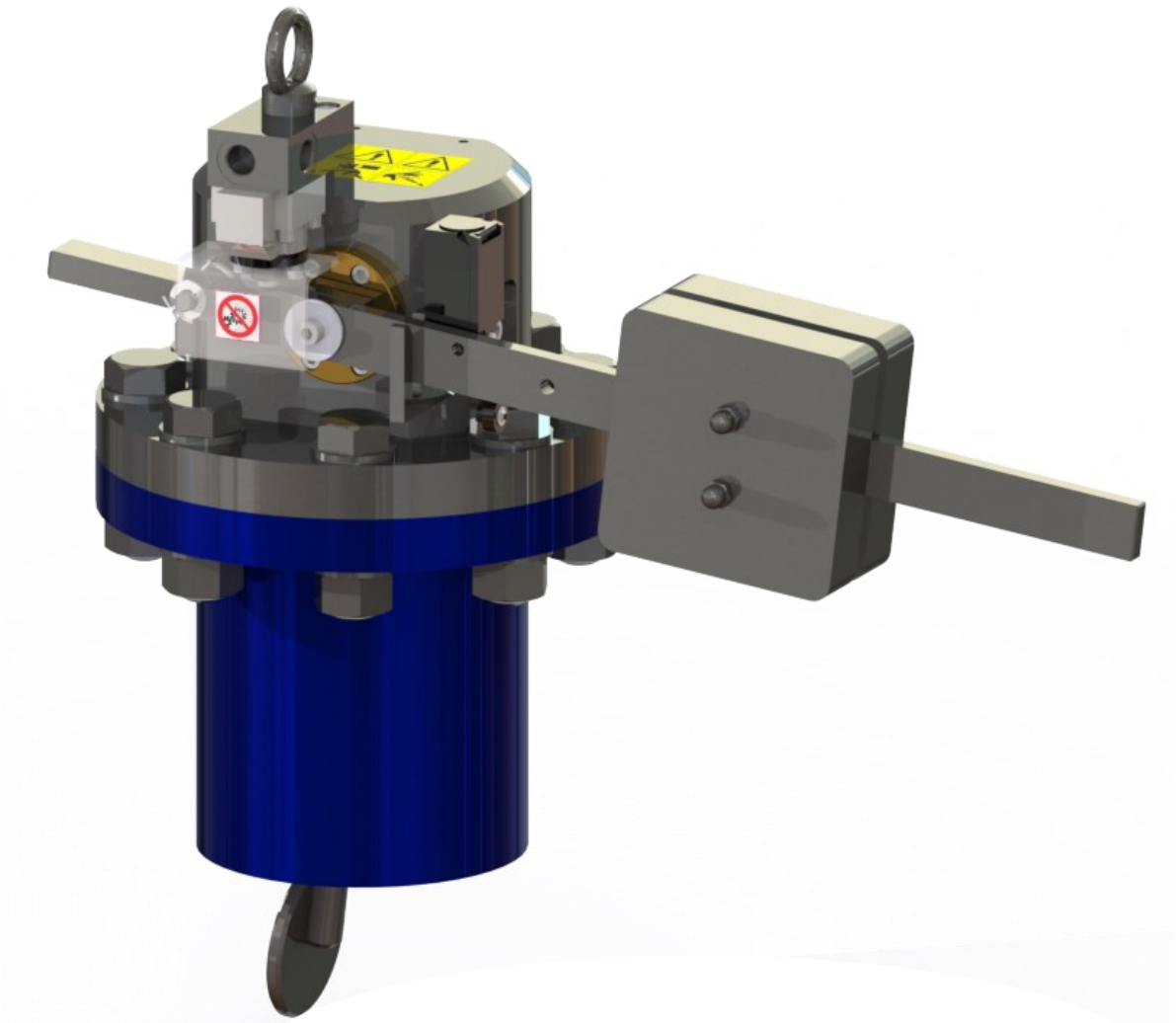
T.i.S.
AN ELECTROSTEEL ENTERPRISE

PADDLE FLOW DETECTION SYSTEM

SS3000



PADDLE FLOW DETECTION SYSTEM SS3000

CONTENTS

MAIN FEATURES

The paddle velocity detection device is designed to monitor the fluid flow in a pipeline and register any anomalous increases, generally caused by breakage of the pipeline itself.

The detector is normally installed in combination with a water flow gate valve, together comprising a safety system.

The detection of the flow rate is achieved with a mechanical system that acts on a hydraulic device without electrical power or any other external energy sources. When a set critical flow rate is reached, the displacement of a paddle lever closes a butterfly valve and interrupts the water supply in the pipeline.

Applications: the detection device is normally installed upstream of pressurized pipelines or in areas at high risk of landslides in order to avoid damage resulting from the incidental rupturing of pipes.

CONSTRUCTIONAL FEATURES

The characterizing features of the paddle detection system are the simplicity and efficiency of its operating mechanism.

The lever mechanism consists essentially of a system of three levers: a release lever, a counterweight lever, and a paddle lever.

Most of the components comprising the detector are made in stainless steel. The moving parts are mounted on bronze radial bearings.

The sealing gasket is made in high wear resistance polyurethane rubber.

The hydraulic circuit and hydraulic unit (both supplied on request with the detector) are made in compliance with standard EN ISO 4413; *"General rules and safety requirements for hydraulic systems"*.

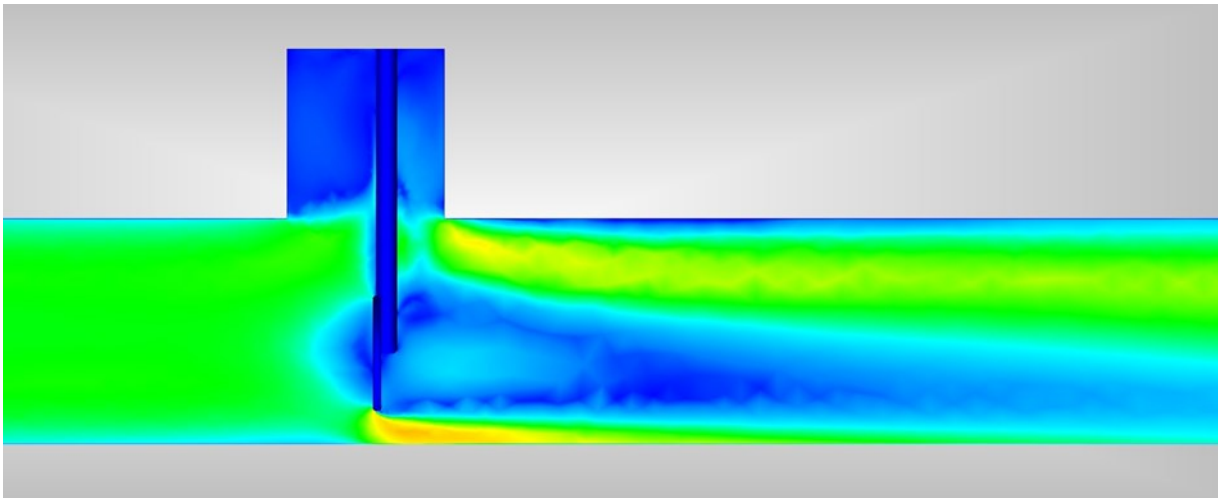


Fig.1: Paddle flow velocity detection device: velocity range from CFD analyses.

OPERATING PRINCIPLE

The fluid flow in the pipeline generates a pushing force on disk submerged in the fluid. The pressure varies according to the flow velocity in the pipeline: as the velocity increases the resulting pushing force also increases. The paddle is balanced by a counterweight, the position of which determines the adjustment of the system (Fig. 2).

When the set critical velocity is exceeded the system acts on a three-way hydraulic distributor (button). The distributor causes the release of the hydraulic cylinder that keeps the main pipeline safety gate valve open.

The closure of the gate valve shuts off the pipeline, avoiding damage or danger in the area downhill of the damaged pipe.

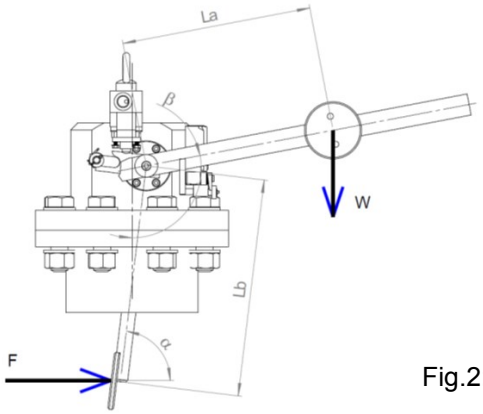
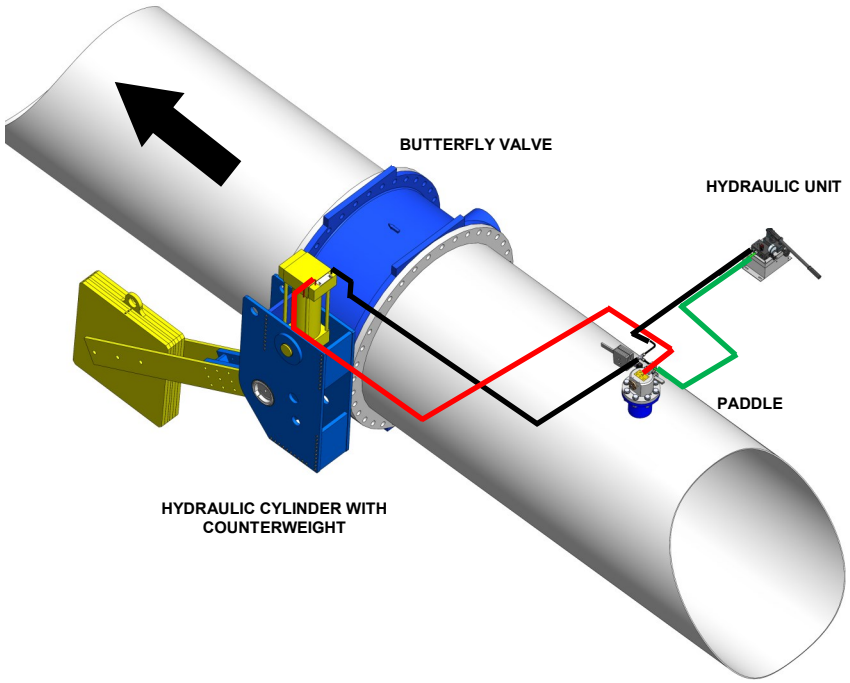


Fig.2: Paddle system linkage.

OVERALL SYSTEM LAYOUT

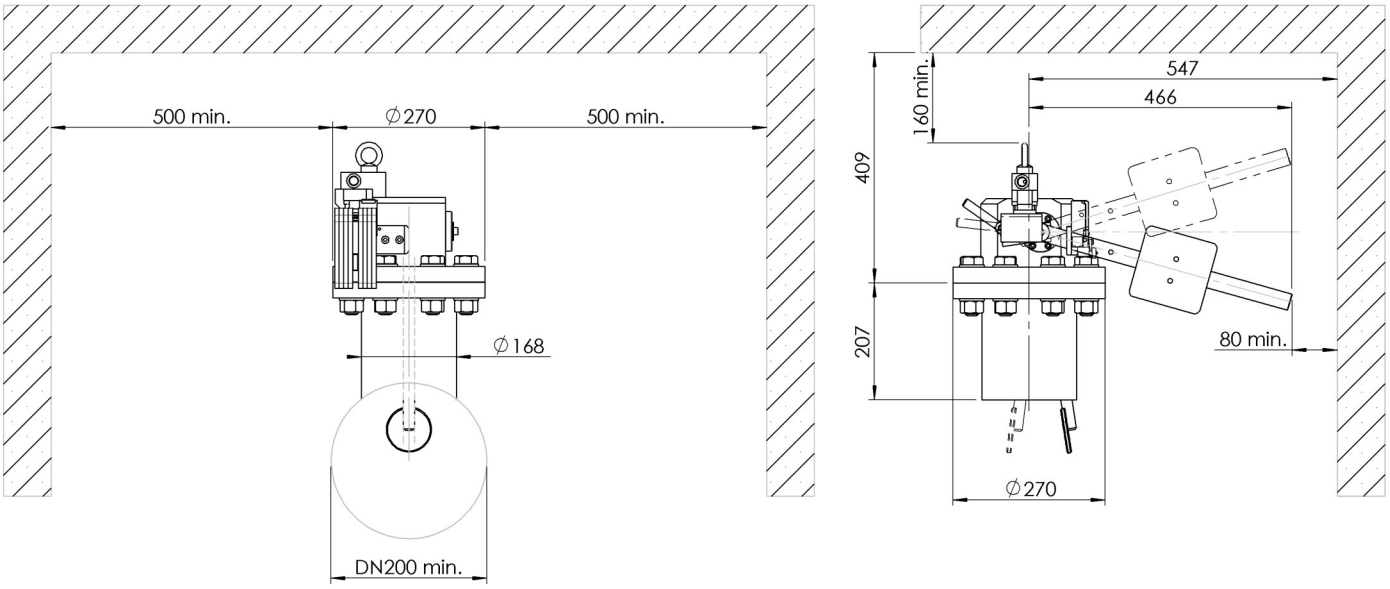


OPTIONS

1. The detector can be provided with a *hydraulic unit* for resetting the counterweight (on request also including an electrical panel). Any minor leakage does not compromise the operation of the system. Optional additional hydraulic fluid accumulator.

2. Automatic system reset using a hydraulic cylinder.

DIMENSIONS AND WEIGHT



Overall dimensions of paddle detection system. NB: respect the indicated minimum distances.

Overall system mass: **45 [kg] (standard configuration)**

GENERAL FEATURES

Surface coating

The main components are in stainless steel. The remaining parts vulnerable to corrosion are protected with epoxy powder coating (FBE), min. thickness 300 µm, color Blu RAL5015, approved for contact with drinking water.

Applications

The paddle detection system is designed and constructed to operate with fresh water and raw water, on pipelines of nominal minimum diameter ND200 and maximum nominal pressure NP40.
Flow rate range: 1.5 to 6 [m/s].
For any other applications contact the manufacturer.

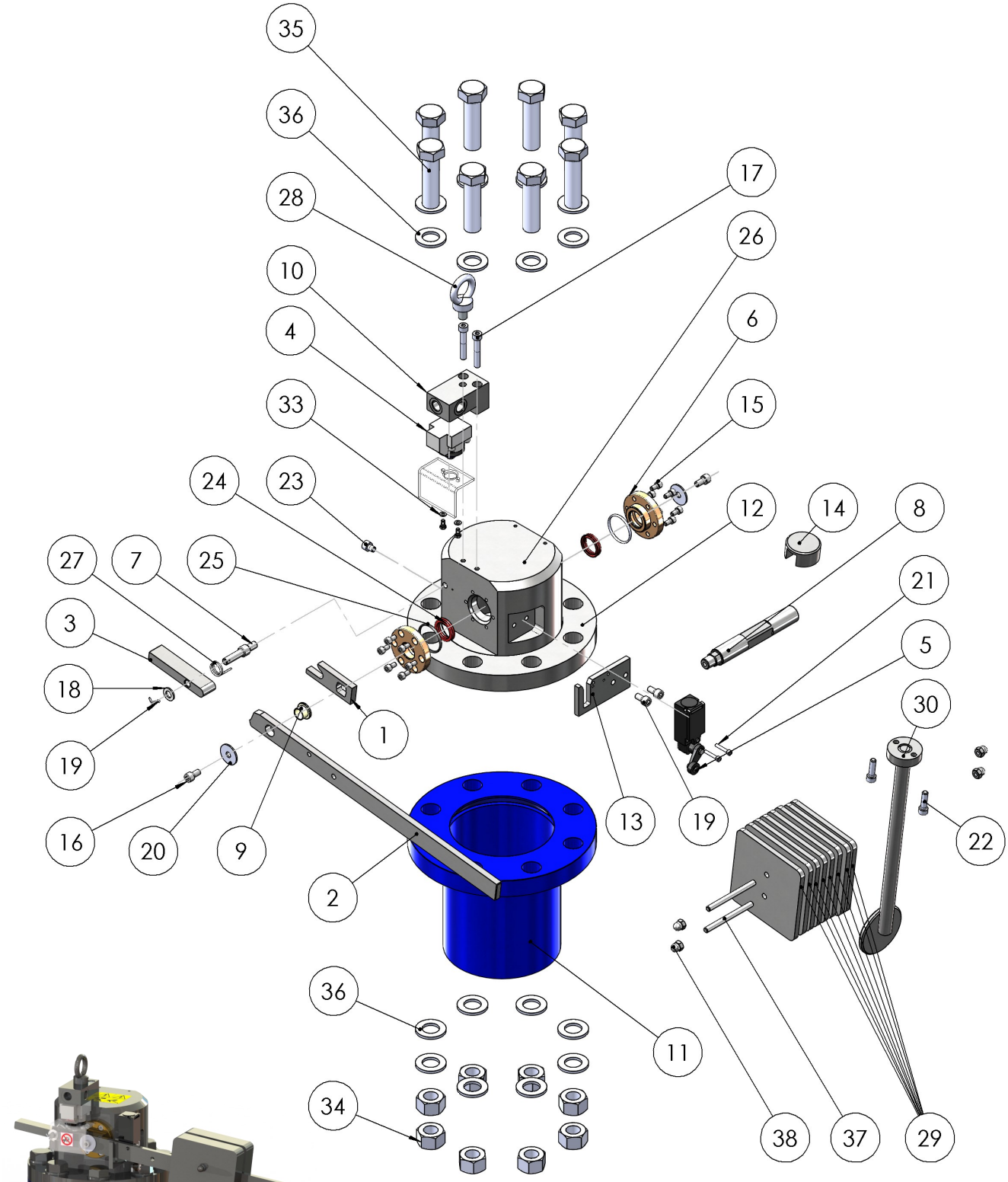
Standards

For compliance testing the harmonized standard EN 12100 was applied (the paddle detection system is classed as "Partly completed machinery")
The components of the system are compliant with the following regulations:
Machine Directive 2006/42/CE
EN ISO 4413

Operating limits

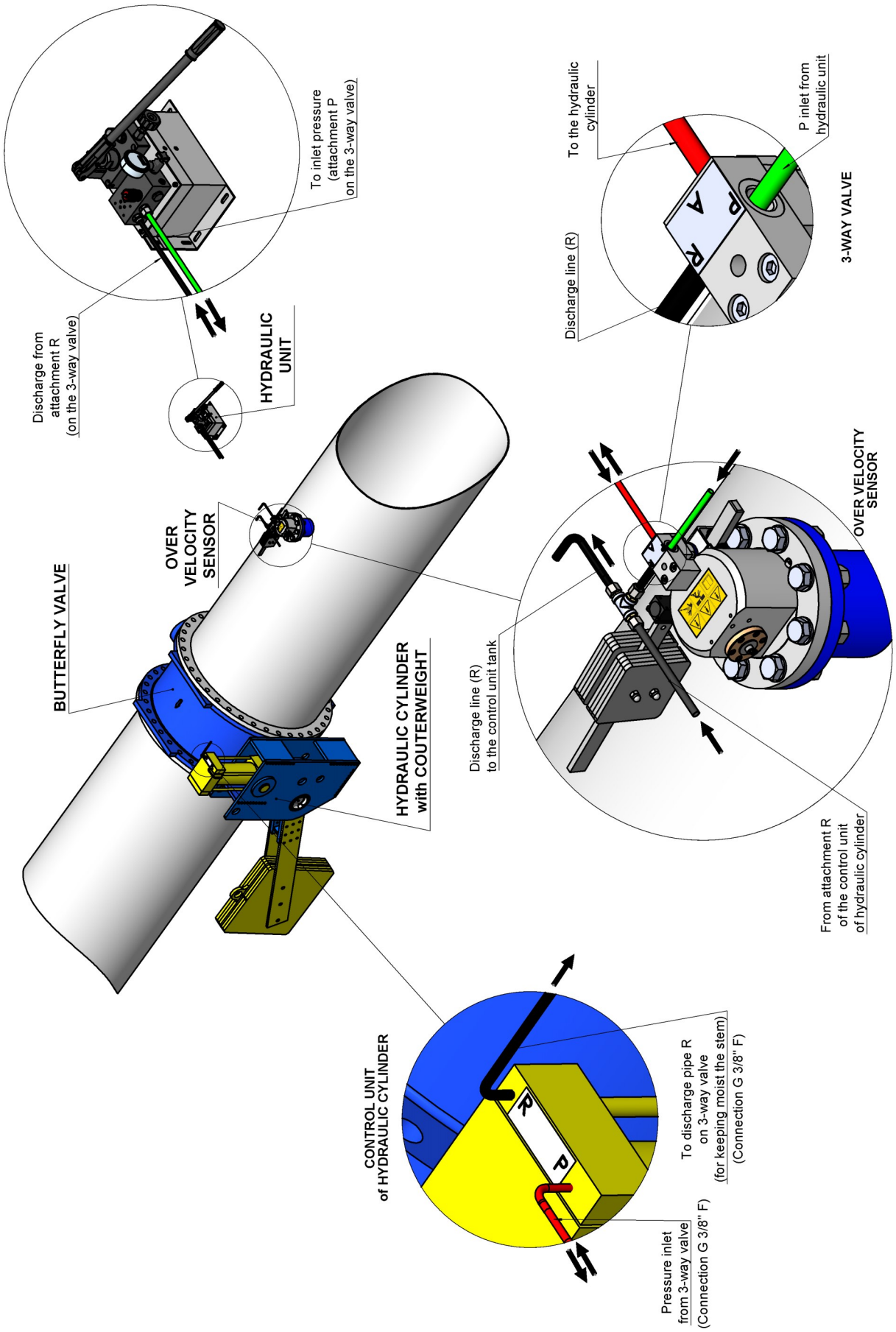
Admissible fluid temperature limits (TS):	min +2°C	max +70°C
Air temperature:	min +1°C	max +80°C
Storage temperature: (ambient temp.)	min - 20°C	max. +70°C.

SS3000 PADDLE DETECTOR: EXPLODED VIEW and VALVE DESCRIPTION



ITEM	CODE	DESCRIPTION	MATERIAL	Q.TY
1	L.15.7.06.01	RELEASE LEVER	1.4306 EN10088-3 (AISI304L)	1
2	L.15.7.05.01	WEIGHT LEVER	1.4306 EN10088-3 (AISI304L)	1
3	L.15.7.06.02	RELEASE TOOTH	1.4306 EN10088-3 (AISI304L)	1
4	HAWE T3	HAWE T3	/	1
5	OMRON-D4N1120	LIMIT SWITCH	/	1
6	L.15.7.09.01	FLANGE BUSHING	CW614N EN12164 (OT58)	2
7	L.15.7.04.01	RELEASE TOOTH PIVOT PIN	1.4028 EN10088-3 (AISI420B)	1
8	L.15.7.08.01	SHAFT	1.4301 EN10088-3 (AISI304)	1
9	L.15.7.10.01	BUSHING	CC483K EN1982 (GCuSn12)	1
10	L.15.7.12.01	HAWE BASE	1.4306 EN10088-3 (AISI304L)	1
11	L.15.7.02.01	LOWER BODY	S275JR EN10025-2 (Fe430b)	1
12	L.15.7.01.02	UPPER BODY FLANGE	1.4301 EN10088-3 (AISI304)	1
13	L.15.7.13.01	MICROSWITCH SUPPORT	1.4306 EN10088-3 (AISI304L)	1
14	L.15.7.03.04	PADDLE TRANSMISSION	1.4028 EN10088-3 (AISI420B)	1
15	TCEI M6x12-A2	SCREW	A2-70	12
16	TCEI M8x16-A2	SCREW	A2-70	4
17	TCEI M8X50-A2	SCREW	A2-70	2
18	ROSETTA M10-A2	WASHER	A2-70	1
19	COPIGLIA 2.5X18-A2	SPLIT PIN	A2-70	1
20	ROSETTA M8-32-A2	WASHER	A2-70	2
21	TCEI M4X25-A2	SCREW	A2-70	2
22	TCEI M8x30-A2	SCREW	A2-70	2
23	TCEI M8X10-A2	SCREW	A2-70	1
24	LABBRO 25.35	LIP SEAL	TPU	2
25	NBR-2.62X39.34	O-RING 3156	NBR	2
26	L.15.7.01.03	UPPER BODY	1.4301 EN10088-3 (AISI304)	1
27	L.15.7.23.01.1	RESET SPRING	1.4310-NS EN10270-3(AISI302)	1
28	9.GOL1.M12.A4	EYEBOLT	A4-70	1
29	L.15.7.18.05	WEIGHT thick. 8	1.4301 EN10088-3 (AISI304)	8
30	L.15.7.03.06	PADDLE LEVER	1.4028 EN10088-3 (AISI420B)	1
31	L.15.7.22.04	GUARD	PMMA	1
32	9.TE.M5X10.A2.0	SCREW	A2-70	2
33	9.RN.M5.A2.0	WASHER	A2-70	2
34	9.DA.M24.A2.0	NUT	A2-70	8
35	9.RN.M24X90.A2.0	SCREW	A2-70	8
36	9.RN.M24.A2.0	WASHER	A2-70	16
37	5.BFIL.M8.A2	THREADED BAR FOR COUNTER-	A2-70	2
38	9.DA.M8.DIN1587CIECO	HEXAGONAL CAP NUT	A2-70	4

SYSTEM DIAGRAM



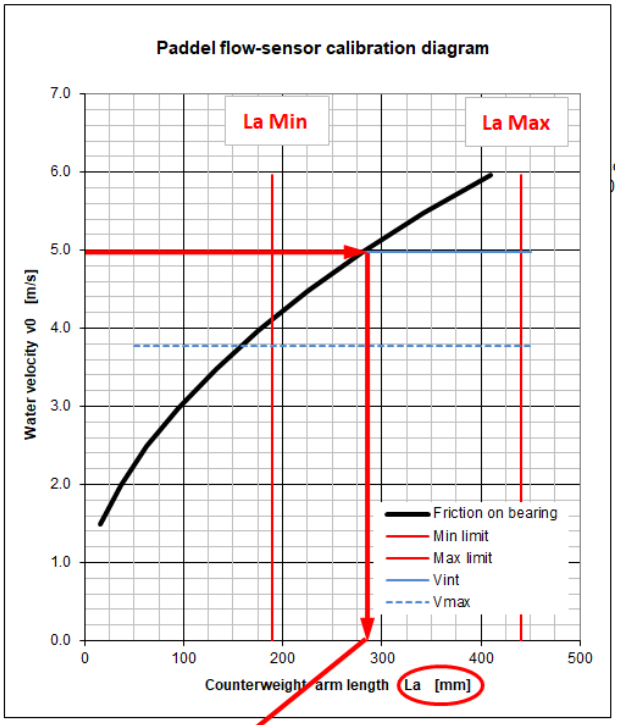
EXAMPLE CALCULATION

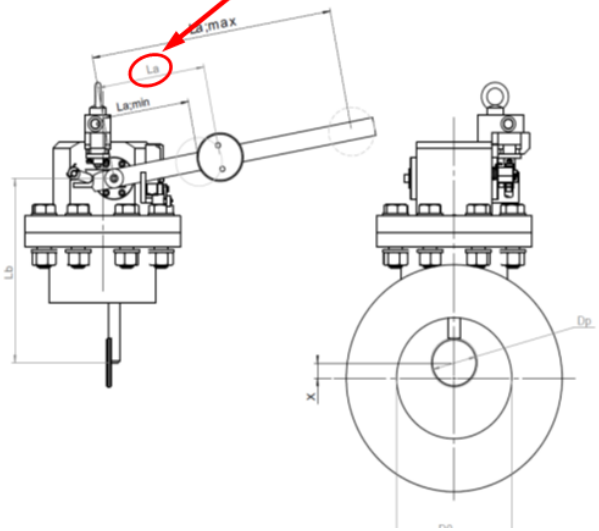
Pipe internal diameter	D0	800	mm
Operating pressure	Pmax	0.5	bar
Operating flow rate	Qmax	1900	l/s
Operating velocity in the pipe	vmax	3.78	m/s
Intervention flow rate	Qint	2500	l/s
Intervention velocity	vmax	4.97	m/s
	OK, Qint/Qmax >= 1.25		
Paddle diameter		D80	
Paddel arm length	Lb	355	mm
Position paddle	x	335	mm
Number Counterweight square discs 130x130 mm		8	
Custom		0	
	W	83	N
Count.wt arm min length	La,min	190	mm
Count.wt arm max length	La,max	440	mm
Drag coefficient	Cd	1.24	---
Hysteresys	Hys	0.03	---

Operating conditions at max normal flow rate

Velocity (referred to diam. D0)	vmax	3.78	m/s
Reynolds (ref: water20C)	Re	3.02E+05	---
Press.drop coefficients	ξ	1.28E-02	---
Pressure drops	ΔP	9.31E-03	mWH
Strouhal number	S	0.13	---
Eddy frequency	fv	6.1	Hz

Intervention velocity:
STANDARD range: 1,5…3 m/s (Paddle ϕ110)
Range on request: 2…6 m/s (Paddle ϕ80)





- Intervention flow rate: refers to the flow rate, and therefore the flow velocity, above which the sensor must trigger to close the safety valve, connected to the paddle device through a hydraulic system. The intervention flow velocity must be at least 25% higher than the maximum operating velocity in order to avoid the paddle system triggering at velocities too close to operating levels.

- The number and position of the counterweights to fit depends on the pressure exercised on the paddle by the fluid in the pipeline.

Data required for correct sizing:

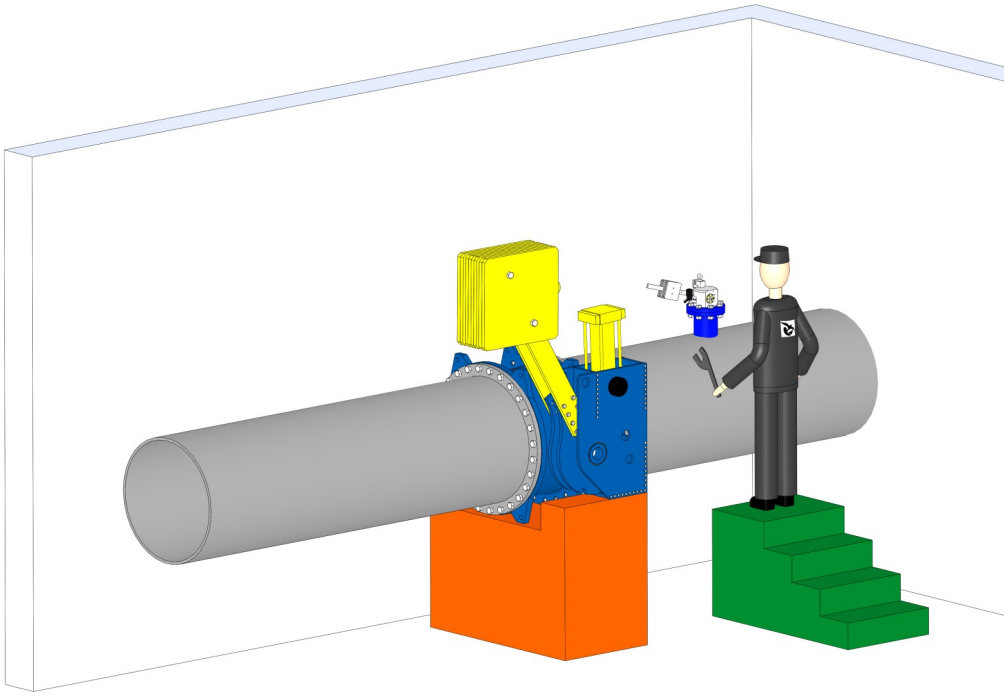
⇒ Nominal diameter of pipeline (minimum admissible diameter ND200)

⇒ Normal operating velocity (maximum admissible velocity 5 m/s)

⇒ Intervention velocity:

- STANDARD range: from 1.5 to 3 m/s (detector paddle ø110)
- Range ON REQUEST: from 2 to 6 m/s (detector paddle ø80)

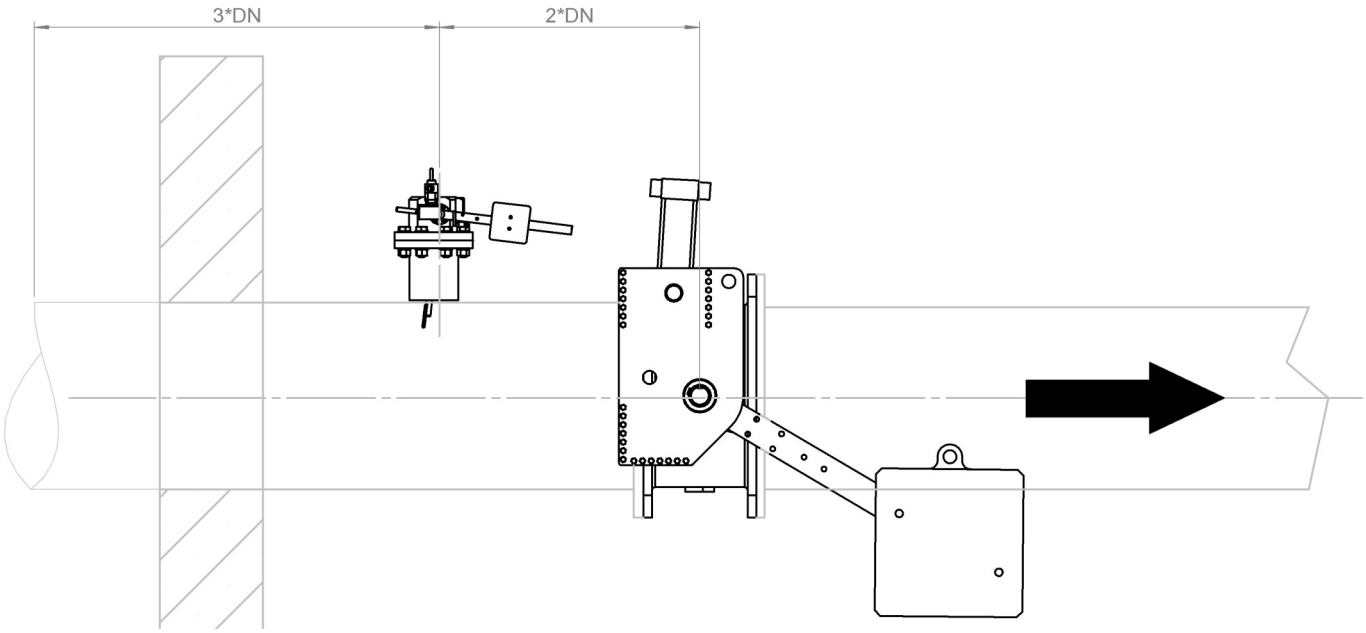
RECOMMENDED INSTALLATION



The paddle detection system with hydraulic unit must be installed in a suitable operating compartment designed with sufficient space for easy access (see minimum overall dimensions on page 6), or in the open. In the latter case it must be protected with a structure to provide shelter and insulation.

The velocity detector must always be installed upstream of the safety valve to which it is associated and it must be at a minimum distance from the valve of at least 2 x ND. Upstream of the velocity detector there must be a section of straight piping of at least 3 x ND in order to avoid the potential influence of turbulence generated by cones or changes in pipe cross section on the operation of the detector.

The velocity detector assembly is fitted on the pipeline using a specific flanged stub pipe suitably profiled and welded to the pipeline (for installation details refer to the instructions in the Technical Manual of Instructions, Use, and Maintenance provided together with the detector).



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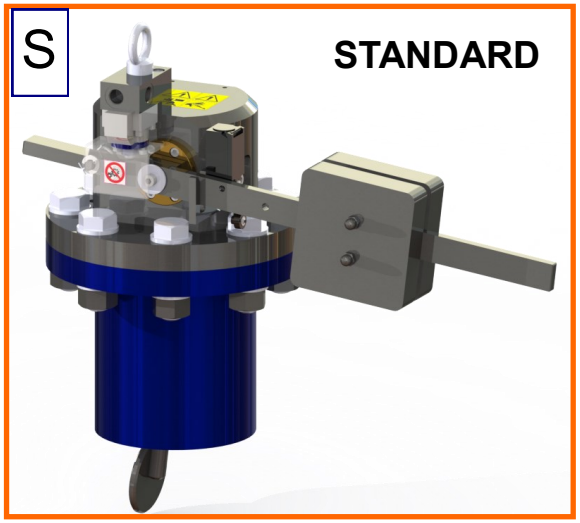
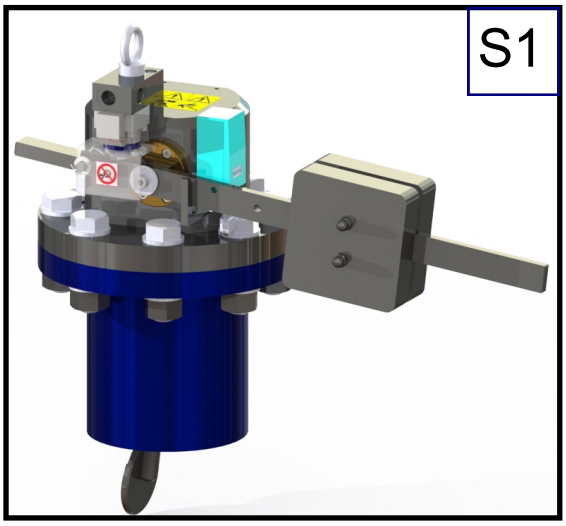
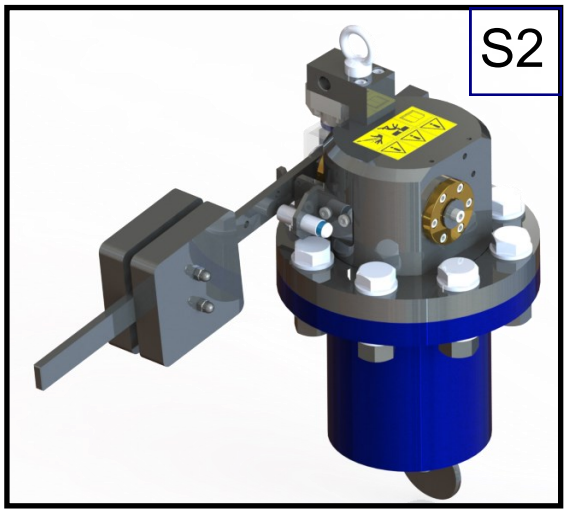
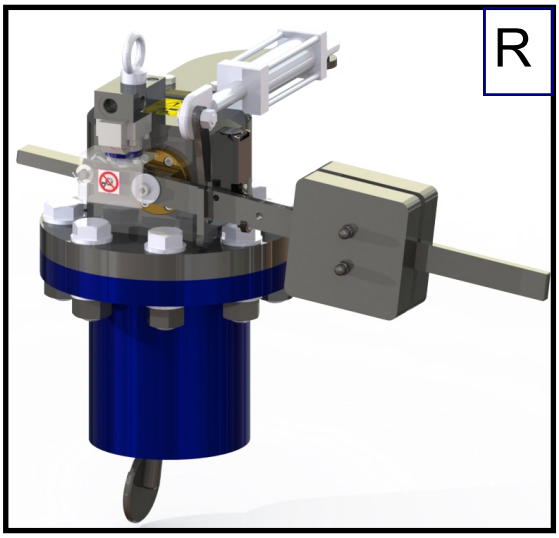
CONFIGURATIONS AVAILABLE

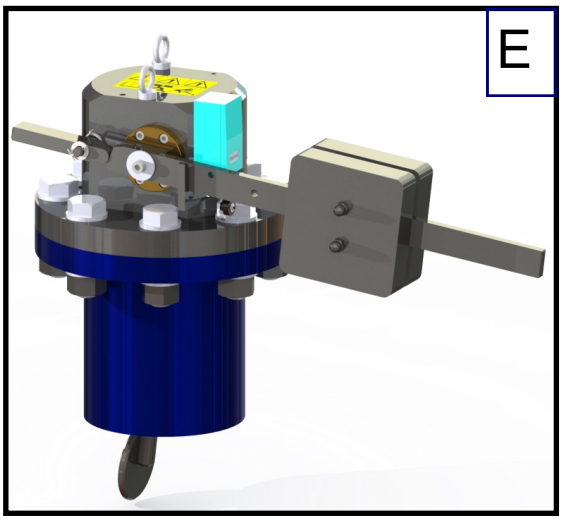


OPTIONS









S: STANDARD version with HAWE button and OMRON D4N1120 mechanical limit switch

LIMIT SWITCH OPTIONS:
S1: standard version with the single difference of a SIEMENS 3SE5 mechanical limit switch
S2: standard version with the single difference of a PNP M18 IFM IGS244 proximity limit switch

VERSION WITH REMOTE RESET:
R: remote reset using hydraulic cylinder (can be integrated with versions S, S1, and S2).

E: special version with only electrical limit switch and without hydraulic button - fitted standard with SIEMENS 3SE5 limit switch

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