valmet consistency

SMART-PULP
Market leader in consistency control

metso automation

SMART-PULP market leader in

We have over 40,000 reasons to say, "we are the leading manufacturer for consistency measurement products". During the last decade our customers have shown their success with and confidence in our products by giving us almost half of the global market share in delivered consistency solutions.

Metso Automation's development of consistency transmitters is based on over 40 years of experience, where technology changes, changing customer needs and innovative research in co-operation with our customers has made Metso Automation, formerly Valmet, the leading consistency transmitter supplier worldwide.

This would not have been possible without numerous mill projects and development projects in close cooperation with our customers. The driving force behind this development has always been, and continues to be, obtaining better measurements and controls for improving the pulp and papermaking processes.

Experience in this field takes us back to the development of mechanical consistency measurements, often called shear force or blade type consistency transmitters. The development of consistency transmitters was started almost 50 years ago and it has gone through several technological changes. The names of Pulp-AIR, Pulp-EL and SMART-PULP are well recognized among papermakers.

Today, during the era of digital technology; production and maintenance have demanded easier start ups, faster calibration and more information from the process. Smart products have made this possible and even more changes are on the way. Fieldbus solutions are gaining ground, and we are also supporting Foundation Fieldbus and Profibus.

Superior performance

Obtaining a truly representative measurement signal has been one of the primary goals of the product developers in Metso Automation. This may sound obvious, but a closer look at the flow profile of pulp shows the need for measurements from the main line. This is the only way to ensure fast and representative measurements. Main line installation sets high requirements for the technology and requires intensive research with different pulp grades and a thorough understanding of stock flow profiles.

There are several ways to get around this challenging problem. Measurement chambers, commonly used with rotating type shear force transmitters, are one of them. The drawback is an extremely slow and filtered measurement signal. Higher purchase cost, as well as higher installation, maintenance and operating cost can also be associated with rotating technology.

Too often, manufacturers of blade type transmitters claim that one blade fits all pulp grades. But this claim is poorly supported and is counter to the research done by Metso Automation. We have found that attempts to fit one blade to all pulps will cause significant sensitivity problems with shorter fiber pulps, mechanical pulps and recycled fiber as well as poor flow compensation.

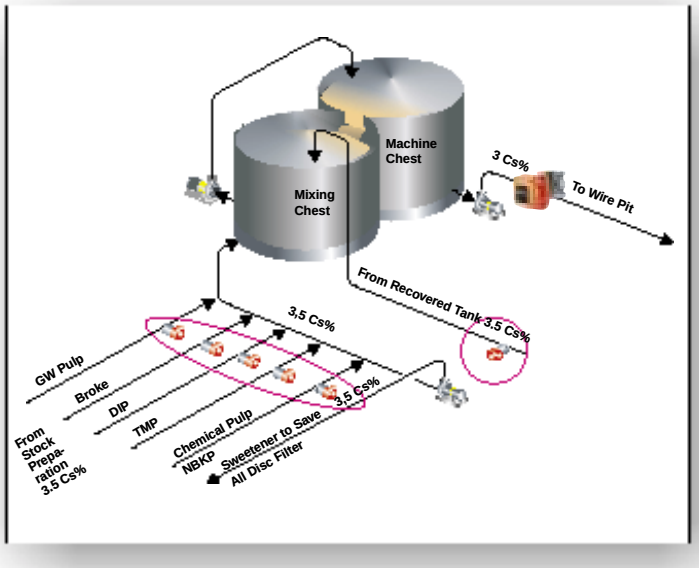
There are no shortcuts if a representative consistency measurement is needed. Metso Automation's SMART-PULP is a result of continuous development work Metso Automation has made. This has been proven in several independent tests by international institutes including API, WIP and Norske Skogindustri.

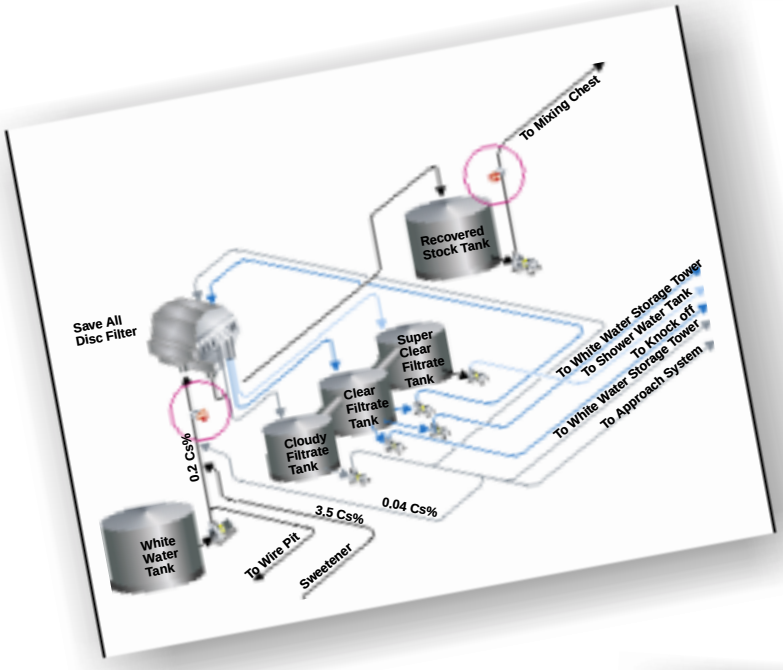
SMART-PULP is provided with HART® communication and it can be connected to Metso Automation Neles FieldBrowser condition monitoring system.
The transmitter is also AMS-compatible (AMS=Asset Management Solutions system).

Mixing chests, machine chests

SMART-PULP is suited for consistency measurements from the mixing chest when the quality of the pulp components is rather stable. The example in the figure comes from a newsprint PM with a lot of variation in the furnish components. The kajaaniMCAi is a good choice for broke and DIP lines.

The SMART-PULP transmitter is also used on chemical pulp and DIP lines, for example after storage chests and to measure the consistency of pulp fed into refiners.



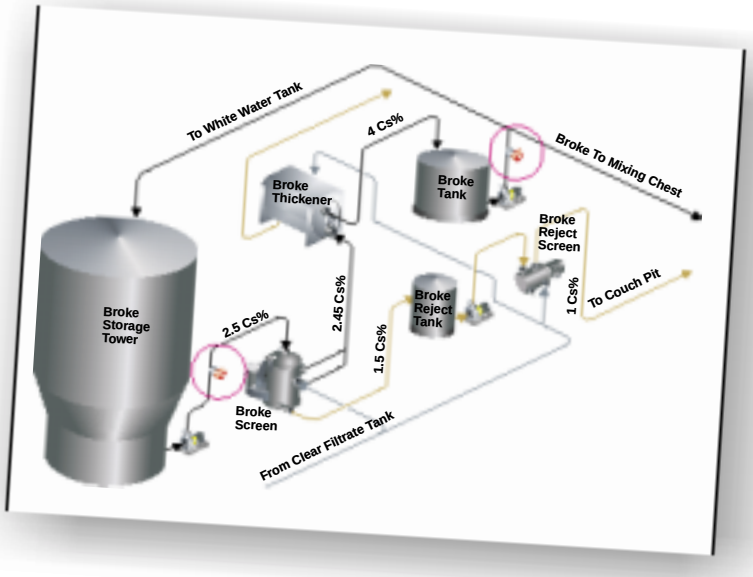


Saveall

At the saveall, the SMART-PULP UL transmitter can be used to measure the consistency of disc filter feed. Consistency at this point is about 1.2-1.3 %Cs. When the feed consistency is below 1.2 %Cs, the SmartLC or kajaaniMCAi can also be used. Chemical pulp fibers fed from the mixing chest are used as sweetener. With SmartLC the maximum SW chemical pulp consistency is 1.2 %Cs.

Broke processing

On newsprint machines the furnish consistency is measured with SMART-PULP. The installation points are located in the screen feed line after the storage chest, and in the pipeline to the mixing chest. The kajaaniMCAi transmitter can also be used in these measurement points; it is a good alternative especially for the mixing chest measurement, particularly when the pulp components of the broke vary significantly.



Small details make the difference

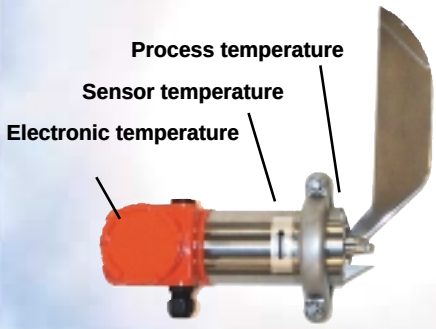
Mechanical construction is the key element in consistency measurement with shear force transmitters. Robust design with a metal diaphragm process seal, solid bearing with journals and overload protection has made SMART-PULP a long lasting transmitter for the harsh process environment. SMART-PULP requires no regular maintenance. Transmitter performance can be easily evaluated if the mill standards so require. Long-term drifting, sensitivity and repeatability can be verified quickly in the instrument shop.

Separate temperature compensation for the electronics, shear force sensor and process temperature may sound unnecessary, but machine start-up requires accurate and immediate consistency control. Water viscosity and fiber stiffness change due to temperature variations, and these changes can cause significant error in the measurement signal if not compensated for. We are the only manufacturer of shear force transmitters to recognize this, and have added temperature compensation as a standard feature to our SMART-PULP transmitters.

Doing the right things right, focusing on customer needs, employing dedicated designers with proven results, a strong support organization, maintenance friendly calibration, and keeping an eye open for new technology have made SMART-PULP supreme among shear force transmitters.

SMART-PULP sensors

Exhaustive laboratory research is the basis for our sensor (blade) development. The growing demands for recycled fiber have changed the requirements for shear force measurement in this arena. There is lower shear to measure, better accuracy needed, debris that causes fouling and mechanical damage, etc. We have developed two sensors specifically to cover these ONP and OCC applications. This speaks for our commitment to finding better solutions for stock preparation and papermaking.



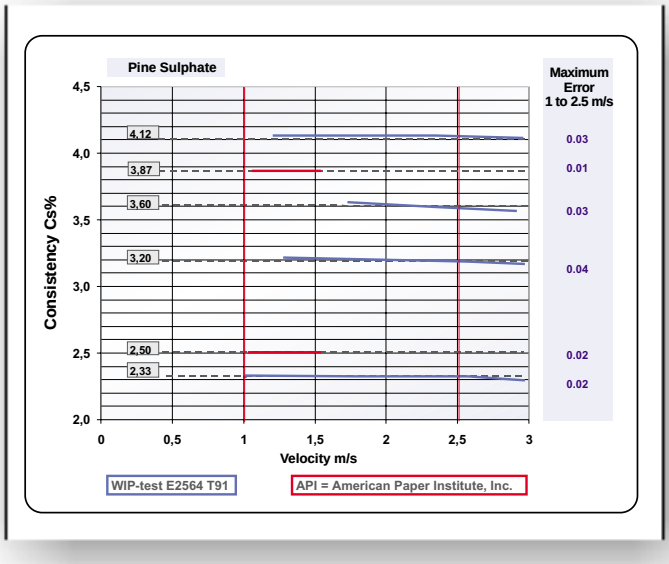
Some of the sensors available:

- The WS sensor was developed for unscreened recycled fibers where string, metal wires, plastics, sand and stones can cause contamination problems or, worse still, severe mechanical damage to the transmitter. Sensor design, the special protective plate and the process coupling prevent contamination and debris hang-on the sensor and maximize protection against mechanical damage.

- The HL sensor was designed for consistencies from 6 %Cs and up. The blowline and blow tank pulp contain hard, large particles (knots etc.) which can disturb the measurement signal. Our target is therefore a blade with the smallest possible impact area without losing sensitivity. The HL sensor meets these challenging requirements.

- The RL sensor was made for short fibers such as ONP, TMP and GW, and in a very short time it has taken the market leader position in these process lines. This would not have been possible without proven performance in real processes all over the world.

Flow compensated fiber consistency transmitter



Over 40 years of experience and over 40,000 blade type transmitters delivered have been the proven platform for SMART-PULP development. The sensors available today have gone through our intensive research process where sensitivity to fiber consistency and ideal flow compensation have been the goals and the ways to meet the papermakers' requirements.

To ensure our customers maximum value and to assure the highest level of applications integrity, we have developed software tools such as the Cs-Advisor. Cs-Advisor has made transmitter selection easier than ever before, and clear installation instructions for each specific application guarantee the best possible performance based on the actual process conditions.

Quick installation and start up

Improvements in mechanics, electronics and software have led to faster installation, calibration and start-up. Calibration can be accomplished before or after installation. In most cases the fine-tuning can be done using single point calibration. "First day calibration is the final calibration" and "the first transmitter that is capable of measuring wide consistency ranges instead of one point" are familiar comments among SMART-PULP users.

SMART-PULP has a library of over 40 ready-made calibration curves for different pulp grades and sensor types. This library can be used to set up the calibration for each application separately. When running different grades in the same process line, up to 8 recipes can be contained within the unit. The recipes can be selected using our operator terminal, a HART®-communicator or binary inputs, whichever best suits the user.

SMART-PULP is cost-efficient and easy to install.

HART® -terminal

Binary control

SMART-PULP operator terminal

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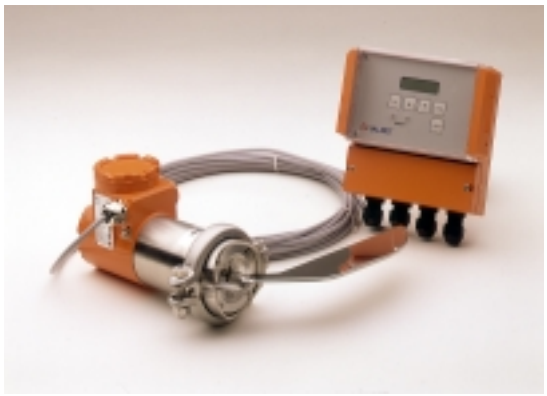
SMART-PULP smart consistency transmitter

BCs160
May 02, 2002



The SMART-PULP consistency transmitter is used for pulp consistency measurement in the pulp and paper industry. The transmitter's operation is based on shear force measurement and it is mounted directly on the process pipe.

The transmitter is supplied with an operator unit (may also be supplied without one), a sensor type to suit the specified application, and a process coupling.

TECHNICAL SPECIFICATIONS

Consistency range:
0.7% to 16% Cs.

Types: Refer to type specification chart and applicability table.

Span
Min. 0.8 %Cs
Max. 30 N - zero elevation

Zero elevation: Max. 30 N - Span

Damping time constant: 1 to 60s
Factory setting 2 s (type HL: 20 s)

Output signal
Two-wire transmitter (2W):
4-20 mA + HART®

Power supply: 18 to 35 VDC

Load capacity
18 V / 250 Ω
23 V / 500 Ω
30 V / 850 Ω
35 V / 1050 Ω
Note! HART® requires min. 250 Ω load resistance

Process pressure: max. 25 bar
If process pressure > 10 bar, see if the coupling's mounting hole has to be reinforced. Refer to Operating and Installation Instructions.

Environmental conditions
Ambient: -20 to 60°C, 0-100% RH (no condensate)
Process: 0 to 120°C
Storage: -50 to 80°C

Type specification chart

SMART-PULP ☐☐☐☐

Sensor type

LL/LS/JL/UL/GL/RL/HL/WS

Construction and wetted materials *)

SS AISI316
TI Titanium
HC Hastelloy C276
SB AISI316 (HL sensor in blow line)

Process coupling and its material *)

NO No process coupling
SS Std., AISI316 (LL, LS, UL, GL, RL, HL)
TI Std. Titanium (LL, LS, UL, GL, RL, HL)

HC Std. Hastelloy C276 (LL, LS, UL, GL, RL, HL)
SB Blow line installation for HL sensor, AISI316
SW For WS sensor, AISI316
TJ For JL sensor, Titanium.
Laminated on fibreglass-reinforced pipe.

Sensor finish (UL, LL, LS, JL)

S Unpolished
P Polished (GL, RL, HL and WS always polished)

*) Only HC and TI are marked on weted parts

PERFORMANCE SPECIFICATIONS

Tested in reference conditions in accordance with IEC60770.

Linearity of force measurement:
±0.5% of span
Hysteresis: 0.025 N
Repeatability: 0.01 N

Examples:
- 0.01 N corresponds to 0.005% consistency variation in bleached softwood chemical pulp (e.g. spruce sulphate) at 3.0% consistency when using the LL sensor.
- 0.1 N corresponds to 0.01% consistency variation in screened recycled fiber pulp at 3% consistency when using the RL sensor.

Static pressure effect: 0.02 N per 1 bar
Process temperature effect:
1% of reading per 10°C
Vibration effect: 2 g per 10-2000 Hz:
less than ±0.03 N

Applicable ranges of different sensor types (%Cs)

Sensor type	UL	LL	LS	GL	RL	WS	HL	JL
Softwood chemical pulp	0.7-3	1.5-6		(1.7-7)	(1.5-6)		4-16	1.5-6
Hardwood chemical pulp	1-3	(1.8-5)		1.8-7.5	1.7-6,5		5-16	1.8-6
Groundwood (SGW, PGW)	1-4			1.8-7.5	1.7-6.5		5-16	
RMP, TMP (CSF<200ml, SR>52) 3)	0.7-3			1.5-6.5	1.7-6.5		5-16	
RMP, TMP (CSF>200ml, SR<52) 3)	0.7-3	1.5-5.5	3-6	(1.5-6)			4-16	
CTMP	0.7-3	1.5-5.5	3-6		(1.5-5)		4-16	
Recycled fibre, unscreened						2-8		
Recycled fibre, OCC, unscreened						2-8		
Recycled fibre, screened	1-5			1.8-8	1.7-8		5-16	
Recycled fibre, OCC, screened	1-3			1.7-8	1.5-7		4-16	

3) Wood raw material: spruce
Notice the following when choosing the sensor type: Applications whose consistency values are given in parentheses are not optimum solutions.

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SMART-PULP smart consistency transmitter

EMC test standards
Radiated interference:
EN50081 - 1: 1993
Reference standard EN 55022:
1987 / Class B
Interference immunity:
EN 50082 - 2: 1995
Reference standards EN 61000-4-2,
-4, -5, -8, -11, ENV 50140, ENV 50204,
ENV 50141

Permissible velocity of flow (m/s)

	Min / max
SMART-PULP UL	0.1 / 1-3
SMART-PULP HL	0.4 / 8
SMART-PULP WS	0.4 / 4
Other types	0.4 / 5

For detailed specification of flow velocities, refer to the Consistency Advisor (PC) program and Operating and Installation Instructions.

Materials
Wetted materials: See type specification chart
Electronics housing: Aluminium alloy
Mounting clamps and screws: AISI316
Wetted gaskets: PTFE and special rubber material
Operator unit: Plastic

Enclosure class
Transmitter: IP66 (NEMA 4X)
Operator unit: IP65

Weight
SMART-PULP WS: 7.3 kg
Other transmitter types: 6.0 kg

ACCESSORIES

Installation pipe FlowTR-P
The installation pipe will improve the measurement particularly in highly demanding applications.

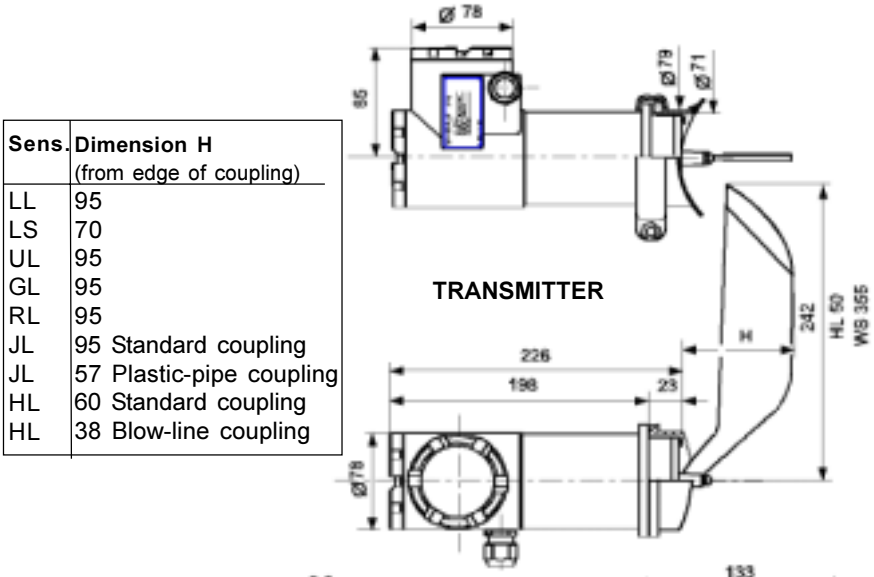
Welding guide
We recommend the use of the welding guide shown in Fig. 5 for the installation of a standard process coupling.

Patents

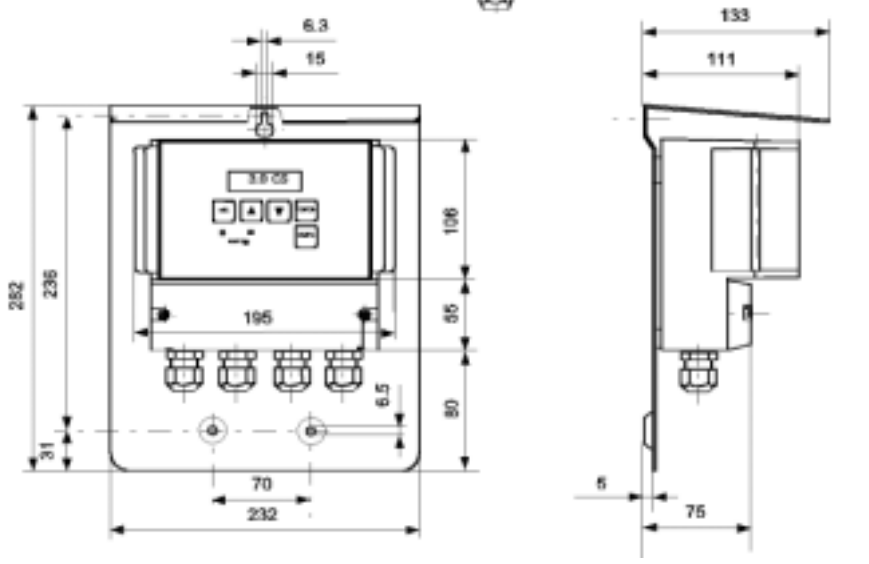
AT E77691 B	FR 0274478
DE 3780021	GB 0274478
EP 0274478	SE 0274478
FI 75424	US 4,757,708

Dimensions

Sens.	Dimension H (from edge of coupling)
LL	95
LS	70
UL	95
GL	95
RL	95
JL	95 Standard coupling
JL	57 Plastic-pipe coupling
HL	60 Standard coupling
HL	38 Blow-line coupling



TRANSMITTER



OPERATOR UNIT

Calibration curves and calibration
The transmitter is provided with built-in calibration curves and linearisation for all sensor types and recommended pulp types. There are max. 8 customised recipes, each of which contains one automatically calibrated pulp type curve and possible information on filler content.
Active recipe is selected from the display unit's operating keys, through HART® interface or through binary inputs.

Sampling and calibration support
Includes calculation of shear force, standard deviation of consistency and average consistency during sample taking. Sampling time can be synchronised exactly with average value calculation with a sampler provided with switch function (Valmet NOVE). Each of the 8 recipes can be calibrated automatically with 1 or 2 samples. Recipe No. 1 can be additionally calibrated with 16 calibration points.

Installation

Process connections and deflector plate

The process coupling to be welded on the process pipe, gasket and mounting clamps with screws and nuts are supplied with the transmitter. Apply 25 Nm torque to tighten the nuts. The process pipe's nominal diameter should be specified in the order. If not, a process coupling to suit a DN200 pipe will be supplied.

Deflector plate is included in the delivery, except for types UL and HL (if HL is supplied with a blow-line coupling).

Installation of process couplings and deflector plate

Refer to Operating and Installation Instructions for detailed instructions.

SMART-PULP LL/LS/GL/RL/HL

Using a welding guide, weld the process coupling as shown in Fig. 1. First make a dia. 71 mm hole in the pipe. Deflector distances L3 and L4 for types LL/LS/GL/RL: L3 = L4 = 300 mm except on digester blow line and blow tank applications L3 = L4 = 150 mm; and for type HL: L3 = L4 = 150 mm, and for type HL: L3 = L4 = 150 mm.

SMART-PULP UL

This type is mounted in a bypass line. Install the process coupling as described above, but omit the deflector plates. If installing in the actual process line, you may need an installation tube without deflectors.

SMART-PULP WS

Weld the process coupling as shown in Fig. 2. Cut a 9 mm by 182 mm hole for the deflector in the pipe.

SMART-PULP HL in digester blow line installations

Install the special blow-line coupling as shown in fig. 3.

SMART-PULP JL

See Fig. 4 for installing the process coupling on a fibreglass-reinforced pipe.

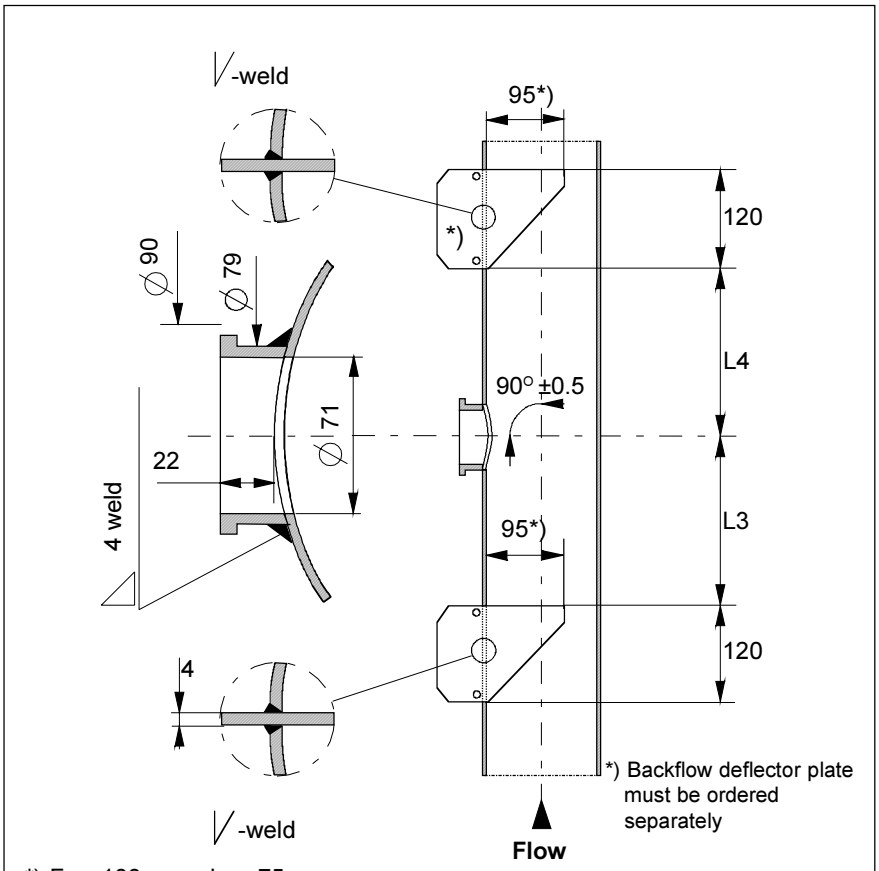


Figure 1 - SMART-PULP LL/LS/GL/RL/HL

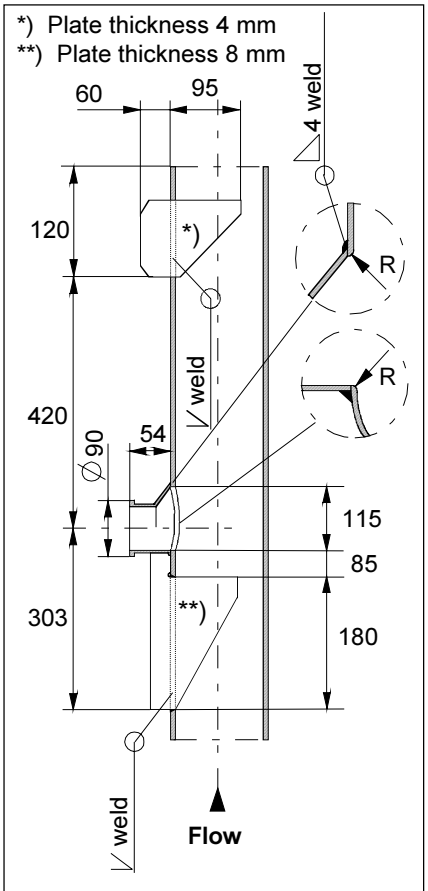


Figure 2 - SMART-PULP WS

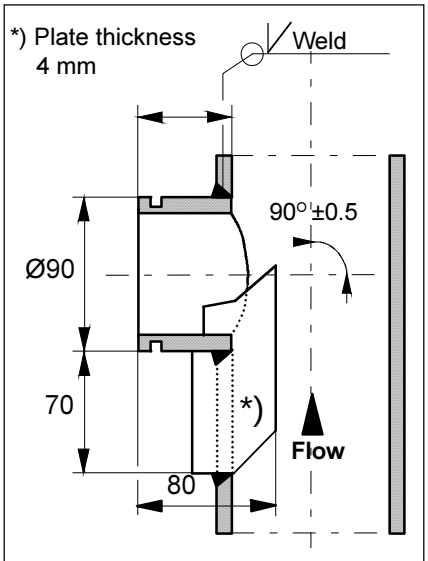


Figure 3 - SMART-PULP HL
(in digester blow line)

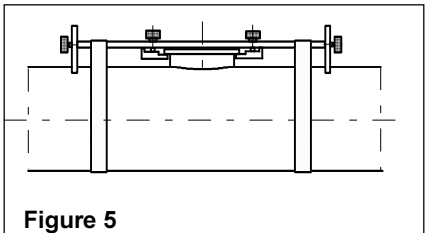


Figure 5
Welding guide for process coupling

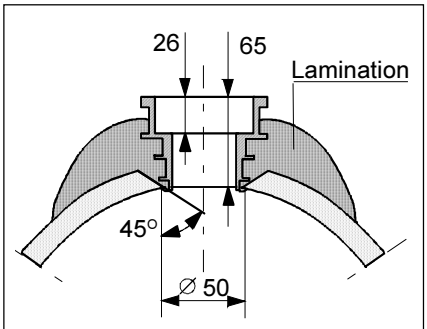
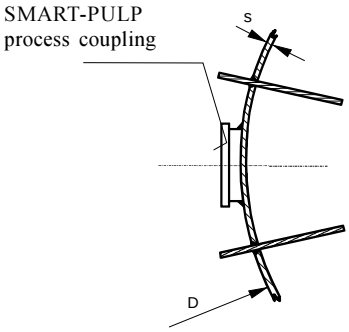


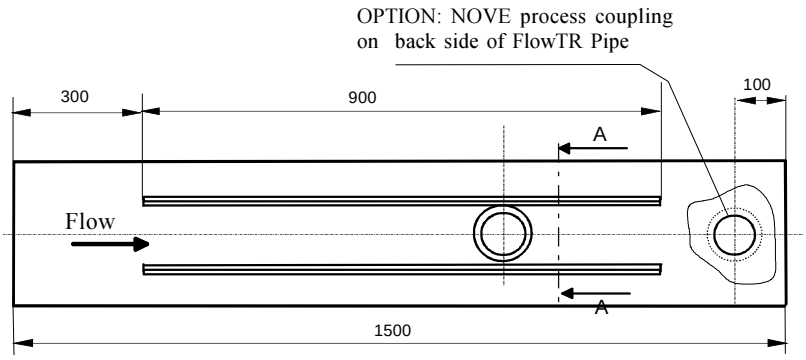
Figure 4 - SMART-PULP JL

FlowTR-P pipe

For different process line sizes: DN
Material: AISI 316 L



View A - A



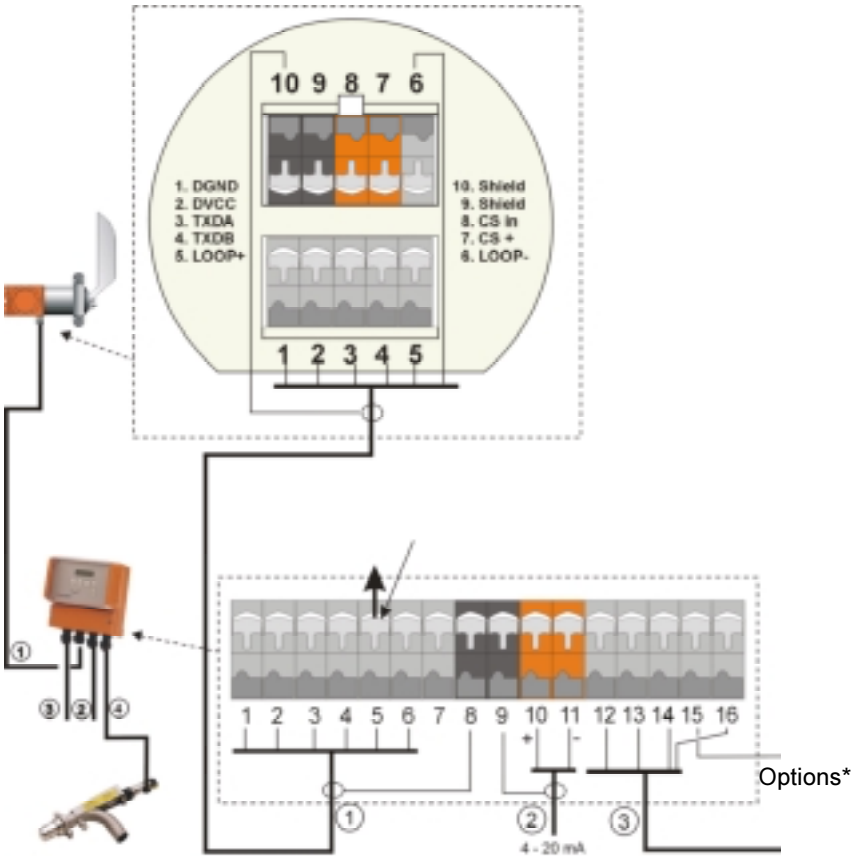
DN	D x s	Pmax/bar	Product n:o
100	114.3 x 2	18	A4730188V1
125	139.7 x 2	16	A4730189V1
150	168.3 x 2	12	A4730190V1
200	219.1 x 3	16	A4730180V1
250	273.0 x 4	10	A4730181V1
300	323.9 x 4	10	A4730182V1
350	355.6 x 4	10	A4730183V1
400	406.4 x 5	10	A4730184V1
500	508.0 x 5	8	A4730185V1
600	609.6 x 5	6	A4730186V1
700	711.2 x 6	6	A4730187V1

Electrical connections
The connections are made as shown in the appended wiring diagram.
The wire inlets are provided with PG13.5 gland packings or optionally with 1/2-14 NPS adapter for connection alternative 5.

The cable between the transmitter and operator unit is factory connected to the operator unit.

The cable (2) can also be connected to the transmitter end, refer to the Operating and Installation Instructions.

The transmitter can also be used without the operator unit. In that case you perform calibration through HART275® user interface.



Options*
- NOVE -state of the valve (4) and recipe selection (3)

Refer to the Operating and Installation Instructions.