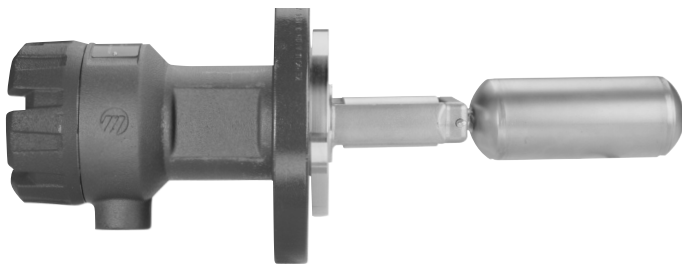


Tuffy® T3 Liquid Level Controls with Electric Switches

Installation and Operating Manual

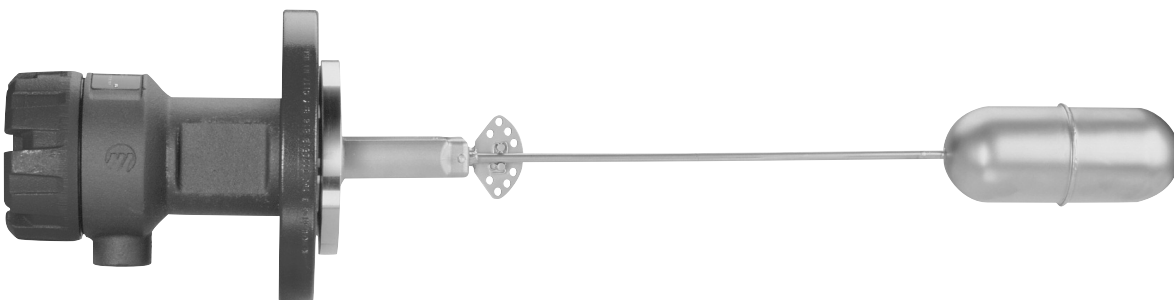
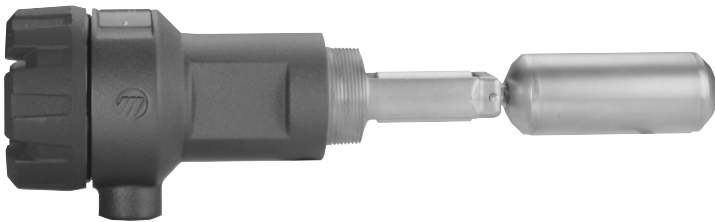


Side

Mounted

Float Level

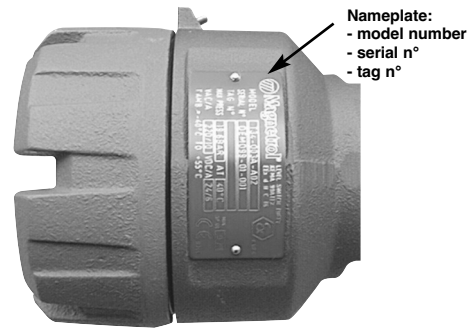
Switch



UNPACKING

Unpack the instrument carefully. Make sure all components have been removed from the foam protection. Inspect all components for damage. Report any concealed damage to the carrier within 24 hours. Check the contents of the carton/crates against the packing slip and report any discrepancies to Magnetrol. Check the nameplate model number to be sure it agrees with the packing slip and purchase order. Check and record the serial number for future reference when ordering parts.

Cut and remove the plastic shipping straps on flanged units.



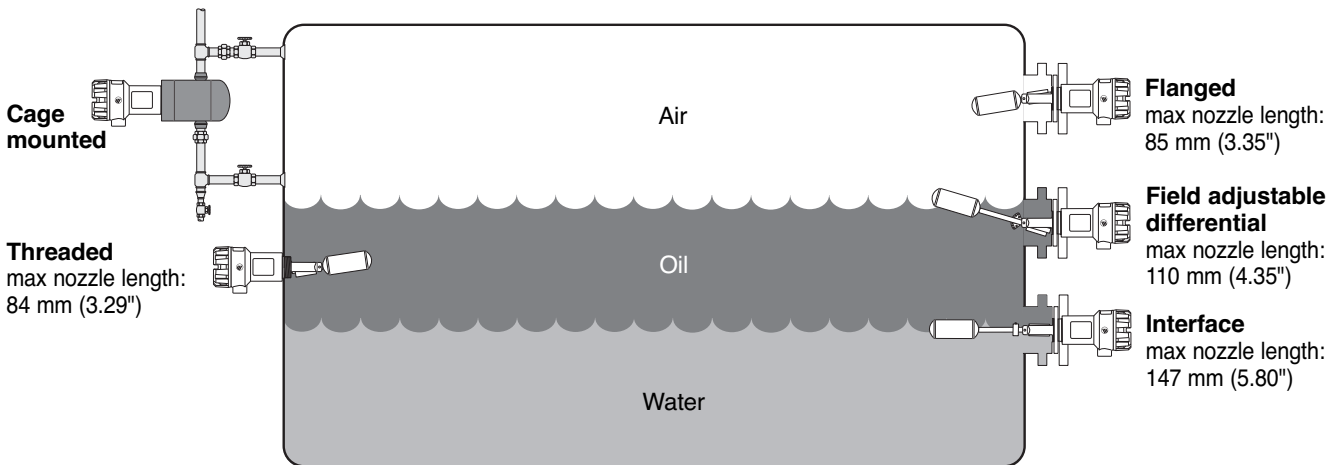
These units are in conformity with the provisions of:

1. Directive 2014/34/EU for equipment or protective system intended for use in potentially explosive atmospheres. EC-type examination certificate number ISSeP10ATEX032 (Ex d units; applied standards EN 60079-0:2009, EN 60079-1:2007 and EN 60079-26:2007) or ISSeP00ATEX010X (Ex i units; applied standards EN 50014:1997 + A1 + A2, EN 50020:1994, EN 50284:1999).
2. The PED directive 97/23/EC (pressure equipment directive). Safety accessories per category IV module H1.

SPECIAL CONDITIONS FOR ATEX INTRINSICALLY SAFE USE

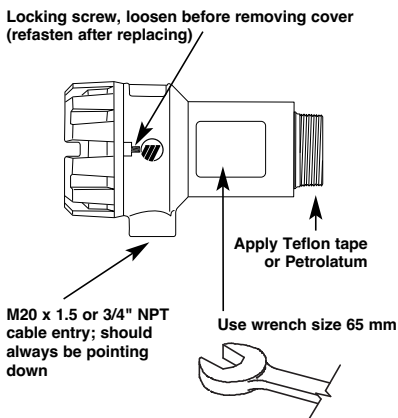
When the material is equipped with an aluminium enclosure, all precautions shall be taken to avoid all impacts or frictions which can result in the ignition of the potentially explosive atmosphere.

MOUNTING

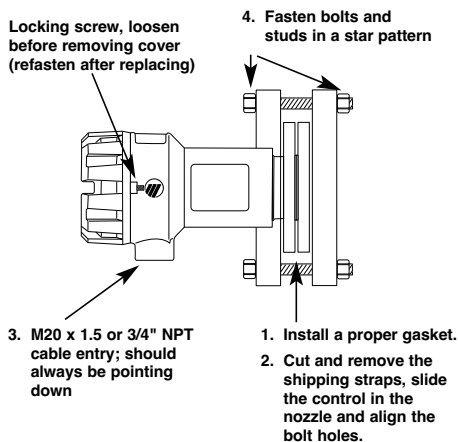


Note: min nozzle size is 3" SCH 80 (max nozzle lengths are specified as per this size)

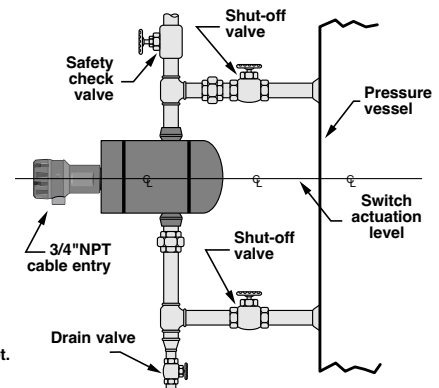
2" NPT Tuffey



Flanged Tuffey

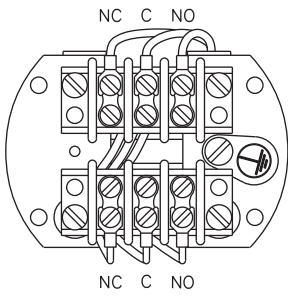


External cage mounted Tuffey

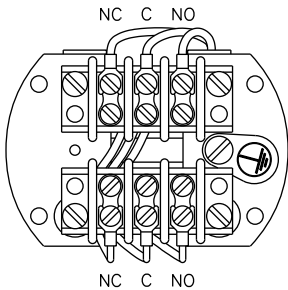


WIRING

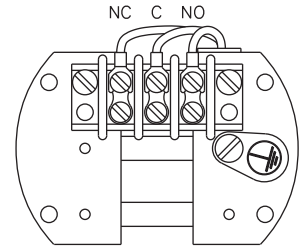
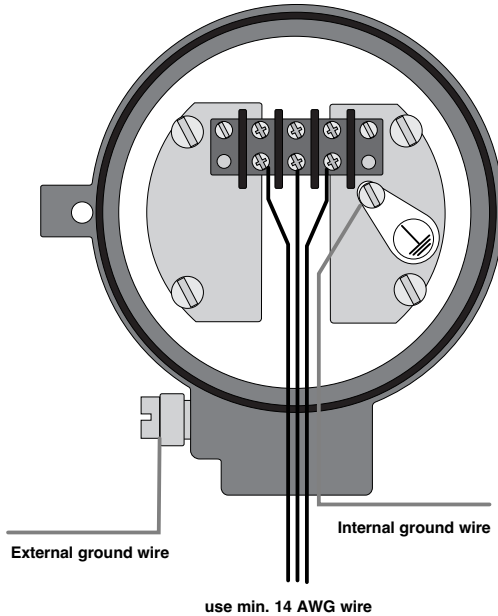
CAUTION: power must be switched OFF before wiring the unit.



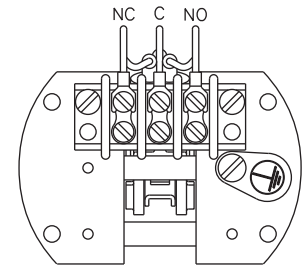
**Terminal connections
DPDT dry contact switch
with silver contacts**



**Terminal connections
DPDT dry contact switch
with gold contacts**

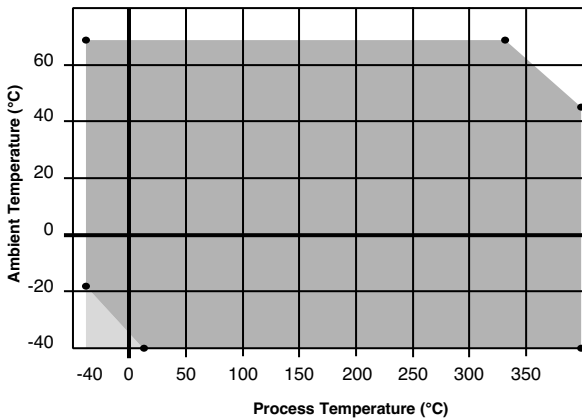


**Terminal connections
SPDT dry contact switch
with silver or gold contacts**

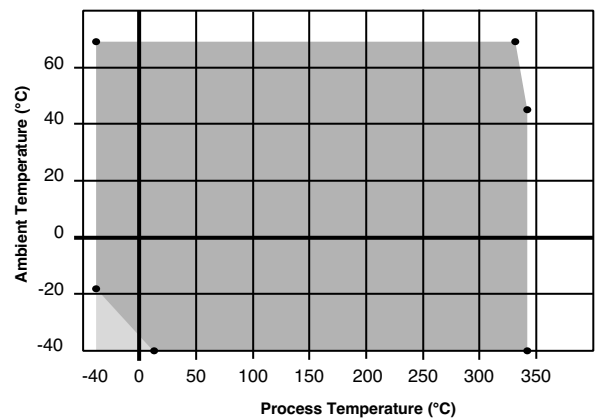


**Terminal connections
SPDT HS switch
with silver or gold contacts**

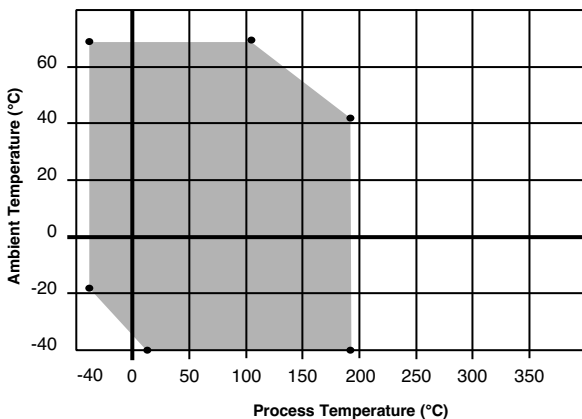
**Allowable operating range
Cast iron housing** with silver switch contacts
with silver/gold contacts HS



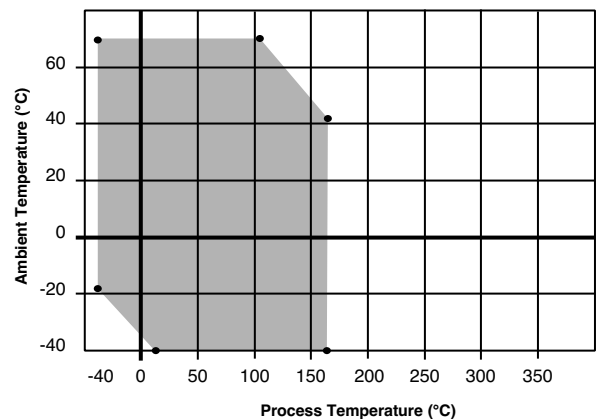
**Allowable operating range
Aluminium housing** with silver switch contacts
with silver/gold contacts HS



**Allowable operating range
Cast iron housing with gold switch contacts**



**Allowable operating range
Aluminium housing with gold switch contacts**



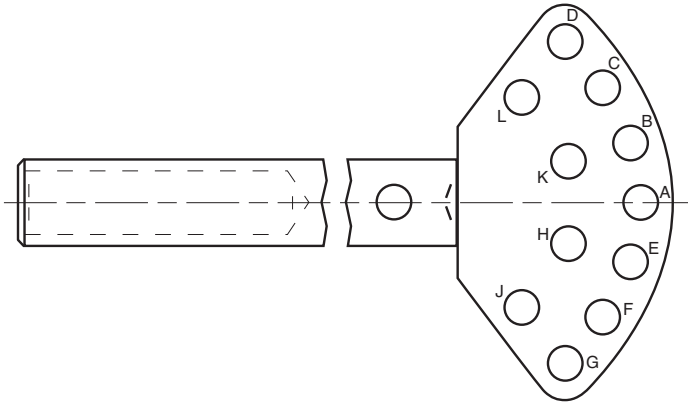
CALIBRATION

For T31-T35 / T3B / T3D and T3E units

Properly selected TUFFY units do not need any field calibration.

For T3C: field adjustable differential units

The Adjustable Differential Tuffly II, model T3C, may be set in the field for one of a variety of level differentials. By specific placement of the stops in the holes of the adjustment plate, the level differential may be changed.



To determine the differential

Example: T3C-C unit with stop holes **B** and **G**

1. Select the rising level of the upper stop:
example: upper stop = hole **B**: +85 mm
2. Select the falling level of the lower stop:
example: lower stop = hole **G**: -205 mm
3. Subtract levels:
rising level / upper stop - falling level / lower stop:
example: +85 mm - (-205 mm) = +290 mm

Example 2: T3C-8 unit: with stop holes **D** and **B**:
+183 mm - (+115 mm) = 68 mm

Partnumber	Level	Stop holes in mm (divide by 25,4 to obtain inches)										
		Upper stops					middle	Lower stops				
		B	C	D	K	L	A	E	F	G	H	J
T3C-4XXX-XXX	Rising	+47	+90	+124	+39	+104	+4	-37	n/a	n/a	-42	n/a
	Falling	+80	n/a	n/a	+84	n/a	+38	-10	-47	-82	+4	-62
T3C-8XXX-XXX	Rising	+63	+131	+183	+51	+153	-3	-67	n/a	n/a	-75	n/a
	Falling	+115	n/a	n/a	+122	n/a	+50	-25	-84	-136	-3	-106
T3C-CXXX-XXX	Rising	+85	+183	+259	+67	+215	-11	-105	n/a	n/a	-115	n/a
	Falling	+160	n/a	n/a	+170	n/a	66	-43	-128	-205	-11	-106

Impossible stop hole combinations due to the diameter of the stem (of the float):

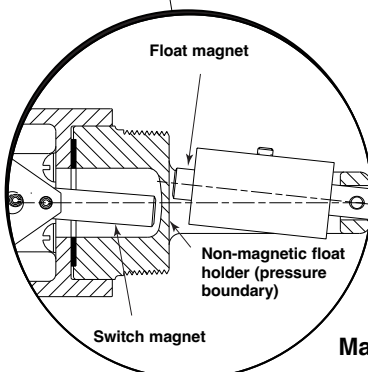
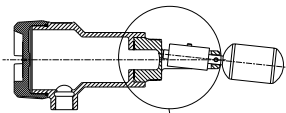
A and B **B and C** **C and D** **D and L** **E and F** **F and H** **J and G**
A and E **B and K** **C and K** **E and H** **F and J**
A and H **C and L** **F and G**
A and K

TROUBLESHOOTING

Symptom

Cause of malfunction / Action

Failure of the controlled equipment
eg. pump does not start,
signal lamps fail to operate etc...



Magnet/Switch action

Check external causes first:

- blown fuses
- tripped reset button
- open power switch.
- controlled equipment fails.
- defective wiring to level switch.

Check wiring as per wiring diagrams on page 3

Check actuating arm and magnet assembly

1. Remove switch mechanism
2. Check for wiring interference or binding of actuating arm. The switch and magnet must move throughout its entire range of motion without interference.
3. Replace the switch mechanism in case of binding.

Check float assembly

1. Remove the unit from service
2. Clean the mechanism if required
3. Tilt the float, when the unit is limited by its motion:
check differential setting (for T3C units only) – see above
4. Replace the unit in case cleaning and/or resetting did not solve the problem.

PREVENTIVE MAINTENANCE

Periodic inspections are a necessary means to keep your level control in good working order. This control is a safety device that protects the valuable equipment it serves. A systematic program of preventive maintenance should be implemented when the control is placed into service. If the following instructions are observed, your control will provide reliable protection of your equipment for many years.

What to do

1. Keep control clean.

Be sure the switch housing is always in place. This cover is designed to keep dust and dirt from interfering with the switch mechanism operation. In addition it protects against damaging moisture and acts as a safety feature by keeping bare wires and terminals from being exposed. Should the housing cover become damaged or misplaced, obtain a replacement immediately.

2. Inspect switch mechanisms, terminals and connections monthly.

Tuffy T3 level switches may sometimes be exposed to excessive heat or moisture. Under such conditions insulation on electrical wires may become brittle, eventually breaking or peeling away. The resulting bare wires can cause short circuits. Check wiring carefully and replace at first sign of brittle insulation.

Vibration may sometimes cause terminal screws to loosen. Check all terminal connections to ensure that screws are tight. Check wiring carefully and repair or replace if necessary.

Note: It is recommended that spare switches, housing covers and o-rings be kept on hand at all times.

3. Inspect entire Tuffy T3 unit periodically.

A periodic cleaning of the float and counterweight assembly will ensure continued free movement of the mechanism.

What to avoid

1. NEVER leave the switch housing cover off of the control longer than is necessary to make routine inspections.
2. NEVER place a jumper wire across terminals to "cut-out" the control. If a jumper is necessary for test purposes, ensure that it is removed before placing the control into service.
3. NEVER attempt to make adjustments to or replace switches without reading instructions carefully. When in doubt, consult the factory or your local representative.
4. NEVER use in systems containing iron particles. The magnet in the float assembly can attract the particles and become jammed.
5. NEVER put insulation over the switch housing.

SPECIFICATIONS

PHYSICAL SPECIFICATIONS

Description	Specification
Measured variable	Liquid level
Physical range	Narrow differential: 13 mm (0.5") Adjustable differential: up to 464 mm (18.26") Interface Service Differential: 44 mm (1.72") Interface: min S.G. difference between both liquids: 0,1
Ambient temperature	-40 °C to + 70 °C (-40 °F to +160 °F)
Process temperature	From -55 °C (-65 °F) up to 400 °C (750 °F) depending switch/housing selection
Process pressure	Standard models: up to 50 bar abs. (720 psi) High pressure models: up to 150 bar abs. (2160 psi)
Wetted parts	316/316L (1.4401/1.4404) or Hastelloy C (2.4819)
Flange materials	Carbon steel 316/316L (1.4401/1.4404) or Carbon steel with 316/316L (1.4401/1.4404) cladding Hastelloy C (2.4819) or Carbon steel with Hastelloy C (2.4819) cladding
Housing materials	Cast aluminium or cast iron

ELECTRICAL SPECIFICATIONS

Description	Specification
Switch ratings	Up to 10 A @ 240 V AC Up to 6.0 A @ 24 V DC
Signal output	Single SPDT or single DPDT contacts
Switch types	Dry contact with silver or gold plated contacts Hermetically sealed for corrosive environment
Approvals	ATEX II 1/2 G / IECEx Ex d IIC T6 Ga/Gb, explosion proof ATEX II 1G EEx ia II C T6, intrinsically safe NEMA 4X/7/9, Class 1, Div 1, Groups B, C & D
Cable entries	3/4" NPT or M20 x 1,5

REPLACEMENT PARTS

Partn°:

Serial n°:

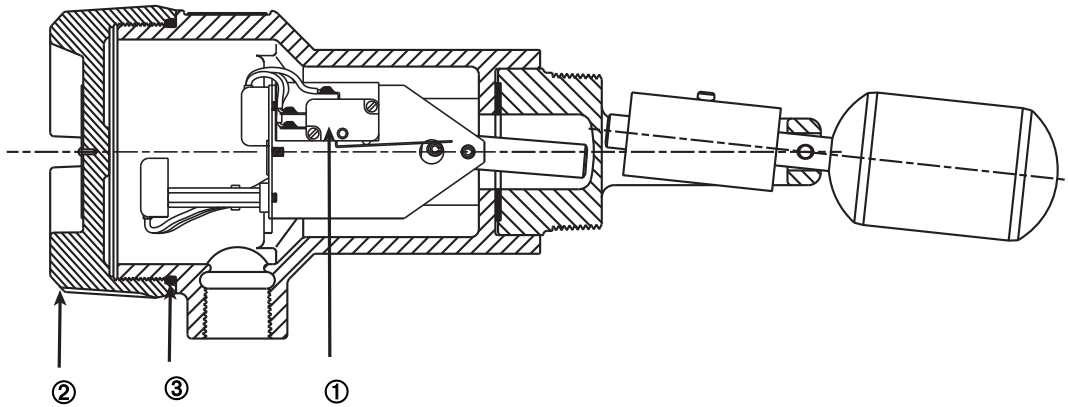
Digit in partn°: X 1 2 3 4 5 6 7 8 9 10

See nameplate, always provide complete partn° and serial n° when ordering spares.

↳ X = product with a specific customer requirement

EXPEDITE SHIP PLAN (ESP)

Several parts are available for quick shipment, within max. 1 week after factory receipt of purchase order, through the Expedite Ship Plan (ESP).
Parts covered by ESP service are conveniently grey coded in the selection tables.



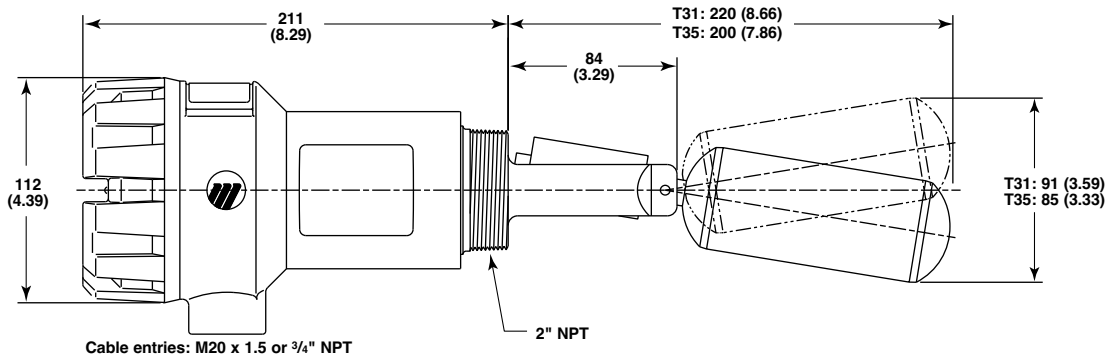
(1) Switch assembly	
Digit 9	Replacement part
0	031-5144-001
1	031-5146-001
2	031-5144-002
3	031-5146-002
4	031-5145-001
6	031-5145-002

(2) Housing cover	
Digit 10	Replacement part
1 or 3	004-9197-011
2, 4, N or R	004-9197-002
M or P	004-9197-005

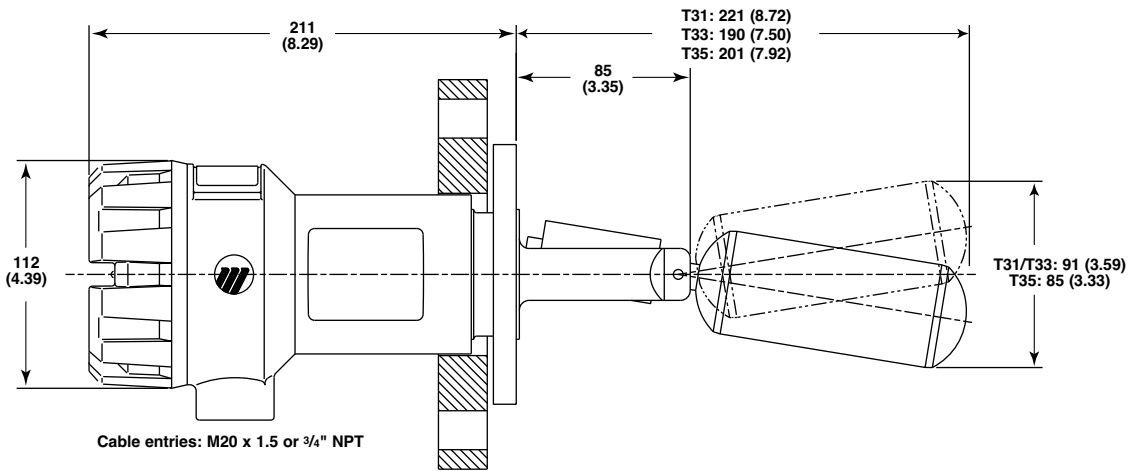
	Replacement part
(3) "O"-ring	012-2201-240

DIMENSIONS in mm (inches)

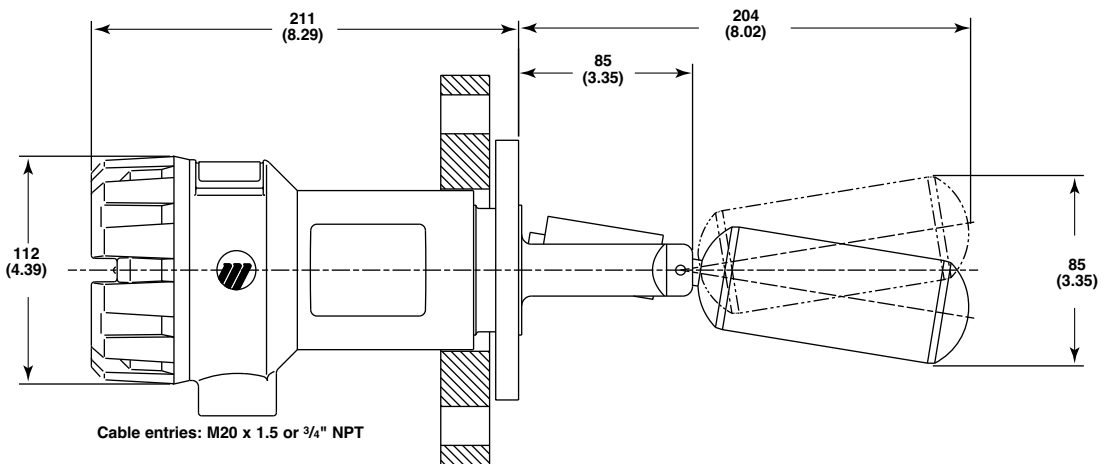
T31 and T35: threaded narrow differential



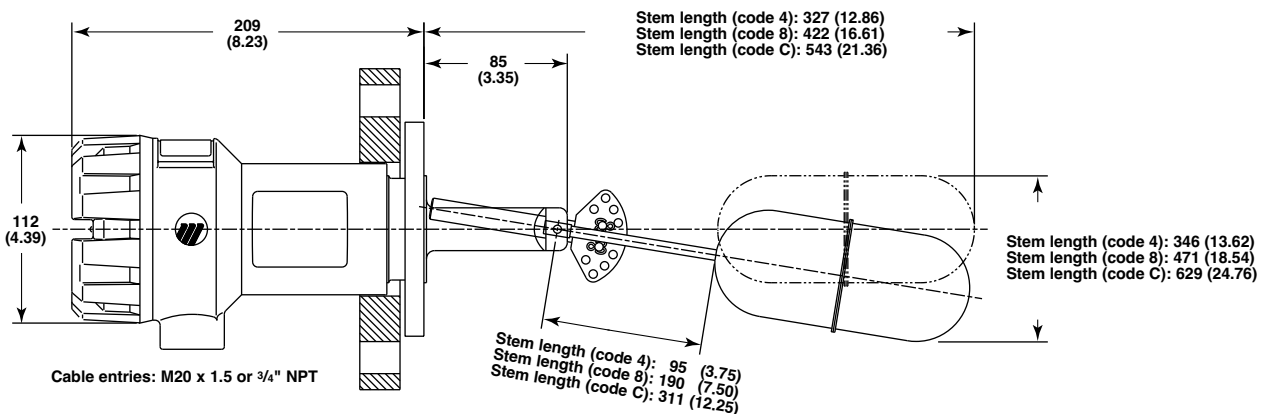
T31, T33 and T35: flanged narrow differential



T32: flanged high pressure narrow differential

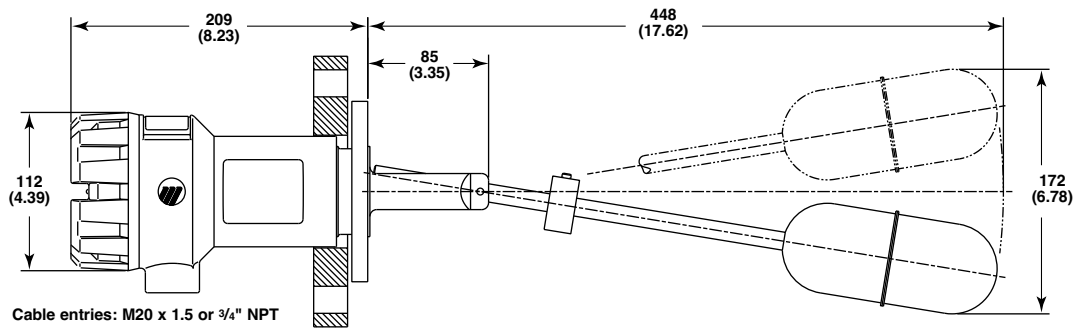


T3C: adjustable wide differential



DIMENSIONS in mm (inches)

T3B: interface



MODEL IDENTIFICATION

T 3 1	Tuffy with 316/316L (1.4401/1.4404) float - min S.G. 0,4 / max 50 bar abs (720 psi)
T 3 2	Tuffy with 316/316L (1.4401/1.4404) float - min S.G. 0,6 / max 150 bar abs (2160 psi)
T 3 3	Tuffy with Hastelloy C (2.4819) float - min S.G. 0,65 / max 50 bar abs. (720 psi)
T 3 5	Tuffy with 316/316L (1.4401/1.4404) float - min S.G. 0,6 / max 103 bar abs (1500 psi)
T 3 B	Interface Tuffy with 316/316L (1.4401/1.4404) float - max 50 bar abs (720 psi)
T 3 C	Adjustable diff. Tuffy with 316/316L (1.4401/1.4404) float - min S.G. 0,78 / max 50 bar abs (720 psi)

NARROW DIFFERENTIAL UNITS - T31, T32, T33 AND T35

0	Standard level differential of 13 mm (0,5")
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SPECIFIC GRAVITY OF LOWER LIQUID FOR T3B

0,81	0,82	0,83	0,84	0,85	0,86	0,87	0,88	0,89	0,90	Specific Gravity
A	B	C	D	E	F	G	H	J	K	Code

0,91	0,92	0,93	0,94	0,95	0,96	0,97	0,98	0,99	1	Specific Gravity
L	M	N	P	R	S	T	U	V	W	Code

STEM EXTENSION LENGTH FOR T3C - DIMENSION "A"

4	95 mm (3.75") stem extension / 346 mm (13.62") differential
8	190 mm (7.50") stem extension / 471 mm (18.54") differential
C	311 mm (12.25") stem extension / 629 mm (24.76") differential

PROCESS CONNECTION – ANSI Flanges

3 A	3" 150 lbs RF ANSI Flange
3 B	3" 300 lbs RF ANSI Flange
3 C	3" 600 lbs RF ANSI Flange
3 D	3" 900 lbs RF ANSI Flange
4 A	4" 150 lbs RF ANSI Flange
4 B	4" 300 lbs RF ANSI Flange
4 C	4" 600 lbs RF ANSI Flange
4 D	4" 900 lbs RF ANSI Flange
5 A	5" 150 lbs RF ANSI Flange
5 B	5" 300 lbs RF ANSI Flange
6 A	6" 150 lbs RF ANSI Flange
6 B	6" 300 lbs RF ANSI Flange

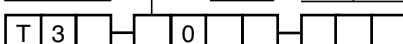
PROCESS CONNECTION – THREADED

2 N	2" NPT connection
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PROCESS CONNECTION – EN/DIN Flanges

A 1	DN 80, PN 16	EN 1092-1 Type B1
A 2	DN 80, PN 25/40	EN 1092-1 Type B1
A 3	DN 80, PN 63	EN 1092-1 Type B2
A 4	DN 80, PN 100	EN 1092-1 Type B2
A 5	DN 80, PN 160	DIN 2527 Form E flange
B 1	DN 100, PN 16	EN 1092-1 Type B1
B 2	DN 100, PN 25/40	EN 1092-1 Type B1
B 3	DN 100, PN 63	EN 1092-1 Type B2
B 4	DN 100, PN 100	EN 1092-1 Type B2
B 5	DN 100, PN 160	DIN 2527 Form E flange
C 1	DN 125, PN 16	EN 1092-1 Type B1
C 2	DN 125, PN 25/40	EN 1092-1 Type B1
D 1	DN 150, PN 16	EN 1092-1 Type B1
D 2	DN 150, PN 25/40	EN 1092-1 Type B1

SEE PAGE 10



complete code for TUFFY® T3

MODEL IDENTIFICATION

SEE PAGE 9

DESIGN CODE AND FLANGE MATERIAL

Design codes				Flange material
Standard	ANSI/ ASME B31.3	NACE	ANSI/ASME B31.3 & NACE	
1	2	3 ^①	4 ^①	Carbon steel
A	E	J	N	Carbon steel w. 316/316L cladding
B	F	K	P	316/316L (1.4401/1.4404) stainless steel
C	G	L	R	Carbon steel w. Hastelloy C cladding
D	H	M	T	Hastelloy C (2.4819)

① Not for all models

SWITCH TYPE (see table below - "SWITCH MECHANISMS")

0	SPDT with silver contacts
1	DPDT with silver contacts
2	SPDT with gold plated contacts
3	DPDT with gold plated contacts
4	Hermetically sealed, SPDT with silver contacts
6	Hermetically sealed, SPDT with gold plated contacts

HOUSING MATERIALS AND CABLE ENTRY

Consult factory for proper partnumbers for FM/CSA approved units

1	Cast aluminium, single 3/4" NPT cable entry,	ATEX II 1/2G / IECEx Ex d II C T6 Ga/Gb
2	Cast iron, single 3/4" NPT cable entry,	ATEX II 1/2G / IECEx Ex d II C T6 Ga/Gb
3	Cast aluminium, single M20 x 1,5 cable entry,	ATEX II 1/2G / IECEx Ex d II C T6 Ga/Gb
4	Cast iron, single M20 x 1,5 cable entry,	ATEX II 1/2G / IECEx Ex d II C T6 Ga/Gb
M	Cast aluminium, single 3/4" NPT cable entry,	ATEX II 1G EEx ia II C T6
N	Cast iron, single 3/4" NPT cable entry,	ATEX II 1G EEx ia II C T6
P	Cast aluminium, single M20 x 1,5 cable entry,	ATEX II 1G EEx ia II C T6
R	Cast iron, single M20 x 1,5 cable entry,	ATEX II 1G EEx ia II C T6

T 3

complete code for TUFFY® T3

SWITCH MECHANISMS

All TUFFY® are available with a selection of switch modules that vary in switch rating (Amp) and max process temperature allowance. The max temperature is dependent upon the housing material selected. Consult table below, before selecting the proper module in the order number structure on pages 9 or 10.

Code	Contacts and type	Electric switch rating				Process temperature range @ 40 °C (100 °F) ambient temp.	
		V AC		V DC		Cast Iron	Cast Aluminium
0	SPDT with silver contacts	10.0	10.0	6.0	0.6	-40 °C to +400 °C (-40 °F to +750 °F)	-40 °C to +345 °C (-40 °F to +650 °F)
1	DPDT with silver contacts	10.0	10.0	6.0	0.6	-40 °C to +400 °C (-40 °F to +750 °F)	-40 °C to +345 °C (-40 °F to +650 °F)
2	SPDT with gold plated contacts	0.1	-	0.1	-	-40 °C to +190 °C (-40 °F to +375 °F)	-40 °C to +160 °C (-40 °F to +325 °F)
3	DPDT with gold plated contacts	0.1	-	0.1	-	-40 °C to +190 °C (-40 °F to +375 °F)	-40 °C to +160 °C (-40 °F to +325 °F)
4	HS SPDT with silver contacts	1.0	1.0	3.0	0.5	-55 °C to +400 °C (-65 °F to +750 °F)	-55 °C to +345 °C (-65 °F to +650 °F)
6	HS SPDT with gold plated contacts	0.5	0.5	0.5	0.5	-55 °C to +400 °C (-65 °F to +750 °F)	-55 °C to +345 °C (-65 °F to +650 °F)