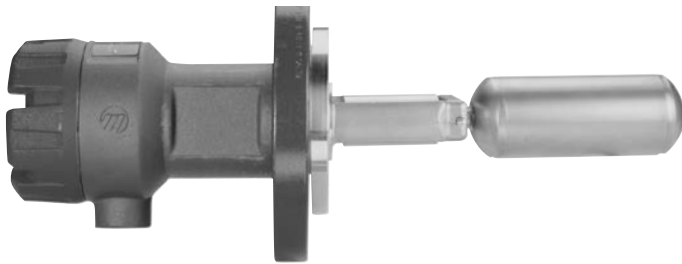


Tuffy® T3 Liquid Level Controls with Electric Switches

Installation and Operating Manual

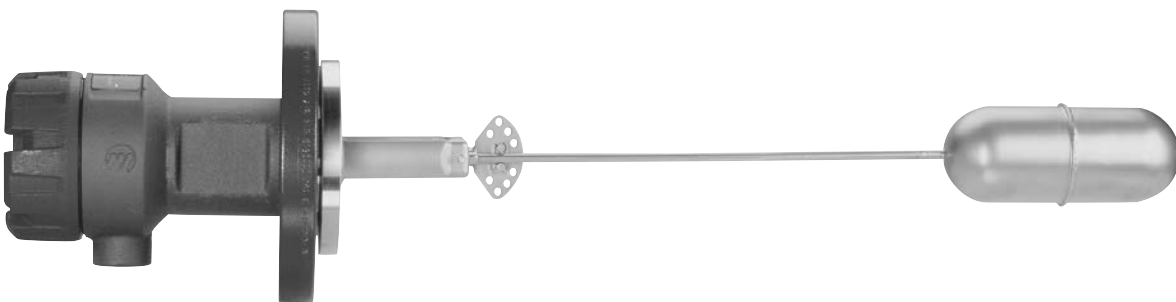


Side

Mounted

Float Level

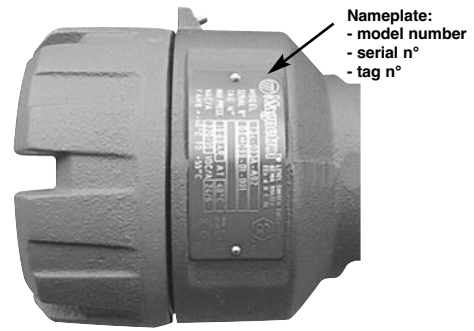
Switch



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.



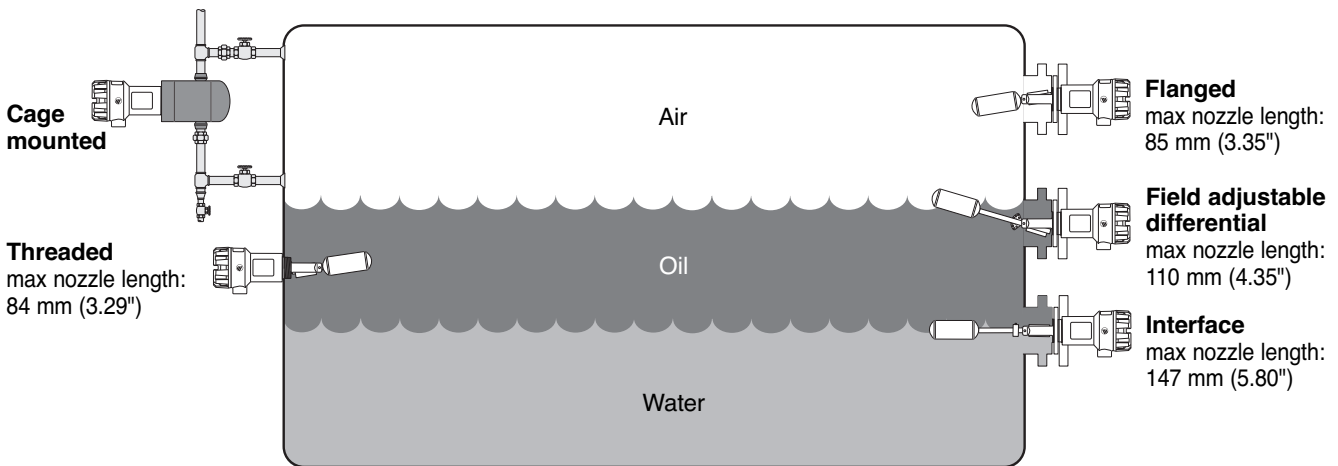
These units are in conformity with the provisions of:

1. Directive 2014/34/EU for equipment or protective system intended for use in potentially explosive atmospheres. EC-type examination certificate number BK119ATEX0015X (Ex d units) or KIWA18ATEX0022X (Ex i units).
2. The PED directive 2014/68/EU (pressure equipment directive).

SPECIAL CONDITIONS FOR ATEX INTRINSICALLY SAFE USE

When the product is installed in an area requiring EPL Ga and the enclosure is made of aluminium, all precautions shall be taken in order to avoid all impacts or frictions which can result in the ignition of the potentially explosive atmosphere.

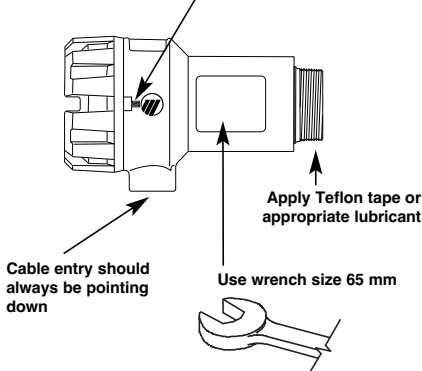
MOUNTING



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

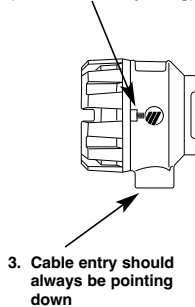
2" NPT Tuffey

Locking screw, loosen before removing cover (refasten after replacing)



Flanged Tuffey

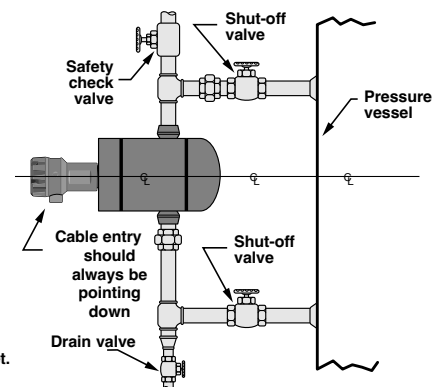
Locking screw, loosen before removing cover (refasten after replacing)



4. Fasten bolts and studs in a star pattern

1. Install a proper gasket.
2. Cut and remove the shipping straps, slide the control in the nozzle and align the bolt holes.

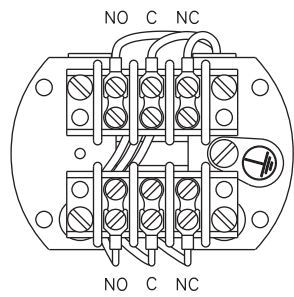
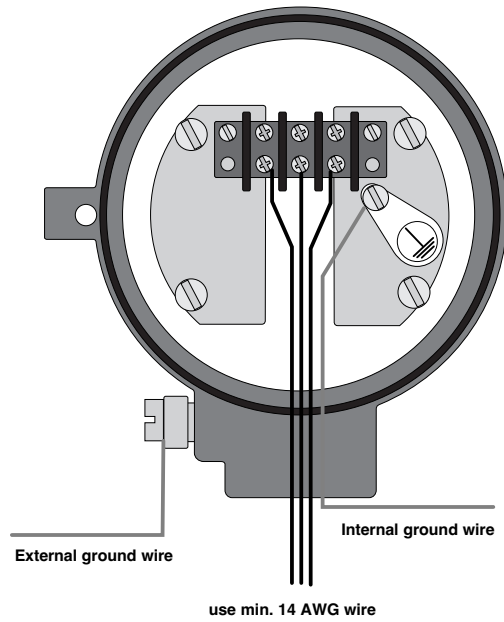
External cage mounted Tuffey



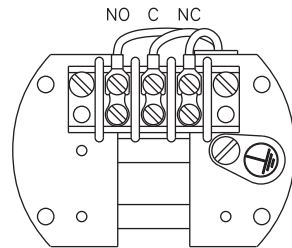
Install cage so that tappings are within 3° of vertical in all directions.

WIRING

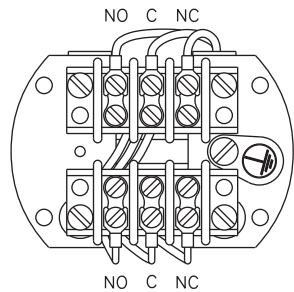
CAUTION: power must be switched OFF before wiring the unit.



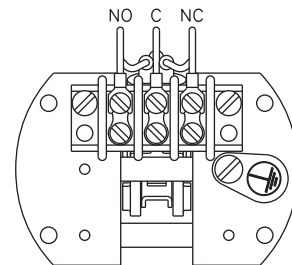
**Terminal connections
DPDT dry contact switch
with silver contacts**



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



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



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

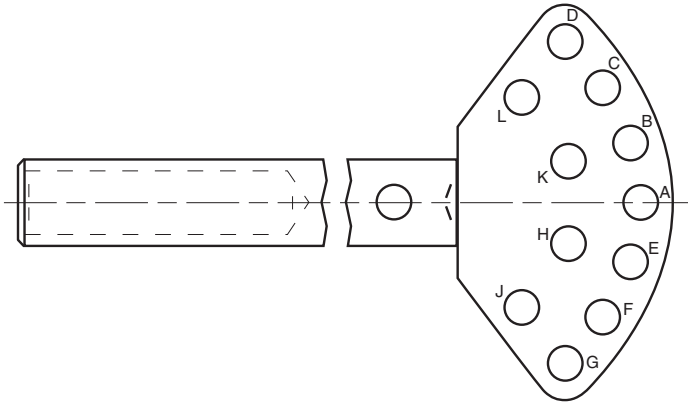
CALIBRATION

For T31-T35 / T3B 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):

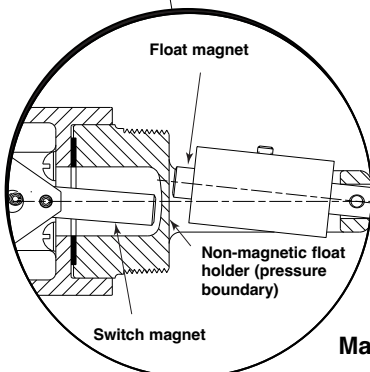
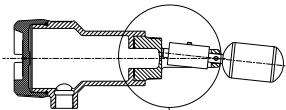
A and B **B and C** **C and D** **D and L** **E and F** **F and H** **J and G**
A and E **B and K** **C and K** **E and H** **F and J**
A and H **C and L** **F and G**
A and K

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

<i>Description</i>	<i>Specification</i>
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 482 °C (900 °F) depending switch/housing selection
Process pressure	Standard models: up to 49,6 bar (720 psi) High pressure models: up to 149 bar (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

<i>Description</i>	<i>Specification</i>
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 db IIC T6 Ga/Gb, flameproof enclosure ATEX II 1 G / IECEx Ex ia IIC T6 Ga 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

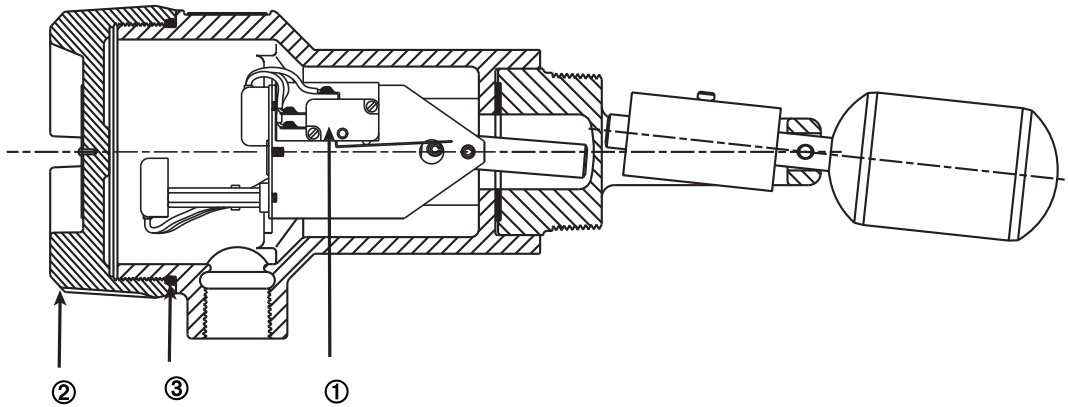
See nameplate, always provide complete partn° and serial n° when ordering spares.

↳ 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.



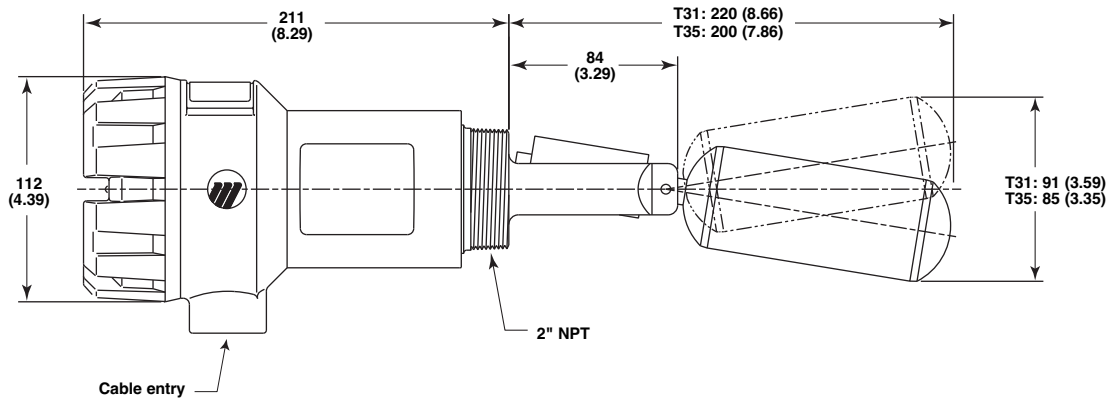
(1) Switch assembly	
Digit 9	Replacement part
0	031-5144-001
1	031-5146-001
2	031-5144-002
3	031-5146-002
4	031-5145-001
6	031-5145-002
7	031-5148-001

(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

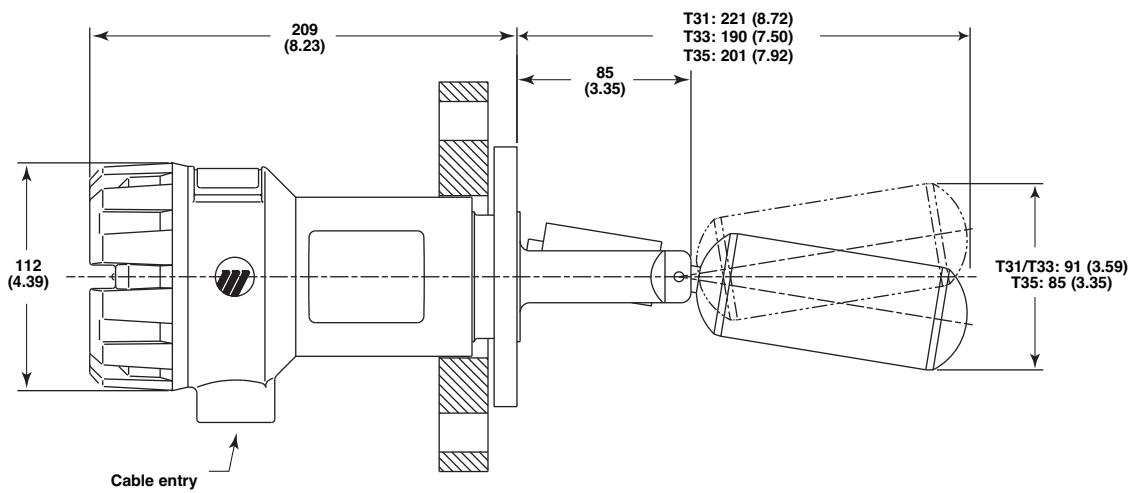
	Replacement part
(3) "O"-ring	012-2201-240

DIMENSIONS in mm (inches)

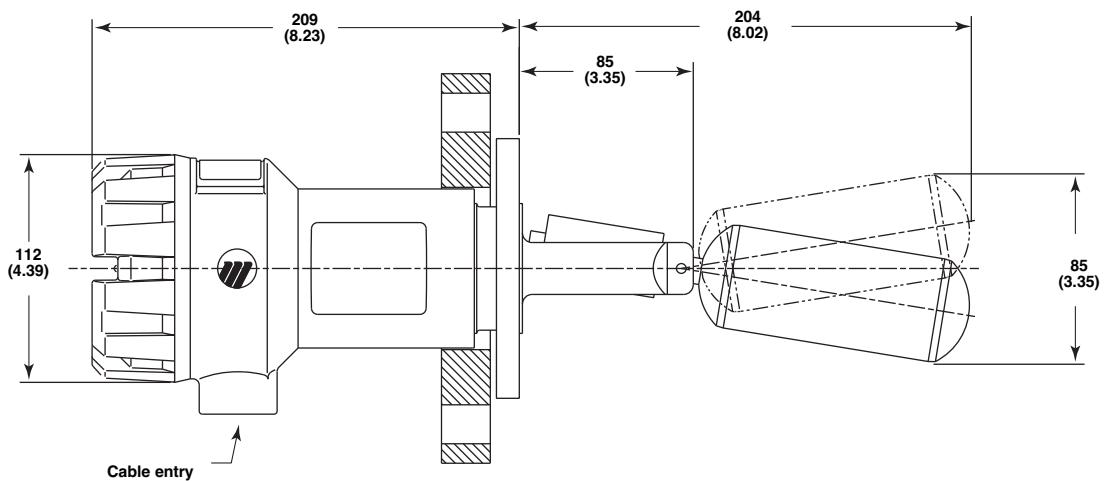
T31 and T35: threaded narrow differential



T31, T33 and T35: flanged narrow differential

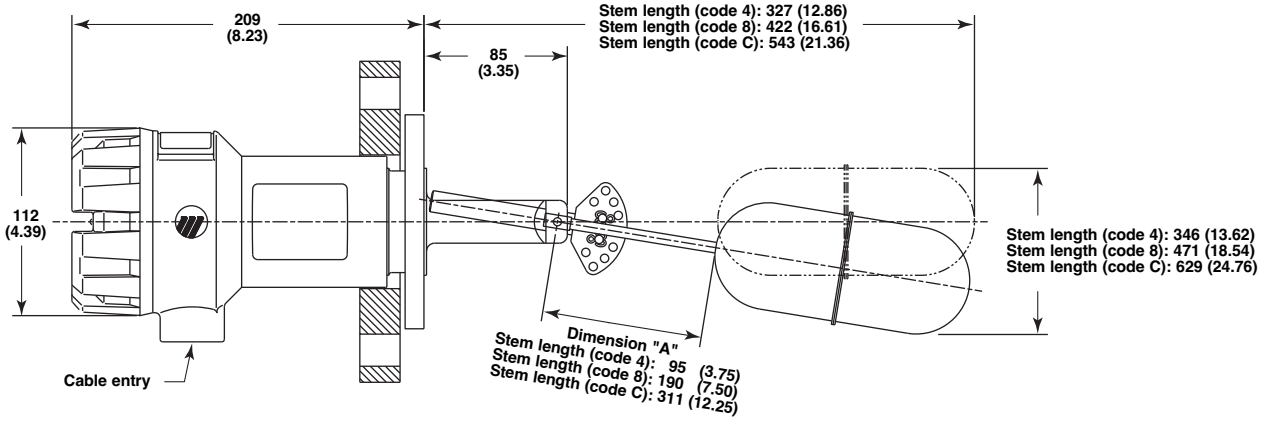


T32: flanged high pressure narrow differential

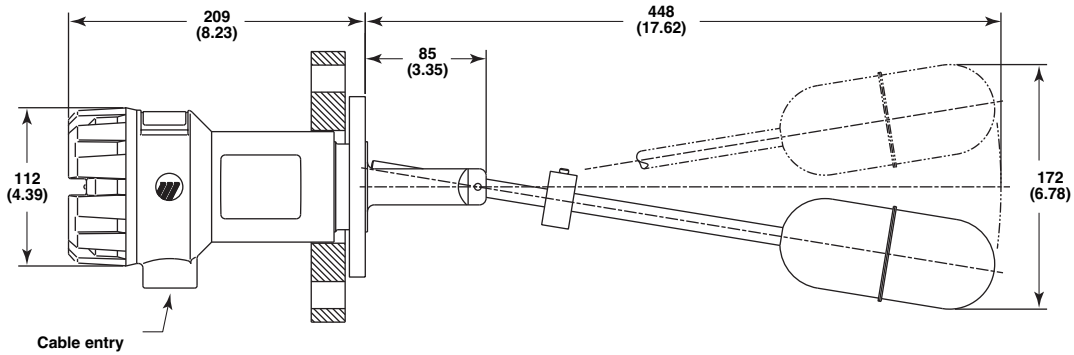


DIMENSIONS in mm (inches)

T3C: adjustable wide differential



T3B: interface



MODEL IDENTIFICATION

1 - 3 | BASIC MODEL NUMBER

T	3	1	Tuffy with 316/316L (1.4401/1.4404) float - min S.G. 0,4 / max 49,6 bar (720 psi)
T	3	2	Tuffy with 316/316L (1.4401/1.4404) float - min S.G. 0,6 / max 149 bar (2160 psi)
T	3	3	Tuffy with Hastelloy C (2.4819) float - min S.G. 0,65 / max 49,6 bar (720 psi)
T	3	5	Tuffy with 316/316L (1.4401/1.4404) float - min S.G. 0,6 / max 124 bar (1800 psi)
T	3	B	Interface Tuffy with 316/316L (1.4401/1.4404) float - max 49,6 bar (720 psi)
T	3	C	Adjustable diff. Tuffy with 316/316L (1.4401/1.4404) float - min S.G. 0,78 / max 49,6 bar (720 psi)

4 | NARROW DIFFERENTIAL UNITS - T31, T32, T33 AND T35

0	Standard level differential of 13 mm (0,5")
---	---

4 | 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

4 | 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

6 - 7 | PROCESS CONNECTION

ASME Flanges

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

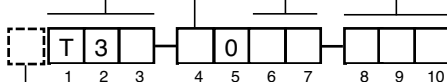
THREADED

2	N	2" NPT connection
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EN 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	EN 1092-1 Type B2
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	EN 1092-1 Type B2
C	1	DN 125, PN 16	EN 1092-1 Type B1
C	2	DN 125, PN 25/40	EN 1092-1 Type B1
C	3	DN 125, PN 63	EN 1092-1 Type B2
C	4	DN 125, PN 100	EN 1092-1 Type B2
D	1	DN 150, PN 16	EN 1092-1 Type B1
D	2	DN 150, PN 25/40	EN 1092-1 Type B1
D	3	DN 150, PN 63	EN 1092-1 Type B2
D	4	DN 150, PN 100	EN 1092-1 Type B2

SEE PAGE 10



complete code for TUFFY® T3

X = product with a specific customer requirement

MODEL IDENTIFICATION

SEE PAGE 9

8 | DESIGN CODE AND FLANGE MATERIAL

Model	Design codes				Flange material
	Standard	ASME B31.3	NACE	ASME B31.3 & NACE	
T31/T32/T35 T3B/T3C	1	2	-	-	Carbon steel
	A	E	J	N	Carbon steel w. 316/316L cladding
	B	F	K	P	316/316L stainless steel
T33	C	G	L	R	Carbon steel w. Hastelloy C cladding
	D	H	M	T	Hastelloy C (2.4819)

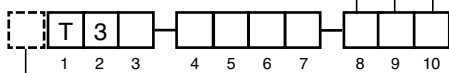
9 | SWITCH TYPE (see table below - "SWITCH MECHANISMS")

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
7	High temperature, hermetically sealed, SPDT with silver contacts

10 | 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 1/2 G / IECEx Ex db IIC T6 Ga/Gb
2	Cast iron, single 3/4" NPT cable entry, ATEX II 1/2 G / IECEx Ex db IIC T6 Ga/Gb
3	Cast aluminium, single M20 x 1,5 cable entry, ATEX II 1/2 G / IECEx Ex db IIC T6 Ga/Gb
4	Cast iron, single M20 x 1,5 cable entry, ATEX II 1/2 G / IECEx Ex db IIC T6 Ga/Gb
M	Cast aluminium, single 3/4" NPT cable entry, ATEX II 1 G / IECEx Ex ia IIC T6 Ga
N	Cast iron, single 3/4" NPT cable entry, ATEX II 1 G / IECEx Ex ia IIC T6 Ga
P	Cast aluminium, single M20 x 1,5 cable entry, ATEX II 1 G / IECEx Ex ia IIC T6 Ga
R	Cast iron, single M20 x 1,5 cable entry, ATEX II 1 G / IECEx Ex ia IIC T6 Ga



complete code for TUFFY® T3

X = product with a specific customer requirement

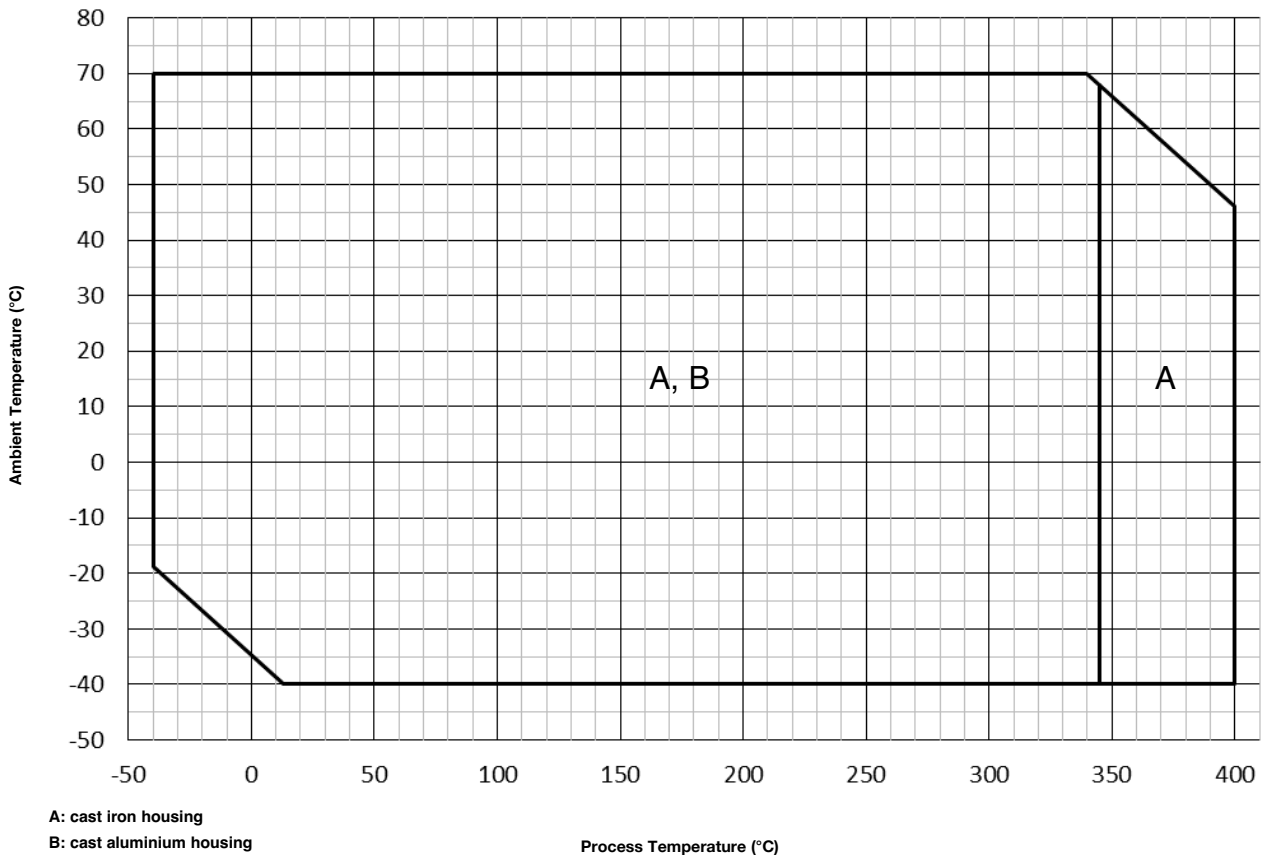
SWITCH MECHANISMS

TUFFY® T3 is 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.

Code	Contacts and type	Electric switch rating				Process temperature range @ 40 °C (100 °F) ambient temp.	
		V AC		V DC		Cast Iron	Cast Aluminium
		120	240	24	120		
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)
7	HS SPDT with silver contacts	2.5	-	4.0	0.3	up to +482 °C (900 °F)	-

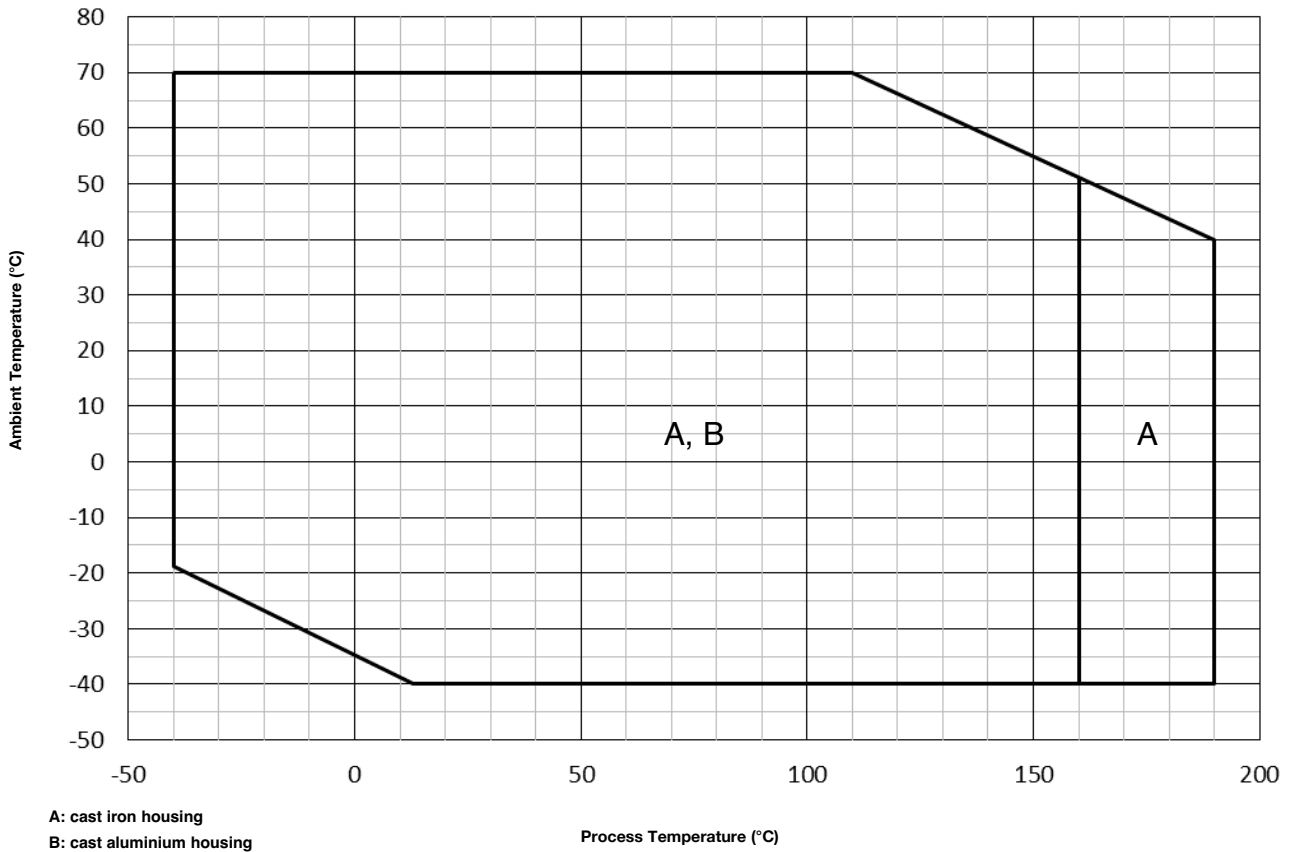
ALLOWABLE OPERATING RANGE

Switch with silver contacts – digit 9 = 0 or 1



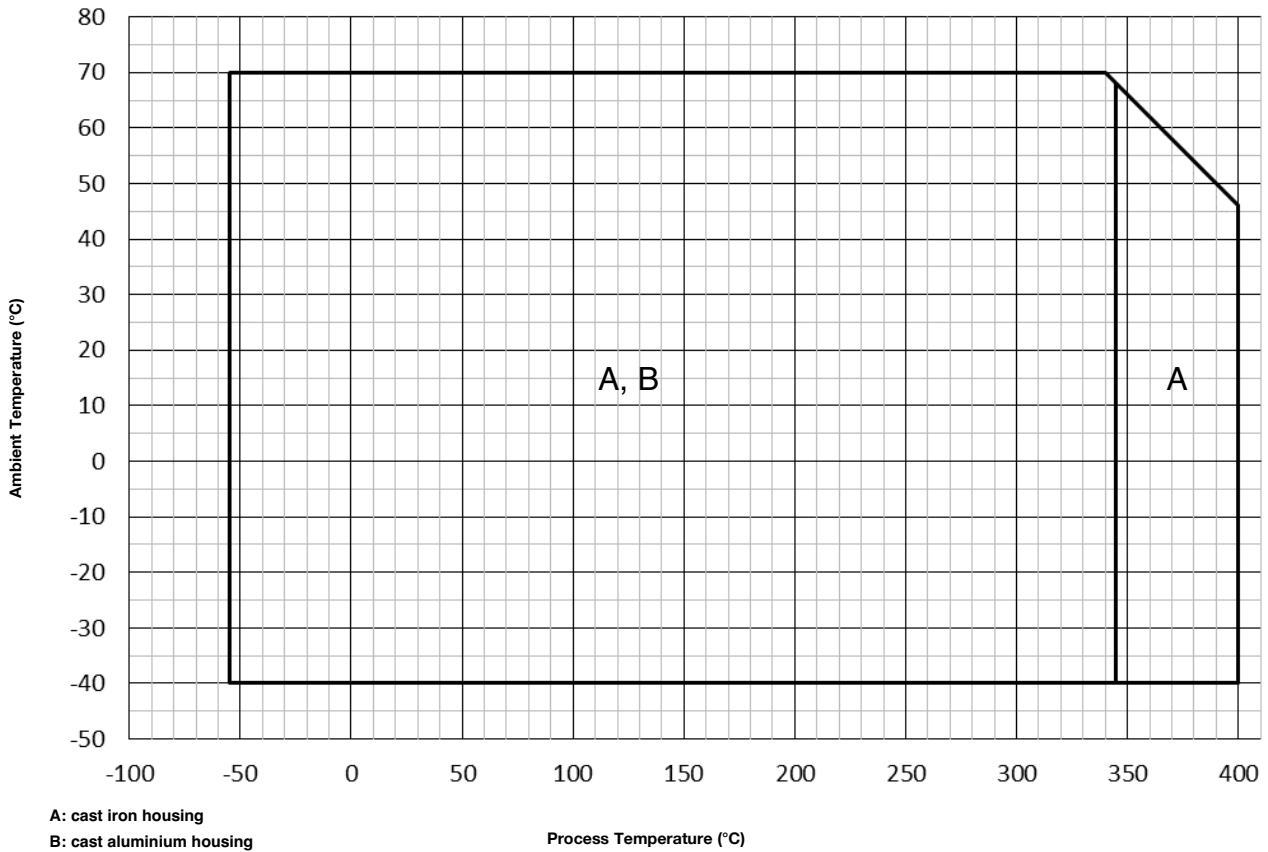
ALLOWABLE OPERATING RANGE

Switch with gold plated contacts – digit 9 = 2 or 3



ALLOWABLE OPERATING RANGE

Hermetically sealed switch with silver or gold plated contacts – digit 9 = 4 or 6



OPTIONAL MOUNTING FLANGES for 2" NPT threaded TUFFY models

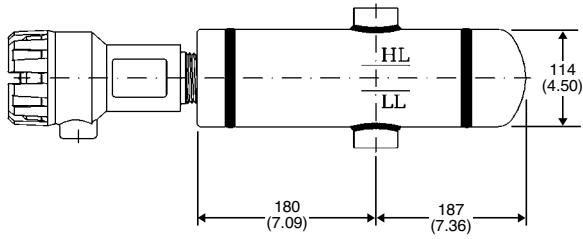
Raised face mounting flanges are available in the sizes and materials shown below. Consult factory (C/F) for additional flange sizes.

ASME RF Flange		Part number	
Size	Rating	316/316L (1.4401/1.4404)	Carbon steel
3"	150 lbs	004-6820-024	004-6820-001
4"		004-6820-025	004-6820-007
6"		004-6820-026	004-6820-016
3"	300 lbs	004-6820-005	004-6820-002
4"		004-6820-011	004-6820-008
6"		004-6820-033	004-6820-029
3"	600 lbs	004-6820-006	004-6820-003
4"		004-6820-012	004-6820-009
6"		004-6820-034	004-6820-030

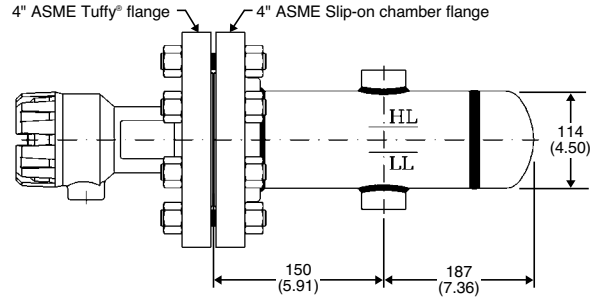
EXTERNAL CAGES FOR NARROW DIFFERENTIAL TUFFY (T31, T35)
 DIMENSIONS in mm (inches)

CAGE – STYLE

Sealed cage 033

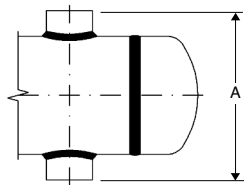


Flanged cage 035



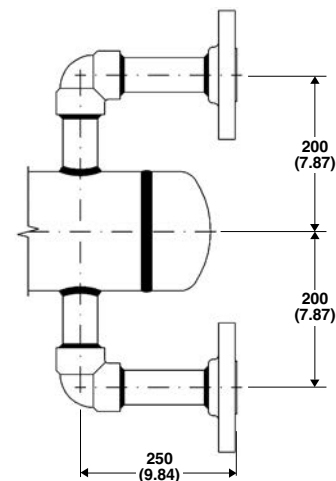
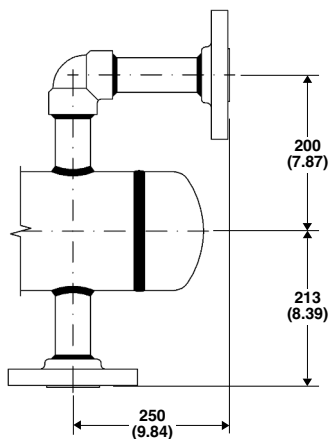
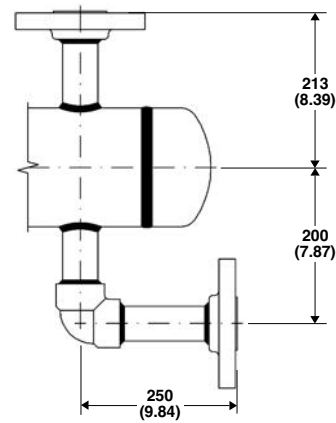
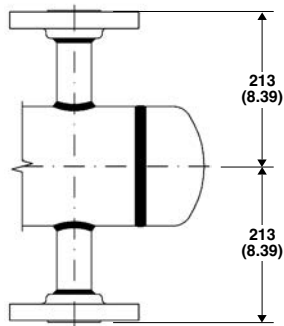
CAGE – PROCESS CONNECTION

Threaded/Socket weld



CONNECTION	DIMENSION A		
	1"	1 1/2"	2"
NPT-F & Socket weld	164 (6.46)	188 (7.40)	194 (7.64)

Flanged



1 - 3 | BASIC MODEL NUMBER

0	3	3	4" sealed cage (matches TUFFY® with 2" NPT-M process connection)
0	3	5	4" flanged cage (matches TUFFY® with 4" ASME flange process connection)

4 | MATERIAL OF CONSTRUCTION

4	Carbon steel
5	316/316L (1.4401/1.4404) stainless steel

5 | PROCESS CONNECTION – TYPE + RATING
Threaded or socket weld

A	Threaded NPT-F
B	Socket weld

ASME flanges

D	150 lbs RF	Slip-On
E	300 lbs RF	Slip-On
F	600 lbs RF	Slip-On
L	150 lbs RF	Weld Neck
M	300 lbs RF	Weld Neck
N	600 lbs RF	Weld Neck
P	600 lbs RJ	Weld Neck

EN flanges

3	PN 16	EN 1092-1 Type B1
5	PN 25/40	EN 1092-1 Type B1
6	PN 63	EN 1092-1 Type B2
8	PN 100	EN 1092-1 Type B2

6 | PROCESS CONNECTION – SIZE
Threaded, socket weld or ASME flanges

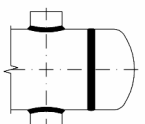
B	1"
C	1 1/2"
D	2"

EN flanges

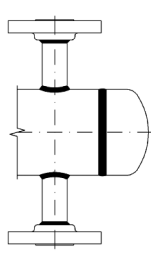
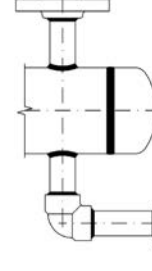
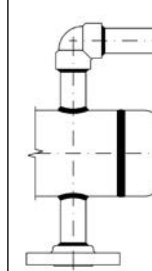
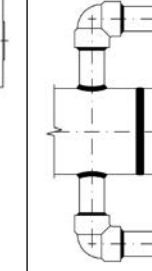
2	DN 25
3	DN 40
5	DN 50

7 - 10 | CAGE CONFIGURATION

Threaded or socket weld process connection

	M-000	033-cage
	M-001	035-cage (matches 4" 150 lbs RF flanged Tuffly®)
	M-002	035-cage (matches 4" 300 lbs RF flanged Tuffly®)
	M-003	035-cage (matches 4" 600 lbs RF flanged Tuffly®)

Flanged process connection ①

			
N - 0 0 0	P - 0 0 0	R - 0 0 0	S - 0 0 0

① If 035-cage then select flanged Tuffly® as per table below:

ASME / EN rating process flanges	Flanged Tuffly®
150 lbs / PN 16	4" 150 lbs RF
300 lbs / PN 25/40	4" 300 lbs RF
600 lbs / PN 63 / PN 100	4" 600 lbs RF



complete code for external cage

X = product with a specific customer requirement

IMPORTANT

SERVICE POLICY

Owners of Magnetrol products may request the return of a control; or, any part of a control for complete rebuilding or replacement. They will be rebuilt or replaced promptly. Magnetrol International will repair or replace the control, at no cost to the purchaser, (or owner) **other than transportation cost** if:

- a. Returned within the warranty period; and,
- b. The factory inspection finds the cause of the malfunction to be defective material or workmanship.

If the trouble is the result of conditions beyond our control; or, is **NOT** covered by the warranty, there will be charges for labour and the parts required to rebuild or replace the equipment.

In some cases, it may be expedient to ship replacement parts; or, in extreme cases a complete new control, to replace the original equipment before it is returned. If this is desired, notify the factory of both the model and serial numbers of the control to be replaced. In such cases, credit for the materials returned, will be determined on the basis of the applicability of our warranty.

No claims for misapplication, labour, direct or consequential damage will be allowed.

RETURNED MATERIAL PROCEDURE

So that we may efficiently process any materials that are returned, it is essential that a "Return Material Authorisation" (RMA) form will be obtained from the factory. It is mandatory that this form will be attached to each material returned. This form is available through Magnetrol's local representative or by contacting the factory. Please supply the following information:

1. Purchaser Name
2. Description of Material
3. Serial Number and Ref Number
4. Desired Action
5. Reason for Return
6. Process details

Any unit that was used in a process must be properly cleaned in accordance with the proper health and safety standards applicable by the owner, before it is returned to the factory.

A material Safety Data Sheet (MSDS) must be attached at the outside of the transport crate or box.

All shipments returned to the factory must be by prepaid transportation. Magnetrol **will not accept** collect shipments.

All replacements will be shipped Ex Works.

UNDER RESERVE OF MODIFICATIONS

BULLETIN N°: BE 44-605.12
EFFECTIVE: APRIL 2021
SUPERSEDES: April 2019

European Headquarters & Manufacturing Facility

Heikensstraat 6

9240 Zele, Belgium

Tel: +32-(0)52-45.11.11 • Fax: +32-(0)52-45.09.93

e-mail: info@magnetrol.be

www.magnetrol.com

