

MONITORING SYSTEMS FOR HYDRAULIC ACCUMULATORS – Bladder Integrity System - BIS –

GENERAL

A bladder accumulator consists of a fluid section and a gas section with the bladder acting as the gas-proof separation element. It is the component that requires the greatest robustness between gas and fluid.

Bladder deformation, influences in temperature and attacks on the elastomer material by aggressive media can all destroy the bladder.

HYDAC has developed the **Bladder Integrity System**, or **BIS** for short, to meet this challenge. It consists of:

- BIS bladder
- BIS adapter
- BIS 1000 electronics system



The identification in the model code is carried out with a "D...":

SB330 **DA** 50...

...

- DA** = BIS-basic, industry model
- DB** = BIS-ATEXia, intrinsically safe, without encapsulation
- DC** = BIS-ATEXd, pressure-capsulated
- DD** = BIS-ATEXd+, pressure-capsulated, junction box of aluminium
- DE** = BIS-ATEXd+, pressure-capsulated, junction box of stainless steel

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18/12/2018

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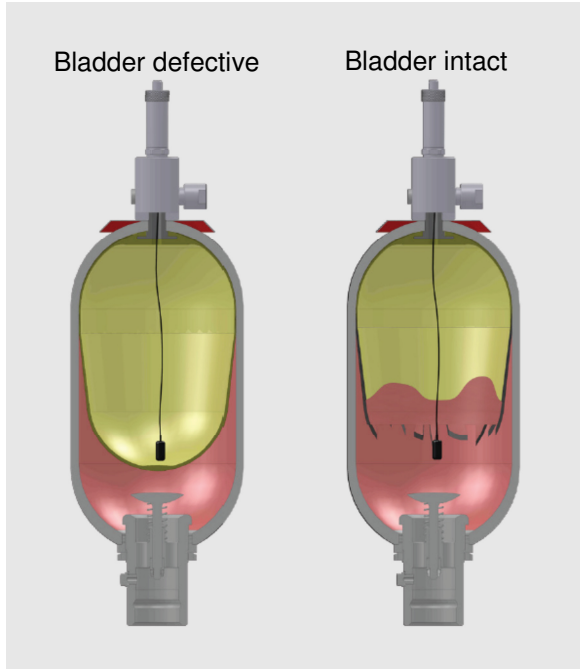
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HYDAC ACCUMULATORS

DESCRIPTION

The BIS detects when fluid has entered the bladder and triggers a signal. This makes it possible to detect bladder breakage. In addition, temperature and pressure can be recorded via electronics (current loop/HART).

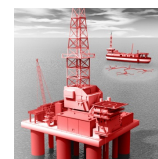
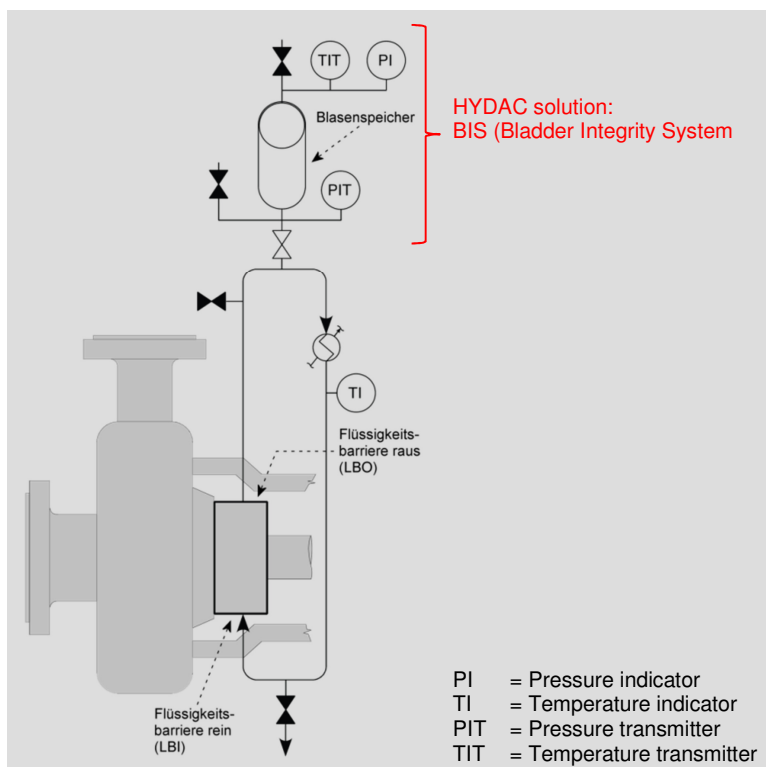


ADVANTAGES

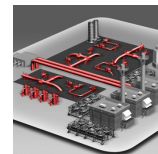
- Early detection of a defective bladder minimizes the downtimes
- Enhancement of process reliability through continuous p_0 monitoring at the accumulator → no system downtime due to maintenance
- The replacement of the accumulator bladder can be planned → optimized spare parts storage and personnel utilization
- Optimisation of the monitoring of the entire system through signal processing and error analysis → Exclusion of a defective bladder, e.g.: Mechanical seal systems in refineries
- Fulfilment of national/industry-specific requirements (e.g. API 682 Rev.4, DGRL, ASME, ...)

EXAMPLE OF APPLICATION

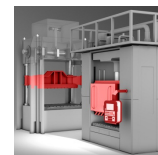
The American standard API 682 (Shaft sealing systems for centrifugal and rotary pumps) describes in Plan 53B of the fourth edition of 1 May 2014 the structure used for checking the intactness of the bladder.



Oil & Gas



Loading stations /
Refineries



Accumulator
stations



Chemical
industry,
and much more

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VARIANTS

The BIS is available together with the bladder accumulator as initial equipment, see also the section "ORDERING EXAMPLE AND FURTHER OPTIONS".

A retrofit version is also available.

Designation	BIS-basic		BIS-ATEXia		BIS-ATEXd	
Type code (bladder accumulator model code)	DA		DB		DC, DD, DE	
Figure						
Connection	M12x1		M12x1		Conduit / connection box (optional)	
Ex-protection approval	-		ATEX (94/9/EC) IECEX		ATEX (94/9/EC) IECEX cCSAus	
EX type of protection	-		Intrinsically safe (ia)		Flameproof enclosure (d)	
HART protocol	with corresponding software, all signals extractable via HART protocol					
Signal	Analogue	Digital*	Analogue	Digital*	Analogue	Digital*
• Pressure	-	HART	-	HART	-	HART
• Temperature (4 ... 20 mA)	✓	HART	✓	HART	✓	HART
• BIS status	✓	HART	✓	HART	✓	HART
• Serial number	-	HART	-	HART	-	HART
Protection class	IP 67					
Supply voltage	12 ... 30 V DC		12 ... 30 V DC		12 ... 30 V DC	
Measurement accuracy Temperature and pressure	± 1 %					
Permitted fluid viscosity	max. 320 cSt.					
Pressure	100, 250, 400, 600 bar (1500, 3000, 6000, 10000 psi)					
Hydraulic accumulator volume range	10 ... 450 litres, others on request					
Gas-side connection, accumulator	7/8-14 UNF or 1/4-BSP others on request					
Permitted fluid temperature	-40 ... +85 °C					

* can be evaluated only with on-site HART interface

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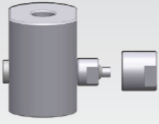
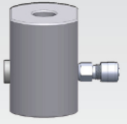
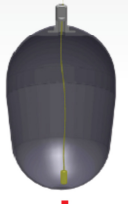

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HYDAC ACCUMULATORS

PRODUCT INFORMATION

ORDERING EXAMPLE AND FURTHER OPTIONS

Initial equipment	Re-trofit	Spare parts	Types*				
BIS - Bladder Integrity System	BIS - Bladder Integrity System	Electronic component BIS1000	 BIS-basic = <u>DA</u>	 BIS-ATEXia = <u>DB</u>	 BIS-ATEXd = <u>DC</u>	 BIS-ATEXd+ = <u>DD</u> with junction box in aluminium	 BIS-ATEXd+ = <u>DE</u> with junction box in stainless steel
		BIS-Adapter	 7/8-14 UNF		 1/4-BSP		
		BIS-Bladder with integrated sensor	 Gas valve material: Stainless steel Bladder material: NBR, ECO, IIR, FPM				
Bladder accumulator +	-	-					

Order example: SB330-50A1/112U-330A
+ BIS-basic¹⁾
SB330DA-50A1/112U-330A

Part numbers and prices on request.

* others on request
1) for other variants, see section "Variants"

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TECHNICAL DATA BIS 1000

General

Input data for temperature	
Measurement principle	PT 10000
Measurement range	-40 ... +100 °C (-40 ... +212 °F)
Pressure resistance	2000 bar (29000 psi)
Mechanical connection	G1/2 A DIN 3852, outside
Tightening torque	45 Nm
Parts in contact with fluid	Mechanical connection: stainless steel 1.4435; 1.4404; 1.4405; 1.4548 Seal: FPM, EPDM, DELO™ 2K-Epoxy

Output data temperature signal	
Output signal	4...20 mA or HART protocol
Permitted resistance	$R_{LMax} = (U_B - 12 \text{ V}) / 20 \text{ mA} \text{ [k}\Omega\text{]}$
HART Communication	according to Standard HART Specification Additional zero point / range setting available (reranging) recommended ohmic resistance: min. 250 Ω
Accuracy to DIN 16086, limit setting	Typ. $\leq \pm 1.5 \%$ FS max $\leq \pm 3.0 \%$ FS
Rise time to DIN EN 60751	t_{50} : ~ 15 s t_{90} : ~ 20 s

Input data pressure (optional)				
Measuring ranges ¹⁾	100 bar (1500 psi)	250 bar (3000 psi)	400 bar (6000 psi)	600 bar (10000 psi)
Overload pressures ²⁾	200 bar (3000 psi)	500 bar (7250 psi)	800 bar (11600 psi)	1000 bar (14500 psi)
Burst pressure ²⁾	500 bar (7000 psi)	1250 bar (15000 psi)	2000 bar (29000 psi)	2000 bar (29000 psi)

Output data pressure (optional)	
Output signal	4...20 mA or HART protocol
Permitted resistance	$R_{LMax} = (U_B - 12 \text{ V}) / 20 \text{ mA} \text{ [k}\Omega\text{]}$
HART Communication	according to Standard HART Specification Additional offset / range setting available (reranging) recommended ohmic resistance: min. 250 Ω
Accuracy to DIN 16086, limit setting	Typ. $\leq \pm 0.5 \%$ FS max $\leq \pm 1.0 \%$ FS
Accuracy at minimum setting (B.F.S.L.)	Type $\leq \pm 0.25 \%$ FS max $\leq \pm 0.5 \%$ FS
Temperature compensation offset	Type $\leq \pm 0.015 \%$ / °C [$\leq \pm 0.0085 \%$ FS / °F] max $\leq \pm 0.025 \%$ / °C [$\leq \pm 0.014 \%$ FS / °F]
Temperature compensation span	Type $\leq \pm 0.015 \%$ / °C [$\leq \pm 0.0085 \%$ FS / °F] max $\leq \pm 0.025 \%$ / °C [$\leq \pm 0.014 \%$ FS / °F]
Non-linearity at max. setting to DIN 16086	max $\leq \pm 0.3 \%$ FS
Hysteresis	max $\leq \pm 0.4 \%$ FS
Repeatability	$\leq \pm 0.1 \%$ FS
Long-term drift	Typ. $\leq \pm 0.3 \%$ FS / year

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FS (Full Scale) = relative to complete measuring range B.F.S.L. = Best Fit Straight Line

¹⁾ Other setting ranges on request

²⁾ Overload pressure and burst pressure depends on used sensor cell type

Additional Technical Data BIS-basic (DA)

Output data BIS status	
Switching output	Switch for external supply voltage (galvanically isolated), max 30 V
Permitted resistance	$R_{LMax} = (U_B - 8 \text{ V}) / 30 \text{ mA [k}\Omega\text{]}$
Switching current	max. 30 mA (short circuit)
Ambient conditions	
Compensated temperature range	-25 ... +85 °C (-13 ... +185 °F)
Operating / Ambient temperature range ³⁾	-40 ... +85 °C (-40 ... +185 °F) -25 ... +85 °C (-13 ... +185 °F)
Storage temperature range	-40 ... +100 °C (-40 ... +212 °F)
Vibration resistance to DIN EN 60068-2-6 at 10 ... 500 Hz	≤ 10 g
Shock resistance to DIN EN 60068-2-29	≤ 50 g (6 ms)
Protection class to IEC 60529	IP 67 (M12x1 male connector, for use with a IP 67 female connector)
Other data	
Supply voltage	12 ... 30 V DC 2 conductor 8 ... 30 V DC switching output
Short circuit protection	Reverse polarity protection of the supply voltage, excess voltage, override and short circuit protection
Residual ripple of supply voltage	46 to 125 Hz: < 0.2 Vpp >125 Hz: < 1.2 mV RMS
Life expectancy	> 10 million load cycles (0 ... 100 % FS)
Weight	approx. 300 g

FS (Full Scale) = relative to complete measuring range **B.F.S.L.** = **Best Fit Straight Line**

³⁾ Minus temperature range depending on sealing of pressure port: -20°C with FPM or EPDM seal, -40°C on request

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Additional Technical Data BIS-ATEXia (DB)

Output data BIS status	
Switching output	Switch for external supply voltage (galvanically isolated), max 28 V
Permitted resistance	$R_{LMax} = (U_B - 8 \text{ V}) / 30 \text{ mA [k}\Omega\text{]}$
Switching current	max. 30 mA (short circuit)

Ambient conditions	
Compensated temperature range	-25 ... +85 °C (-13 ... +185 °F)
Operation / ambient temperature range ³⁾	T6, T80, T85 °C, T ₅₀₀ 90 °C Ta = -40 ... +60 °C (-40 ... +140 °F) T5, T90, T ₅₀₀ 100 °C Ta = -40 ... +70 °C (-40 ... +158 °F) T100, T ₅₀₀ 110 °C Ta = -40 ... +80 °C (-40 ... +176 °F) T4 Ta = -40 ... +85 °C (-40 ... +185 °F)
Storage temperature range	-40 ... +100 °C (-40 ... +212 °F)
Certificates	DEKRA 13ATEX0031 X / DEKRA 13ATEX0032 X IECEX DEK 14.0055X
Vibration resistance to DIN EN 60068-2-6 at 10 ... 500 Hz	≤ 10 g
Protection class to IEC 60529	IP 67 (M12x1 male connector, for use with a IP 67 mating connector)

Relevant data for Ex applications	Ex ia, ic	Ex nA, ta, tb, tc
Supply voltage	$U_i = 12 \dots 28 \text{ V}$	12 ... 28 V
Max. input current	$I_i = 100 \text{ mA}$	
Max. input power	$P_i = 0.7 \text{ W}$	Max. power consumption ≤ 1 W
Connection capacitance of the sensor	$C_i \leq 33 \text{ nF}$	
Inductance of the sensor	$L_i = 0 \text{ mH}$	

Other data	
Supply voltage	12 ... 28 V DC 2 conductor 8 ... 28 V DC switching output
Short circuit protection	Reverse polarity protection of the supply voltage, excess voltage, override and short circuit protection
Residual ripple of supply voltage	46 to 125 Hz: < 0.2 Vpp >125 Hz: < 1.2 mV RMS
Life expectancy	> 10 million load cycles (0 ... 100 % FS)
Weight	approx. 300 g

FS (Full Scale) = relative to complete measuring range **B.F.S.L.** = Best Fit Straight Line

³⁾ Minus temperature range depending on sealing of pressure port: -20 °C with FPM or EPDM seal, -40 °C on request

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Additional Technical Data BIS-ATEXd (DC, DD, DE)

Output data BIS status	
Switching output	Switch for external supply voltage (galvanically isolated), max 30 V
Permitted resistance	$R_{LMax} = (U_B - 8 \text{ V}) / 30 \text{ mA [k}\Omega\text{]}$
Switching current	max. 30 mA (short circuit)
Ambient conditions	
Compensated temperature range ⁴⁾	T6: T110 °C ; -25 ... +60 °C (-13 ... +140 °F) T5: T120 °C ; -25 ... +70 °C (-13 ... +158 °F)
Operation / ambient temperature range ^{3) 4)}	T6: T110 °C ; -40 ... +60 °C (-40 ... +140 °F) T5: T120 °C ; -40 ... +70 °C (-40 ... +158 °F)
Storage temperature range	-40 ... +100 °C (-40 ... +212 °F)
Certificates	CSA MC:224264 ATEX KEMA 10ATEX0100x IECEX KEM 10.0053x
Vibration resistance to DIN EN 60068-2-6 at 10 ... 500 Hz	≤ 10 g ≤ 5 g with junction box
Protection class to IEC 60529	IP 69K
Other data	
Supply voltage	12 ... 30 V DC 2 conductor 8 ... 30 V DC switching output
Short-circuit protection	Reverse polarity protection of the supply voltage, excess voltage, override and short circuit protection
Residual ripple of supply voltage	46 to 125 Hz: < 0.2 Vpp >125 Hz: < 1.2 mV RMS
Life expectancy	> 10 million load cycles (0 ... 100 % FS)
Weight	approx. 300 g

FS (Full Scale) = relative to complete measuring range **B.F.S.L.** = **Best Fit Straight Line**

³⁾ Minus temperature range depending on the sealing of pressure port: -20 °C with FPM or EPDM seal, -40 °C on request

⁴⁾ Ta 70 °C; T120 °C only with electrical connection, Section 2.3.1

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Technical details and versions of bladder accumulators can be found in the following brochure sections:

- Hydraulic Bladder Accumulators Low-Pressure
No. 3.202
- Hydraulic Bladder Accumulators Standard
No. 3.201

The respective instruction manual for the bladder accumulators and the following instruction manuals must be observed!

- Instruction manual SB - BIS
No. 3201.01Z
- BIS 1000-HART Standard E/D
No. 669970 for Type DA
- BIS 1000-HART EXia E/D
No. 669921 for Type DB
- BIS 1000-HART EXd E/D
No. 669906 for Type DC, DD, DE

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