ABB MEASUREMENT & ANALYTICS

Pressductor Pillowblock Load Cells Horizontal Measuring PFTL 101

User manual

3BSE009965R0401 en Rev G

USE OF SYMBOLS

This publication includes the following symbols with information regarding safety or other important information:

CAUTION	Caution icon indicates important information. Risk of damage to equipment, property or software.
DANGER	Danger icon indicates a hazard which could result in personal injury or even death.
ELECTRICAL	Electrical warning icon indicates the presence of a hazard which could result in electrical shock.
ESD	ESD icon indicates that electrostatic discharge precautions are needed.
Information	Information icon alerts the reader to relevant facts and conditions.
Tip	Tip icon advise how to design your product or how to use a certain function.

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Provided that the installation is carried out in accordance with the installation instructions given in this manual this product meets the requirements for CE-marking specified in: the RoHS directive 2011/65/EU + AD 2015/863/EU, EMC directive 2014/30/EU and the Low Voltage Directive 2014/35/EU and Conformity to UK regulations: The Electrical Equipment (Safety) Regulations 2016, S.I.2016:1101, The Electromagnetic Compatibility Regulations 2016, S.I.2016:1091 and The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012, S.I. 2012:3032.

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1 Introduction

1.1 About this Manual

This manual describes load cells PFTL 101A, PFTL 101AE, PFTL 101AER, PFTL 101B, PFTL 101BE and PFTL 101BER in a Pressductor® Tension Measuring System.

The purpose of this manual is to describe the general function and design of the load cells and also to be a guidance at installation, commissioning, preventive maintenance and fault tracing.

1.2 Cyber Security Disclaimer

This product has been designed to be connected and communicate data and information via a network interface which should be connected to a secure network. It is the sole responsibility of the person or entity responsible for network administration to ensure a secure connection to the network and to take the necessary measures (such as, but not limited to, installation of firewalls, application of authentication measures, encryption of data, installation of antivirus programs, etc.) to protect the product and the network, its system and interface included, against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB is not liable for any such damages and/or losses.

1.3 China RoHS Marking en-zh

Table 1 有害物质 Hazardous Substances

产品名称 Product name	铅 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr (VI))	多溴联苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)
金属部件 Metal Parts	O	O	O	O	O	O
电路板组件 Printed Circuit Board Assemblies	X	O	O	O	O	O
电缆 Cables	O	O	O	O	O	O

本表格依据 SJ/T 11364 标准的规定编制。
This table is prepared in accordance with the provisions of SJ/T 11364.

O: 表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 标准规定的限量要求以下。
O: Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572.

X: 表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 标准规定的限量要求。
X: Indicates that said hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T 26572.

电子电器产品的环保使用期限依据 SJT/ 11388 标准的规定确定。
The EPUP value of EEP is defined according to SJ/T 11388 standard.

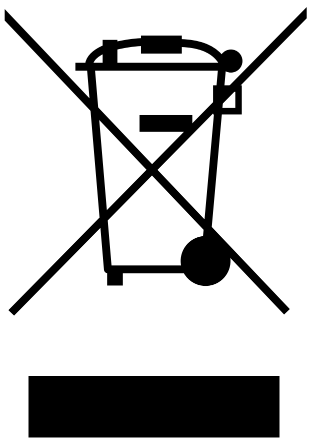
环保使用期限仅在产品使用说明书规定的条件下才有效。The Environment Protection Use Period is valid only when the product is operated under the conditions defined in the product manual.	

1.4 Disposal and Recycling

1.4.1 Environmental Policy

ABB is committed to its environmental policy. We strive continuously to make our products environmentally more sound by applying results obtained in recyclability and life cycle analyses. Products, manufacturing process as well as logistics have been designed taking into account the environmental aspects.
Our environmental management system, certified to ISO 14001, is the tool for carrying out our environmental policy. However it is on the customer’s responsibility to ensure that local legislation is followed.

1.4.2 Recycling Electrical and Electronic Equipment, WEEE



The crossed – out wheeled bin symbol on the product(s) and / or accompanying documents means that used electrical and electronic equipment (WEEE) should not be mixed with general household waste.
If you wish to discard electrical and electronic equipment (EEE), in the European Union, please contact your dealer or supplier for further information.
Outside of the European Union, contact your local authorities or dealer and ask for the correct method of disposal.
Disposing of this product correctly will help save valuable resources and prevent any potential negative effects on human health and the environment, which could otherwise arise from inappropriate waste handling.

1.4.3 Recycling the Transport Material

ABB designs all transport material to be recyclable where practical. The recycling of the transport material depends on the material type and availability of local recycling programs.
After receiving the system into the site, the package and the transportation locking have to be removed. Recycle the transport material according to local regulations.

1.4.4 Disposal of the Product

When the product is to be disposed, it should be dismantled and the components recycled according to local regulations.

1.4.4.1 Dismantling and Recycling of the Product

Dismantle and recycle the components of the product according to local regulations.

CAUTION
Some of the components are heavy! The person who performs the dismantling of the system must have the necessary knowledge and skills to handle heavy components to avoid the risk of accidents and injury from occurring.

- Load cell: These parts are made of structural steel, which can be recycled according to local instructions. All the auxiliary equipment, such as cabling or hoses must be removed before recycling the material.

1.5 Function and Design

1.5.1 General

A complete measuring system normally consists of two load cells, a junction box, one control unit with two measurement channels and cabling.

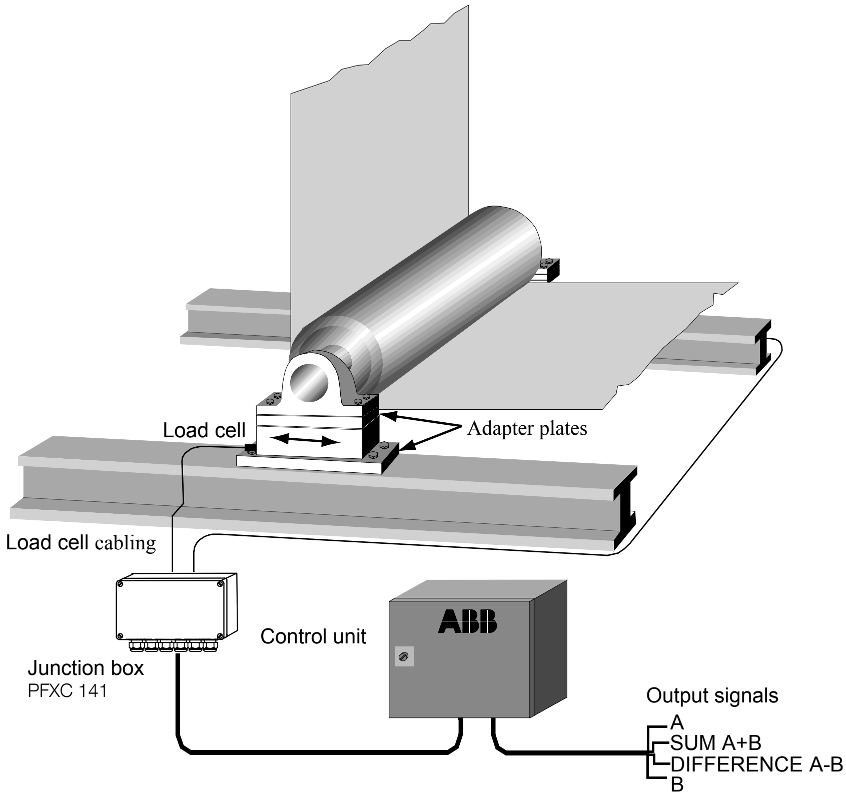


Figure 1. Complete Measuring System

1.5.2 Loads cells PFTL 101

The load cells are installed under the roll bearings, where they measure forces parallel to the mounting surface.

The reactive force from the web/strip, which is proportional to the web/strip tension, is transferred to the load cells via the roll and the bearings

The load cells are connected to the control unit via a junction box. The control unit converts the load cell signals to DC voltages that are proportional to the reaction force. Depending on which control unit is chosen, it is possible to have the analog signals for the two individual load cells (A and B), the sum of the load cell signals (A+B), and/or the difference between the load cell signals (A-B).

1.5.3 Principle of Measurement

The load cell only measures force in the direction F_R. The measurement force may be positive or negative. The load cell is normally installed under the roll bearings. When there is a web/strip in tension over the roll, the tension (T) gives rise to two force components, one in the direction of measurement of the load cell (F_R) and one at right angles (F_V).
The measuring force depends on the relationship between the tension (T) and the wrap angle formed by the web/strip around the measuring roll.

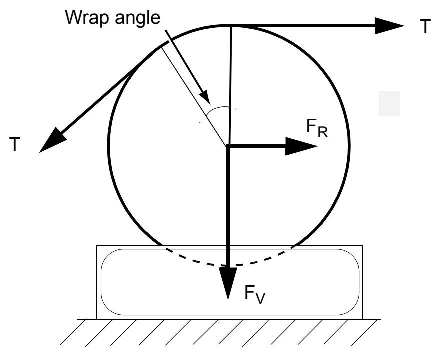


Figure 2. Measuring roll with Force Vectors

2 Description

2.1 General

The load cells in the PFTL 101 family are available in six different measuring ranges from 0.5 to 20 kN and two different sizes (see 2.2 Technical Data). Each load cell is individually calibrated and temperature compensated.

The load cells are usually mounted and fixed to a base and a bearing housing with six screws, four on one side of the load cells and two on the opposite side.

For all load cells of type PFTL 101 the load cell house is machined from a single block of steel.
A sensor is then welded into the load cell house and oriented so that it is sensitive to force in the direction of measurement and insensitive in other directions.

The load cell types PFTL 101A, PFTL 101AE, PFTL 101B and PFTL 101BE are made of stainless steel.
PFTL 101A and PFTL 101B are equipped with a connector for the pluggable connection cable.
PFTL 101AE and PFTL 101BE are equipped with a fixed connection cable.

Load cell types PFTL 101AER and PFTL 101BER are specially designed for installation in corrosive environment. They are made of acid resistant stainless steel and they also have a fixed connection cable.

Dimensions for all load cell types are given in A Drawings.

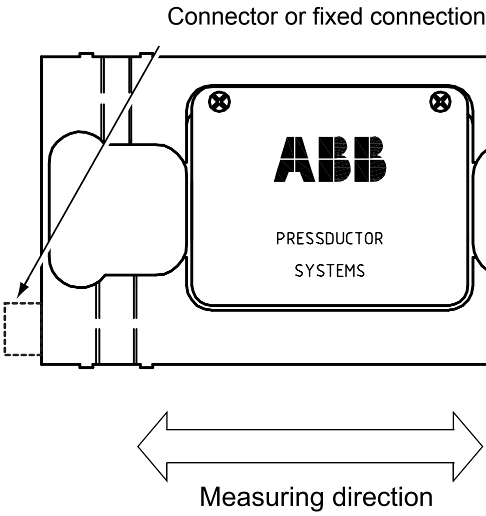


Figure 3. Load cells PFTL 101 A/AE/AER

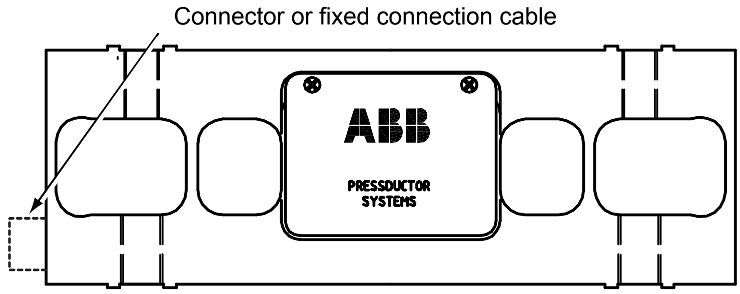


Figure 4. Load cells PFTL 101 B/BE/BER

2.2 Technical Data

Table 2 Technical Data Load Cell PFTL 101

PFTL 101	Type	Data						Unit
Nominal Loads [1)]								
Nominal load in measuring direction, F_{nom}	A/AE/AER	0,5	1,0	2,0				kN
	B/BE/BER			2,0	5,0	10	20	
Permitted transverse force within the accuracy, F_{Vnom}	A/AE/AER	5	10	10				
	B/BE/BER			30	30	30	40	
Permitted axial load within the accuracy, F_{Anom}	A/AE/AER	2	5	5				
	B/BE/BER			5	10	10	10	
Overload capacity								
Max. load in measurement direction without permanent change of data, F_{max}	A/AE/AER	2,5	5	10				kN
	B/BE/BER			10	25	50	80	
Spring constant	A/AE/AER	32	65	130				kN/mm
	B/BE/BER			130	325	650	1300	
Mechanical data								
Length	A/AE/AER	230	230	230				mm
	B/BE/BER			360	360	360	360	
Width	A/AE/AER	84	84	84				
	B/BE/BER			104	104	104	104	
Height	A/AE/AER	125	125	125				

	B/BE/BER			125	125	125	125	
Weight	A/AE/AER	9	9	10				kg
	B/BE/BER			20	21	21	23	
Material	A/AE/B/BE	Stainless steel SIS 2383 DIN 17440 X12CrMoS17 Werkstoffnr 1.4104 AISI 430F						
	AER/BER	Acid resistant steel: DIN 17440 X2CrNiMo17 13 2 Werkstoffnr 1.4404 AISI 316L						
Accuracy								
Accuracy class	A/AE/AER B/BE/BER	± 0,5			%			
Linearity deviation		< ± 0,3						
Repeatability error		< ± 0,05						
Hysteresis		<0,2						
Compensated temperature range		+20 - +80			°C			
Zero point drift		30 (80 [2])			ppm/K			
Sensitivity drift		150						
Working temperature range		-10 - +105			°C			
Zero point drift		50 (100 [1])			ppm/K			
Sensitivity drift		250						
Storage temperature range		-40 - +105			°C			
1) Definitions of directions designations “$_V$”and “$_A$” in F_V and F_A are given in 2.5.1 Coordinate System. 2) PFTL 101AER -0.5 kN/ -1.0 kN								

2.3 Definitions

Nominal load

Nominal load, F_{nom}, is the maximum load in the measurement direction for which the load cell is dimensioned to measure within the specified accuracy class. The load cell is calibrated up to F_{nom}.

Sensitivity

Sensitivity is defined as the difference in output values between nominal load and zero load.

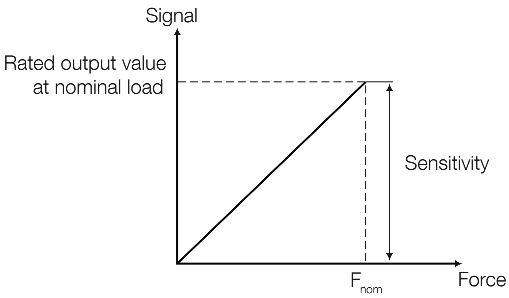


Figure 5. Sensitivity

Accuracy and Accuracy Class

Accuracy class is defined as the maximum deviation, and is expressed as a percentage of the sensitivity at nominal load. This includes linearity deviation, hysteresis and repeatability error.

Linearity Deviation

Linearity deviation is the maximum deviation from a straight line drawn between the output values at zero load and nominal load. Linearity deviation is related to the sensitivity.

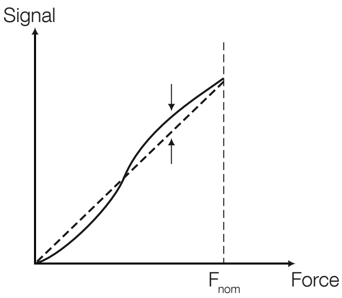


Figure 6. Linearity Deviation

Hysteresis

Hysteresis is the maximum difference in the output signal at the same load during a cycle from zero load to nominal load and back to zero load, related to the sensitivity at nominal load. The hysteresis of a Pressductor transducer is proportional to the load cycle.

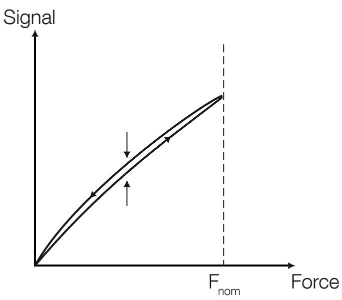


Figure 7. Hysteresis

Repeatability error

Repeatability error is defined as the maximum deviation between repeated readings under identical conditions. It is expressed as a percentage of the sensitivity at nominal load.

Compensated temperature range

The temperature drifts of the load cell have been compensated for in certain temperature ranges. That is the temperature range within which the specified permitted temperature drifts (i.e. zero point and sensitivity drifts) of the load cell are maintained.

Working temperature range

Working temperature range is the temperature range within which the load cell can operate within a specified accuracy. The maximum permitted temperature drifts (i.e. zero point and sensitivity drifts) of the load cell are not necessarily maintained in the whole working temperature range.

Storage temperature range

Storage temperature range is the temperature range within which the load cell can be stored.

Zero point drift with temperature

Zero point drift is defined as the signal change with temperature, related to the sensitivity, when there is zero load on the load cell.

Sensitivity drift with temperature

Sensitivity drift is defined as the signal change with temperature at nominal load, related to the sensitivity, excluding the zero point drift.

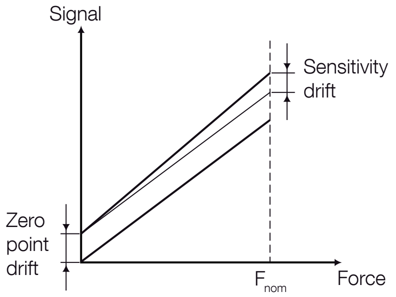


Figure 8. Sensitivity drift with temperature

Deflection

Deflection is the total deformation in the measuring direction of the load cell when the load is increased from zero to the nominal value.

2.4 Measuring principle of the sensor

The measuring principle of the sensor is based on the Pressductor® technology and the fact that the permeability of a magnetic material changes under mechanical stress.

The transducer is made up of a stack of specially treated laminates, forming the measuring body. Primary and secondary windings are wound through four holes in the sensor so that they cross at right angles.

The primary winding is supplied with an alternating current which creates a magnetic field around the primary winding. Since the two windings are at right angles to each other, there will be no magnetic field around the secondary winding, as long as there is no load on the sensor.

When the sensor is subjected to a mechanical force in the direction of measurement, the propagation of the magnetic field changes so that it surrounds the secondary winding, inducing an alternating voltage in that winding.
The control unit converts this alternating voltage into a DC voltage proportional to the applied force. If the measurement force changes direction, the sensor signal changes also polarity.

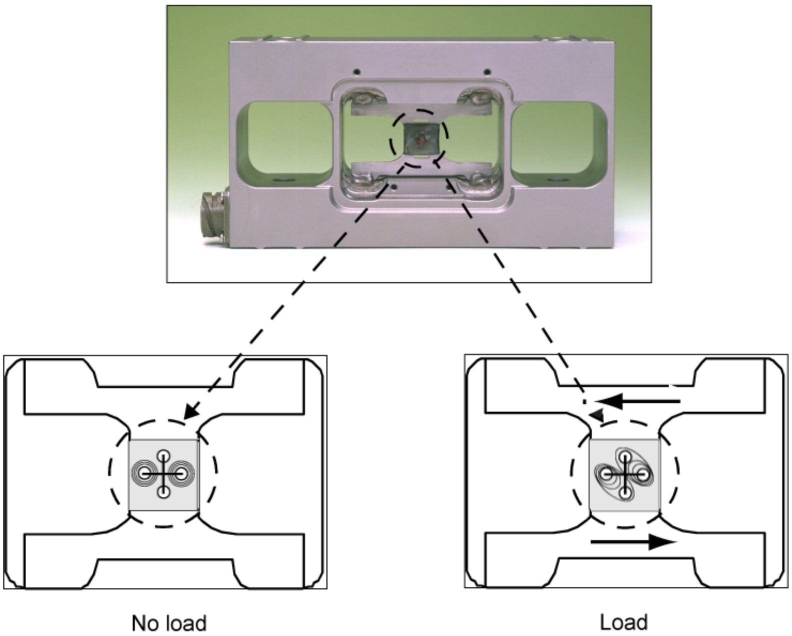


Figure 9. Propagation of magnetic field around secondary winding due to mechanical force on sensor

2.5 Mounting Arrangement

When choosing a mounting arrangement it is important to remember to position the load cell in a direction that gives sufficient measuring force (F_R) to achieve the highest possible accuracy.

The load cell has no particular correct orientation; it is positioned in the orientation best suited for the application, bearing in mind the positions of the screw holes. The load cell can also be installed with the roll suspended under the load cell.

The load cell has the same sensitivity in both directions, so that the load cell can be installed in the easiest manner.

Typical mounting arrangements are horizontal and inclined mounting.

2.5.1 Coordinate System

A coordinate system is defined for the load cell. This is used in force calculations to derive force components in the load cell principal directions.
Where direction designations R, V and A are recognized as suffixes for force components, F, this represents the force component in the respective direction. The suffix R may be omitted, when measuring direction is implied by the context.

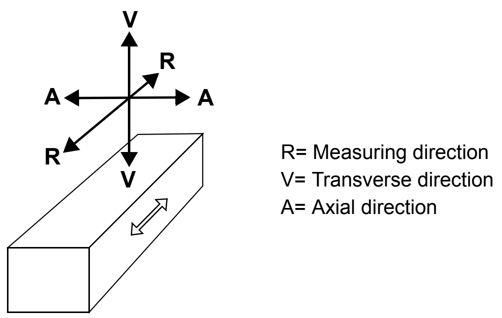


Figure 10. Coordinate system defining directions used in force calculation

2.5.2 Horizontal Mounting

In the majority of cases horizontal mounting is the most obvious and easiest mounting method.

When calculating the force, the equations below must be used:

$F_R = T \times (\cos\beta - \cos\alpha)$
$F_{RT} = 0$
$F_{Rtot} = F_R + F_{RT} = T \times (\cos\beta - \cos\alpha)$
$F_V = T \times (\sin\alpha + \sin\beta)$
$F_{VT} = \text{Tare}$
$F_{Vtot} = F_V + F_{VT} = T \times (\sin\alpha + \sin\beta) + \text{Tare}$

where:

T = Web/strip tension

F_R = Force component from web/strip tension in measurement direction, R

F_{RT} = Force component from Tare in measurement direction, R

F_{Rtot} = Total force in measurement direction, R

F_V = Force component from web/strip tension in transverse direction, V

F_{VT} = Force component from Tare in transverse direction, V

F_{Vtot} = Total force in transverse direction, V

Tare = Force due to tare weight

α = Deflection angle on one side of the roll relative the horizontal plane

β = Deflection angle on the other side of the roll relative the horizontal plane

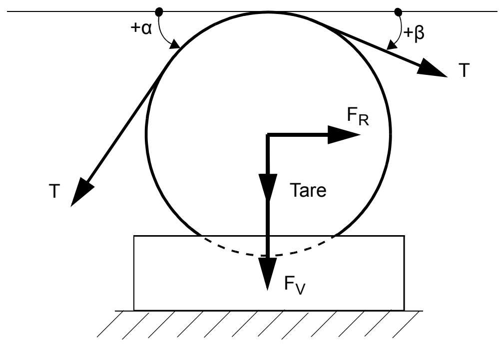


Figure 11. Horizontal Mounting

2.5.3 Inclined Mounting

Inclined mounting means arrangements in which the load cell is inclined relative to the horizontal plane. In some cases this is the only option.
When calculating the force, the equations below must be used:

$F_R = T \times [\cos(\beta + \gamma) - \cos(\alpha - \gamma)]$

$F_{RT} = \text{Tare} \times \sin\gamma$

$F_{Rtot} = F_R + F_{RT} = T \times [\cos(\beta + \gamma) - \cos(\alpha - \gamma)] + (-\text{ Tare x } \sin\gamma)$

$F_V = T \times [\sin(\alpha - \gamma) + \sin(\beta + \gamma)]$

$F_{VT} = -\text{ Tare} \times \cos\gamma$

$F_{Vtot} = F_V + F_{VT} = T \times [\sin(\alpha - \gamma) + \sin(\beta + \gamma)] + \text{Tare} \times \cos\gamma$

where:

T = Web/strip tension

F_R = Force component from web/strip tension in measurement direction, R

F_{RT} = Force component from Tare in measurement direction, R

F_{Rtot} = Total force in measurement direction, R

F_V = Force component from web/strip tension in transverse direction, V

F_{VT} = Force component from Tare in transverse direction, V

F_{Vtot} = Total force in transverse direction, V

Tare = Force due to tare weight

α = Deflection angle on one side of the roll relative the horizontal plane

β = Deflection angle on the other side of the roll relative the horizontal plane

γ = Angle for load cell mounting surface relative the horizontal plane

When calculating it is important that the angles are set into the equations with the correct signs in relation to the horizontal plane, see Figure 12. Inclined Mounting page 19.

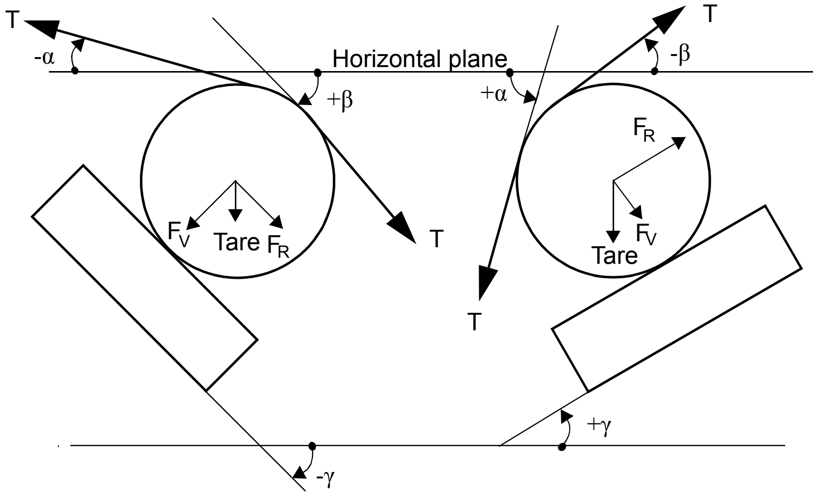


Figure 12. Inclined Mounting

2.6 The Electrical Circuit

The electrical circuit of the load cell is shown in the diagram below.

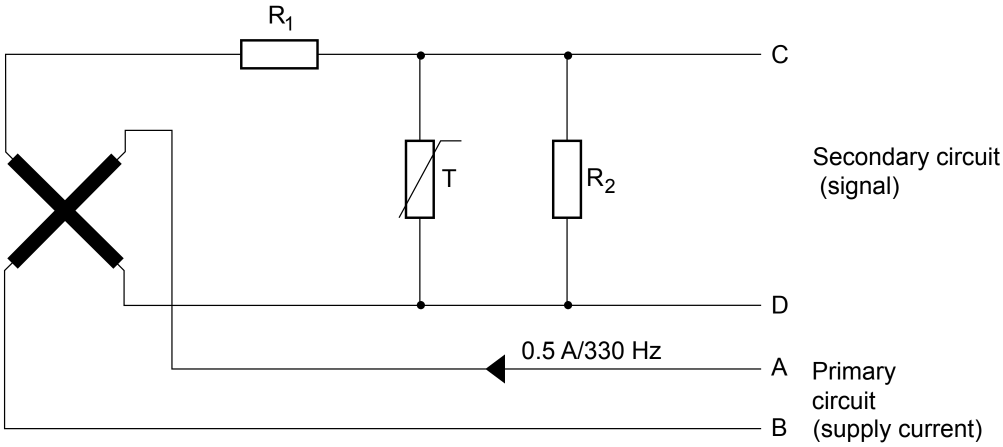


Figure 13. Load cell circuit diagram

The load cell is supplied with a 0.5 A, 330 Hz alternating current. The secondary signal is calibrated for the correct sensitivity with a voltage divider R_1 - R_2, and temperature compensation is provided by thermistors T.

All resistances on the secondary side are relatively low. The output impedance is typically 1-3 Ω , which helps to suppress interference.

3 Installation

3.1 General

The equipment is a precision instrument which, although intended for severe operating conditions, must be handled with care. The load cells should not be unpacked until it is time for installation.

To achieve the specified accuracy, the best possible reliability and long-term stability, the load cells must be installed in accordance with the instructions below. See also 6.4 Fault Tracing in the Mechanical Installation.

- When a load cell type PFTL 101AER or PFTL 101BER is used for an acid resistant application it is recommended to use adapter plates and screws of austenitic, acid resistant steel.

> **Information**
> For all types of installations of these load cell types, austenitic steel must be used, preferably acid resistant or stainless steel.

- The foundation for the load cell must be made as stable as possible. A sturdy construction reduces the vibration energy of the measuring roll and bearing arrangement.
- The surfaces closest to the load cell, and other surfaces that affect the fit, must be machined flat to within 0.05 mm.
- There must not be any shims immediately above or below the load cell, as this may adversely affect the flatness. Instead, shims may be placed between the adapter plate and the foundation or between the adapter plate and the bearing housing.
- The screws that secure the load cell must be tightened with a torque wrench.
- The bearing arrangement for the measuring roll must be designed to allow axial expansion of the roll with changes in temperature.
- Any drive to the roll must be applied in such a way that interfering forces from the drive are kept to a minimum.
- The measuring roll must be dynamically balanced.
- The mounting surfaces of the load cells must be on the same height and parallel with the measuring roll.
- In a corrosive environment, galvanic corrosion may occur between the load cell, galvanized screws and adapter plates. This makes it necessary to use stainless steel screws and adapter plates of stainless steel or equivalent. See adapter plates in A Drawings.

3.2 Unpacking

When the equipment arrives, check against the delivery document. Inform ABB of any complaint, so that errors can be corrected immediately and delays avoided.

3.3 Preparations

Prepare the installation in good time by checking that the necessary documents and material are available, as follows:

- Installation drawings and this manual.
- Standard tools, torque wrench and instruments.
- Rust protection, if additional protection is to be given to machined surfaces. Choose TEC-TYL 511 (Valvoline) or FERRYL (104), for example.
- Load cells, adapter plates, bearing housings, etc.
- Screws as listed in Table 3. page 22 to secure the load cell, and other screws for bearing housing, etc.

3.4 Adapter Plates

The adapter plates for all load cell types in the PFTL 101 family must be machined and have a flatness deviation of maximum 0.05 mm, required surface finish should be Ra 3,2.

For PFTL 101A the thickness of the adapter plates should be minimum 30 mm, and for PFTL 101B 35 mm, see Figure 15. Installation of Adapter Plates and Alignment of Load Cells page 23

> **Information**
> When installing PFTL 101AER and PFTL 101BER adapter plates of austenitic steel must be used, preferably acid resistant or stainless steel.

3.5 Mounting

The instructions below apply to a typical mounting arrangement. Variations are allowed, provided that the requirements of 3.1 General are complied with.

If it is necessary to use tubular dowel pins to secure the position of the load cell, see instructions in Figure 14. Typical Installation page 23.

1. Clean the foundation and other mounting surfaces.

2. Fit the lower adapter plate to the load cell. Tighten the screws to the torque stated in Table 3. page 22.

3. Fit the load cell and the lower adapter plate to the foundation, but do not fully tighten the screws.

4. Fit the upper adapter plate to the load cell. Tighten the screws to the torque stated in Table 3. page 22.

5. Fit the bearing housing and the roll to the upper adapter plate, but do not fully tighten the screws.

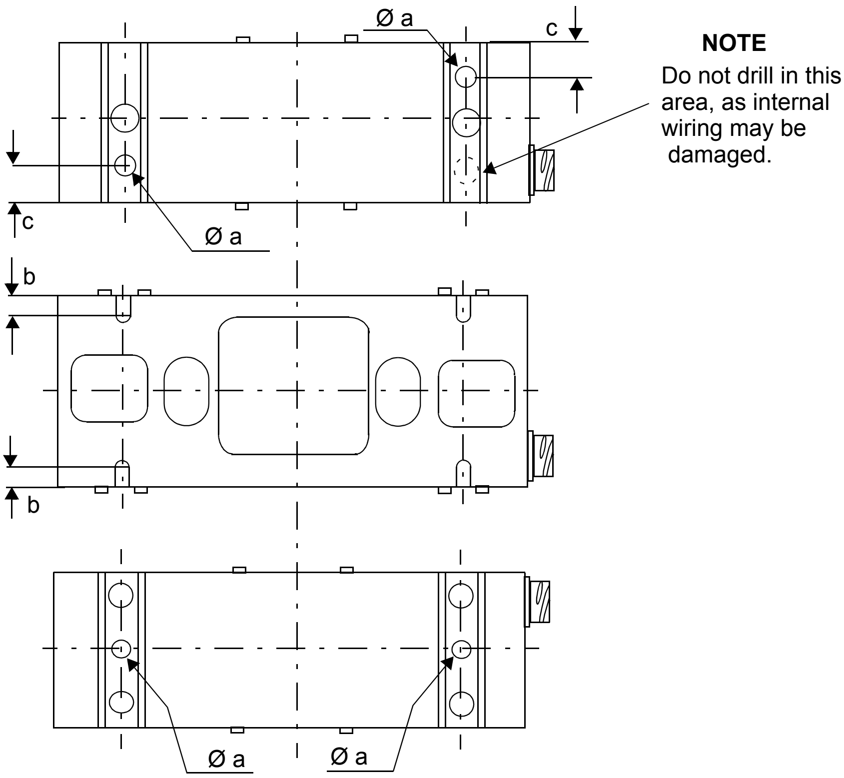
CAUTION
During this operation it is possible to over load the load cells if the operation is done not careful enough, especially if the roll is heavy.
The most critical load cells are naturally the PFTL 101A-0.5 kN and PFTL 101B-2 kN.
Applications with inclined mounting are most critical.

6. Adjust the load cells so that they are in parallel with each other and in line with the axial direction of the roll. Tighten the foundation screws, see Figure 15. Installation of Adapter Plates and Alignment of Load Cells page 23.

7. Adjust the roll so that it is at right angles to the longitudinal direction of the load cells.Tighten the screws in the upper adapter plate, see Figure 15. Installation of Adapter Plates and Alignment of Load Cells page 23.

Table 3 Tightening Torques for Load Cell PFTL 101

Option	Type of screws	Strength class	Type of lubrication	Dimension	Tightening torque [Nm] ± 5%
1 (Recommended)	Alloyed steel screws Strength class according to ISO 898/1	12.9	Oil	M12	136
				M16	333
				M20	649
2 (Recommended)	Alloyed steel screws Strength class according to ISO 898/1	12,9	MoS_2	M12	117
				M16	286
				M20	558
3	Stainless steel (A2-80) or acid resistant steel (A4-80), Strength class according to ISO 3506	A2-80 or A4-80	Wax	M12	76
				M16	187
				M20	364
4	Stainless steel (A2-80) or acid resistant steel (A4-80), Strength class according to ISO 3506	A2-80 or A4-80	Oil or emulsion	M12	65
				M16	161
				M20	313



Load cell PFTL 101	Ø a	b	c	Tubular dowel pin
A/AE/AER	8	15	15	Ø 8.4
B/BE/BER	12	15	20	Ø 12.5

Figure 14. Typical Installation

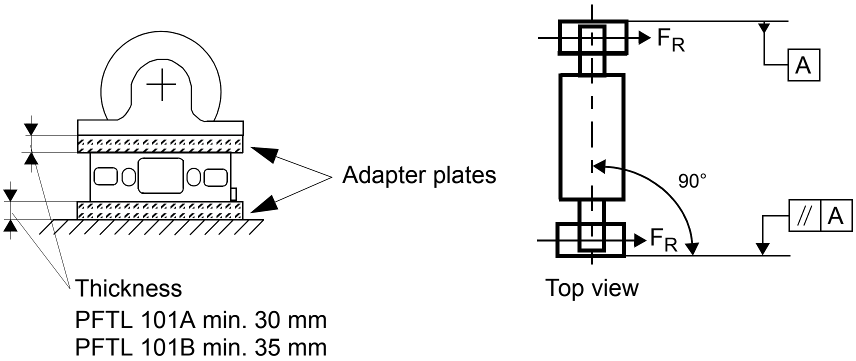


Figure 15. Installation of Adapter Plates and Alignment of Load Cells

3.6 Cabling

The cable must not create shunting forces in the measuring direction of the load cell e.g. forces caused by thermal expansion, gravity or similar.

Therefore make sure that the shunting forces become as small as possible for instance by securing the cable against the supporting structure.

4 Commissioning

4.1 General

The actual procedure for commissioning a load cell is simple, provided that the load cells and cables have been properly installed. Commissioning of the control unit is described in the relevant chapter of the control unit manual.
Check the following:

- that the load cells have been correctly installed and aligned
- that all screws have been tightened to the correct torque
- that all cables are correctly installed and connected
- that all connectors are plugged in

4.2 Preparatory Calculations

To be able to set the correct measuring range, the measurement force per load cell $F_R/2$ at maximum tension T must be calculated. Each load cell is subjected to half the total measurement force F_R. This calculation must be done before commissioning can begin. Calculation of F_R is described in 2.5 Mounting Arrangement.

5 Maintenance

5.1 General

Web/strip Tensiometer Systems with Pressductor® load cells are extremely reliable and do not require daily servicing. As a preventive measure, checks should be done periodically on all parts subject to mechanical wear.

5.2 Preventive Maintenance

Check mounting screws and tighten if necessary.

The gaps between load cell and plates should be checked to ensure that they do not get clogged with dirt, causing shunt force past the load cell. Clean the gaps with compressed air if necessary.

The cable between the load cell and the junction box is subjected to possible damage and should be checked and replaced if necessary.

5.3 Spare Parts

Users are recommended to keep the following spare parts in stock:

- One load cell of correct type and size.
- One connector complete with cable (for PTFL 101A and PFTL 101B).

Table 4 Ordering numbers for Load Cell PFTL 101

Description	Type	Nominal load (kN)	Ordering numbers
Load cell	PFTL 101A	0,5	3BSE004160R1
Load cell	PFTL 101A	1,0	3BSE004166R1
Load cell	PFTL 101A	2,0	3BSE004172R1
Load cell	PFTL 101AE	0,5	3BSE004211R1
Load cell	PFTL 101AE	1,0	3BSE004212R1
Load cell	PFTL 101AE	2,0	3BSE004213R1
Load cell	PFTL 101AER	0,5	3BSE023010R1
Load cell	PFTL 101AER	1,0	3BSE023011R1
Load cell	PFTL 101AER	2,0	3BSE023012R1

Load cell	PFTL 101B	2,0	3BSE004185R1
Load cell	PFTL 101B	5,0	3BSE004191R1
Load cell	PFTL 101B	10,0	3BSE004197R1
Load cell	PFTL 101B	20,0	3BSE004203R1
Load cell	PFTL 101BE	2,0	3BSE004214R1
Load cell	PFTL 101BE	5,0	3BSE004215R1
Load cell	PFTL 101BE	10,0	3BSE004216R1
Load cell	PFTL 101BE	20,0	3BSE004217R1
Load cell	PFTL 201BER	2,0	3BSE023158R1
Load cell	PFTL 201BER	5,0	3BSE023159R1
Load cell	PFTL 201BER	10,0	3BSE023160R1
Load cell	PFTL 201BER	20,0	3BSE023161R1

6 Fault Tracing

6.1 General

It is important to be thoroughly familiar with the description of operation in 2 Description before starting fault tracing.

6.2 Interchangeability

The load cells are factory calibrated and can be replaced directly with another load cell of the same type. The only adjustment required after load cell replacement is zero adjustment in the control unit.

6.3 Fault Tracing Procedure

The measuring equipment can be divided into four parts:

- The mechanical installation.
- The load cell.
- The junction boxes and the cabling.
- The control unit (see the control unit manual).

The fault symptoms indicate in which part the fault lies.

- Faults in the mechanical installation often result in an unstable zero point or incorrect sensitivity.
  If a fault follows something else in the process, such as temperature, or can be linked to a particular operation, it probably originates from something in the mechanical installation.

- Load cells are extremely robust and can withstand five times their nominal load in the measuring direction. If a load cell has nevertheless been so overloaded that its data have been altered, this is probably due to an event in the mill, such as web/strip breakage. On excessive overload the first thing that happens is that the zero point shifts.

- Problems such as interference or unstable zero point may be caused by wiring faults. Some malfunctions may be due to the proximity of cables that cause interference. Incorrect installation, such as imbalance in a cable or screens earthed at more than one end may cause the zero point to become unstable. Cables are subject to mechanical wear, and should be checked regularly. The junction box should also be checked, especially if it is subject to vibration.

- A fault in the control unit usually causes intermittent loss of a function. It is unusual for the control unit to cause stability problems. Faults in connected units may affect the operation of the control unit. For further details see the control unit manual.

6.4 Fault Tracing in the Mechanical Installation

There are a number of parts in the mechanical arrangement that can cause faults. The extent to which these faults are repeatable differs. Possible causes fall into the following groups.

- Defective mounting surface or adapter plates.
- Force shunting.
- Insufficient mounting of load cell and adapter plates.
- Rolls and bearings.
- Driven roll.

6.4.1 Defective Mounting Surface, Support or Adapter Plates

An unmachined or poorly machined mounting surface, which is uneven, may cause bending or twisting of the load cell. This may result in instability of the zero point.

6.4.2 Force Shunting

Force shunting means that some of the force is diverted past the load cell. This may be caused by some kind of obstruction to the force through the load cell. The connecting cables, for example, have been incorrectly installed and are preventing movement. Another possible cause is that the roll is not free to move in the direction of measurement, possibly because something is mounted too close to a bearing housing, or because an object has worked loose and become trapped between the bearing housing and adjacent parts.

Force shunting causes the web/strip tension indication to be lower than the actual web/strip tension.

6.4.3 Fastening of Load cell and Adapter Plates

Screw joints that have not been properly tightened or have lost their pre-tightening force, cause sliding at the mating surfaces. Fastening of the load cell is especially critical. If a load cell is not properly secured, the zero point will be unstable. Sliding between other surfaces may cause the same symptoms.

6.4.4 Rolls and Bearings

An incorrectly designed bearing arrangement may give rise to high axial forces. The roll should be fixed at one end and free at the other.
If both ends are fixed, there will be a high axial (thrust) force due to expansion of the shaft with rising temperature.
Even a correctly designed bearing arrangement may deteriorate with time; bearings become worn, and so on. This may give similar symptoms, such as slow zero point drift between cold and hot machine, or sudden jumps in the signal.

6.4.5 Driven Roll

A source of error that is seldom suspected is the roll itself. The effect is especially critical when measuring forces on the load cell are relatively low. Long drive shafts with their associated universal joints may cause unstable signals if they are not properly maintained. It is important to lubricate universal joints. Longitudinal expansion of the drive shaft should also be taken into account. Since such expansion is often taken up by splines, these must also be lubricated. The symptoms are instability of the signal, for instance jumps in the signal during slow running.

6.5 Fault Tracing of Load Cells, Junction Boxes and wiring

The load cell is very robust and can withstand high overloads. The data of a Pressductor load cell does not change slowly, but in steps, usually in connection with an event in the mill. Excessive overloading usually results in permanent shifting of the zero point.

Poor contact in the junction box causes intermittent faults. Both sensitivity and zero point may vary. Check all screw terminals. Do not use pins crimped to the connecting wires, as these often work loose after a time.

The cabling, especially the cable to the load cell, is the part that is most exposed to damage.

Since the resistance of the load cell windings is low, it is easy to check the load cells and cabling from the control unit.

Typical readings are 1 Ω for the resistance of the primary winding and 1-3 Ω for the output impedance of the secondary winding.

Insulation faults in the cabling or the load cell may cause incorrect sensitivity or unstable zero point. When the load cell circuits have been isolated from earth and from the control unit at the disconnectable terminals, it is easy to measure the insulation from the control unit.
If the cables are not routed correctly, they may pick up interference from other cables.

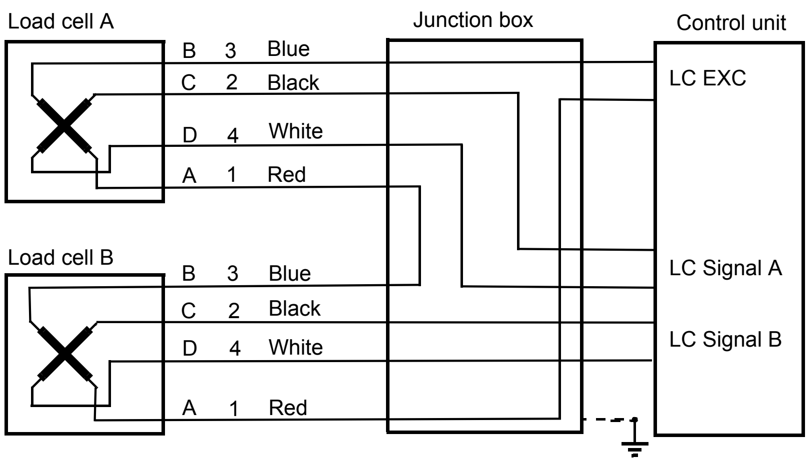


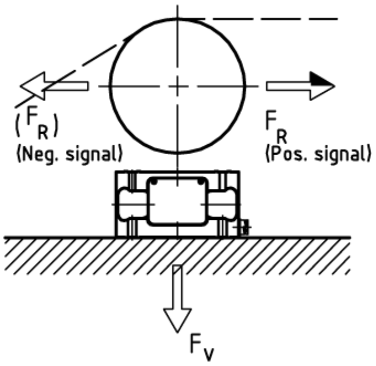
Figure 16. Typical load cell cabling

For circuit diagram applications, see the manual for the applicable control unit:
Millmate Strip Tension Systems with Millmate Controller 400, 3BSE023139Rxxxx
Web Tension Systems with Tension Electronics PFEA 111/112, 3BSE029380Rxxxx
Web Tension Systems with Tension Electronics PFEA 113, 3BSE029382Rxxxx

A Drawings

A.1 Load Cell PFTL 101A (0,5- 2,0 kN), Dimension Drawing

REV	DESCRIPTION	DATE	DEPT./INIT.
-	New document	93-07-07	SEAUT/AGK/RoK
A	Tolerance and text add.	94-10-18	SEISY/AGK/ÅP
B	Connector moved. Text (Neg. signal) and (Pos. signal) added.	2002-01-08	ATCF/FM/GB/LEN

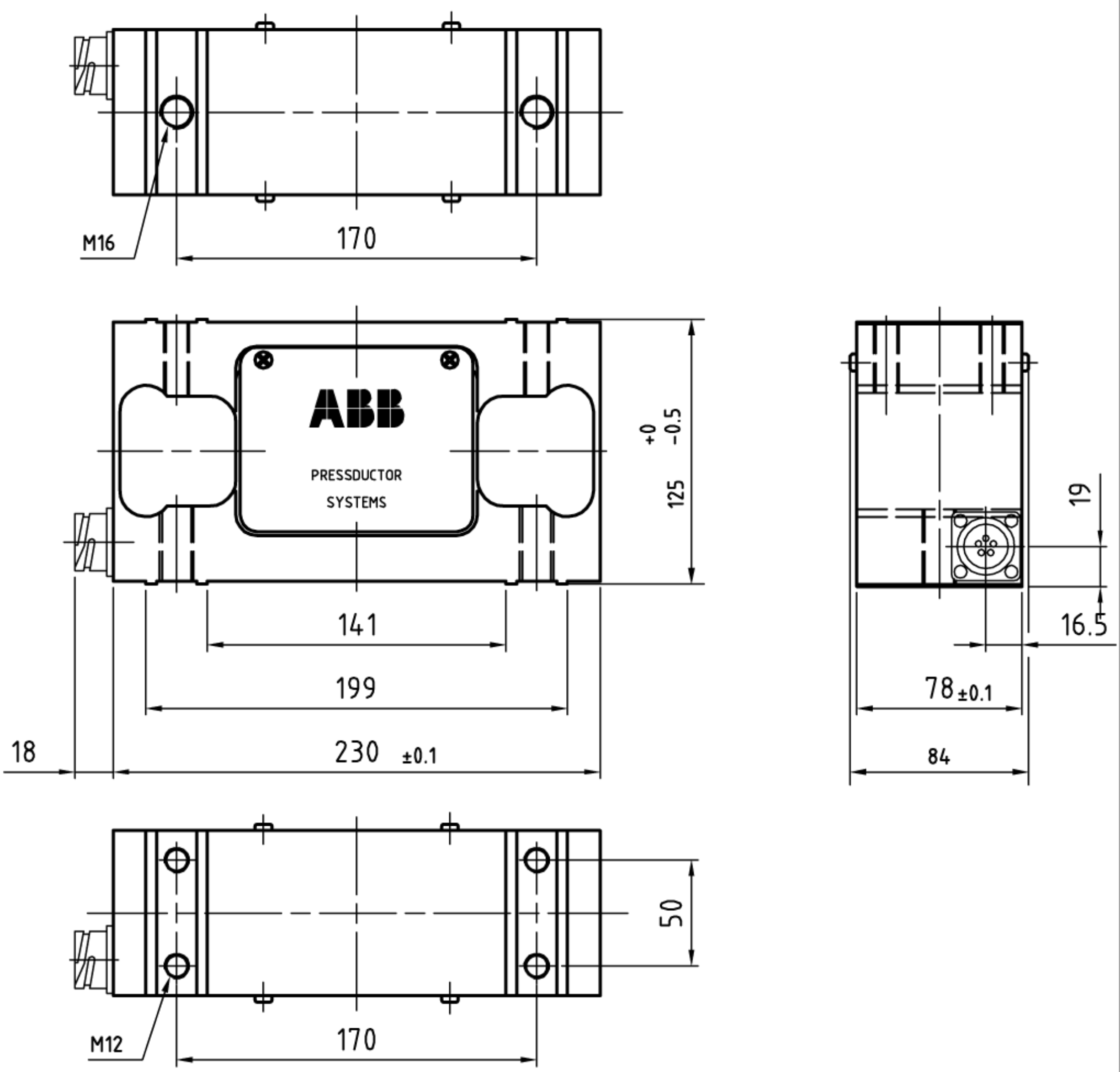


F_R = Measured component

F_V = Force component (not measured)

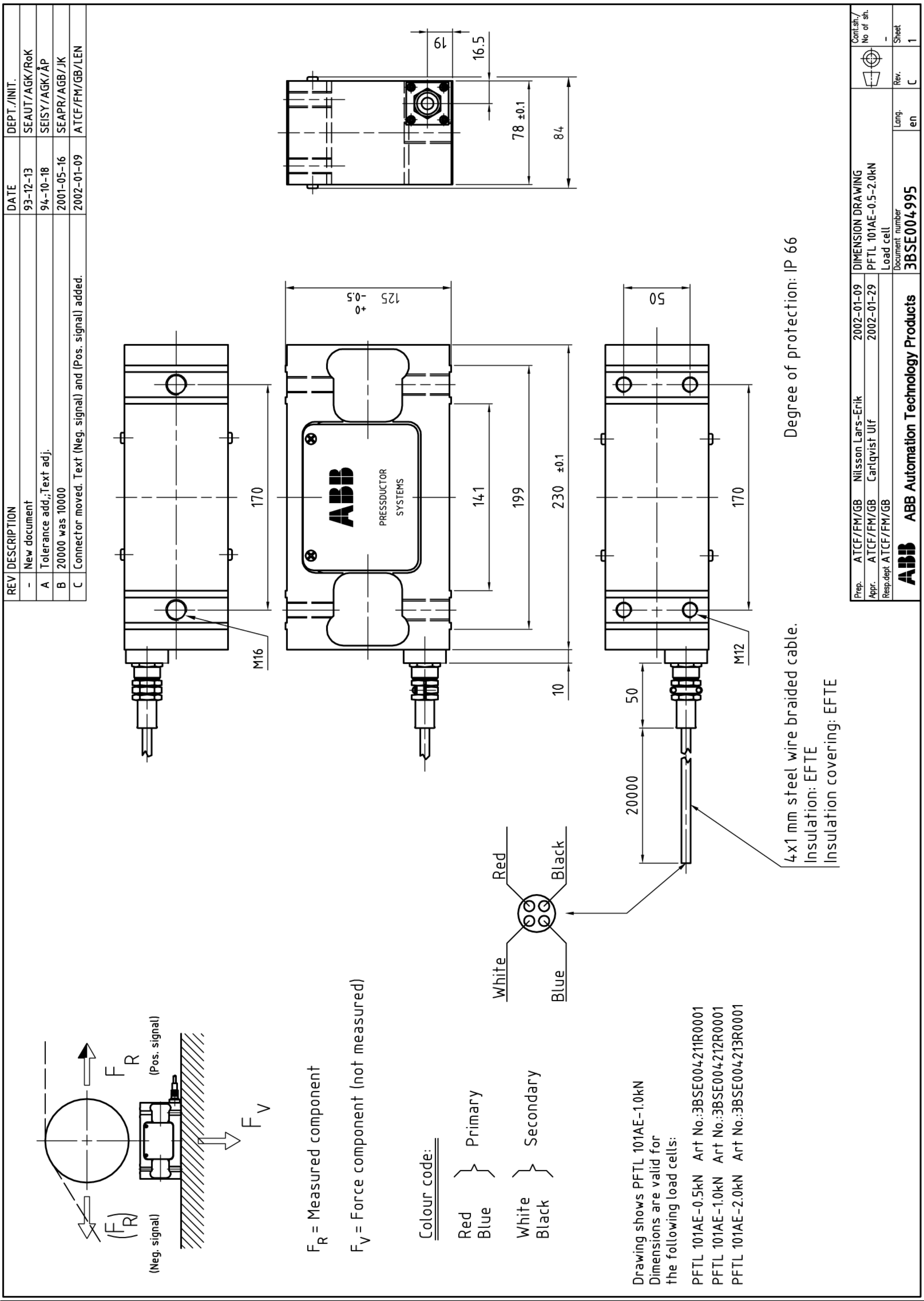
Drawing shows PFTL 101A-1.0kN
Dimensions are valid for the following load cells:

PFTL 101A-0.5kN Art No.:3BSE004160R0001
PFTL 101A-1.0kN Art No.:3BSE004166R0001
PFTL 101A-2.0kN Art No.:3BSE004172R0001

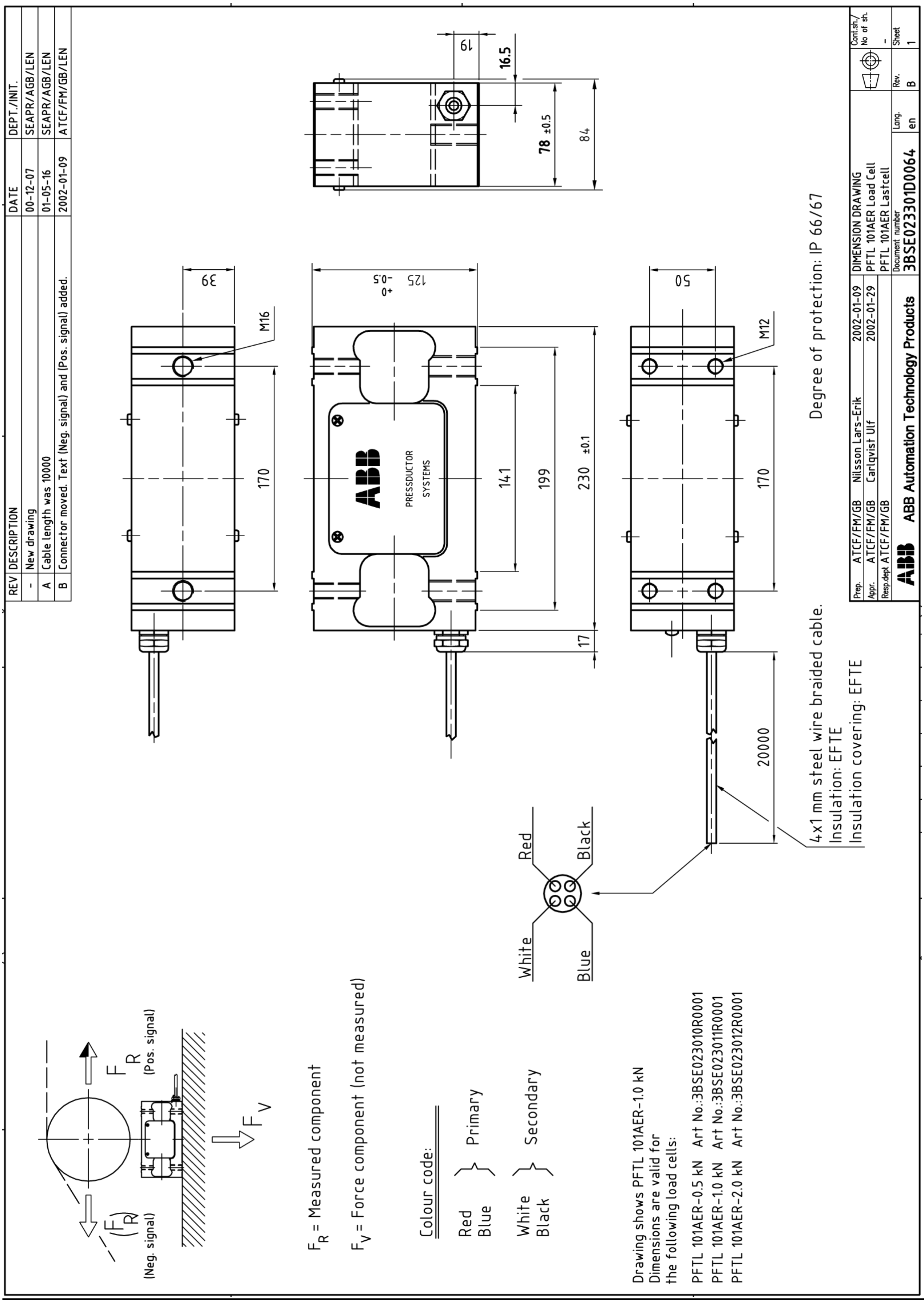


Prep.	ATCF/FM/GB	Nilsson Lars-Erik	2002-01-08	DIMENSION DRAWING		Cont.sh./ No of sh.
Appr.	ATCF/FM/GB	Carlqvist Ulf	2002-01-29	PFTL 101A-0.5-2.0kN		-
Resp.dept	ATCF/FM/GB			Load cell		
ABB	ABB Automation Technology Products			Document number 3BSE004171	Lang. en	Rev. B / Sheet 1

A.2 Load Cell PFTL 101AE (0,5- 2,0 kN), Dimension Drawing

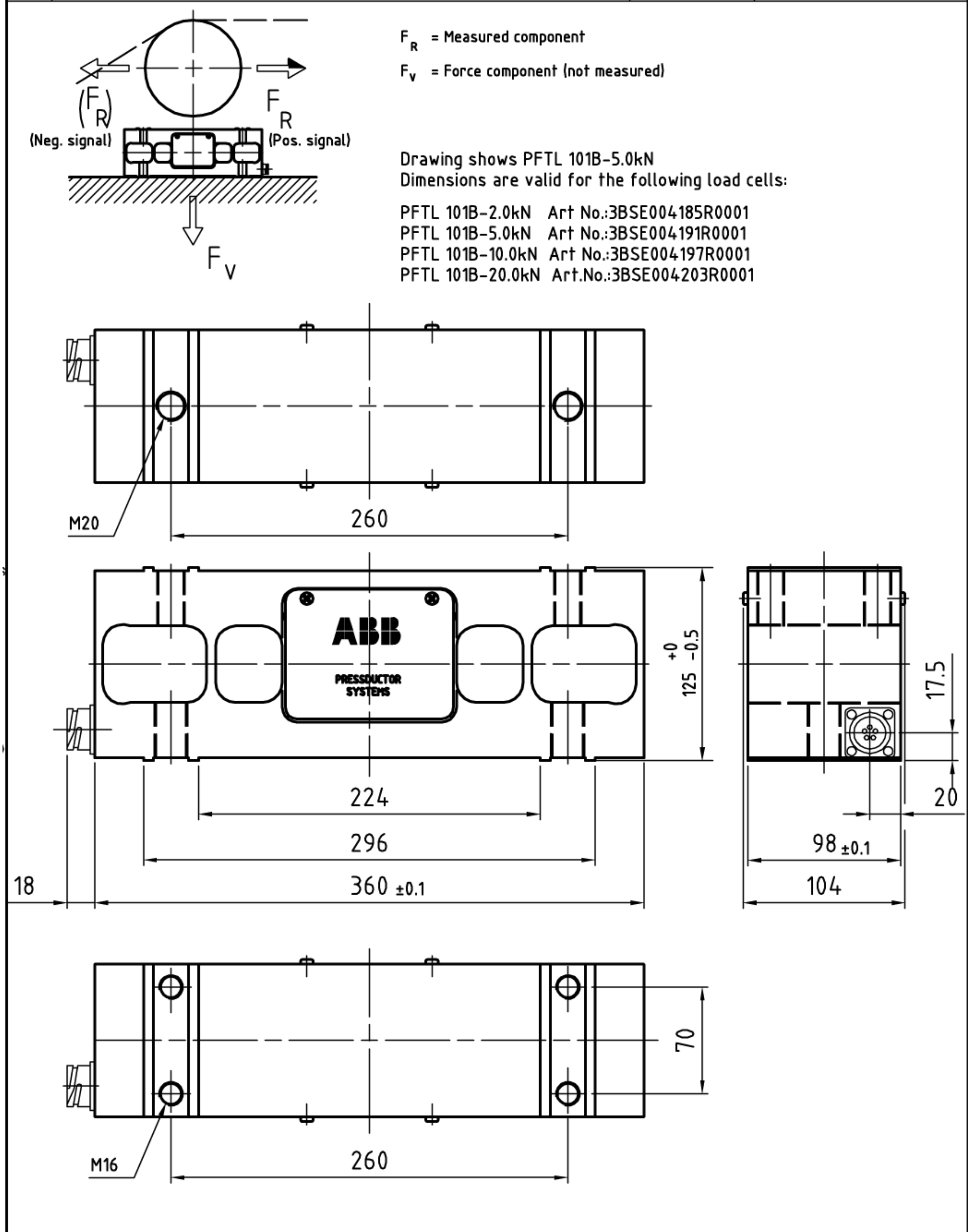


A.3 Load Cell PFTL 101AER (0,5- 2,0 kN), Dimension Drawing



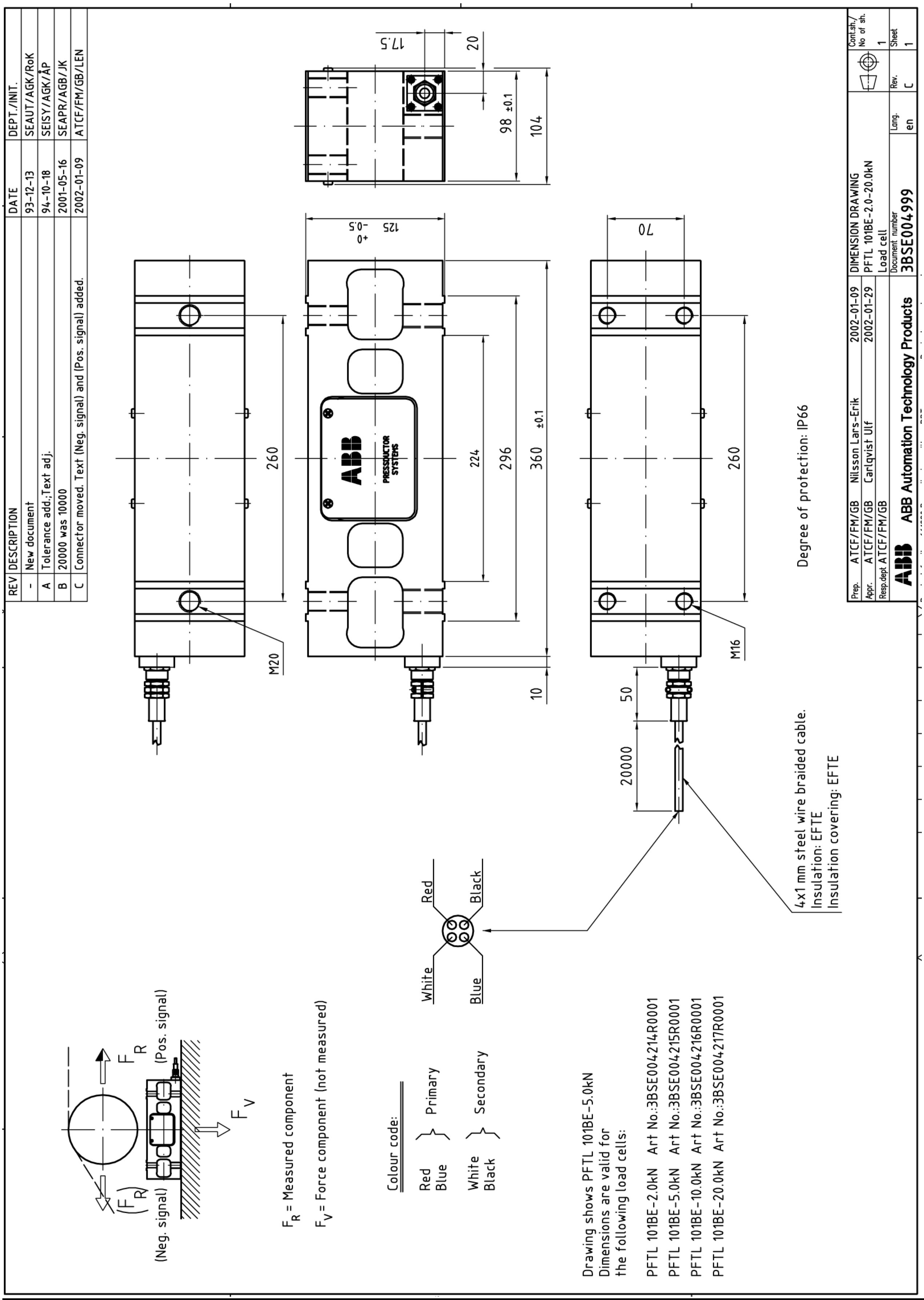
A.4 Load Cell PFTL 101B (2,0- 20 kN), Dimension Drawing

REV	DESCRIPTION	DATE	DEPT./INIT.
-	New document	93-07-11	SEAUT/AGK/RoK
A	Tolerance and text add.	94-10-18	SEISY/AGK/ÅP
B	Art.No. 3BSE004197R0001 var 3BSE004177R0001	95-08-04	SEISY/AGK/ÅP
C	Connector moved. Text (Neg. signal) and (Pos. signal) added.	2002-01-08	ATCF/FM/GB/LEN

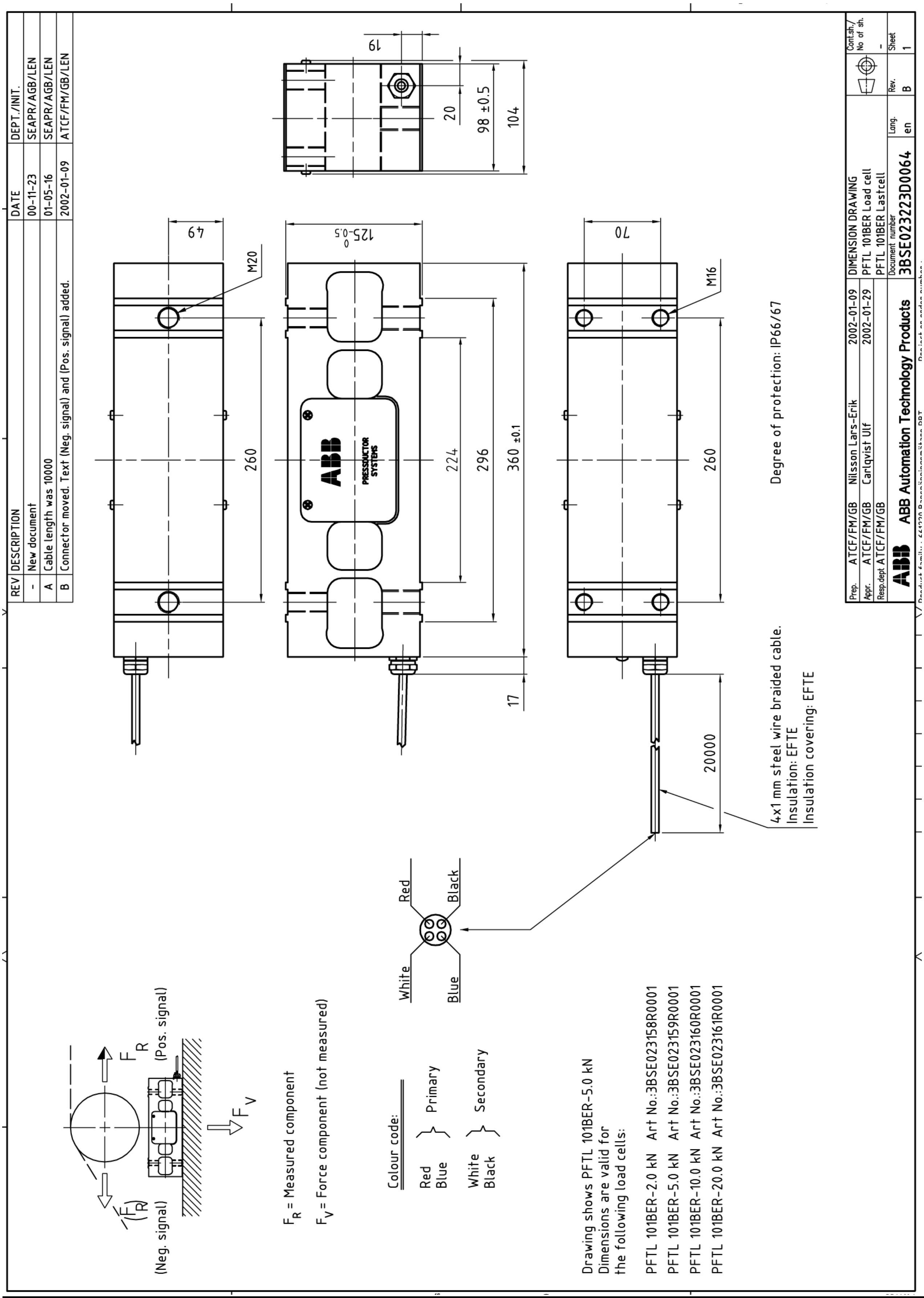


Prep.	ATCF/FM/GB	Nilsson Lars-Erik	2002-01-09	DIMENSION DRAWING			Cont.sh./ No of sh.
Appr.	ATCF/FM/GB	Carlqvist Ulf	2002-01-29	PFTL 101B-2.0-20.0kN			
Resp.dept	ATCF/FM/GB			Load cell			-
ABB	ABB Automation Technology Products			Document number: 3BSE004196	Lang.: en	Rev.: C	Sheet: 1

A.5 Load Cell PFTL 101BE (2,0- 20 kN), Dimension Drawing



A.6 Load Cell PFTL 101BER (2,0- 20 kN), Dimension Drawing

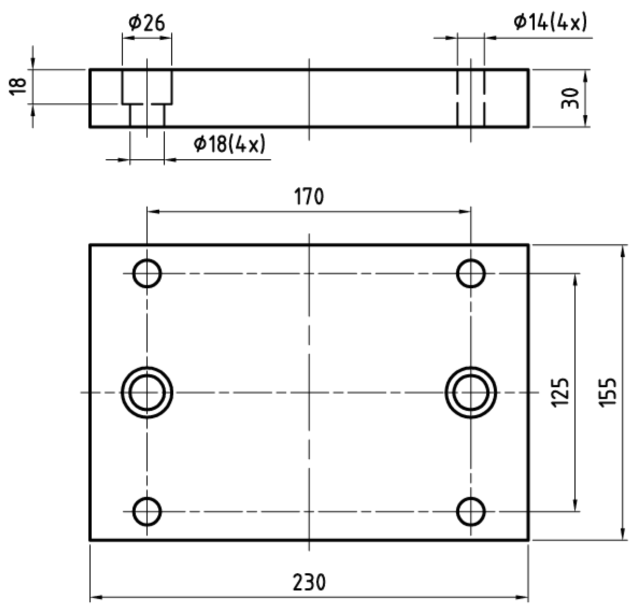


A.7 Adapter Plate Lower PFTL 101A/AE/AER, Dimension drawing

REV	DESCRIPTION	DATE	DEPT./INIT.
-	New drawing	97-02-28	SEISY/AGK/ÅP
A	Yield strenght was 250 N/mm²	97-06-11	SEISY/AGK/ÅP
B	Title block updated	00-10-10	SEAPR/AGB/JK
C	PFTL 101AER added to Material table	01-02-21	SEAPR/AGB/LEN
D	Redrawn , Material table moved to 3BSE030638D3101	2009-04-23	PA/FM/GF/JK
E	Table Technical materials added.	2012-12-07	PA/FM/GF/ML
E	Doc. title Lower adpt. plate for PFTL101A/AE was	2012-12-07	PA/FM/GF/ML
E	Lower adapter plate for PFTL 101 A.	2012-12-07	PA/FM/GF/ML
F	Technical materials table adjusted. Doc. title adjusted.	2013-06-10	PAMP/FMGF/ML

Technical materials

Loadcell	Material description	Material specification	Material designation
PFTL101A/AE	Steel, through hardened	Hardness 300-400HB, Yield stress>500MPa(N/mm²), CTE 11- 13 µm/m/°C. Remanent magnetism of the finished detail must be less than 2 Gauss(0-0,2mT)	34CrNiMo6+QT900, Toolox 33, Toolox 44, W.nr. 1.6582 +QT900, ASTM 4340 or equivalent
	Martensitic Stainless Steel	Hardness 300-400HB, Yield stress>400MPa(N/mm²), CTE 10 - 13 µm/m/°C. Remanent magnetism of the finished detail must be less than 2 Gauss(0-0,2mT)	X12CrMoS13+AT, X20Cr13 +AT, W.nr.1.4005 +AT, W.nr 1.4021 +AT, ASTM 416, 420 or equivalent
PFTL101AER	Austenitic Stainless Steel.	Hardness 150-350HB, Yield stress>220MPa(N/mm²), CTE 16- 18 µm/m/°C. Remanent magnetism of the finished detail must be less than 2 Gauss(0-0,2mT)	X2CrNiMo17-12-2 +AT X5CrNi18-10+AT, W.nr.1.4301+AT, W.nr.1.4404 +AT ASTM 313, 314 or equivalent.



Manufacturing drawing : 3BSE030638D3101

Mass(weight) : App 8 kg

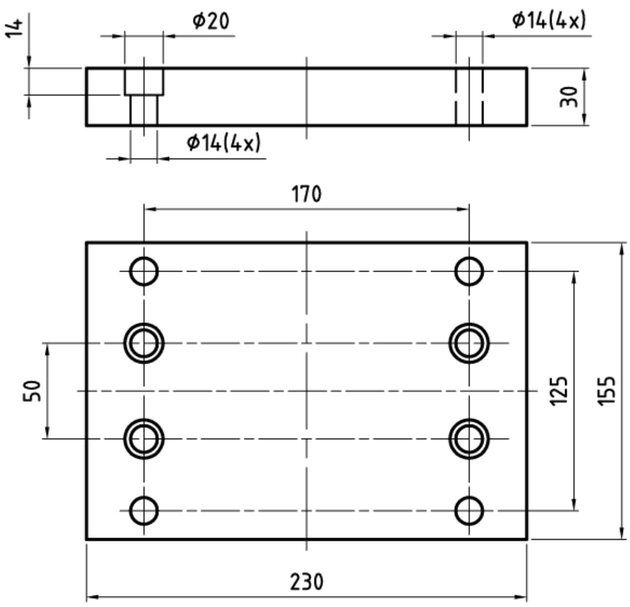
Prep. PA/FMGF	Magnus X Lindström	2013-06-10	Dimension drawing			Cont.sh./ No of sh.
Appr. PA/FMGF	Håkan F Wintzell	2013-06-14	Lower adpt. plate PFTL101A/AE/AER			
Resp.dept PA/FMGF			Und. adpt. platta PFTL101A/AE/AER			-
ABB	ABB AB		Document number 3BSE012173	Lang. en	Rev. F	Sheet 1

A.8 Adapter Plate Upper PFTL 101A/AE/AER, Dimension drawing

REV	DESCRIPTION	DATE	DEPT./INIT.
-	New drawing	97-02-28	SEISY/AGK/ÅP
A	Yield strength was 250 N/mm	97-06-11	SEISY/AGK/ÅP
B	Title block updated	00-10-10	SEAPR/AGB/JK
C	PFTL 101AER added to Material table	01-02-21	SEAPR/AGB/LEN
D	Redrawn , Material table moved to 3BSE030638D3100	2009-04-22	PA/FM/GF/JK
E	Table Technical materials added.	2012-12-07	PA/FM/GF/ML
E	Doc. title Top adpt. plate for PFTL101A/AE was	2012-12-07	PA/FM/GF/ML
E	Top adapter plate for PFTL 101 A.	2012-12-07	PA/FM/GF/ML
F	Technical materials table adjusted. Doc. title adjusted.	2013-06-10	PAMP/FMGF/ML

Technical materials

Loadcell	Material description	Material specification	Material designation
PFTL101A/AE	Steel, through hardened	Hardness 300-400HB, Yield stress>500MPa(N/mm²), CTE 11- 13 μm/m/°C. Remanent magnetism of the finished detail must be less than 2 Gauss(0-0,2mT)	34CrNiMo6+QT900, Toolox 33, Toolox 44, W.nr. 1.6582 +QT900, ASTM 4340 or equivalent
PFTL101A/AE	Martensitic Stainless Steel	Hardness 300-400HB, Yield stress>400MPa(N/mm²), CTE 10 - 13 μm/m/°C. Remanent magnetism of the finished detail must be less than 2 Gauss(0-0,2mT)	X12CrMoS13+AT, X20Cr13 +AT, W.nr.1.4005 +AT, W.nr 1.4021 +AT, ASTM 416, 420 or equivalent
PFTL101AER	Austenitic Stainless Steel.	Hardness 150-350HB, Yield stress>220MPa(N/mm²), CTE 16- 18 μm/m/°C. Remanent magnetism of the finished detail must be less than 2 Gauss(0-0,2mT)	X2CrNiMo17-12-2 +AT X5CrNi18-10+AT, W.nr.1.4301+AT, W.nr.1.4404 +AT ASTM 313, 314 or equivalent.



Manufacturing drawing: 3BSE030638D3100

Mass(weight) : App 8 kg

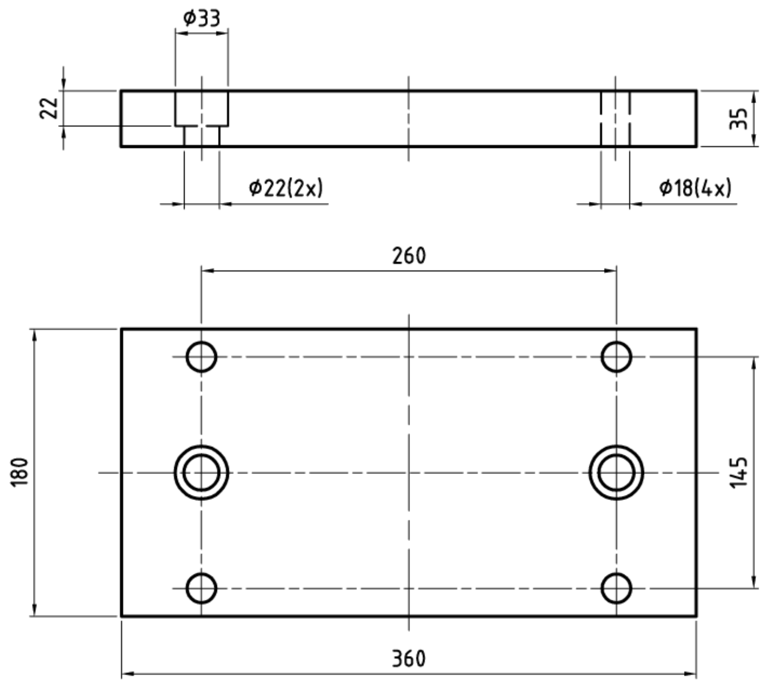
Prep. PA/FMGF	Magnus X Lindström	2013-06-13	Dimension drawing				Cont.sh./ No of sh.
Appr. PA/FMGF	Håkan F Wintzell	2013-06-14	Top adpt. plate PFTL101A/AE/AER				
Resp.dept PA/FMGF			Övr. adpt. platta PFTL101A/AE/AER				-
ABB	ABB AB		Document number 3BSE012172	Lang. en	Rev. F		Sheet 1

A.9 Adapter Plate Lower PFTL 101B/BE/BER, Dimension drawing

REV	DESCRIPTION	DATE	DEPT./INIT.
-	New drawing	97-02-28	SEISY/AGK/ÅP
A	Yield strength was 250N/mm²	97-06-11	SEISY/AGK/ÅP
B	Title block updated	00-10-10	SEAPR/AGB/JK
C	PFTL 101BER added to Material table	01-02-21	SEAPR/AGB/LEN
D	Changed to all english version . Redrawn	2009-04-22	PA/FM/GF/JK
E	Table Technical materials added.	2012-12-07	PA/FM/GF/ML
E	Doc. title Lower adpt. plate for PFTL101B/BE was	2012-12-07	PA/FM/GF/ML
E	Lower adapter plate for PFTL 101 B.	2012-12-07	PA/FM/GF/ML
F	Technical materials table adjusted. Doc title adjusted.	2013-06-10	PAMP/FMGF/ML

Technical materials

Loadcell	Material description	Material specification	Material designation
PFTL101B/BE	Steel, through hardened	Hardness 300-400HB, Yield stress>500MPa(N/mm²), CTE 11- 13 µm/m/°C. Remanent magnetism of the finished detail must be less than 2 Gauss(0-0,2mT)	34CrNiMo6+QT900, Toolox 33, Toolox 44, W.nr. 1.6582 +QT900, ASTM 4340 or equivalent
	Martensitic Stainless Steel	Hardness 300-400HB, Yield stress>400MPa(N/mm²), CTE 10 - 13 µm/m/°C. Remanent magnetism of the finished detail must be less than 2 Gauss(0-0,2mT)	X12CrMoS13+AT, X20Cr13 +AT, W.nr.1.4005 +AT, W.nr 1.4021 +AT, ASTM 416, 420 or equivalent
PFTL101BER	Austenitic Stainless Steel.	Hardness 150-350HB, Yield stress>220MPa(N/mm²), CTE 16- 18 µm/m/°C. Remanent magnetism of the finished detail must be less than 2 Gauss(0-0,2mT)	X2CrNiMo17-12-2 +AT X5CrNi18-10+AT, W.nr.1.4301+AT, W.nr.1.4404 +AT ASTM 313, 314 or equivalent.



Manufacturing drawing : 3BSE030638D3201

Weight: 18 kg

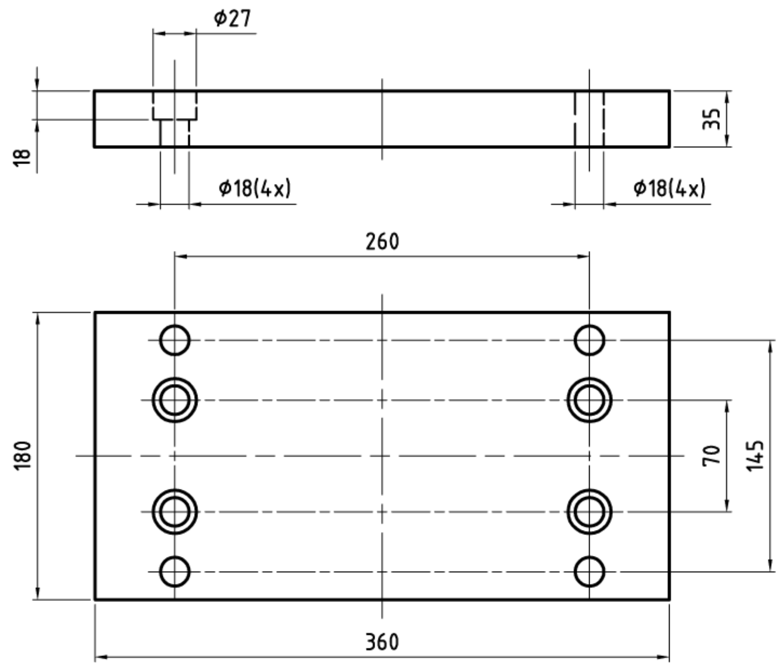
Prep. PA/FMGF	Magnus X Lindström	2013-06-10	Dimension drawing				Cont.sh./ No of sh.
Appr. PA/FMGF	Håkan F Wintzell	2013-06-14	Low. adpt. plate PFTL101B/BE/BER				-
Resp.dept PA/FMGF			Und. adpt. platta PFTL101B/BE/BER				
ABB	ABB AB		Document number 3BSE012171	Lang. en	Rev. F		Sheet 1

A.10 Adapter Plate Upper PFTL 101B/BE/BER, Dimension drawing

REV	DESCRIPTION	DATE	DEPT./INIT.
-	New drawing	97-02-28	SEISY/AGK/ÅP
A	Yield strength was 250 N/mm²	97-06-11	SEISY/AGK/ÅP
B	Title block updated	00-10-10	SEAPR/AGB/JK
C	PFTL 101BER added to Material table	01-02-21	SEAPR/AGB/LEN
D	Changed to all english version ; redrawn.	2009-04-23	PA/FM/GF/JK
E	Table Technical materials added.	2012-12-07	PA/FM/GF/ML
E	Doc. title Top adpt. plate for PFTL101B/BE was	2012-12-07	PA/FM/GF/ML
E	Top adapter plate for PFTL 101 B.	2012-12-07	PA/FM/GF/ML
F	Technical materials table adjusted. Doc. title adjusted.	2013-06-10	PAMP/FMGF/ML

Technical materials

Loadcell	Material description	Material specification	Material designation
PFTL101B/BE	Steel, through hardened	Hardness 300-400HB, Yield stress>500MPa(N/mm²), CTE 11- 13 µm/m/°C. Remanent magnetism of the finished detail must be less than 2 Gauss(0-0,2mT)	34CrNiMo6+QT900, Toolox 33, Toolox 44, W.nr. 1.6582 +QT900, ASTM 4340 or equivalent
	Martensitic Stainless Steel	Hardness 300-400HB, Yield stress>400MPa(N/mm²), CTE 10 - 13 µm/m/°C. Remanent magnetism of the finished detail must be less than 2 Gauss(0-0,2mT)	X12CrMoS13+AT, X20Cr13 +AT, W.nr.1.4005 +AT, W.nr 1.4021 +AT, ASTM 416, 420 or equivalent
PFTL101BER	Austenitic Stainless Steel.	Hardness 150-350HB, Yield stress>220MPa(N/mm²), CTE 16- 18 µm/m/°C. Remanent magnetism of the finished detail must be less than 2 Gauss(0-0,2mT)	X2CrNiMo17-12-2 +AT X5CrNi18-10+AT, W.nr.1.4301+AT, W.nr.1.4404 +AT ASTM 313, 314 or equivalent.



Manufacturing drawing : 3BSE030638D3200

Weight: App.17.5 kg

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Appr. PA/FMGF	Håkan F Wintzell	2013-06-14	Top adpt. plate PFTL101B/BE/BER			
Resp.dept PA/FMGF			Övre adpt platta PFTL101B/BE/BER			-
ABB	ABB AB		Document number 3BSE012170	Lang. en	Rev. F	Sheet 1

Alphabetical index

ABB AB
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Elektronikgatan 35, Bnr 358
SE-721 36 Västerås Sweden
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Internet: www.abb.com/webtension

3BSE009965R401 en Rev G