	DEGREES CELCIUS
CFM	CUBIC FEET PER MINUTE
CGS	COMBUSTIBLE GAS SENSOR
CI	CAST IRON
CO	CLEAN OUT
COND	CONDENSATE
CONN	CONNECTION
CONT	CONTINUOUS
CP	CONTROL PANEL
CS	CARBON STEEL
DB	DRY BULB TEMPERATURE
DIA	DIAMETER
DIFF	DIFFERENTIAL
DIM	DIMENSION
DISCH	DISCHARGE
DP	DIFFERENTIAL PRESSURE
E	ELEMENT/PROBE
EL	ELEVATION
ELEC	ELECTRICAL
ENC	ENCLOSED / ENCLOSURE
EQUIP	EQUIPMENT
EXH	EXHAUST
EXIST	EXISTING
EXP	EXPLOSION PROOF
EXT	EXTERIOR/EXTERNAL
F	DEGREES FAHRENHEIT
FAN	FAN
FP/M	FEET PER MINUTE
FP/S	FEET PER SECOND
FT	FEET
FC	FAIL CLOSE
FO	FAIL OPEN
GALV	GALVANIZED
GAT	GAS ANALYSIS TRANSMITTER
GP/H	GALLONS PER HOUR
GP/M	GALLONS PER MINUTE
H	HIGH
HD	HEAD
HOR	HORIZONTAL
HP	HIGH PRESSURE
HT	HEAT TRACE
HTR	HEATER
I	GAUGE/INDICATION
ID	INSIDE DIAMETER
INSUL	INSULATION
IN	INCH
L	LOW
LA	LEVEL ALARM
LC	LEVEL CONTROL
LT	LIGHT
MB/H	THOUSAND BTU's PER HOUR
MECH	MECHANICAL
MMB/H	MILLION BTU's PER HOUR
MOD	MOTOR OPERATED DAMPER
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
OD	OUTSIDE DIAMETER
OIT	OPERATOR INTERFACE TERMINAL
OT	OXYGEN TRANSMITTER
PPMV	PARTS PER MILLION VOLUME
PNEU	PNEUMATIC
PSIA	POUNDS PER SQ. INCH ABSOLUTE
PSID	POUNDS PER SQ. INCH DIFFERENTIAL
PSIG	POUNDS PER SQ. INCH GAUGE
PPB	PARTS PER BILLION
RAD	RADIATOR
REF	REFERENCE
REQ	REQUIRED
REV	REVISION
RH	RELATIVE HUMIDITY
ROIT	REMOTE OPERATOR INTERFACE TERMINAL
RPM	REVOLUTIONS PER MINUTE
SCFM	STANDARD CUBIC FEET PER MINUTE
SCH	SCHEDULE
SECT	SECTION
S.P.	SET POINT
SPEC	SPECIFICATION
SS	STAINLESS STEEL
STD	STANDARD
SW	SWITCH
T	TRANSMITTER
TBD	TO BE DETERMINED
TC	TEMPERATURE CONTROLLER
TYP	TYPICAL
Ч	MICRON
UL	UNDERWRITERS LABORATORIES, INC
VAC	VACUUM
VERT	VERTICAL
VFD	VARIABLE FREQUENCY DRIVE
VOL	VOLUME
W/	WITH
W/O	WITHOUT
WB	WET BULB TEMPERATURE
WC	WATER COLUMN

LINE LEGEND		COLOR
UNISON SUPPLIED PIPING		*VARIES
CUSTOMER SUPPLIED PIPING		RED
FUTURE PIPING		GRAY
LOCATION DESIGNATOR		BLACK
COMPONENT BOUNDARY		BLACK
UNISON SUPPLIED HEAT TRACE / INSUL	HT HT HT HT HT	BLACK
CUSTOMER SUPPLIED HEAT TRACE / INSUL	HT HT HT HT HT	RED
UNISON SUPPLIED INSULATION	INSUL INSUL INSUL	BLACK
CUSTOMER SUPPLIED INSULATION	INSUL INSUL INSUL INSUL	RED
REVISION CLOUD		BLACK

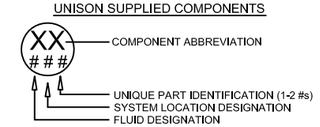
CUSTOMER/VENDOR SUPPLIED COMPONENTS



TIE POINT



UNISON SUPPLIED COMPONENTS



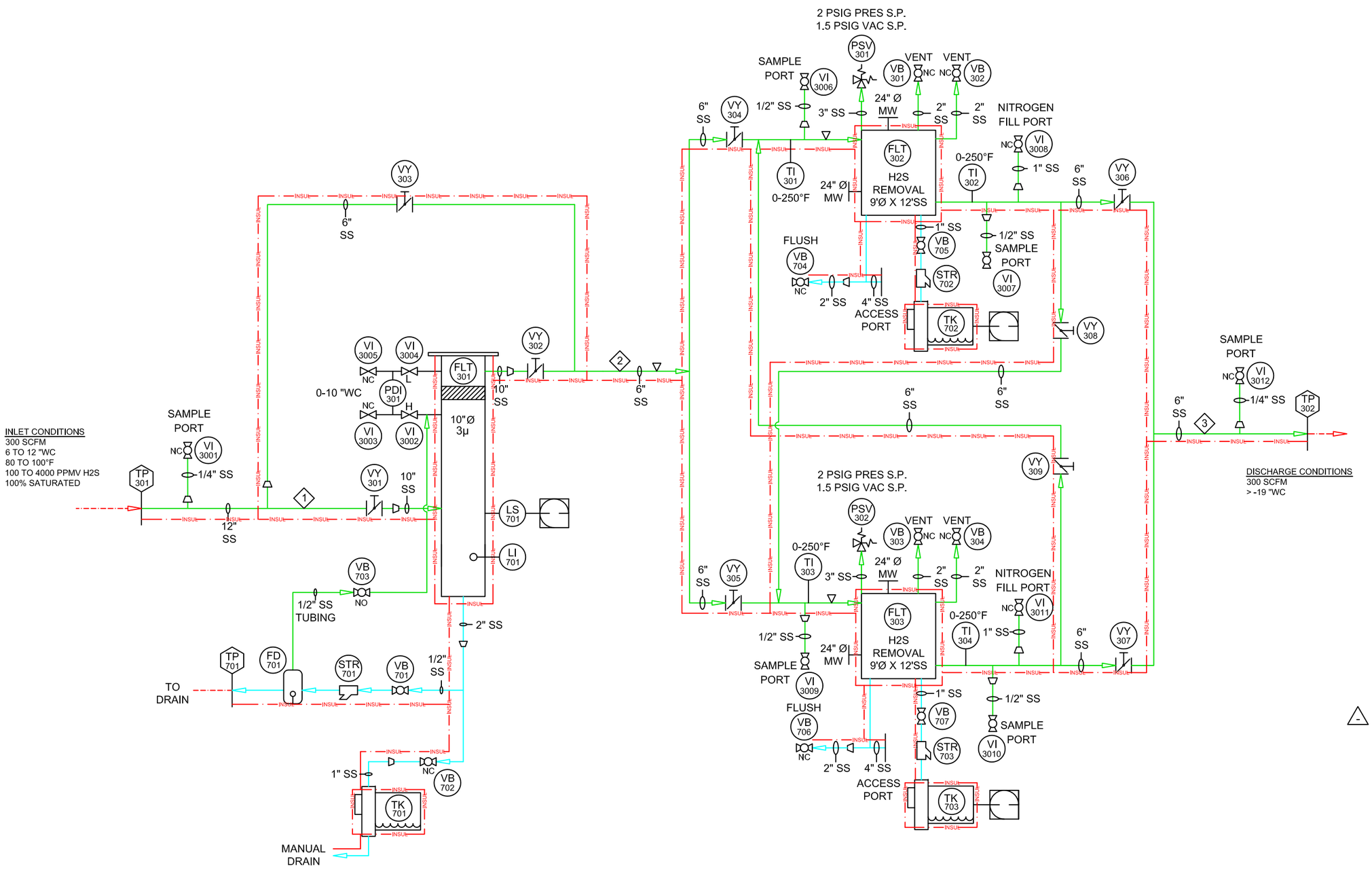
REFERENCE DESIGNATOR FLUID LEGEND		COLOR
1XX	COOLANT/WATER	BLUE
2XX	OIL/LUBRICANTS	ORANGE
3XX	BIOGAS	GREEN
4XX	AIR	YELLOW
5XX	FOSSIL FUEL	L GREEN
6XX	COMBUSTION EXHAUST	PURPLE
7XX	CONDENSATE	L BLUE
8XX	OTHER	BROWN

REFERENCE DESIGNATOR SYSTEM LOCATION LEGEND	
X0X	H2S FILTRATION
X1X	PRE COOLING
X2X	PRE FILTRATION
X3X	COMPRESSION
X4X	GAS DRYING
X5X	DISTRIBUTION/REGULATION
X6X	SILOXANE REMOVAL
X7X	TBD
X8X	TBD
X9X	TBD

UNISON SOLUTIONS

Unison Solutions Inc.
5451 Chavenelle Road
Dubuque, IA 52002
PHONE: 563-585-0967 FAX: 563-585-0970

PROJECT	251-MANTECA WQCF-H2S		
DESCRIPTION	MECHANICAL ABBREVIATIONS & SYMBOLS		
DRAWN BY	KJD	DATE	11-07-2016
DWG. NO.	1M-251-H2S-01		



"AS BUILTS"

APPROVED BY: KJD
DATE: 10-13-2017

DESIGN PARAMETERS

LOCATION ◇	SCFM	ACFM	PSIG	PSIA	°T	R.H.
1	300	313	0.22	14.90	100°F	100%
2	300	316	0.10	14.78	100°F	100%
3	300	334	-0.68	14.00	100°F	94%
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-

SITE CONDITIONS

TEMP	MIN 26°F	GAS COMPOSITION
	MAX 106°F	CH4: 60% TEMPERATURE: 80-100°F CO2: 40% PRESSURE: 6-12 "WC H2S: <4000 PPMV RELATIVE HUMIDITY: 100% SILOXANE: <5000 PPBV
ELEVATION	20' AMSL	

SYSTEM SPECIFICATIONS

PIPE MATERIAL	304 SS
GASKET TYPE	NITRILE BOUND NON-ASBESTOS
FLANGE HARDWARE	304 SS
STAND HARDWARE	
INSTRUMENTATION	PARTS LIST
VALVES	PARTS LIST
HEAT TRACE/ INSULATION	CUSTOMER SUPPLIED
VALVE HANDLE EXTENSIONS	YES
OIL TYPE	NA
GLYCOL TYPE	NA
CONDUIT	NA

NOTES

- ALL PIPING SHALL BE HEAT TRACED AND INSULATED BY OTHERS
- FIELD PIPING SUPPORTS BY OTHERS

REV	BY	APRVD	DATE	DESCRIPTION
-	-	-	-	-

REVISIONS

UNISON SOLUTIONS

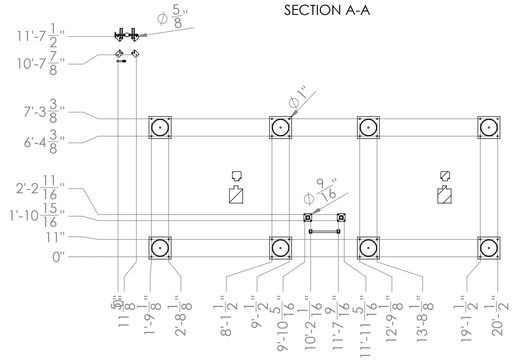
Unison Solutions Inc.
5451 Chavenelle Road
Dubuque, IA 52002
PHONE: 563-585-0967 FAX: 563-585-0970

PROJECT	251-MANTECA WQCF-H2S		
DESCRIPTION	PROCESS & INSTRUMENTATION		
DRAWN BY	KJD	DATE	11-07-2016
DWG. NO.	3G-251-H2S-3-01		

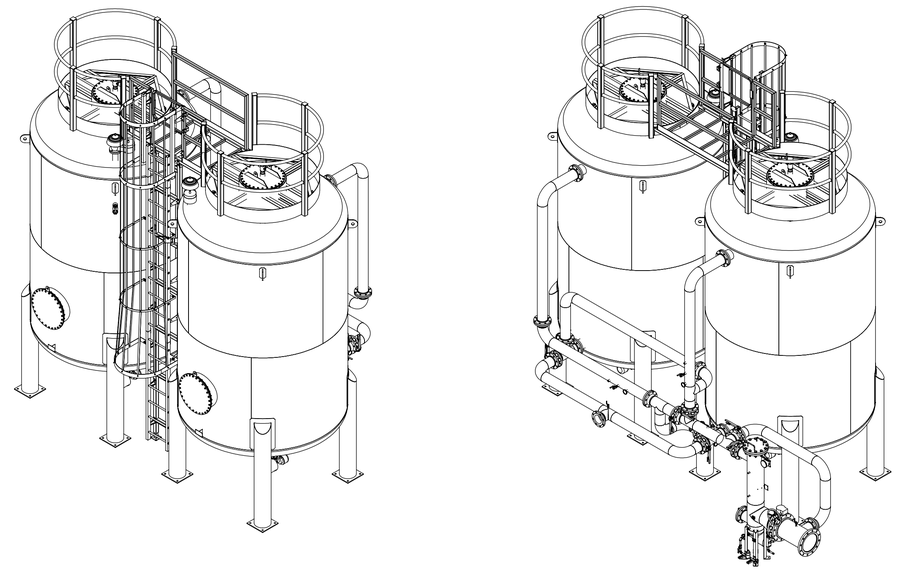
TIE POINT		
#	DESCRIPTION	SIZE
301	GAS INLET	12" 150# RF FLANGE
302	GAS OUTLET	6" 150# RF FLANGE
701	CONDENSATE OUTLET	1/2" 150# RF FLANGE

REVISIONS				
REV.	BY	APPRVD	DATE	DESCRIPTION

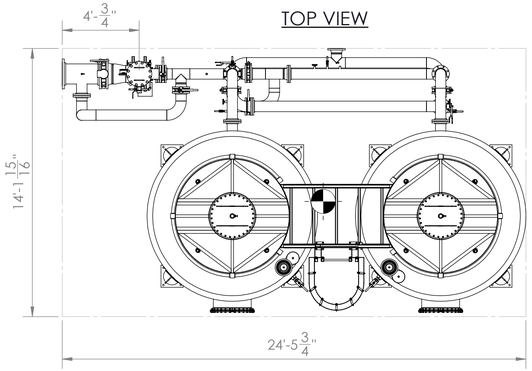
SECTION A-A



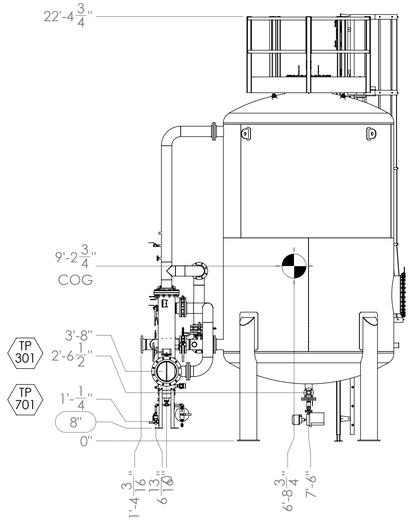
ISOMETRIC VIEW



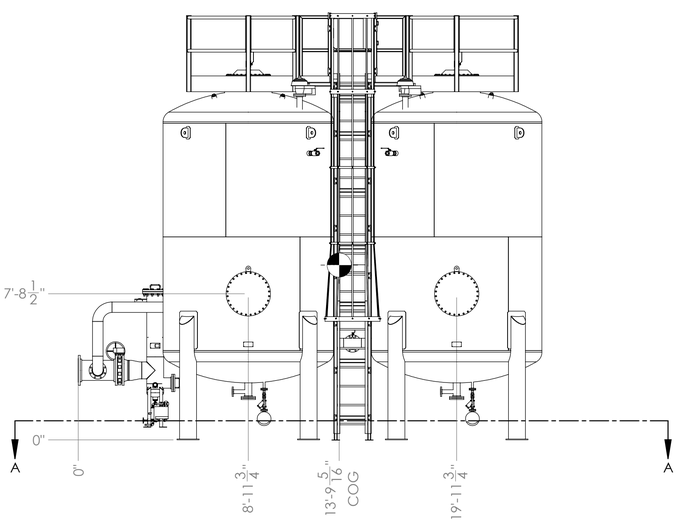
TOP VIEW



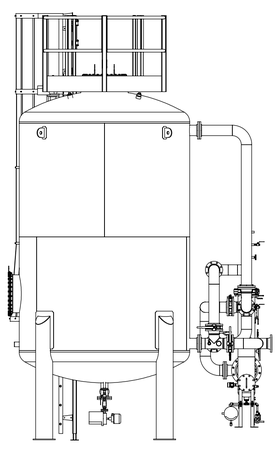
LEFT VIEW



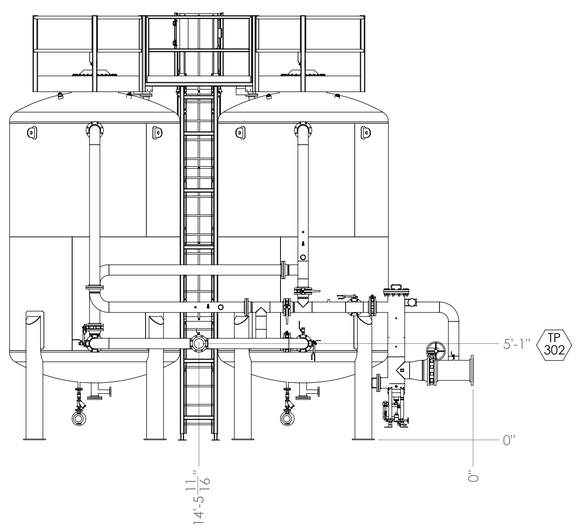
FRONT VIEW



RIGHT VIEW



REAR VIEW



AS BUILTS

APPROVED BY: KJD - 11/2/2017

DATE:

NOTES:	MANUFACTURING TOLERANCE (UNLESS SPECIFIED)
CONDENSATE NOT SHOWN	0.001 +/-0.063 ANGULAR=+/-1° BREAK ALL SHARP EDGES ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED

SCALE:	NTS		
DRAWN BY:	TAB	DATE:	11/15/2016
CHECKED:			
ENGINEER:			
RELEASED:			

THIRD ANGLE PROJECTION

Unison Solutions Inc.
5451 Chavenelle Road
Dubuque, IA 52002
PHONE: 563-585-0967
FAX: 563-585-0970

PROJECT:
251 - Manteca WQCF-H2S FOG

DESCRIPTION
HYDROGEN SULFIDE REMOVAL SYSTEM

DRAWING NO.
6L-251-3-01

WEIGHT	SIZE	SHEET No.	REVISION
16,500 LBS.	D	1 of 1	

MECHANICAL IOM & PROCEDURES

Specific design, calibration, or certification data is provided with associated component's IOM if applicable.
Full mechanical parts list provided with mechanical drawings following this index.
Safety Data Sheets applicable to this system are available upon request; contact Unison Solutions at 563.585.0967 if SDS data is needed.

Ref. Des.	DESCRIPTION	TAB #
Hydrogen Sulfide Removal System		
FLT 30X	H2S Media Monitoring	7A
	H2S Maintenance Log	7B
	H2S Removal Media Change Out	7C
Moisture/Particulate Filters		
FLT 301	Moisture/Particulate Filter Maintenance Procedure	7D
PDI 301	Capsuhelic Maintenance Procedure	7E
Safety Valves		
PSV 30X	Varec Pressure Safety IOM	7F
Condensate Removal		
LS 701	Endress Hauser Level Switch IOM	7G

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HYDROGEN SULFIDE (H_2S) MEDIA MONITORING

H_2S is a flammable, colorless gas that is produced with the bacterial breakdown of organic matter in oxygen free environments. In biogas conditioning systems, depending on the inlet concentrations, H_2S may need to be removed to prevent the siloxane adsorption media from fouling, or to meet the operating specifications for the end use device.

The media in the H_2S vessel(s) has been specifically chosen for its ability to remove H_2S from biogas. This is an electrochemical reaction that requires a moist environment. To confirm that the media is working properly, periodic testing for H_2S should be performed. There are many methods of testing for H_2S in the field. These include handheld meters and Draeger tube systems. Note that H_2S degrades very quickly. If testing is done at a laboratory, the sample should be tested within 24 hours of being collected whenever possible. For additional information on methods for measuring H_2S, or laboratory testing, please contact Unison Solutions at 563-585-0967.

Note: The following protocol is intended to be an example of minimum H_2S testing required to accurately determine the frequency for media changes and overall operation of the H_2S Removal System. As a general rule H_2S levels should be below detection levels on the product side of the vessel(s). Small concentrations of H_2S may be acceptable depending on the end use device.

For systems that also have siloxane removal, the H_2S should be below 10 ppmv, or the siloxane media life will be affected.

Depending on the end use device the manufacturer may have different requirements for H_2S testing as well as different breakthrough levels for H_2S compounds. Please consult the manufacturer of the specific end use device to determine the correct gas testing interval at start up and acceptable H_2S levels.

Hydrogen Sulfide (H_2S) Testing – Sample Protocol

H_2S levels in the raw gas and downstream of the vessel(s) should be recorded once a month for the first three months and then twice per month until breakthrough occurs. For systems with multiple vessels, a sample should be taken after the last vessel. The H_2S level on the product side of the vessel(s) should be below 10 ppmv. If the H_2S level is above 10 ppmv, breakthrough on the media is starting to occur and a media change is recommended.

Once a media change out interval has been established, testing should be done before subsequent change outs to confirm the interval timing. For digester systems, if the waste being treated changes significantly, the H_2S testing should be done once per month to determine a new media change out interval.

Hydrogen Sulfide (H_2S) Testing – Moisture Monitoring

In addition to testing for H_2S, the H_2S removal vessels should be drained of excess liquid weekly and the approximate volume of water recorded in the log. A sample log is included in this section. If no water is being drained from the vessel, the raw gas may not be 100% saturated. Note that this may limit the effectiveness of the H2S removal media and shorten the overall lifespan. Please contact Unison Solutions, Inc. for further direction is this occurs.

H_2S Testing – Site Protocol

Please complete the following as it pertains to this specific system:

Site _____

End use device_____

Sampling interval for H_2S testing

_____

Interval for draining vessels and recording approximate water volume

_____

Acceptable H_2S level for end use device (Include units of measure)

_____

Date_____

Print name_____

Sign_____

Once a site protocol has been established please forward a copy to Unison Solutions, Inc. for our records. This will help us better serve our clients in troubleshooting media related problems, support in media replacement, ordering replacement media, and other media related services. A digital, scanned, or faxed copy can be sent to:

Email: sales@unisonsolutions.com
Fax: 563.585.0970

If assistance is needed establishing a site protocol please contact Unison Solutions, Inc. at 563.585.0967.

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Hydrogen Sulfide (H_2S) Media

Maintenance Log

Sample Date	Sample Location & Valve Number	System Run Hours (hr. meter on panel)	H_2S Level With Units (ppmv/ppbv)	H_2S Test Method	Vessel(s) Drained With Volume	Initial

Sample Date	Sample Location & Valve Number	System Run Hours (hr. meter on panel)	H_2S Level With Units (ppmv/ppbv)	H_2S Test Method	Vessel(s) Drained With Volume	Initial

SULFATREAT H_2S REMOVAL MEDIA CHANGE OUT PROCEDURE

Required Materials/Equipment:

*New SulfaTreat media

*Crane

*Super Sucker" vacuum truck

Important Concepts:

- *It is not recommended to remove spent SulfaTreat media without the assistance of water; the use of water during change-outs dissipates heat and facilitates material handling. If not using water, do not vacuum the spent product from the vessel because a large volume of air moving through the media over a short period of time may create extreme heat and cause a safety hazard.
- Do not open both man-ways at the same time, open one and wait at least an hour before opening the other. Opening both could cause air to chimney rapidly through the media and cause an exothermic reaction.
- H_2S vessels must be insulated and heat traced from top to bottom, including man-ways prior to use
- The filter foam pad should be installed with the edges tucked around the sides of the vessel with a bulge in the center.
- After the fill is complete, the top of the media bed should be level.
- SulfaTreat media may fluff upon loading, exceeding the normal height by 5 to 10%. Verify the correct quantity of media is in the vessel by double-counting empty SulfaTreat bags.

Removing Spent Media:

1. Isolate the desired H_2S vessel from the gas stream by closing the respective isolation and bypass valves listed in the System Manual Valve Listing in Section 1 of the O&M Manual.
2. Open vent valves to vent any gas from the vessel.
3. Un-bolt the top man-way cover, and use a crane to remove it from the vessel.
4. Rake and vacuum (i.e. sized at least 6000 cfm with a 27" Hg PD vacuum pump also known as a "Super Sucker" vacuum truck) the media from the top of the vessel. If necessary, a high pressure water lance (up to 3000 psi) can be used to break the media into more manageable sized chunks.
5. Remove the Side man-way and continue removing media. (Remember to wait at least 1 hour after performing step 3.)
6. After removing the media from the vessel and the media trapped below the support, remove, and dispose of the filter foam pad.
7. Use a pressure washer to flush any solids out of the drain manifold through the run-off drain ports. This is important because the turbulence of the media removal may cause a considerable amount of solid material to be washed into the drain manifold.
8. Close all drain valves on the H_2S vessel. (Refer to the System Manual Valve Listing in Section 1 of the O&M Manual.)
9. Leave man-way covers off and refer to the Loading New Media Procedure below.

Disposing of Spent Media:

Allow the removed media to dry before disposing in a Class 2 landfill (non-hazardous), or other permitted disposal method. (Note: Although both un-reacted and reacted media is non-hazardous, it is recommended to TCLP test the reacted material to be certain that contaminants and VOC's in the gas stream have not caused the product to require special disposal considerations.)

Loading New Media Procedure:

Steps with (***) asterisks are covered in the Removing Spent Media Procedure above, and do not need to be repeated if the unload and load are performed consecutively.

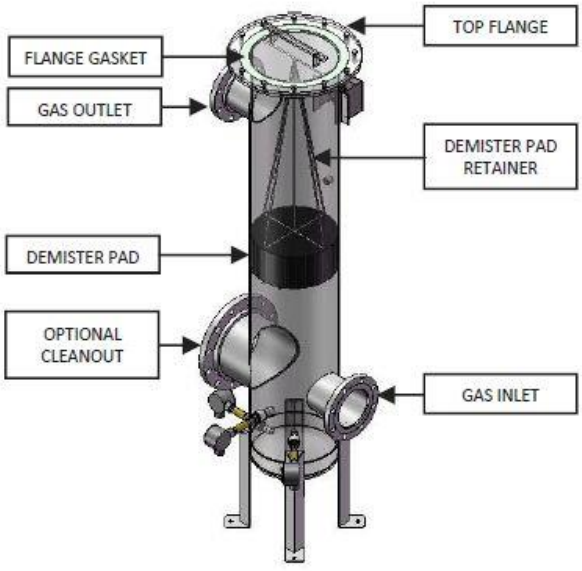
1. ***Isolate the desired H_2S vessel from the gas stream by closing the respective isolation and bypass valves listed in the System Manual Valve Listing in Section 1 of the O&M Manual.
2. ***Open vent valves to vent any gas from the vessel.
3. ***Open the drain keeping a bucket handy to catch any run off that drains from the valves at the base of the vessel.
4. ***Un-bolt the top and side man-way covers, and use a crane to remove them from the vessel.
5. ***Close the vent and drain valves.
6. Install a new filter foam pad and ensure it is installed properly on the mesh grate at the bottom of the vessel, with the edges tucked and a gradual incline towards the center.
7. Replace the side man-way cover and man-way cover gasket. Start all bolts through the cover and gasket. Then, tighten four evenly spaced bolts in small increments to ensure that the cover makes flat, even contact with the gasket.
8. Torque all the man-way cover bolts to 200 foot·pounds using a criss-cross pattern.
9. Re-torque all the man-way cover bolts using a criss-cross pattern.
10. Use a crane to lift the media bags above the top man-way.
11. Position the bag over the man-way; the bags have a plastic string tied in a bow knot for opening the bag. Open the bag and use the spout to slowly fill around the outsides of the foam pad first, and then gradually work towards the center. Cover the pad with 6 to 8 inches of media to ensure the pad stays in place.
12. Fill the vessel with the calculated amount of media.
13. Make certain that the top of the media bed is level. Leveled off, the media should leave around 8-10 inches of head space from the top of the straight side of the vessel.

14. Replace the top man-way cover and man-way gasket. Tighten four evenly spaced bolts in small increments to ensure the cover makes flat, even contact with the gasket.
15. Torque all the man-way cover bolts to 200 foot·pounds using a criss-cross pattern
16. Re-torque all the man-way cover bolts using a criss-cross pattern.
17. When putting the vessel back into service, a large dip in methane and spike in oxygen content will occur in the gas stream. To avoid sending this gas to the end use device, the gas will need to be purged from the skid discharge pipe for several minutes.
18. Open isolation valves that were closed earlier and introduce the gas stream into the vessel.
19. Run the vessel for another day or two and then perform a scrubber clean out procedure on the gas compression/moisture removal system inlet filter

-End of H_2S Removal Media Change Out Procedure-

MOISTURE/PARTICULATE FILTER MAINTENANCE

1. Isolate filter from system.
2. Remove the bolts from the flange at the top of the filter.
3. Remove the flange from the filter being careful not to damage the flange gasket.
4. Take the demister pad retainer bracket out of the filter.
5. The demister pad is press fit into the top of the filter. Grab the U shaped handle protruding from the top of the demister pad and pull the demister pad straight up, out of the top of the filter.
6. The demister pad can be cleaned with a garden hose, compressed air, or any chemicals compatible with polypropylene.
7. Place the demister pad on top of the filter, centered in the opening. The top of the pad has smaller weave than the bottom. Correct orientation of the pad is critical.
8. Align the U shaped handle so it clears the support cross members and push the pad down into the filter until it contacts the support cross members.
9. Re-install the demister pad retainer.
10. Re-install the filter top flange and bolts.
11. Torque the bolts using a crisscross pattern to the specifications below.
    a. ½" bolt thread size: 70 ft-lbs
    b. 9/16" bolt thread size: 100 ft-lbs
    c. 5/8" bolt thread size: 135 ft-lbs
12. Re-check the torque on the bolts using a crisscross pattern



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CAPSUHELIC GAUGE MAINTENANCE

Calibration Instructions

1. Close the two instrumentation valves to isolate the gauge from the process. Refer to Manual Valve Listing in Section 1.
2. Open the two instrumentation valves to expose the gauge to atmospheric pressure. These valves must be opened simultaneously.
3. Check the gauge for proper reading. With both valves open to atmosphere, the gauge should read zero.
4. If the gauge does not read zero, adjust the needle using the calibration screw.
5. Close the two instrumentation valves to isolate the gauge from atmosphere.
6. Open the two instrumentation valves to expose the gauge to the process.

Calibration screw

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VAREC®

Vapor Control Inc.

2010B/~~2020B/3500B~~ Series
Pressure and Vacuum Relief Valve

INSTRUCTION, OPERATION AND MAINTENANCE MANUAL

TABLE OF CONTENTS

List of Figures

Disclaimer of Warranties

The contract between VAREC Vapor Control Inc. and our customer states VAREC's entire obligation. The contents of this instruction manual shall not become part of or modify any prior or existing agreement, commitment or relationship between VAREC Vapor Control Inc. and our customer. There are no express or implied warranties set out in this instruction manual. The only warranties that apply are those in the existing contract between VAREC Vapor Control Inc. and our customer.

The VAREC Vapor Control Inc. 2010B/2020B/3500B Series Pressure and/or Vacuum Relief Valves have not been tested by VAREC Vapor Control Inc. under all possible operational conditions, and VAREC Vapor Control Inc. does not have all the data relative to your application. The information in this instruction manual is not all inclusive and does not and cannot take into account all unique situations. Consequently, you should review this product literature in view of your application. If you have any further questions, please contact VAREC Vapor Control Inc. for assistance.

Limitations of Seller's Liability

If it is determined that this instruction manual created some new warranties, VAREC Vapor Control Inc. liability shall be limited to repair or replacement under the standard warranty clause. In no case shall VAREC Vapor Control Inc. liability exceed that stated as Limitations of Remedy in the contract between VAREC Vapor Control Inc. and our customer

Safety Precautions

READ AND UNDERSTAND THIS INSTRUCTION MANUAL BEFORE INSTALLING, OPERATING OR PERFORMING MAINTENANCE ON VAREC VAPOR CONTROL INC. 2010B/2020B/3500B SERIES PRESSURE AND/OR VACUUM RELIEF VALVE. FOLLOW ALL PRECAUTIONS AND WARNINGS NOTED HEREIN WHEN INSTALLING, OPERATING OR PERFORMING MAINTENANCE ON THIS EQUIPMENT.

WARNING

Relief valve must be isolated from tank pressure before servicing. All gas must be blocked and pressure safely vented.

Safety Precaution Definitions

CAUTION

Damage to equipment may result if this precaution is disregarded.

WARNING

Direct injury to personnel or damage to equipment which can cause injury to personnel may result if this precaution is not followed.

General Information

The 2010B/2020B/3500B Series Pressure and/or Vacuum Relief Valves are designed to protect low pressure storage tanks, sludge digesters and gas holders from excessive pressure and/or vacuum. The valve is installed on the storage tank roof or digester cover. It may be used in combination with a VAREC Vapor Control Inc. Flame Arrester.

The 2010B Series Valve relieves pressure directly to the atmosphere. A weatherhood and mesh screen protect the pressure pallet and guideposts. Vacuum pressure is relieved by inbreathing ambient air.

The 2020B Series valve relieves pressure through an enclosed outlet adapter. Product vapors may be piped away rather than relieving directly to the atmosphere. Vacuum pressure is relieved by inbreathing ambient air.

The 3500B Series Valve is a vacuum relief valve that relieves negative pressure by inbreathing ambient air.

Construction

Standard materials of construction include cast body and cover(s). Pallets are dead weight loaded with lead or coated steel weights and include a flexible membrane sealing insert. The pallet is loosely guided through a center stem and pallet guide posts.

The “All-Weather” Models 2011B, 2021B and 3501B Series include a special coating on portions of the pallets, seat rings and guides to eliminate ice accumulation.

Operation

When the internal tank pressure approaches the valve setting, the pressure pallet begins to lift. As the pressure exceeds the valve setting, the pressure pallet lifts off the seat ring.. Excess product vapor is allowed to vent to the atmosphere or through the pipe away system adapter, relieving the over pressure condition. The pallet automatically re-seats as the tank pressure drops below the valve setting.

If a vacuum within the tank approaches the valve setting, the vacuum pallet begins to lift. As the vacuum exceeds the valve setting, the vacuum pallet lifts off the seat ring. Atmospheric air is allowed to flow into the tank, relieving the excess vacuum condition. The pallet automatically re-seats as the vacuum drops below the valve setting.

Installation

2010B/2020B/3500B Series Pressure and Vacuum Relief Valves must be mated with the appropriate flange(s). The nozzle must be plumb and the inlet flange face level to ensure proper operation of the relief valve.

1. Remove the valve from the shipping container. Check to see if extra loading weights were bagged and packed separately.
2. Remove the weatherhood and/or cover(s) and all packing material above the pallets and within the valve.

CAUTION

Whenever the weatherhood and/or cover(s) is removed and reinstalled, the end of the pallet stem must engage the stem guide in the weatherhood and/or the stem guide chamber in the cover(s) for proper seating and valve operation.

.NOTE

Spun sheet metal pallets have a compensating weight on top of the pallet. Do not remove this weight. Refer to Table 1 for incremental weight information.

3. To load vacuum pallet weights, perform the following:

   a) With vacuum cover and gasket removed, remove vacuum pallet assembly from body.

   b) Remove grip ring from pallet stem.

   c) NON-VARIABLE SETTING: Locate weight marked "VACUUM" and place on top of compensating weight and/or pallet. Secure with grip ring. NOTE: If setting is less than 2" WC, weight will be pre-loaded on the pallet.

   d) VARIABLE SETTING: Each lead weight is calibrated from 1" WC increment. (Increments of 1/4" WC and 1/2" WC may be supplied on special order). Those weights necessary for the initial specified setting will be tagged separately from any extra weight provided. Remove the packaging on the weights tagged from the initial specified setting and place the weights on top of the compensating weight . Secure with grip ring. Store remaining weights for future use (in case the setting needs to be increased).

   e) Weigh entire pallet assembly (including installed weights). Using Table 1, confirm that the assembly is the proper weight to achieve the required setting. Allowable weight tolerance is +5%,-5%.

   f) Remove any remaining packing material from valve body. Wipe vacuum seat ring, guide posts and pallet assembly with a soft cloth to remove any material which could affect valve operation.

   g) Place pallet assembly on valve body seat. Ensure that pallet moves freely within guide posts and rests flat on the seat ring.

   h) Replace the cover gasket and cover. Tighten cover screws uniformly.

CAUTION

The end of the pallet stem must engage the stem guide chamber in the cover for proper seating and valve operation.

.NOTE

Spun sheet metal pallets have a compensating weight on top of the pallet. Do not remove this weight. Refer to Table 1 for incremental weight information.

1. To load pressure pallet weights, perform the following:

   a) With weatherhood from Model 2010B, or pipe away adapter cover and gasket from Model 2020B removed, remove pressure pallet assembly from body.

b) Remove grip ring from pallet stem.

c) NON-VARIABLE SETTING: Locate weight marked "PRESSURE" and place on top of compensating weight and/or pallet. Secure with grip ring. If setting is less than 2" WC, weight will be pre-loaded on the pallet.

d) VARIABLE SETTING: Each lead weight is calibrated from 1" WC increment. (Increments of 1/4" WC and 1/2" WC may be supplied on special order). Those weights necessary for the initial specified setting will be tagged separately from any extra weight provided. Remove the packaging on the weights tagged from the initial specified setting and place the weights on top of the compensating weight . Secure with grip ring. Store remaining weights for future use (in case the setting needs to be increased).

e) Weigh entire pallet assembly (including installed weights). Using Table 1, confirm that the assembly is the proper weight to achieve the required setting. Allowable weight tolerance is +5%,-5%.

f) Remove any remaining packing material from valve body. Wipe pressure seat ring, guide posts and pallet assembly with a soft cloth to remove any material which could affect valve operation.

g) Place pallet assembly on seat. Ensure that pallet moves freely within guide posts and rests flat on the seat ring.

h) Replace the weatherhood on Model 2010B or the pressure cover and gasket on Model 2020B. Tighten all nuts and screws uniformly.

CAUTION

The end of the pallet stem must engage the stem guide in the weatherhood or the stem guide chamber in the cover for proper seating and valve operation.

5. Place the valve in a level position. Reach up through the inlet flange and carefully push up on the pressure pallet, then lower it onto the seat. Pallet should move up and down freely and rest flat on the seat ring.
6. Check the vacuum pallet by using a non-sparking tool which will pass through the center of the mesh screen. Push up on the vacuum pallet, then lower it onto the seat. Pallet should move freely and rest flat on the seat ring.
7. Mount the valve on the flanged nozzle or flame arrester using the appropriate full faced gasket.

CAUTION

DO NOT MATE A FLAT FACE FLANGE TO A RAISED FACE FLANGE.

If it necessary to mate an ANSI Class 125 F.F. flange with an ANSI Class 150 R.F. flange, use the proper spacer to convert the raised face to a flat face.

8. Verify that the valve is level to permit proper operation of the pallets. Install mounting hardware, and tighten uniformly.
9. When using Model 2020B Series, install connecting piping (if required) to outlet flange. Use a full faced gasket and tighten all mounting hardware uniformly.

.NOTE

It is recommended that steel and iron valves be given a coat of paint immediately after installation is completed. Apply paint to external surfaces only.

Maintenance

The valve should be inspected and cleaned at periodic intervals. The first inspection should be made approximately 30 days after commissioning. Subsequent inspections should be made every 30 days. The user may adjust the schedule for his own convenience and safety, depending upon the product being stored.

WARNING

- Relief valve must be isolated from tank pressure before servicing. All gas must be blocked and pressure safely vented. If no isolation valve is present, carefully open vacuum cover or lift pressure pallet, allowing pressure to vent slowly.
- Wear appropriate gloves and/or breathing apparatus if hazardous vapors are present.

1. To inspect valve proceed as follows:
   a) Remove the weatherhood and/or cover(s).
   b) Remove pallets one at a time. Identify the pallets to ensure they are returned to the correct valve seat.
   c) Inspect pallet inserts for ripples, tears, or nicks, as well as seating surfaces for debris, abrasion or pitting. Pallet edges and guide posts should be free or burrs, corrosion or other obvious damage. Clean all components, replacing any showing excess wear or damage. On the "All-Weather" versions, inspect the Teflon coating for any damage that would affect operation.
   d) Reassemble in reverse order.

CAUTION

The end of the pallet stem must engage the stem guide in the weatherhood and/or the stem guide chamber in the cover(s) for proper seating and valve operation.

CAUTION

During periods of freezing weather, extra maintenance is required for Models 2010B/2020B/3500B. Either remove the pallets or apply generous portions of silicone grease to the pallets, seat rings and guide posts. When using silicone grease, inspect valves at least weekly. This procedure is not required for "All-Weather" Models 2011B, 2021B or 3501B.

2. To replace pallet insert proceed as follows:.
   a) Remove weatherhood and/or cover(s) and then pallet assembly.
   b) Remove nut from base of pallet stem. Remove retainer plate and insert. Clean all surfaces and threads. Install new insert, handling carefully to avoid damaging insert or pallet.

c) Reassemble pallet and place on seat of valve body. Ensure pallet assembly moves freely within guide posts and rests flat on seat ring.

d) Reinstall weatherhood and/or cover(s).

CAUTION

The end of the pallet stem must engage the stem guide in the weatherhood and/or the stem guide chamber in the cover(s) for proper seating and valve operation.

3. To replace pressure seat ring perform the following:

   a) For Model 2010B, remove weatherhood, screen, spacer ring, pallet assembly and guide posts. For Model 2020B, remove pressure cover, spacer (high setting), gaskets, pallet assembly, outlet adapter, and guide posts.

   b) Remove seat ring and O-Ring from valve body. Clean body, outlet adapter mating surfaces and O-Ring Groove.

   c) Install new O-Ring into groove; insure that the O-Ring stays properly in groove while installing seat ring.

   d) Install new seat ring carefully to avoid distortion. Reassemble guide posts (2010B) or outlet adapter (2020B) to secure seat. Ensure that seat is flush and level with valve body.

   e) Reassemble guide posts (2020B).

   f) Place pallet assembly on valve body seat. Ensure pallet assembly moves freely within guide posts and rest flat on seat ring.

   g) Reassemble remaining parts in reverse order.

CAUTION

The end of the pallet stem must engage the stem guide in the weatherhood or the stem guide chamber in the cover for proper seating and valve operation.

4. To replace vacuum seat ring perform the following:

   a) Remove vacuum cover, spacer (high setting), gaskets, pallet assembly, screen retainer, screen and guide posts.

   b) Remove seat ring and O-Ring from valve body. Clean body mating surface and O-Ring groove.

   c) Install new O-Ring into groove; insure that the O-Ring stays properly in groove while installing seat ring.

   d) Install new seat ring carefully to avoid distortion. Reassemble screen and retaining ring to secure seat ring. Ensure that seat is flush and level with valve body.

   e) Reassemble guide posts.

   f) Place pallet assembly on valve body seat. Ensure pallet assembly moves freely within guide posts and rests flat on seat ring.

   g) Reassemble spacer, cover and gaskets.

CAUTION

The end of the pallet stem must engage the stem guide chamber in the cover for proper seating and valve operation.

5. Seat ring repair:

   a) Seat may be ground or ground and lapped (in place) to improve seal. Use a lapping plate and medium valve grinding compound, applying light pressure.

   b) Finish lapping with a fine compound. Avoid scoring or removing excessive amounts of material.

   c) Clean all compound from valve parts.

   d) Hand buff seat with a medium grade `Scotch-Brite' (#7447) pad and light oil.

CAUTION

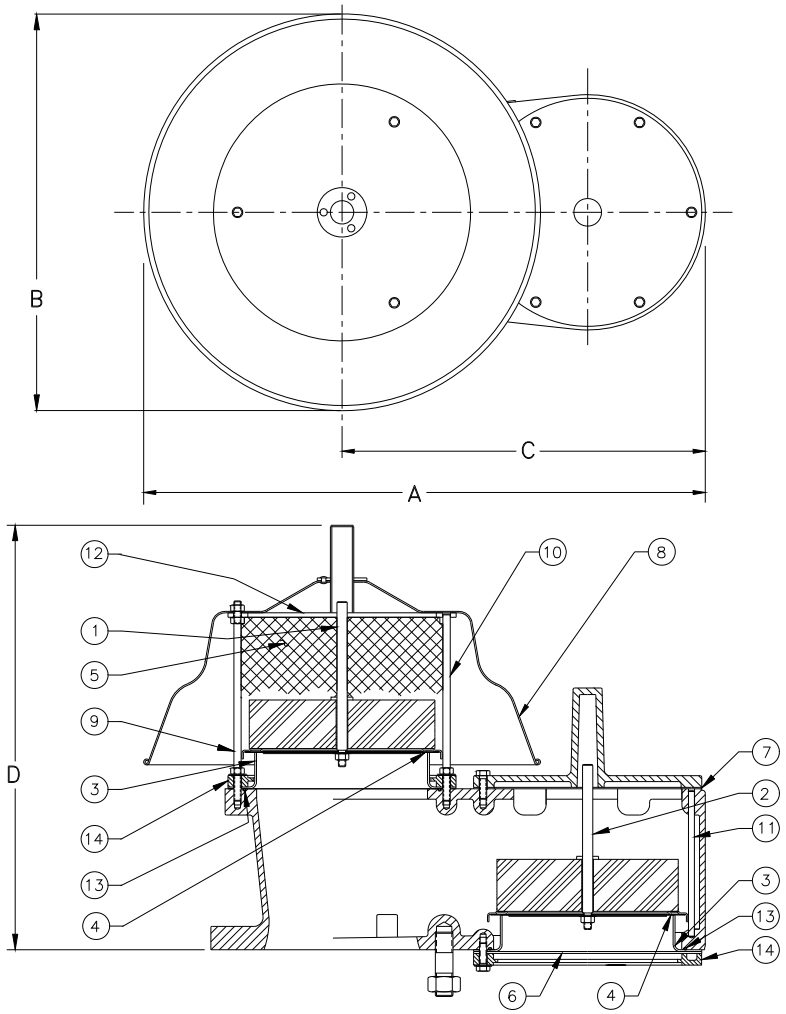
Whenever the weatherhood and/or cover(s) is removed and reinstalled, the end of the pallet stem must engage the stem guide in the weatherhood and/or the stem guide chamber in the cover(s) for proper seating and valve operation.

Calibration

To verify setting, calculate the total necessary weight using the table below. Check this value against the actual weight of the pallet assembly (including loading weights). Adjust loading weights as required.

PALLET LOADING (INCLUDES WEIGHT OF PALLET)		
VALVE SIZE	**OUNCES OF WEIGHT REQUIRED PER OUNCE OF SETTING**	**OUNCES OF WEIGHT REQUIRED PER INCH OF WC SETTING**
2"	8.3	4.8
3"	16.8	9.7
4"	22.1	12.8
6"	43.4	25.1
8"	72.7	42.0
10"	120.1	69.4
12"	179.9	104.0

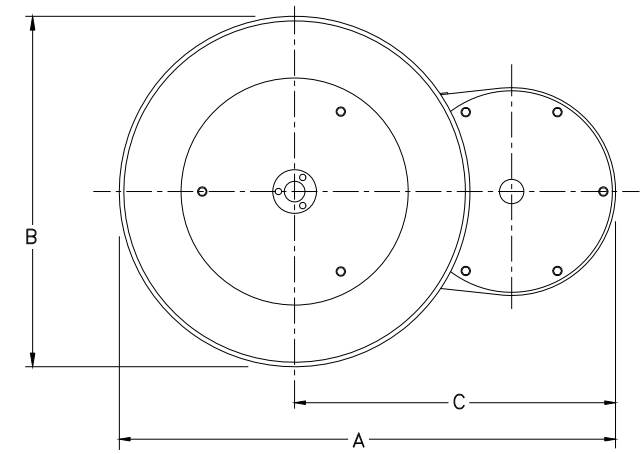
Weight tolerance: + 5%/- 5%
Setting tolerance: + 0%/- 10%

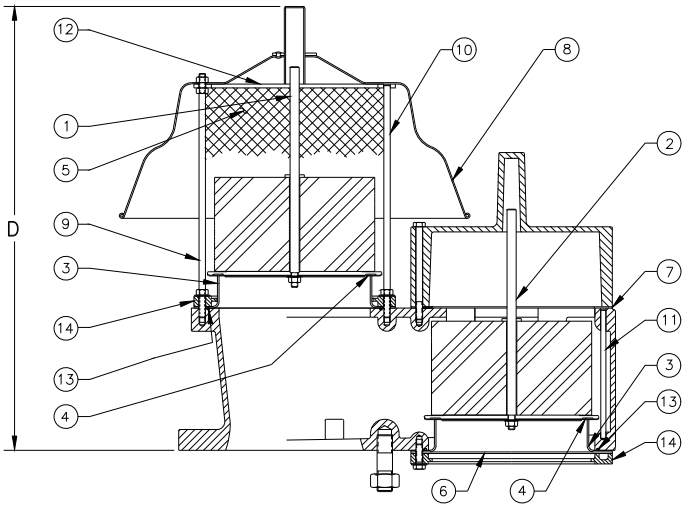


SIZES AND DIMENSIONS					
SIZE		A	B	C	D
2"	IN.	14-1/8	8-1/2	9-7/8	10-7/16
	MM	359	216	251	265
3"	IN.	17-9/16	10-3/4	12-1/4	12-5/16
	MM	446	273	311	313
4"	IN.	19-1/8	13-3/8	12-7/16	14-1/2
	MM	486	339	316	368
6"	IN.	24	17	15-1/2	18-3/16
	MM	610	432	394	462
8"	IN.	29-7/8	20-5/8	19-9/16	21-5/8
	MM	759	524	497	549
10"	IN.	38-7/16	27	24-15/16	27-7/16
	MM	976	686	633	697
12"	IN.	46-5/8	34	29-3/8	31-7/8
	MM	1184	864	746	810

Drilling Per ANSI Class 125 F.F.

Figure 1 – 2010B Low Setting





SIZES AND DIMENSIONS					
SIZE		A	B	C	D
2"	IN.	14-1/8	8-1/2	9-7/8	13-1/4
	MM	359	216	251	337
3"	IN.	17-9/16	10-3/4	12-1/4	15-1/4
	MM	446	273	311	387
4"	IN.	19-1/8	13-3/8	12-7/16	16-5/8
	MM	486	339	316	423
6"	IN.	24	17	15-1/2	21-1/2
	MM	610	432	394	546
8"	IN.	29-7/8	20-5/8	19-9/16	24-3/4
	MM	759	524	497	629
10"	IN.	38-7/16	27	24-15/16	29-7/16
	MM	976	686	633	748
12"	IN.	46-5/8	34	29-3/8	31-7/8
	MM	1184	864	746	810

Drilling per ANSI Class 125 F.F.

Figure 2 – 2010B High Setting

2010B Replacement Parts

When ordering replacement parts, specify relief valve by model number, pipe size and serial number. Identify replacement parts by part number, description and material where possible.

ITEM NO.	DESCRIPTION	USAGE	MATERIAL	NOMINAL PIPE SIZE						
				2”	3”	4”	6”	8”	10”	12”
*1	PRESSURE PALLET ASSEMBLY	LOW SET	ALUM.	06-11485-301	06-11485-401	06-11485-501	06-11485-601	06-11485-701	06-11485-801	06-11485-901
		HIGH SET	ALUM.	06-11486-101	06-11486-201	06-11486-301	06-11486-401	06-11486-501	06-11486-601	06-11486-701
		LOW SET	316 SST	06-11485-306	06-11485-406	06-11485-506	06-11485-606	06-11485-706	06-11485-806	06-11485-906
		HIGH SET	316 SST	06-11486-106	06-11486-206	06-11486-306	06-11486-406	06-11486-506	06-11486-606	06-11486-706
*2	VACUUM PALLET ASSEMBLY	LOW SET	ALUM.	06-11485-101	06-11485-201	06-11485-001	06-11485-601	06-11485-701	06-11485-801	06-11485-901
		HIGH SET	ALUM.	06-11486-101	06-11486-201	06-11486-301	06-11486-401	06-11486-501	06-11486-601	06-11486-701
		LOW SET	316 SST	06-11485-106	06-11485-206	06-11485-006	06-11485-606	06-11485-706	06-11485-806	06-11485-906
		HIGH SET	316 SST	06-11486-106	06-11486-206	06-11486-306	06-11486-406	06-11486-506	06-11486-606	06-11486-706
*3	SEAT RING	ALL	ALUM.	02-10438-001	02-10251-001	02-05464-001	02-05478-001	02-05482-001	02-05487-001	02-05499-001
		ALL	316 SST	02-10438-006	02-10251-006	02-05464-006	02-05478-006	02-05482-006	02-05487-006	02-05499-006
4	PALLET INSERT	ALL	TEFLON	02-10361-093	02-09704-093	B12741-093	B12742-093	B12743-093	B12744-093	B13288-093
5	PRESSURE SCREEN	LOW SET	HDPE	02-10439-051	02-10323-051	B16209-351	B14390-151	B14390-251	B14390-351	B14390-451
		HIGH SET	HDPE	02-10439-151	02-10323-151	B16209-451	B14390-551	B14390-651	B14390-751	B14390-451
6	VACUUM SCREEN	ALL	HDPE	02-11547-051	02-11547-151	02-11547-251	02-11547-351	02-11547-451	02-11547-551	02-11547-651
7	COVER & SPACER GASKET	LOW SET	FIBER	02-11380-071	02-11381-071	02-11382-071	02-11383-071	02-11384-071	02-11385-071	02-11386-071
		HIGH SET	BUNA-N	02-11380-075	02-11381-075	02-11382-075	02-11383-075	02-11384-075	02-11385-075	02-11386-075
8	HOOD	LOW PRESS. SET WITH LOW VAC SET	ALUM.	06-11136-01	06-11136-02	06-11136-08	06-11137-01	06-11137-02	06-11137-03	06-11137-04
			STEEL	02-10455-003	02-10310-003	02-10066-103	D6064-203	C6433-203	C6436-203	C6500-203
			304 SST	02-10455-005	02-10310-005	02-10066-105	E2331-205	C7119-205	E2322-205	E2317-205
		HIGH PRESS. SET WITH LOW VAC SET	ALUM.	06-11136-01	06-11136-02	06-11136-03	06-11137-01	06-11137-02	06-11137-03	06-11137-04
			STEEL	02-10455-003	02-10310-003	02-10066-103	D6064-203	C6433-203	C6436-203	C6500-203
			304 SST	02-10455-005	02-10310-005	02-10066-105	E2331-205	C7119-205	E2322-205	E2317-205
		LOW PRESS. SET WITH HIGH VAC SET	ALUM.	06-11545-01	06-11545-02	06-11545-03	06-11137-05	06-11137-06	06-11137-07	06-11137-04
			STEEL	02-11197-003	02-11199-003	02.11045-203	02-11004-003	02-11006-003	02-11007-003	C6500-203
			304 SST	02-11197-005	02-11199-005	02-11045-205	02-11004-005	02-11006-005	02-11007-005	E2317-205
		HIGH PRESS. SET WITH HIGH VAC SET	ALUM.	06-11545-01	06-11545-02	06-11545-04	06-11137-01	06-11137-02	06-11137-03	06-11137-04
			STEEL	02-11197-103	02-11199-103	02-11045-303	D6064-203	C6433-203	C6436-203	C6500-203
			304 SST	02-11197-105	02-11199-105	02-11045-305	E24331-205	C7119-205	E2322-205	E2317-205
*9	PRESS. GUIDE POST (HOOD ATTM’T)	LOW SET	316 SST	02-11411-106	02-11411-206	02-11412-106	02-11413-106	02-11413-206	02-11415-106	02-11415-206
		HIGH SET	316 SST	02-11411-306	02-11411-406	02-11412-206	02-11413-306	02-11413-406	02-11415-306	02-11415-206
*10	PRESSURE GUIDE POST	LOW SET	316 SST	---	---	---	02-11414-106	02-11414-206	02-11416-106	02-11416-206
		HIGH SET	316 SST	---	---	---	02-11414-306	02-11414-406	02-11416-306	02-11416-206
*11	VACUUM GUIDE POST	ALL	316 SST	02-11015-106	02-11015-206	02-11432-106	B14384-106	B14384-206	B14384-506	02-11433-106
12	SPACER RING	ALL	ALUM	---	---	---	B14389-011	B14439-011	B14449-011	B16113-011
		ALL	STEEL	---	---	---	B14389-003	B14439-003	B14449-003	B16113-003
		ALL	316 SST	---	---	---	B14389-006	B14439-006	B14449-006	B16113-006
13	O-RING	ALL	BUNA-N	P014-03-285	P014-03-273	P014-03-286	P014-03-287	P014-03-288	P014-03-289	P014-03-290
14	RETAINING RING	ALL	POLYPROPYLENE	02-11396	02-11397	02-11398	02-11399	02-11400	02-11401	02-11402
* FOR ALL WEATHER PARTS, ADD -1 TO END OF LISTED PART NUMBERS.										

VAREC

REVISIONS

REV.	DESCRIPTION	APPROVAL/DATE
C	ECN #01-1226	S.WILLIS 8-17-01 G.SETZER 8-20-01 D.WYANT 8-20-01
D	ECN #07-1454 Revised table on pg.12.	S.WILLIS 2-12-08 D.WYANT 2-29-08 D.K.SHARMA 2-29-08

THIS PAGE IS FOR APPROVALS AND REVISION RECORDS OF THE DOCUMENT IN THIS FOLDER. COPIES OF THIS PAGE ARE NOT TO BE DISTRIBUTED WITH THE ASSOCIATED DOCUMENT.

EXCLUDING THIS PAGE, THIS DOCUMENT CONTAINS 18

DWN			INSTALLATION, OPERATION & MAINTENANCE MANUAL FOR 2010B/2020B/3500B SERIES PRESSURE OR VACUUM RELIEF VALVES		
CHK					
APPR					
APPR					
APPR			SIZE		REV.
APPR			A	33-11516	D

FORM NO. 1500 REV. A 5/93

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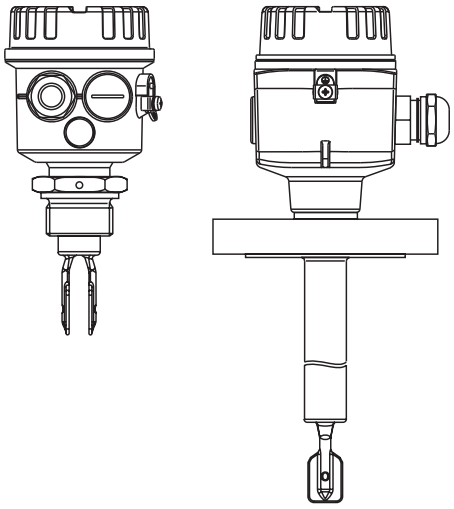
Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Operating Instructions

Liquiphant M FTL50, FTL51



en – Point Level Switch

KA143F/00/a6/07.10
71118926

Endress+Hauser
People for Process Automation

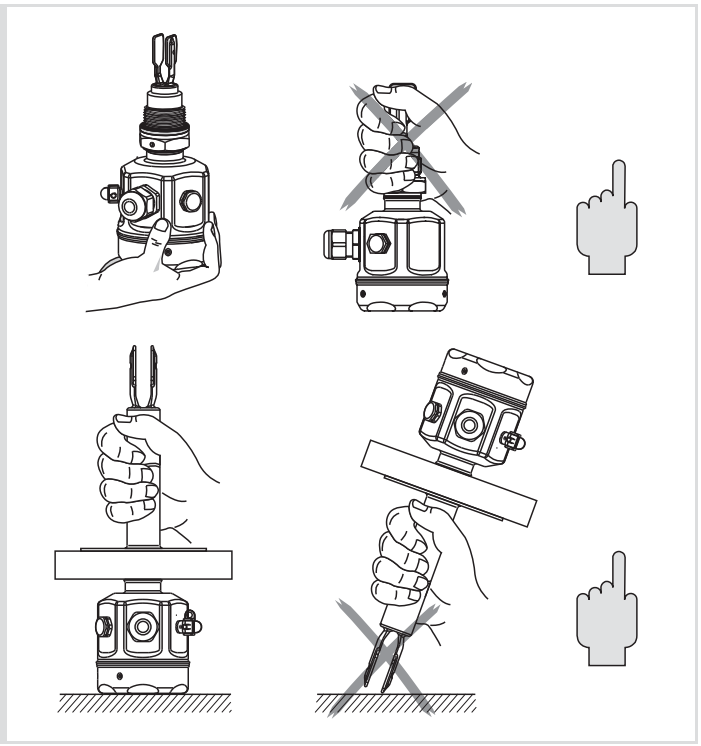
en - Contents

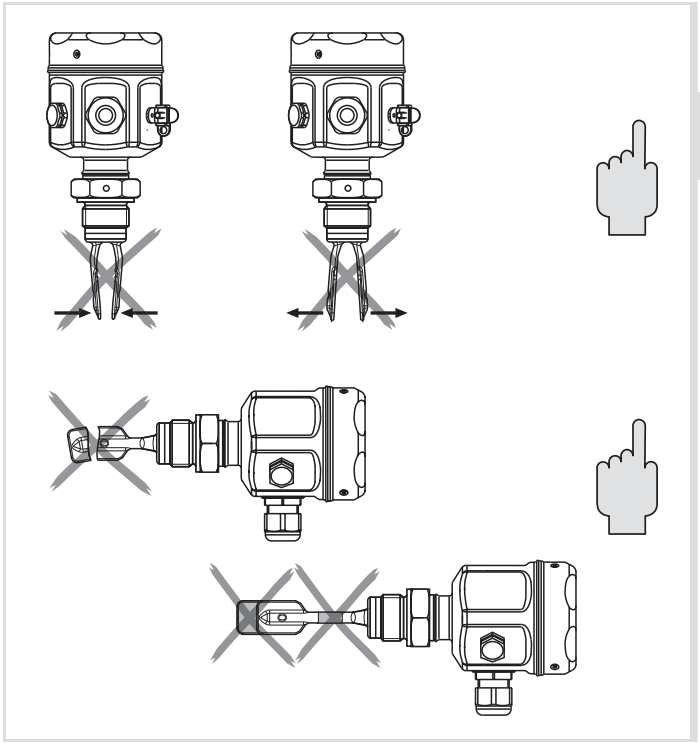
Caution!
= forbidden;
leads to incorrect operation or destruction.

en - Notes on Safety

The Liquiphant M FTL50, FTL51 is designed for point level detection in liquids.
If used incorrectly it is possible that application-related dangers may arise.
The level limit switch Liquiphant M FTL50, FTL51 may be installed, connected, commissioned, operated and maintained **by qualified and authorised personnel only**, under strict observance of these operating instructions, any relevant standards, legal requirements, and, where appropriate, the certificate.
Install an easily accessible power switch in the proximity of the device.
Mark the power switch as a disconnector for the device.

en - Handling
Hold by housing, flange or extension tube.



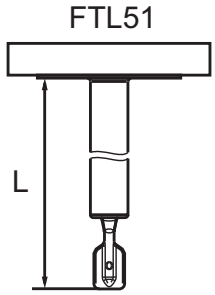


en - Do **not** bend
Do **not** shorten
Do **not** lengthen

ENDRESS+HAUSER
LIQUIPHANT M

Order Code

FTL5#–########## #### mm
in



A	*[1]
B	ATEX II 3 G EEx nC II T6, WHG
	ATEX II 3 D T85°C*[3]
C	ATEX II 3 G EEx nA II T6, WHG
	ATEX II 3 D T85°C*[3]
D	*[1], WHG
E	ATEX II 1/2 G EEx de IIC T6, WHG → KA163
F	ATEX II 1/2 G EEx ia IIC T6, WHG
	ATEX II 1/2 D T80°C*[3]
G	ATEX II 1/2 G EEx ia IIC T6
	ATEX II 1/2 D T80°C*[3]
H	ATEX II 1 G EEx ia IIC T6
I	ATEX II 1/2 G EEx de IIC T6 → KA163
J	ATEX II 1 G EEx ia IIC T6, WHG
K	ATEX II 1/2 G EEx d IIC T6
L	ATEX II 1/2 G EEx d IIC T6, WHG
M	NEPSI Ex ia IIC T6
N	NEPSI Ex d IIC T6
P	FM IS, Cl. I, II, III, Div. 1, Gr. A-G
Q	FM XP, Cl. I, II, III, Div. 1, Gr. B-G, E5 => Gr. A-G
R	FM NI, Cl. I, Div. 2, Gr. A-D
S	CSA IS, Cl. I, II, III, Div. 1, Gr. A-G
T	CSA XP, Cl. I, II, III, Div. 1, Gr. A-G
U	CSA General purpose
V	TIIS Ex ia IIC T3
W	TIIS Ex d IIB T3
X	TIIS Ex ia IIC T6
7	TIIS Ex d IIC T3
8	TIIS Ex d IIC T6
Y	*[2]

A##	Flanges	→ 12 13	
B##			
C##			
D##			
F##			
K##			
N##			
GE2	R ¾,	DIN 2999, 316L	max. 100 bar, 150 °C
GE5	R ¾,	DIN 2999, AlloyC4	
GE6	R ¾,	DIN 2999, AlloyC22	
GF2	R 1,	DIN 2999, 316L	
GF5	R 1,	DIN 2999, AlloyC4	
GF6	R 1,	DIN 2999, AlloyC22	
GM2	NPT ¾,	ANSI, 316L	
GM5	NPT ¾,	ANSI, AlloyC4	
GM6	NPT ¾,	ANSI, AlloyC22	
GN2	NPT 1,	ANSI, 316L	
GN5	NPT 1,	ANSI, AlloyC4	
GN6	NPT 1,	ANSI, AlloyC22	
GQ2	G ¾,	ISO 228, 316L	max. 100 bar, 150 °C
GQ5	G ¾,	ISO 228, AlloyC4	
GQ6	G ¾,	ISO 228, AlloyC22	
GR2	G 1,	ISO 228, 316L	
GR5	G 1,	ISO 228, AlloyC4	
GR6	G 1,	ISO 228, AlloyC22	
GW2	G 1,	ISO 228, 316L	max. 25 bar, 150 °C max. 40 bar, 100 °C
TC2	DN25-38 (1...1½"), Tri-Clamp	ISO 2852, 316L	max. 16 bar, 120 °C max. 2 bar, 150 °C
TE2	DN40-51 (2"), Tri-Clamp	ISO 2852, 316L	
YY9	*[2]		

→ 10 11

*[1] without

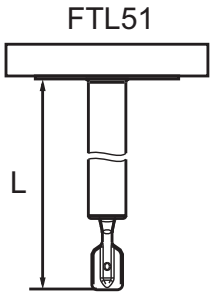
*[2] others

*[3] not valid for PBT

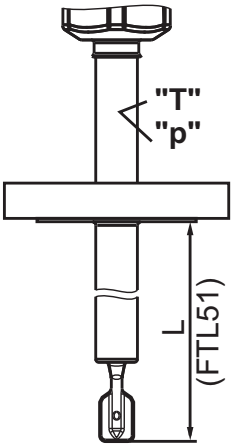
ENDRESS+HAUSER
LIQUIPHANT M

Order Code

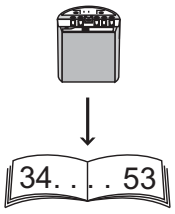
FTL5#–########## #### mm
in



AA	*[2],		Ra < 3.2 µm/80 grit (FTL50)
BB	..... mm,	316L,	Ra < 3.2 µm/80 grit
BE	..... mm,	AlloyC4,	Ra < 3.2 µm/80 grit
CB	..... in,	316L,	Ra < 3.2 µm/80 grit
CE	..... in,	AlloyC4,	Ra < 3.2 µm/80 grit
DB	"L II",	316L,	Ra < 3.2 µm/80 grit
DE	"L II",	AlloyC4,	Ra < 3.2 µm/80 grit
IA	*[2],		+ **"T"** (FTL50)
JB	..... mm,	316L	+ **"T"**
JE	..... mm,	AlloyC4	+ **"T"**
KB	..... in,	316L	+ **"T"**
KE	..... in,	AlloyC4	+ **"T"**
LB	"L II",	316L	+ **"T"**
LE	"L II",	AlloyC4	+ **"T"**
QA	*[2],		+ **"p"** (FTL50)
RB	..... mm,	316L	+ **"p"**
RE	..... mm,	AlloyC4	+ **"p"**
SB	..... in,	316L	+ **"p"**
SE	..... in,	AlloyC4	+ **"p"**
TB	"L II",	316L	+ **"p"**
TE	"L II",	AlloyC4	+ **"p"**
YY	*[2]		

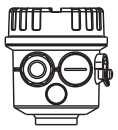


A	FEL50A, PROFIBUS PA
1	FEL51, 19…253 V AC
2	FEL52, 10… 55 V DC, PNP
4	FEL54, 19…253 V AC, 19…55 V DC, DPDT
5	FEL55, 11… 36 V DC, 8/16 mA
6	FEL56, NAMUR, L-H
7	FEL57, PFM
8	FEL58, NAMUR, H-L
9	*[2]

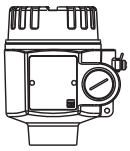


E1	F27	NEMA6P,	NPT ¾
E4	F16,	NEMA4X,	NPT ½
E5	F13/17,	NEMA4X,	NPT ¾
E6	F15,	NEMA4X,	NPT ½
F1	F27,	IP68,	G ½
F4	F16,	IP66,	G ½
F5	F13/17,	IP66,	G ½
F6	F15,	IP66,	G ½
G1	F27,	IP68,	M20
G4	F16,	IP66,	M20
G5	F13/17,	IP66,	M20
G6	F15,	IP66,	M20
N4	F16,	IP66,	M12
N5	F13/17,	IP66,	M12
N6	F15,	IP66,	M12
Y9	*[2]		

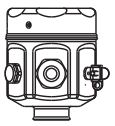
F16 (PBT)



F13/17 (Alu)
F27 (316L)



F15 (316L)



#3 compact housing → KA220

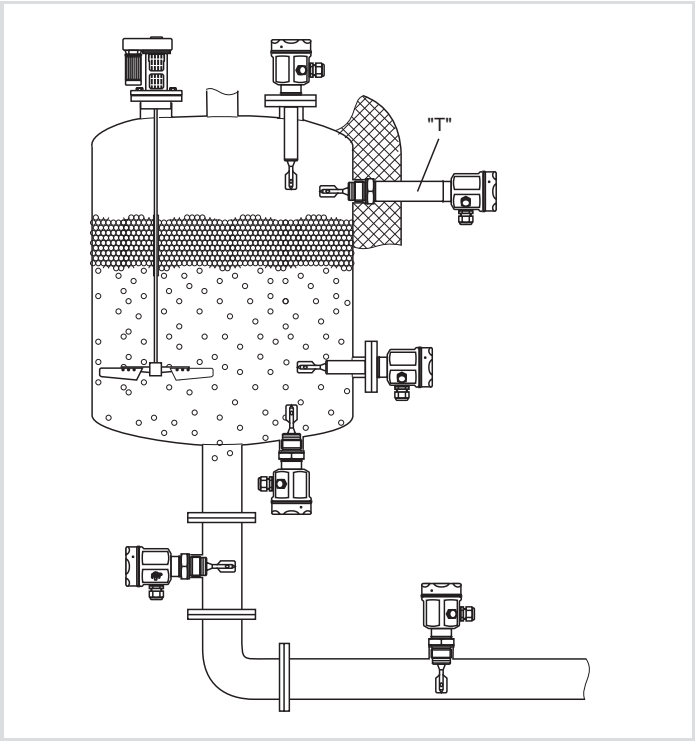
#7 Alu/sep. → KA163

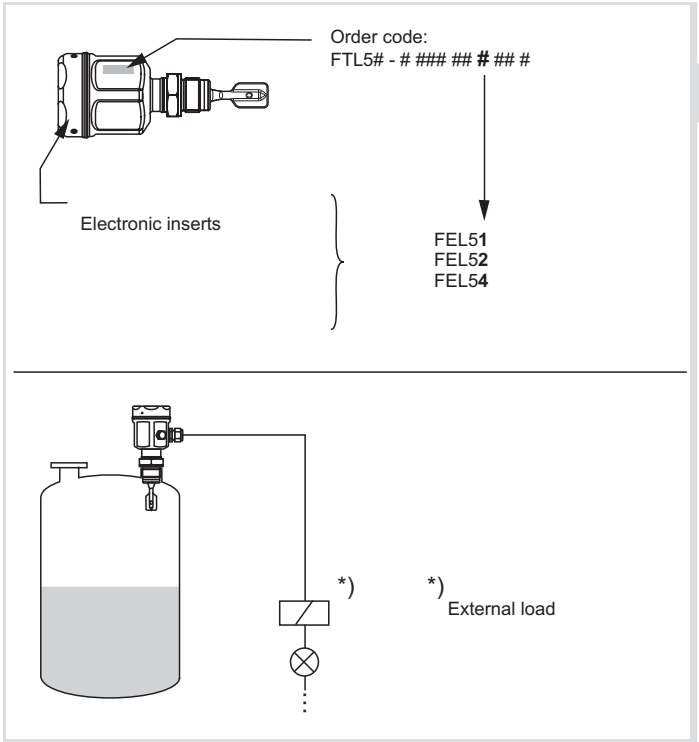
A	*[1]
B	~~PVIS free~~
C	EN 10204 - 3.1, 316L
K	Spec. adjustment density H20
L	Spec. adjustment density H20, EN10204-3.1
N	EN 10204 - 3.1, NACE MR0175, 316L
P	100 bar (FTL51)
R	100 bar, EN 10204 - 3.1, NACE MR0175, 316L (FTL51)
S	GL/ABS marine certificate (FTL51: max. 1600 mm)
Y	*[2]

*[1]	without
*[2]	others

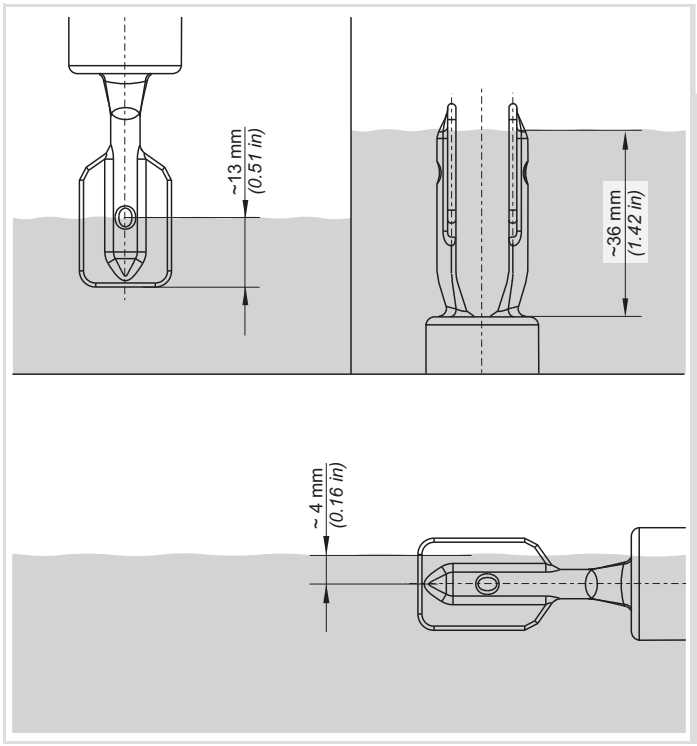
“L II”	Switchpoint
	Liquiphant II FTL 360/365, FDL 30/35
“T”	Temperature spacer
“p”	Pressure sealed bushing

en - Application
Level limit detection in liquids

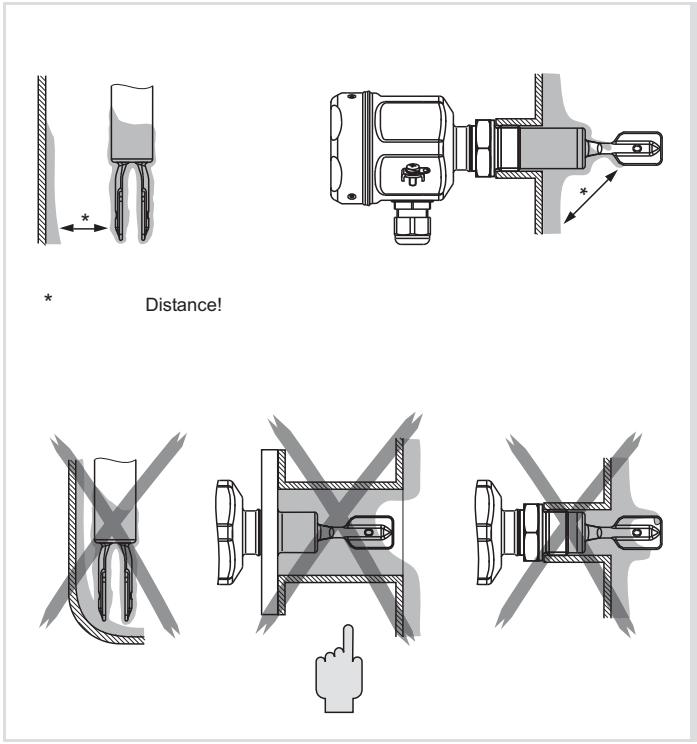




en - Measuring system
for direct connection

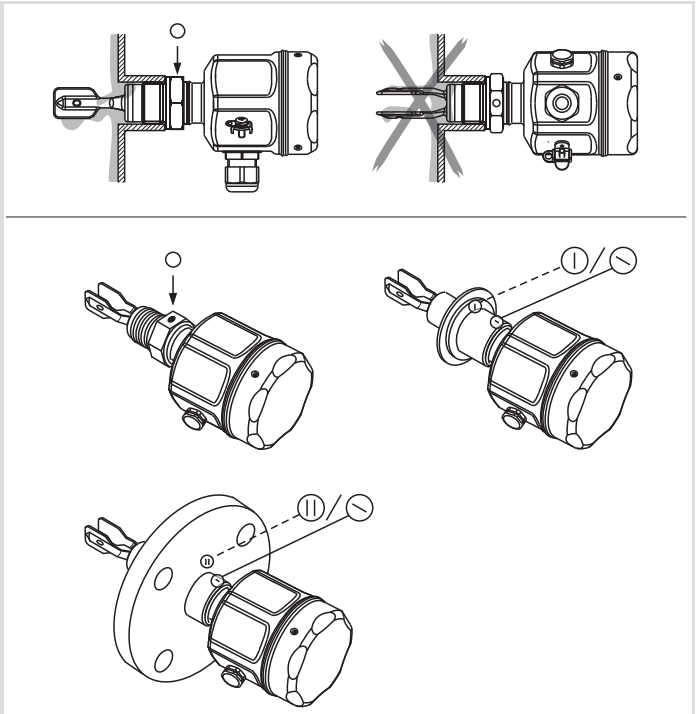


en - Installation
Switchpoint depends
on mounting position

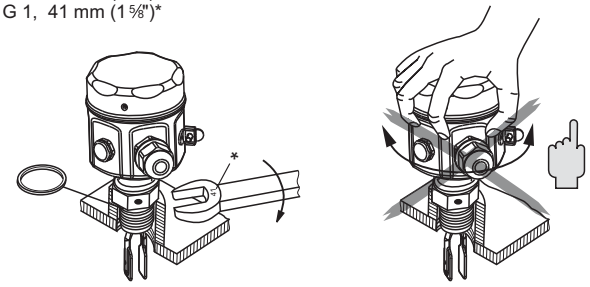


en - Consider build-up.
Fork may not contact the build-up.

en – Orientation of fork tines:
Marking above or below

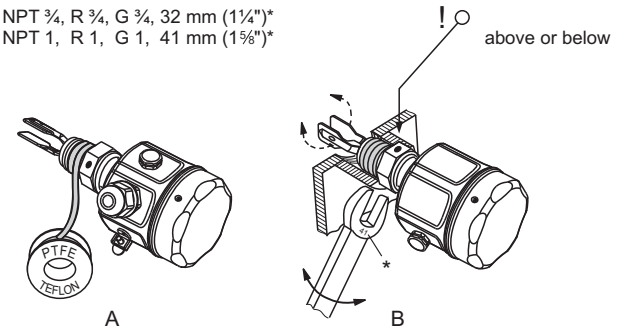


G ¾, 32 mm (1¼")*
G 1, 41 mm (1⅝")*

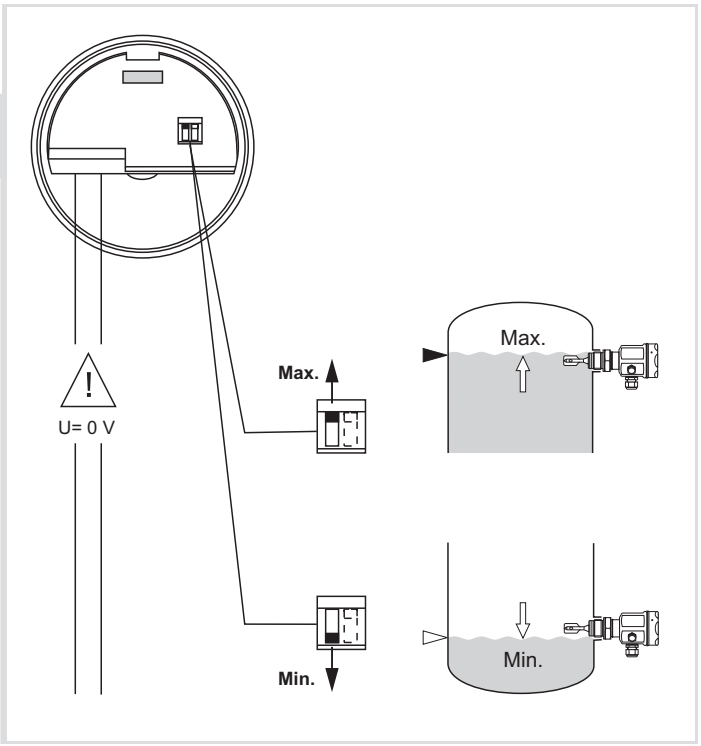


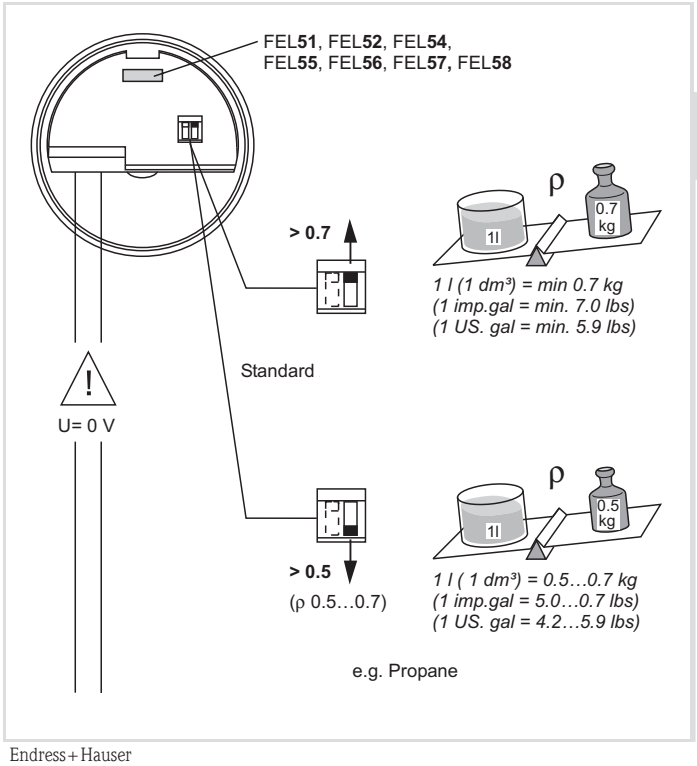
en – Screw Liquiphant into process connection.
Don't use housing to turn.

NPT ¾, R ¾, G ¾, 32 mm (1¼")*
NPT 1, R 1, G 1, 41 mm (1⅝")*



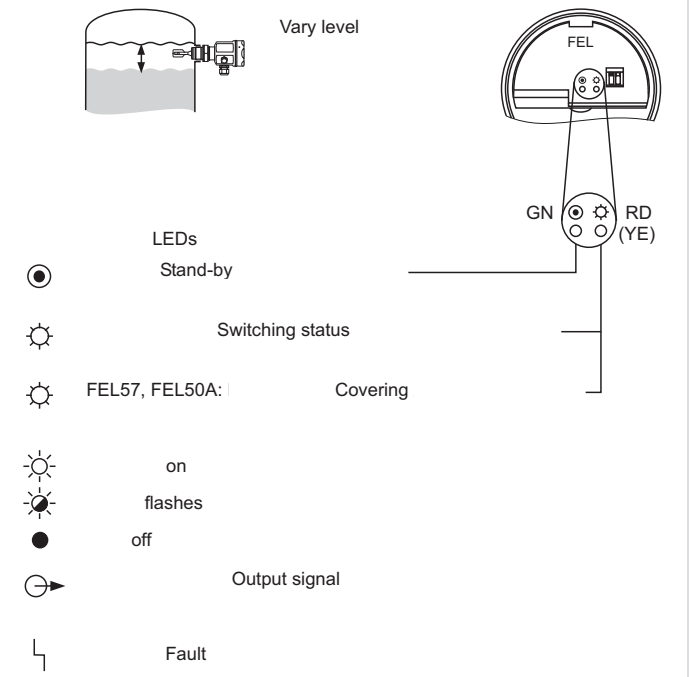
en - Setting-up
Minimum/maximum
fail-safe mode





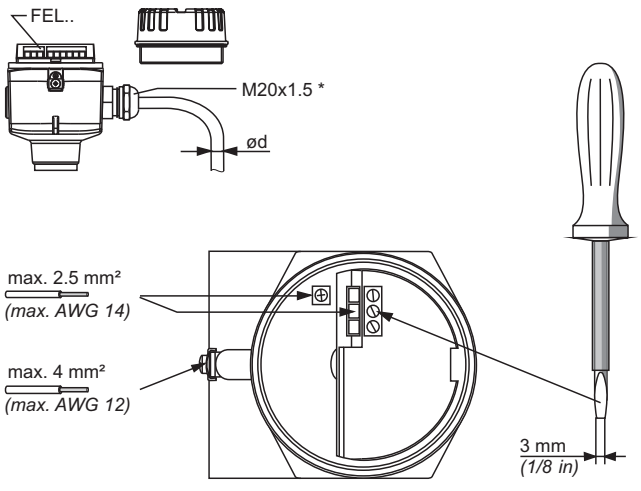
en - Liquid density.
Density ρ measured in g/cm³
or in kg/l.

en - Light signals



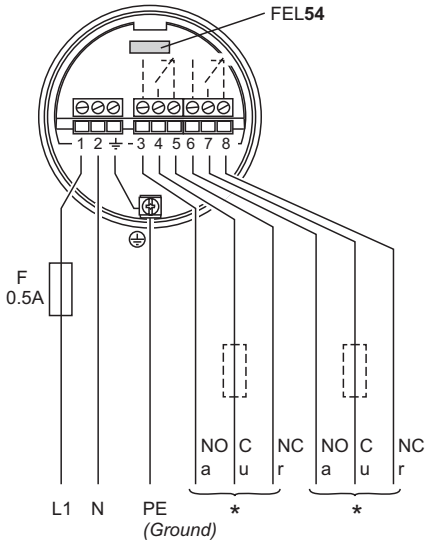
en - Connections

Note national regulations!



***Cable entry**
Nickel-plated brass:
Ød = 7...10,5 mm (0,28...0,41 in)
Plastic:
Ød = 5...10 mm (0,2...0,38 in)
Stainless steel:
Ød = 7...12 mm (0,28...0,47 in)

en – Connections FEL54
Universal connection
Relay output

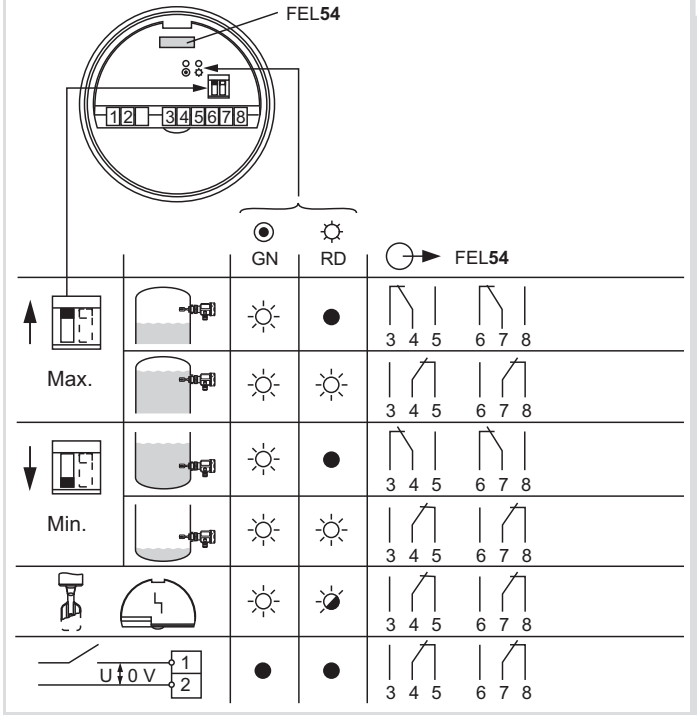


U~ 19…253 V *(AC)*

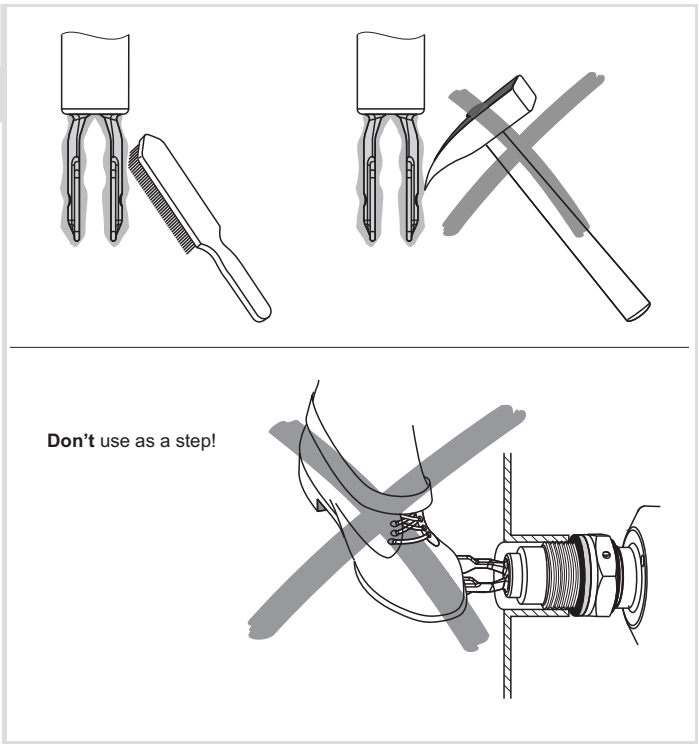
L+ L–
U⎓ 19… 55 V *(DC)*

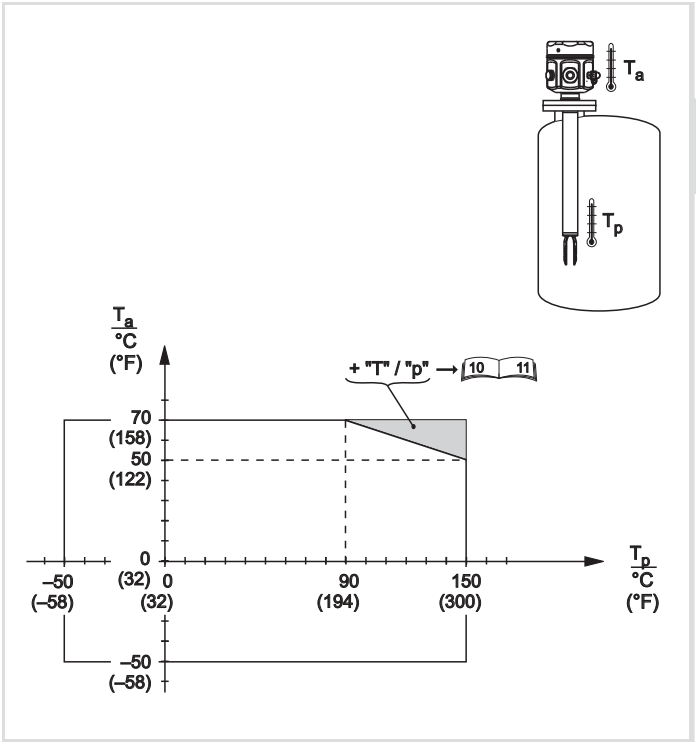
* U~ max. 253 V, I~ max. 6 A
P~ max. 1500 VA, cos φ = 1
P~ max. 750 VA, cos φ > 0.7
I⎓ max. 6 A, U⎓ < 30 V
I⎓ max. 0.2 A, U⎓ < 125 V

en – Function FEL54



en - Maintenance, Cleaning
Removal of encrustation





en - Technical Data
Ambient temperature T_a
Process temperature T_p

Fault	Reason	Remedy
Does not switch	No power	Check power
	Faulty signal line	Check signal line
	Faulty electronic insert - FEL51 connected directly to L1 and N	Exchange - always connect FEL51 via external load
	Density of liquid too low	Set density to > 0.5 at electronic insert
	Fork encrusted	Clean fork
	Fork corroded (Indication on FEL: red/yellow flashes, FEL58: green flashes 0.3 Hz)	Exchange fork and process connection
	FEL51: Internal resistance of connected relay too large	Connect suitable relay
	FEL51: Holding current of connected relay too low	Connected resistor in parallel with relay
	FEL54: Contacts welded together (after short-circuit)	Exchange FEL54; put fuse in contact circuit
Switches incorrectly	Min-/Max- fail-safe mode set wrongly	Set correct mode at electronic insert
Sporadic faulty switching	Thick heavy foam, very turbulent conditions, foaming liquid	Mount Liquiphant in bypass
	Extreme RFI	Use screened cable
	Extreme vibration	Decouple, damp, turn fork 90°
	Water in housing	Screw cover and cable gland tight
	FEL52: Output overloaded	Reduce load,(cable) capacitance
Switches incorrectly after power failure	FEL57, behaviour during switch-on test (functional test)	Observe switching behaviour of FEL57; After power failure blockplant control for up to 45 s

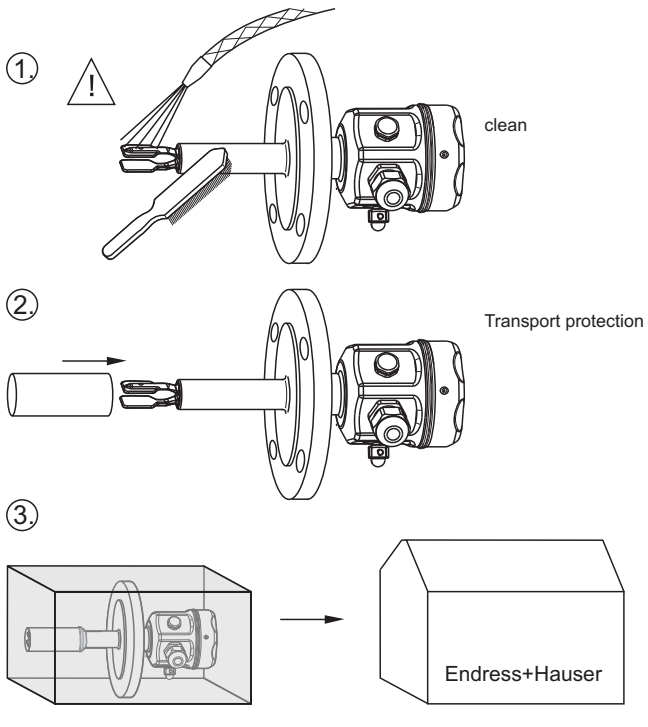
en - Trouble- shooting Supplement

If the switching behaviour of the fork is abnormal, the fork frequency can be measured at PIN 4 of the diagnosis socket. With electronic inserts FEL51/52/54/55/56/57/58 this is a sinusoidal vibration whose amplitude makes it possible to determine the condition of the fork.
With FEL50A, only the fork frequency measurement is possible due to a rectangular pulse signal.

en - Spare parts
Electronic inserts

FEL51	52002304
FEL52	52002305
FEL54	52002306
FEL55	52002307
FEL56	52002308
FEL57	52002309
FEL58	52006454
FEL50A	52010527

Installation specification: During installation, please keep in mind that electrical resources (electronic inserts) which are powered by non-intrinsically-safe circuits may **no** longer be interconnected with intrinsically-safe circuits.



en - Repair
at Endress+Hauser