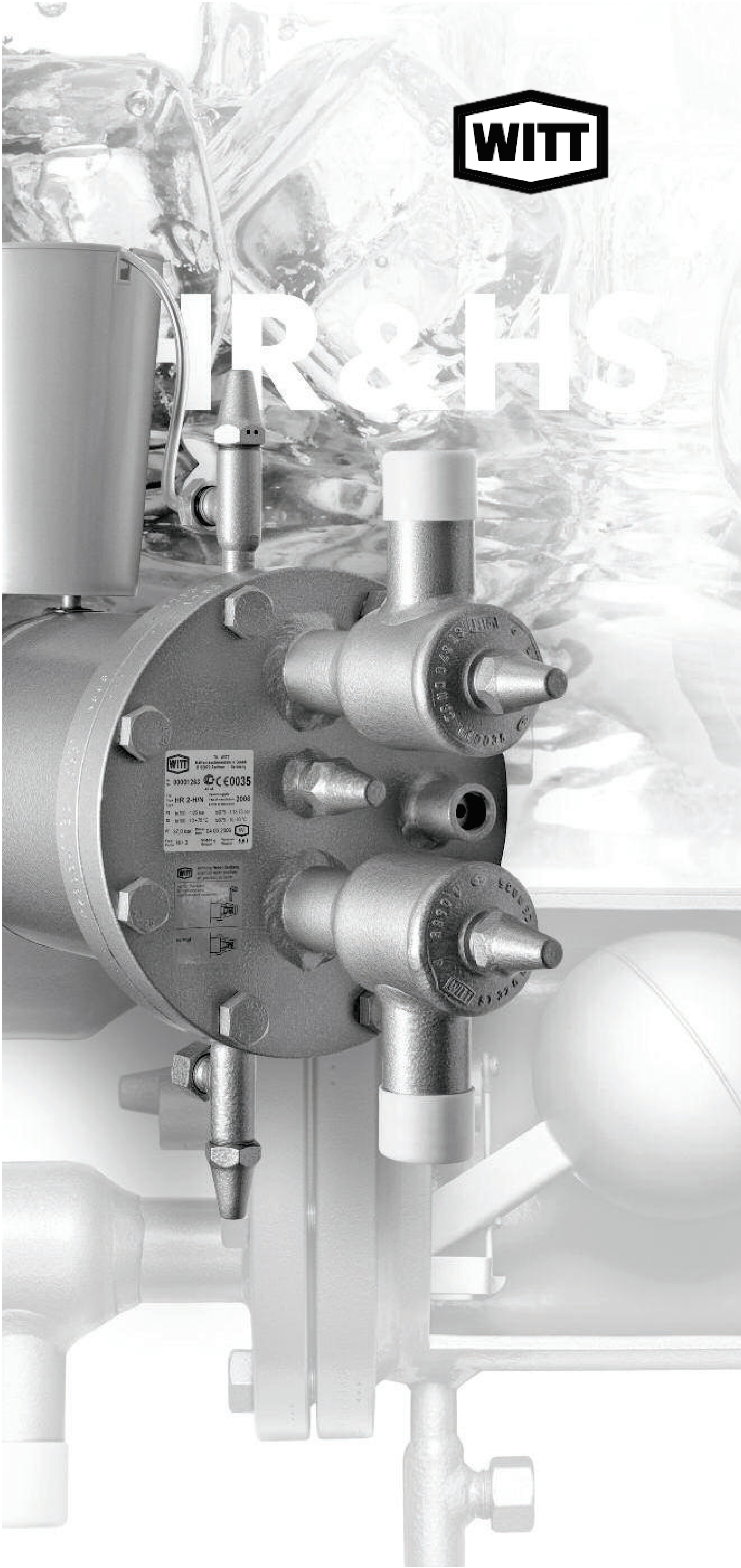
High side float regulator

Installation- and operating instructions

HR & HS



Content

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1. INTRODUCTION

Please read the entire manual careful before selecting, installing, commissioning or servicing the high-pressure float regulators.

1.1 INTENDED USE

The WITT high-pressure float regulator is intended for the use in refrigerant plants to expand liquid refrigerant from the high pressure to the low-pressure side. WITT float regulator selections are executed using the properties of pure refrigerant and we take a safety factor into consideration. This safety factor is normally sufficient to take care of the influence refrigerant oil may have on buoyancy and adhesion to the float.

In practice we have observed that the use of low viscosity oil at low temperatures may lead to functional problems (E.G. the float ball does not lift and refrigerant is backed up). This particularly effects systems where oil of viscosity group **(ISO VG) > 68** is in use, which is common in heat pump applications but is also used for the cold side of the refrigeration system. In such cases the performance of the high side float regulator is not unrestricted and should be checked by TH. WITT before ordering.

1.2 SAFETY REQUIREMENTS

Any of the following specified procedures must be carried out by trained and knowledgeable personnel experienced in installation and service of refrigerant plants. All personnel must be familiar with the National legal require-ments and safety regulations. All safety regula-tions and codes of practice concerning the use of refrigerants must be adhered to, with special attention paid to protection clothing and wear-ing of safety glasses.

Under no circumstances are the stated design temperature- and pressure limitations on the data plate to be exceeded!

When installing inlet and outlet valves please ensure that the valves are fully open during operation.

Important! The contents of this manual must be adhered to. Deviation from the specified conditions will make any claim for liability or warranty void!

All local rules for operation of refrigeration systems and ecological requirements, especially waste treatment of refrigerants and oils must be complied with.

1.3 MANUFACTURER DISCLAIMER

Even when the float regulator is used for the specified intended purpose it cannot be totally excluded some danger for the life of the user may exist in the installation or system. Translations are carried out to the best of our knowledge. We are unable to accept any liability for translation errors. We reserve the right to change descriptions, graphs or other statements, which are required due to technical development of the high-pressure float regulators.

2. TERMS OF WARRENTY

In order to avoid accidents and ensure optimum performance, no modifications or conversions may be carried out to the high-pressure float regulator without the explicit written approval by TH.WITT KÄLTEMASCHINENFABRIK GMBH.

These instructions are based on internationally standardised SI units of measurements.

All data and information on the operation and maintenance of the float regulators are provided based on our extensive experience and to the best of our technical knowledge.

Our liability or warranty is excluded, if:

- The information and instructions in the operating manual are ignored,
- The high-pressure float regulators including accessories are operated incorrectly or are not installed according to the instructions.
- The high-pressure float regulators are used for purpose other than that for which it was designed.
- Safety devices fitted are not used or disconnected
- There have been modifications made to the high pressure float regulator without the manufacturers written approval
- The safety regulations are not adhered to
- The high-pressure float regulators have not been maintained or repaired properly (regarding timing and execution)
- Parts that are used during maintenance or service are not the approved genuine TH. WITT spare parts.

3. TECHNICAL INFORMATION

3.1 DESCRIPTION OF TYPES

There are four sizes of standard float regulators available: HR1 to HR4. Furthermore we offer modular designed regulators HS30 to HS50, WPHR types for heat-pump applications and a HR1BW for condensate draining.

The float regulator housing may be equipped with different types of float balls. There are type N- and R-ball floats available for different refrigerants.

Executions –H, -M, -L have different liquid orifice out-let dimensions respective varying lever transmissions.

HR-regulators are used for ammonia systems up to condensing temperatures of about 35°C and for synthetic refrigerants (e.g. HCFC, HFC, HFO) over the entire temperature range.

HS-regulators offer larger capacities at a reduced size of the housing. Also at low densities (e.g. ammonia at condensing temperatures > 35°C) or CO2 applications up to 40 bar, HS types are the right choice.

WPHR- types were designed for the use with NH3 heat pumps. They are rated for PS 40 or PS 65 and include a pressure-released float.

The type HR1 BW is especially designed for the condensate drainage at hot gas defrosting in systems with long hot gas lines. They are also favourable to work in conjunction with desuperheaters or in combination with an oil separator as an oil return.

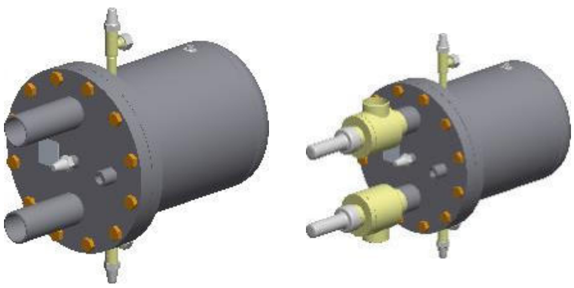


Fig. 1a: **HR 1 – 3**

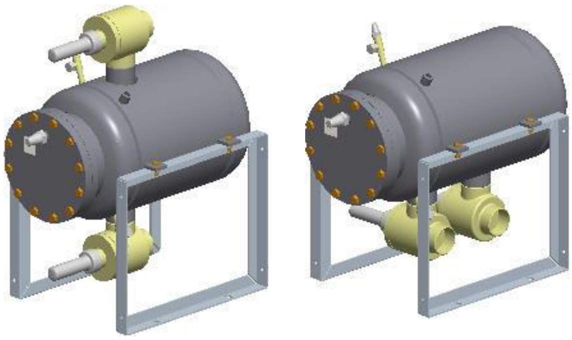


Fig. 1b: **HR 4**

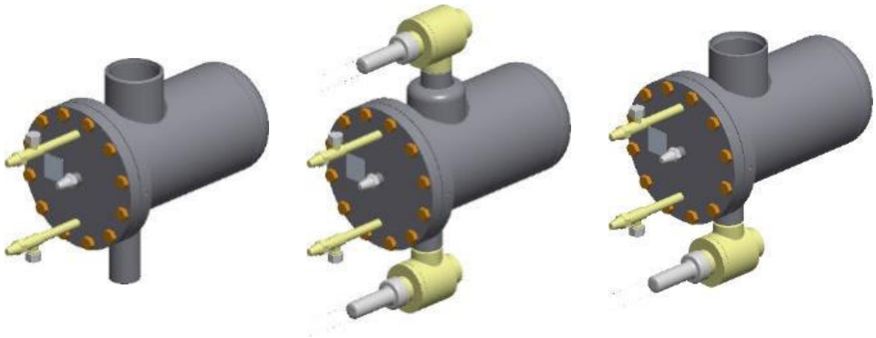


Fig. 1c: **HS30 – HS40**

Fig. 1d: **HS50**

In addition to the regular version with inlet connection piece on the upper side of the housing, we also offer the option of exchanging the inlet connection piece for an inlet flange on the housing head for the HS float regulators of types HS 30 and HS 40.

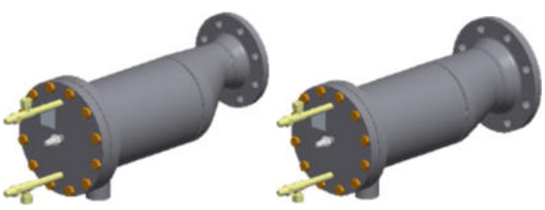


Abb. 1e: **HSF30 F100 / HSF30 F150**

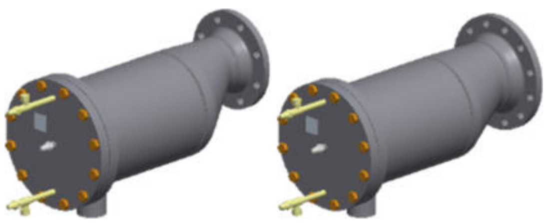


Abb. 1f: **HSF40 F150 / HSF40 F200**

3.2 WEIGHTS

	Weight with nozzles / with valves [kg]
HR 1 BW	13
HR 1	14,6
HR 2	24,4 / 29,6
HR 3	45,2 / 56,0
HR 4	122 / 149
HS 30	46,2 / 55,5
HS 40	108,6 / 125,0
HS 50	114,0 / 114,0
HS 3x F	40,0 (F 100) / 45,5 (F 150)
HS 4x F	89,5 (F 150) / 95 (F 200)
WP 2 HR	24
WP 3 HR-65	61

3.3 SCOPE OF DELIVERY

STANDARD SCOPE OF DELIVERY HR

Stop valves at inlet and outlet respective ASTM connections schedule 40 (please specify)
Top mounted regulating valve for purging (EE3 resp. EE6 for HR4)
Bottom mounted drainage valve EA10GB
Combined G ½” / G ¼” threaded connection for safety valve (larger than HR2)
Integrated low pressure nozzle
Cap for hand lever control
mounting frame, only for HR4

OPTIONAL SCOPE OF DELIVERY HR

Support brackets or mounting frame (supplied loose)
Alternative valve connection positions (see chapter 4.5)
Closed low pressure nozzle
Gas purge kit (special water container with hose and connection to the purge valve)
Individual inspections of TÜV or other institutions
Special non standard executions upon request

STANDARD SCOPE OF DELIVERY HS

DIN-or ASTM (Schedule 40) inlet connection (please specify)
Stop valve or ASTM connection at the outlet (please specify)
Extended purge valve EE6, top mounted in the cover plate
Extended stop valve EA10 GB for drainage, bottom mounted in the cover plate
Cap for hand lever control
Mounting frame, only for HS50

STANDARD SCOPE OF DELIVERY HS-flanged version

DIN inlet flange (please specify size): DN100, DN150, DN200

OPTIONAL SCOPE OF DELIVERY HS

Low pressure nozzle for HS types
Gas purge kit (special water container with hose and connection to the purge valve)
Individual inspections of TÜV or other institutions

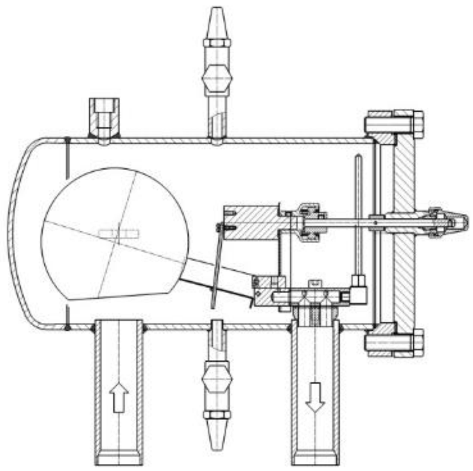


Fig. 1e **WP2HR / WP3HR**

STANDARD SCOPE OF DELIVERY WPHR

DIN inlet and outlet connection

Top mounted regulating valve EE3 for purging

Bottom mounted drainage valve EA10GB

Combined G ½" / G ¼" threaded connection for safety valve

Integrated low pressure nozzle

Cap for hand lever control

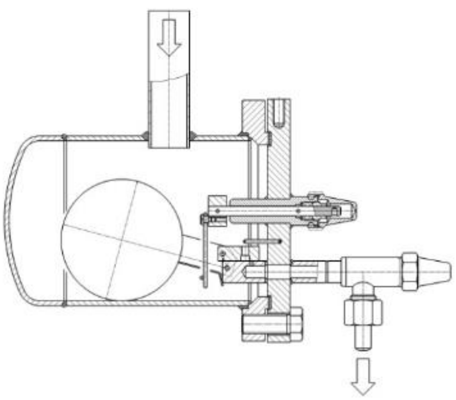


Fig. 1f **HR1BW**

STANDARD SCOPE OF DELIVERY HR1BW

DIN inlet connection

Stop valve EA10 at the outlet

Cap for hand lever control

3.4 Inspections/Certificates

High side float regulators are designed and manufactured as pressure resistant equipment and will be supplied with CE mark according to PED.

The evaluation is based on the AD regulation and actual material standards.

The regulators can also be ordered with GOST mark.

A certificate, stating that the ATEX regulation does not apply to high side float regulators, is available upon request. It was based a risk assessment considering potential ignition sources.

3.5 Orderinformation

In order to select the correct high side float regulator for your application we will need the following information

- Refrigerant
- Condensing temperature …. [°C or °F]
- Evaporating temperature....[°C or °F]
- Capacity … [kW]
- Refrigeration oil [Type, Viscosity]

Please always specify the following technical information when ordering a float regulator:

- Size: HR 1 to HR 4, resp. HS30 to HS50
- Refrigerant: N- or R-ball, resp. for HS also SK-ball
- Execution: –L, -M, -H
- With or without low pressure nozzle for HS-regulators
- WP HR regulators in 40 or 65 bar
- Required standard of inspection and certification documentation.
- If required alternative valve position, see chapter 4.6
- Any special non standard requirements

Order text

e.g. HR3 with N-float ball or

for HS-regulators the first number indicates the size, whereas the second number has the following meaning:

1 N-float ball, without low pressure nozzle

2 special SK- ball, without low pressure nozzle

3 R- float ball, without low pressure nozzle

4 N-Kugel float ball, with low pressure nozzle

5 special SK- ball, with low pressure nozzle

6 R- float ball, with low pressure nozzle

e.g. HS34-M (HS-regulator with N-float ball, with low pressure nozzle and M-execution)

Ordering replacement parts

Replacements parts for the slide valve control are only available as a complete control unit, including the ball float, because all parts need to be adjusted.

Please indicate **type, refrigerant** and **year** when ordering a control unit:

e.g. HR3 – M, NH_3, 05/96

3.6 Control Unit

article-No.	model	ball-type*	orifice [mm²]	low-press. nozzle ø [mm]	ball ø [mm]	length lever ~ [mm]	weight control unit ~ [kg]
3.591.000.232	HR1-L	N	5	0,7	100	87	0,31
3.591.000.233	HR1-M	N	3	0,7	100	87	0,31
3.591.000.234	HR1-H	N	2	0,7	100	87	0,31
3.591.000.235	HR1-L	R	11	0,7	100	48	0,49
3.591.000.236	HR1-M	R	6	0,7	100	87	0,51
3.591.000.237	HR1-H	R	4	0,7	100	87	0,51
3.591.000.238	HR2-L	N	56	1,5	120	95	0,44
3.591.000.239	HR2-M	N	37	1,5	120	87	0,44
3.591.000.240	HR2-H	N	19	1	120	87	0,44
3.591.000.267	HR2-X	N	12	1	120	87	0,44
3.591.000.245	HR2 SK-M	SK	30	2	150	87	0,7
3.591.000.246	HR2 SK-H	SK	19	1,5	150	87	0,7
3.591.000.242	HR2-M	R	56	1,5	120	95	0,65
3.591.000.243	HR2-H	R	37	1	120	87	0,65
3.591.000.247	HR3-L	N	159	3	150	148	0,9
3.591.000.248	HR3-M	N	108	3	150	133	0,9
3.591.000.249	HR3-H	N	69	2	150	133	0,9
3.591.000.268	HR3-X	N	40	2	150	133	0,9
3.591.000.254	HR3 SK-M	SK	85	3	200	133	1,75
3.591.000.255	HR3 SK-H	SK	69	2	200	133	1,75
3.591.000.251	HR3-M	R	159	3	150	148	1,2
3.591.000.252	HR3-H	R	108	2	150	133	1,2
3.591.000.256	HR4-L	N	333	6	200	300	2,65
3.591.000.257	HR4-M	N	236	6	200	300	2,65
3.591.000.258	HR4-H	N	154	4	200	300	2,65
3.591.000.262	HR4 SK-H	-	146	4	230	300	2,5
3.591.000.259	HR4-L	R	470	6	150	300	3,36
3.591.000.260	HR4-M	R	333	6	150	300	3,36
3.591.000.261	HR4-H	R	236	4	150	300	3,36

Control unit complete until 05/2009

article-No.	model	ball-type*	orifice [mm²]	low-press. nozzle ø [mm]	ball ø [mm]	length lever ~ [mm]	weight control unit ~ [kg]
3.591.713.001	HS31-L	N	56	without	120	95	0,44
3.591.713.002	HS31-M	N	37		120	87	0,44
3.591.713.003	HS31-H	N	19		120	87	0,44
3.591.713.004	HS32-L	SK	52	without	150	87	0,7
3.591.713.005	HS32-M	SK	30		150	87	0,7
3.591.713.006	HS32-H	SK	19		150	87	0,7
3.591.713.007	HS33-M	R	56	without t	120	95	0,65
3.591.713.008	HS33-H	R	37		120	87	0,65
3.591.713.009	HS34-L	N	56	with	120	95	0,44
3.591.713.010	HS34-M	N	37		120	87	0,44
3.591.713.011	HS34-H	N	19		120	87	0,44
3.591.713.012	HS35-L	SK	52	with	150	87	0,7
3.591.713.013	HS35-M	SK	30		150	87	0,7
3.591.713.014	HS35-H	SK	19		150	87	0,7
3.591.713.015	HS36-M	R	56	with	120	95	0,65
3.591.713.016	HS36-H	R	37		120	87	0,65
3.591.813.001	HS41-L	N	159	without	150	148	0,9
3.591.813.002	HS41-M	N	108		150	133	0,9
3.591.813.003	HS41-H	N	69		150	133	0,9
3.591.813.004	HS42-L	SK	140	without	200	133	1,75
3.591.813.005	HS42-M	SK	85		200	133	1,75
3.591.813.006	HS42-H	SK	69		200	133	1,75
3.591.813.007	HS43-M	R	159	without	150	148	1,2
3.591.813.008	HS43-H	R	108		150	133	1,2
3.591.813.009	HS44-L	N	159	with	150	148	0,9
3.591.813.010	HS44-M	N	108		150	133	0,9
3.591.813.011	HS44-H	N	69		150	133	0,9
3.591.813.012	HS45-L	SK	140	with	200	133	1,75
3.591.813.013	HS45-M	SK	85		200	133	1,75
3.591.813.014	HS45-H	SK	69		200	133	1,75
3.591.813.015	HS46-M	R	159	with	150	148	1,2
3.591.813.016	HS46-H	R	108		150	133	1,2

Control unit complete for HS from 06/2009

article-No.	model	ball-type*	orifice [mm²]	low-press. nozzle ø [mm]	ball ø [mm]	length lever ~ [mm]	weight control unit ~ [kg]
3.591.713.021	HS31-L	N	56	without	120	95	0,44
3.591.713.022	HS31-M	N	37		120	87	0,44
3.591.713.023	HS31-H	N	19		120	87	0,44
3.591.713.024	HS32-L	SK	52	without	150	87	0,7
3.591.713.025	HS32-M	SK	30		150	87	0,7
3.591.713.026	HS32-H	SK	19		150	87	0,7
3.591.713.027	HS33-M	R	56	without	120	95	0,65
3.591.713.028	HS33-H	R	37		120	87	0,65
3.591.713.029	HS34-L	N	56	with	120	95	0,44
3.591.713.030	HS34-M	N	37		120	87	0,44
3.591.713.031	HS34-H	N	19		120	87	0,44
3.591.713.032	HS35-L	SK	52	with	150	87	0,7
3.591.713.033	HS35-M	SK	30		150	87	0,7
3.591.713.034	HS35-H	SK	19		150	87	0,7
3.591.713.035	HS36-M	R	56	with	120	95	0,65
3.591.713.036	HS36-H	R	37		120	87	0,65
3.591.813.021	HS41-L	N	159	without	150	148	0,9
3.591.813.022	HS41-M	N	108		150	133	0,9
3.591.813.023	HS41-H	N	69		150	133	0,9
3.591.813.024	HS42-L	SK	140	without	200	133	1,75
3.591.813.025	HS42-M	SK	85		200	133	1,75
3.591.813.026	HS425-H	SK	69		200	133	1,75
3.591.813.027	HS43-M	R	159	without	150	148	1,2
3.591.813.028	HS43-H	R	108		150	133	1,2
3.591.813.029	HS44-L	N	159	with	150	148	0,9
3.591.813.030	HS44-M	N	108		150	133	0,9
3.591.813.031	HS44-H	N	69		150	133	0,9
3.591.813.032	HS45-L	SK	140	with	200	133	1,75
3.591.813.033	HS45-M	SK	85		200	133	1,75
3.591.813.034	HS45-H	SK	69		200	133	1,75
3.591.813.035	HS46-M	R	159	with	150	148	1,2
3.591.813.036	HS46-H	R	108		150	133	1,2
3.591.000.256	HS51/54-L	N	333	without / optional	200	300	2,65
3.591.000.257	HS51/54-M	N	236		200	300	2,65
3.591.000.258	HS51/54-H	N	154		200	300	2,65
3.591.000.259	HS53/56-L	R	470	without / optional	200	300	3,36
3.591.000.260	HS53/56-M	R	333		200	300	3,36
3.591.000.261	HS53/56-H	R	236		200	300	3,36

article-No.	model	ball-type*	orifice [mm²]	low-press. nozzle ø [mm]	ball ø [mm]	length lever ~ [mm]	weight control unit ~ [kg]
3.591.000.244	WP2 HR	WP	11	1,8	150	87	0,38
3.591.000.253	WP3 HR	WP	46	3	200	133	1,01
3.591.000.270	WP3HR-65bar	WP	46	3	200	133	1,03
3.591.000.232	HR1 BW-L	N	5	-	100	87	0,31
3.591.000.233	HR1 BW-M	N	3	-	100	87	0,31
3.591.000.234	HR1 BW-H	N	2	-	100	87	0,31
3.591.000.235	HR1 BW-L	R	11	-	100	48	0,49
3.591.000.236	HR1 BW-M	R	6	-	100	87	0,51
3.591.000.237	HR1 BW-H	R	4	-	100	87	0,51

***float ball type:**

- **N** for refrigerants with low density ? < 1000 kg/m³ e.g. NH_3 (R717), Propan (R290), oil
- **R** for refrigerants with density ? > 1000 kg/m³ e.g. R22, R507, R134a, R404a
- **SK** for refrigerants with higher condensing temperature
- **WP** for heat pump applications

4. TECHNICAL DATA

4.1 Materials

Housing:	P 265 GH (St 35.8)	**Flange:**	P 265 GH
End caps:	P 265 GH	**Bolts:**	A2-70
Gaskets:	Centellen	**Cap:**	Al
Gland:	Al	**Packing:**	Ne
Lever:	St	**Painting system:**	W 9.1 + W 9.2 *

* W9.1 + W9.2 = 2k epoxidy finish according DIN ISO 12944/5, RAL 7001

4.2 Pressure/Temperature Range

HR, HS50 and HR1BW

Permitted operating pressure [bar]	25 (+75 / -10°C) 18,75 (-10 / -60°C)
Test pressure (oil) [bar]	37

HS30 and HS40 (standard and flanged version)

Permitted operating pressure [bar]	40 (+75 / -10°C) 30 (-10 / -60°C)
Test pressure (oil) [bar]	59

WP 40bar model

Permitted operating pressure [bar]	40 (+75 / -10°C) 30 (-10 / -60°C)
Test pressure (oil) [bar]	59

WP 65bar model

Permitted operating pressure [bar]	65 (+75 / -10°C) 49 (-10 / -60°C)
Test pressure (oil) [bar]	100

4.3 Sectional drawings

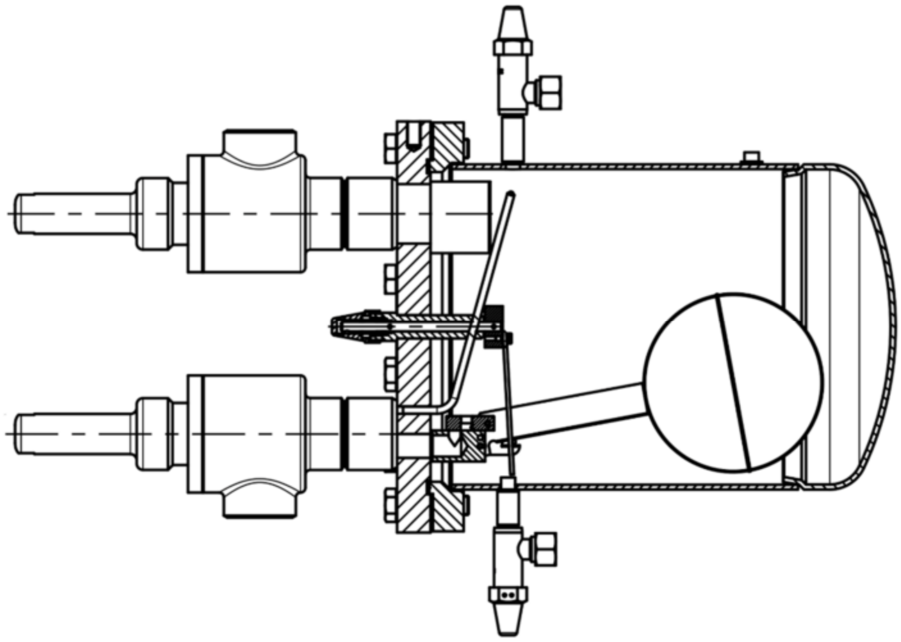


Fig. 2a **HR1 – HR3**

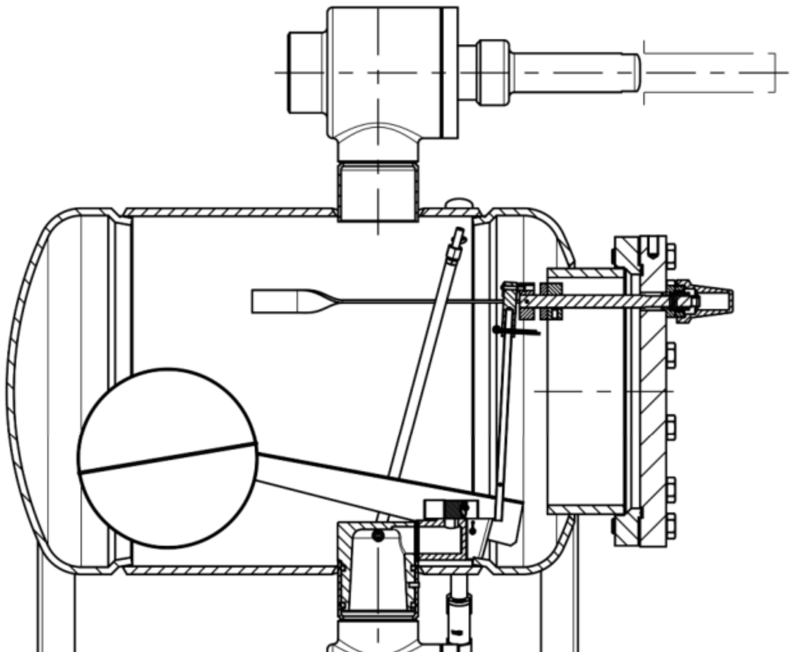


Fig. 2b **HR4**

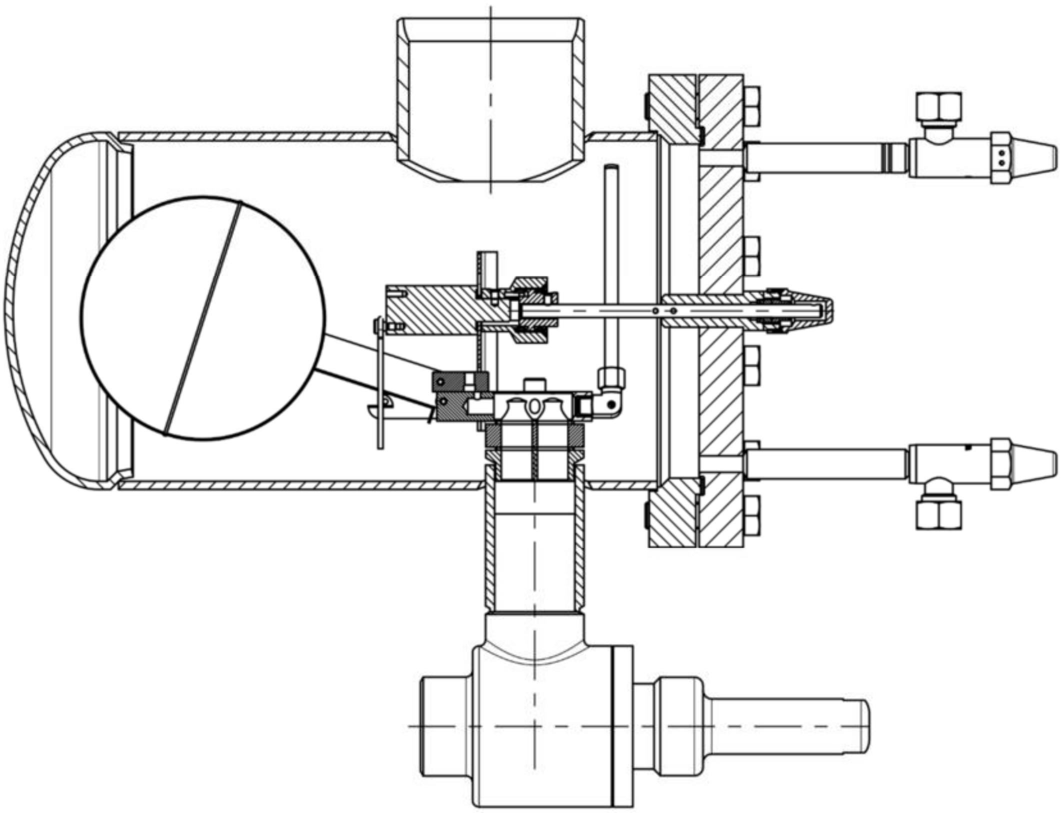


Fig. 2c **HS30 – HS40**

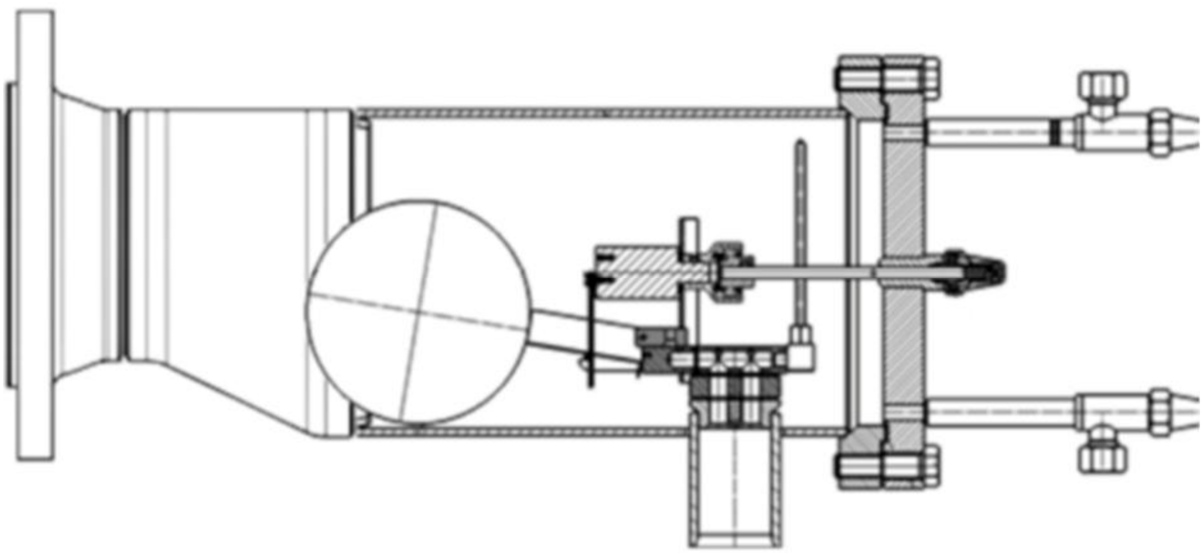


Fig. 2d **HS30 F – HS40 F**

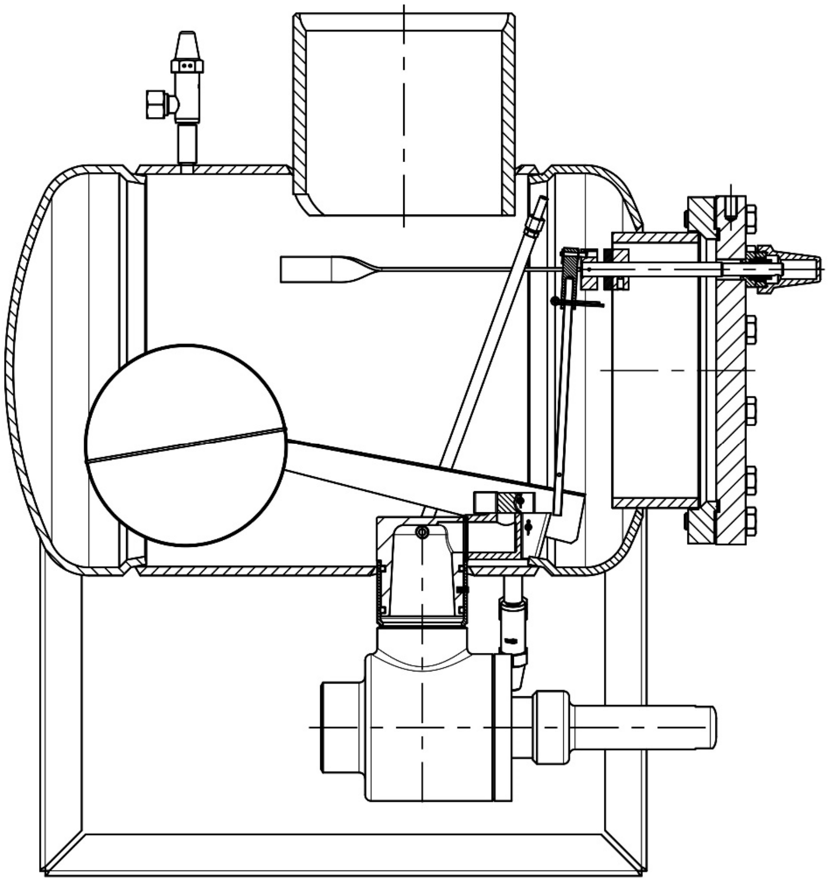


Fig. 2e **HS50**

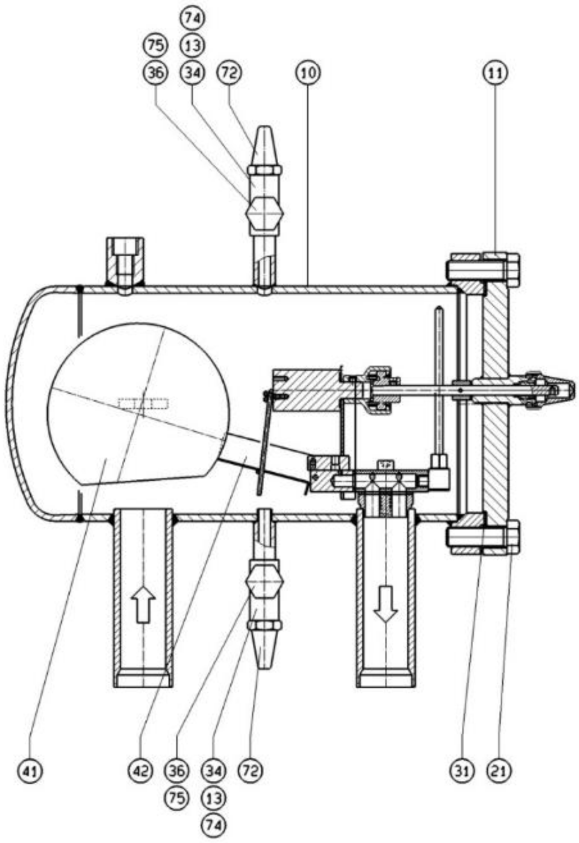


Fig. 2f **WP2HR / WP3HR**

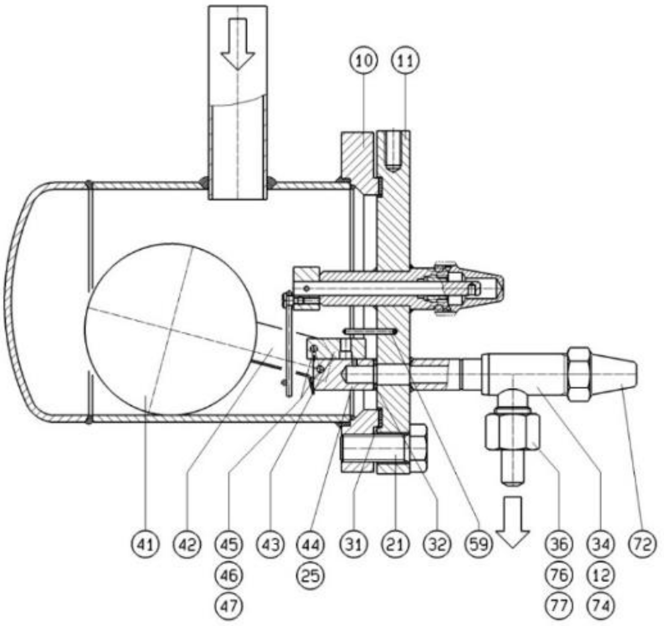


Fig. 2g **HR1BW**

4.3.1 **Parts List WP/HR**

		HR 1 / HR 1 BW		HR 2 / WP 2 HR		HR 3 / WP 3 HR		HR 4	
	part	dimension	article no.	dimension	article no.	dimension	article no.	dimension	article no.
main housing	10	Typ 1		Typ 2		Typ 3		Typ 4	
cover plate	11	Typ 1		Typ 2		Typ 3		Typ 4	
inlet valve	12	EA 20		EA 32		EA 50		EA 80	
vent valve	13	EE 3 GB		EE 3 GB		EE 3 GB		EE 6 GB	
drain valve	14	EA 10 GB		EA 10 GB		EA 10 GB		EA 10 GB	
cover plate hexagon screw	21	M16x40	5111.CLA3B3	M16x40	5111.CLA3B3	M16x50	5111.CLA3BD	M16 x 50	5111.CLA3BD
cover plate hexagon screw for 65 bar	21					M20x70	5111.CLC2BX		
hexagon head cap screw	22a							M12 x 35	5111.CH81AY
hexagon nut	22b							M12	5151.AH8100
nut insert	23	M 10		M 10		M 10			
hexagon socket screw	24	------------		M8x30		M8x30			
hexagon socket screw	25	M8x20	5112.BC61AJ	M8x20	5112.BC61AJ	M8x20	5112.BC61AJ	M6x20	5112.BC51AJ
cover plate gasket	31	125/145x2	5632.1DGE0K	180/200x2	5632.1EZFJK	260/280x2	5632.1H7HRK	260/280x2	5632.1H7HRK
gasket behind orifice house	32	18/50x2	5632.1AHBDK	18/50x2	5632.1AHBDK	26x60x2	5632.1APBNK	43/74x2	5632.1B6C1K
packing for 12	33	8/14x8	5643.ABAP01	8/14x8	5643.ABAP01	12x4	5642.ABAX02	19x4	5642.ABBL01
packing for 13	34	8/14x8	5643.ABAP01	8/14x8	5643.ABAP01	8/14x8	5643.ABAP01	8/14x8	5643.ABAP01
packing for 50	35	8x3	5642.AJAP01	8x3	5642.AJAP01	8x3	5642.AJAP01	12x4	5642.ABAX02
gasket for valve cap for 13+14+12 HR1BW	36	10/18x2	5632.1A9AHK	10/18x2	5632.1A9AHK	10/18x2	5632.1A9AHK	10/18x2	5632.1A9AHK
gasket at orifice	37			ø 45x2		ø 60x2			
ball	41	ø 100		ø 120		ø 150		ø 200	
ball lever	42	Typ 1		Typ 2		Typ 3		Typ 4	
slide valve	43	34x15x12,5		34x15x12,5		40x25x12.5		60x40x20,5	
orifice block	44	50x35x18		50x35x18		60x44x26		85x44x65	
pin	45	ø 4x25		ø 4x25		ø 4x35		ø 4x35x22	
washer	46	A 4,3		A 4,3		A 4,3		A 4,3	
solit pin	47	ø 1x15		ø 1x15		ø 1x15		ø 1x15	
mount at orifice	48			Typ 1		Typ 2			
mounting plate	49			ø 45x19		ø 60x19			
spindle	50	ø 8x115	3.591.000.123	ø 8x135	3.591.000.124	ø 8x135	3.591.000.124	ø 14x200	3.591.000.125
Spindle for WP 65bar	50					ø 8x200	3.591.000.120		
locking pin for 50	51	ø 3x10	5723.AA0301	ø 3x10	5723.AA0301	ø 3x10	5723.AA0301		
base ring	52	ø 13x8x2	6438.000004	ø 13x8x2	6438.000004	ø 13x8x2	6438.000004		
excenter for hand operation	53	ø 25x15	3591.000115	ø 35x15	3591.000116	ø 35x15	3591.000116	ø 40x16	3591.000117
locking pin for 53	54	ø 3x30	5723.AA0302	ø 3x30	5723.AA0302	ø 3x30	5723.AA0302	ø 3x30	5723.AA0302
pan head screw/bolt	55	M4 x 5	5117.AB30A4	M4 x 5	5117.AB30A4	M4 x 5	5117.AB30A4	ø 4x25x22	5724.A00401
tow/pressure bar	56	ø 3x60	3.591.000.095	ø 3x94	3.591.000.096	ø 3x121	3.591.000.097	ø 8x1x235	3.591.000.100
tow/pressure bar	56			ø 3x94	3591.000096	ø 3x118	3591.000093		
guide bracket	57			67,5x50x15		65,5x60x15			
low pressure nozzle	58	ø 6x1x107		ø 6x1x156		ø 6x1x230		ø 6x1x360	
locking pin for HR 1 BW	59	ø 3x30							
column for WP-HR	60			Typ 1	3591000111	Typ 2	3591000112		
clutch .... for WP - HR	61			ø 50x30	3591000118	ø 50x30	3591000118		
collet WP -HR	62			ø 8/16x15	3591000126	ø 8/16x15	3591000126	ø 14/40x16	3591000127
locking pin/grub screw for WP - HR+HR 4	63			ø 3x30	5723.AA0302	ø 3x30	5723.AA0302	M6x12	5121.CD50AB
spindle cap for 12	71	SW 27	6436.AAP270	SW 27	6436.AAP270	SW 27	6436.AAP270	SW 46	6436.AAP460
spindle cap for 13+14+12 HR 1BW + 50	72	SW 27	6436.AAP270	SW 27	6436.AAP270	SW 27	6436.AAP270	SW 27	6436.AAP270
gland for 12	73	SW 12	6438000006	SW 12	6438000006	SW 17	6438000002	SW 22	6438000003
gland for 50	74	SW 12	6438000001	SW 12	6438000001	SW 12	6438000001	SW 17	6438000002
blind cap	75	G 1/2	6436.ABDD00	G 1/2	6436.ABDD00	G 1/2	6436.ABDD00	G 1/2	6436.ABDD00
cap nut for 12 HR 1 BW	76	SW 27	6436.ACDD00						
welded-in stub	77	41426	6424.AH0001						
frame, galvanized	81							600x495	
vent container	91								
hose	92								
threaded pin	93	M 10x65		M 10x65		M 10x65		M 10x65	

4.3.3 Parts List HS

		HS 30		HS 40		HS 50	
	part	dimension	article no.	dimension	article no.	dimension	article no.
main housing	10	Typ 3	----.------	Typ 4	----.------	Typ 5	----.------
cover plate	11	Typ 3	----.------	Typ 4	----.------	Typ 5	----.------
outlet valve	12	EA 50	----.------	EA 80	----.------	EA 80	----.------
vent valve	13	EE 6 GB/L	----.------	EE 6 GB/L	----.------	EE 6 GB	----.------
drain valve	14	EA 10 GB/L	----.------	EA 10 GB/L	----.------	EA 10 GB	----.------
cover plate hexagon screw	21	M16x60	5111.CLA3BN	M16x70	5111.CLA3BX	M16x50	5111.CLA3BD
hexagon head cap screw	22a	----------	----.------	----------	----.------	M12x35	5111.CH81AY
hexagon nut	22b	----------	----.------	----------	----.------	M12	5151.AH8100
hexagon socket screw	24a	M8x30	5112.BC61AT	M8x45	5112.BC61B8	----------	----.------
hexagon socket screw	24b	M8x45	5112.BC61B8	M8x65	5112.BC61BS	----------	----.------
hexagon socket screw	25	M8x20	5112.BC61AJ	M8x20	5112.BC61AJ	M6x20	5112.BC51AJ
cover plate gasket	31	206/225x2	5632.1FPG8K	311/330x2	5632.1IMJ5K	260/280x2	5632.1H7HRK
gasket behind orifice house	32	18/50x2	5632.1AHBDK	26/50x2	5632.1APBNK	43/74x2	5632.1B6C1K
packing for 12	33	12x4	5642.ABAX02	19x4	5642.ABBL01	19x4	5642.ABBL01
packing for 13 + 14	34	8/14x8	5643.ABAP01	8/14x8	5643.ABAP01	8/14x8	5643.ABAP01
packing for 50	35	8x3	5642.AJAP01	8x3	5642.AJAP01	12x4	5642.ABAX02
gasket for valve cap for 13+14	36	10/18x2	5632.1A9AHK	10/18x2	5632.1A9AHK	10/18x2	5632.1A9AHK
gasket at orifice	37	45x2	----.------	60x2	----.------	----------	----.------
ball	41	ø120/ø150	----.------	ø150/ø200	----.------	ø200	----.------
ball lever	42	Typ 2	----.------	Typ 3	----.------	Typ 4	----.------
slide valve	43	34x15x12.5	----.------	40x25x12.5	----.------	60x40x20.5	----.------
orifice block	44	50x35x18	----.------	60x44x26	----.------	75x85x44	----.------
pin	45	ø4x25	----.------	ø4x35	----.------	ø4x35x22	----.------
washer	46	A 4,3	----.------	A 4,3	----.------	A 4,3	----.------
solit pin	47	ø1x15	----.------	ø1x15	----.------	ø1x15	----.------
mount at orifice	48	Typ 1	----.------	Typ 2	----.------	Typ 3	----.------
mounting plate	49	ø60x19	----.------	ø88x25	----.------	----------	----.------
stem for hand operation	50	ø 8x185	3.591.045.010	ø 8x185	3.591.045.010	ø 14x200	3.591.000.125
locking pin for 50	51	ø 3x10	5723.AA0301	ø 3x10	5723.AA0301	----------	----.------
excenter for hand operation	53	76-5/10	3591.043008	76-5/10	3591.043008	ø 40x16	3591.000117
locking pin for 53	54	----------	----.------	----------	----.------	ø 3x30	5723.AA0302
pan head screw/bolt	55	M4x5	5117.AB30A4	M4x5	5117.AB30A4	ø 4x25x22	5724.A00401
tow/pressure bar	56	ø 3x__	----.------	ø 3x__	----.------	ø 8x1x235	3.591.000.100
tow/pressure bar	56	ø 3x__	----.------	ø 3x__	----.------	ø 8x1x235	3.591.000.100
guide bracket	57	67.5x50x15	----.------	65.5x60x15	----.------	----------	----.------
low pressure nozzle	58	ø 6x1x136	----.------	ø 6x1x230	----.------	ø 6x1x360	----.------
column	60	HS 3	3591.042005	HS 4	3591.042006	----------	----.------
clutch	61a	ø 14	2441.001001	ø 14	2441.001001	----------	----.------
clutch	61b	ø 8	2441.001002	ø 8	2441.001002	----------	----.------
locking pin/grub screw for HS 50	63		----.------	----------	----.------	M 6x12	5121.CD50AB
spindle cap for 12	71	SW 27	6436.AAP270	SW 46	6436.AAP460	SW 46	6436.AAP460
spindle cap for 13+14 + 50	72	SW 27	6436.AAP270	SW 27	6436.AAP270	SW 27	6436.AAP270
gland for 12	73	SW 17	6438.000002	SW 17	6438.000002	SW 22	6438.000003
gland for 50	74	SW 12	6438.000001	SW 12	6438.000001	SW 17	6438.000002
blind cap	75	G 1/2"	6436.ABDD00	G 1/2"	6436.ABDD00	G 1/2"	6436.ABDD00
frame, galvanized	81		----.------	----------	----.------	600x495	----.------
vent container	91		----.------	----------	----.------	----------	----.------
hose	92		----.------	----------	----.------	----------	----.------
threaded pin	93	M 10	----.------	M 10	----.------	M 10	----.------

4.3.4 Spare parts

	part	HR1 / HR1 BW article no.	HR2 / WP2 HR article no.	HR3 / WP3 HR article no.	HR4 / HS50 article no.	HS30 article no.	HS40 article no.
Control unit 1 x part no. 41, 42, 43, 44 2 x part no. 45; 47 6 x part no. 46	40	Kap.3.4	Kap.3.4	Kap.3.4	Kap.3.4	Kap.3.4	Kap.3.4
Brackets	70	3911.420000	3911.420000	3911.420000	-----		
Vent device (only HR 3) 1 x part no. 91, 92, 93	90	3.591.000.346					
Seet of gaskets 1 x part no. 31, 32, 35 2 x part no. 34, 36 6 x part no. 33	E30	3.591.000.363	3.591.000.364	3.591.000.365	3.591.000.366	up to 05/2009 3.591.000.395 from 06/2009 3.591.000.401	up to 05/2009 3.591.000.396 from 06/2009 3.591.000.402

4.4 DIMENSIONS

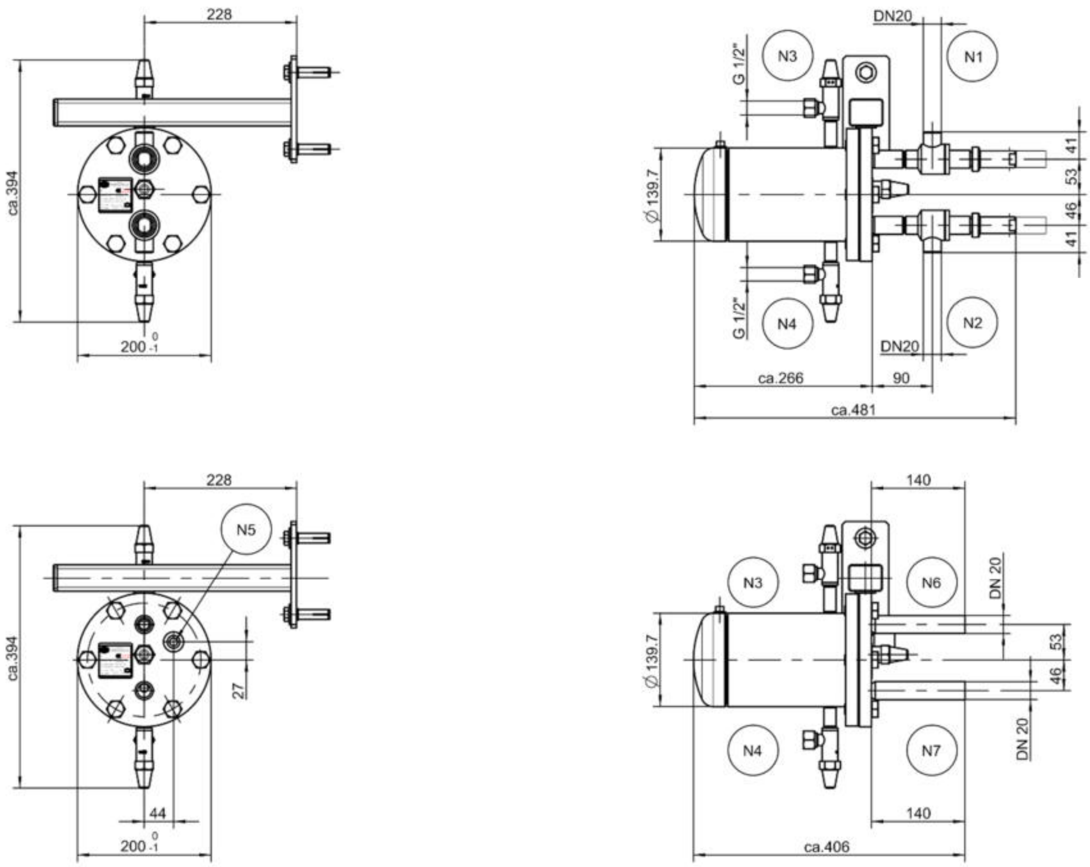


Fig. 3a: HR 1

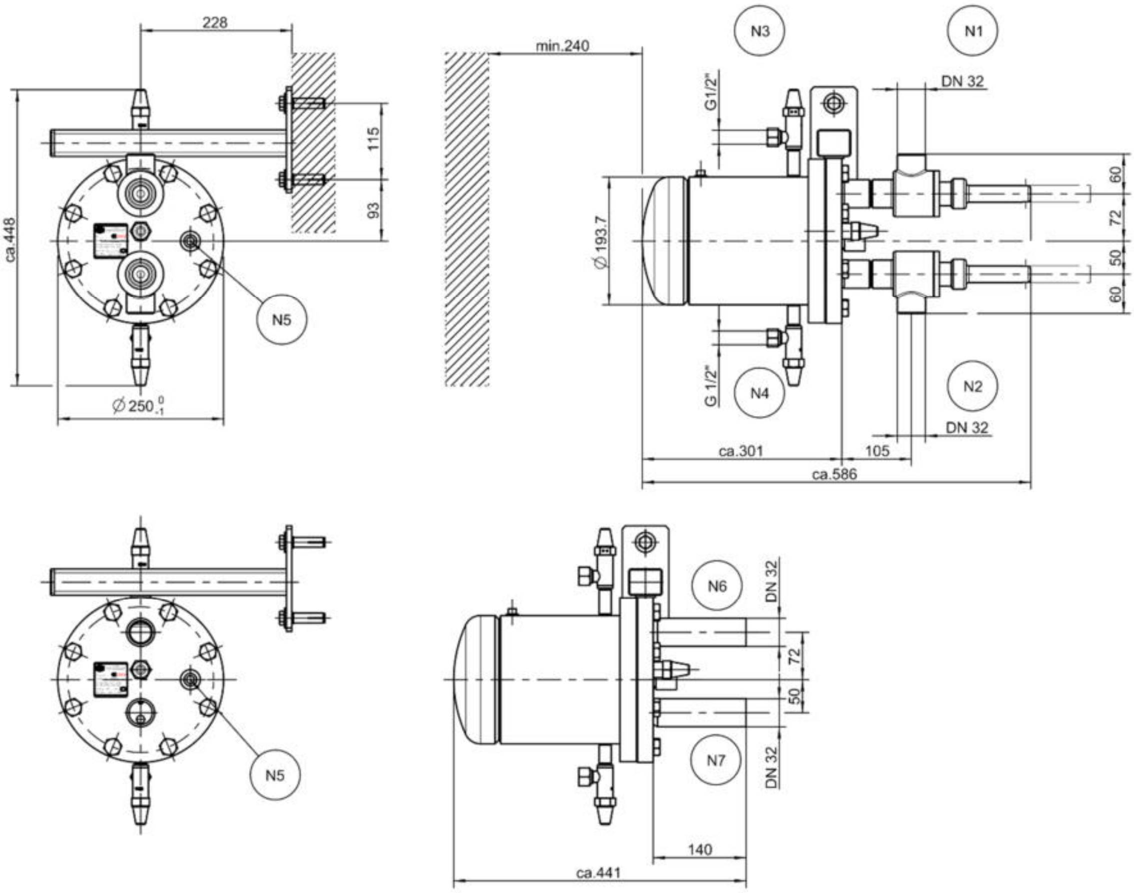

228
min.240
N3
N1
DN 32
G1/2"
115
93
ca.448
N5
∅ 193.7
60
72
50
60
∅ 250
G 1/2"
N4
N2
DN 32
ca.301
105
ca.586
N6
DN 32
72
50
N7
DN 32
N5
140
ca.441

Fig. 3b: HR 2

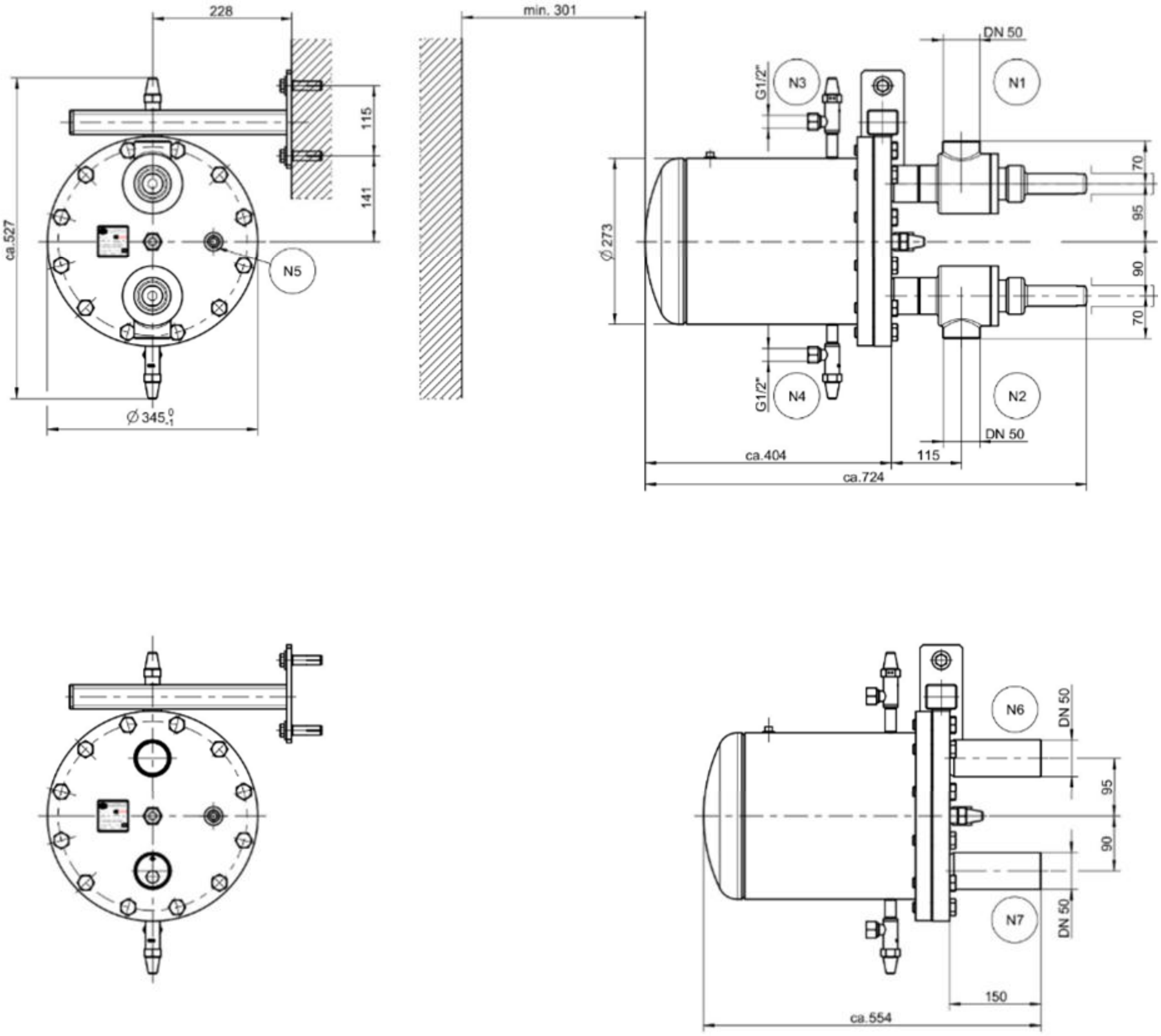

228
min. 301
DN 50
G1/2"
N3
N1
115
141
ca.527
N5
Ø 273
70
95
90
70
G1/2"
N4
N2
DN 50
Ø 345
ca.404
115
ca.724
N6
DN 50
95
90
N7
DN 50
150
ca.554

Fig. 3c: **HR 3**

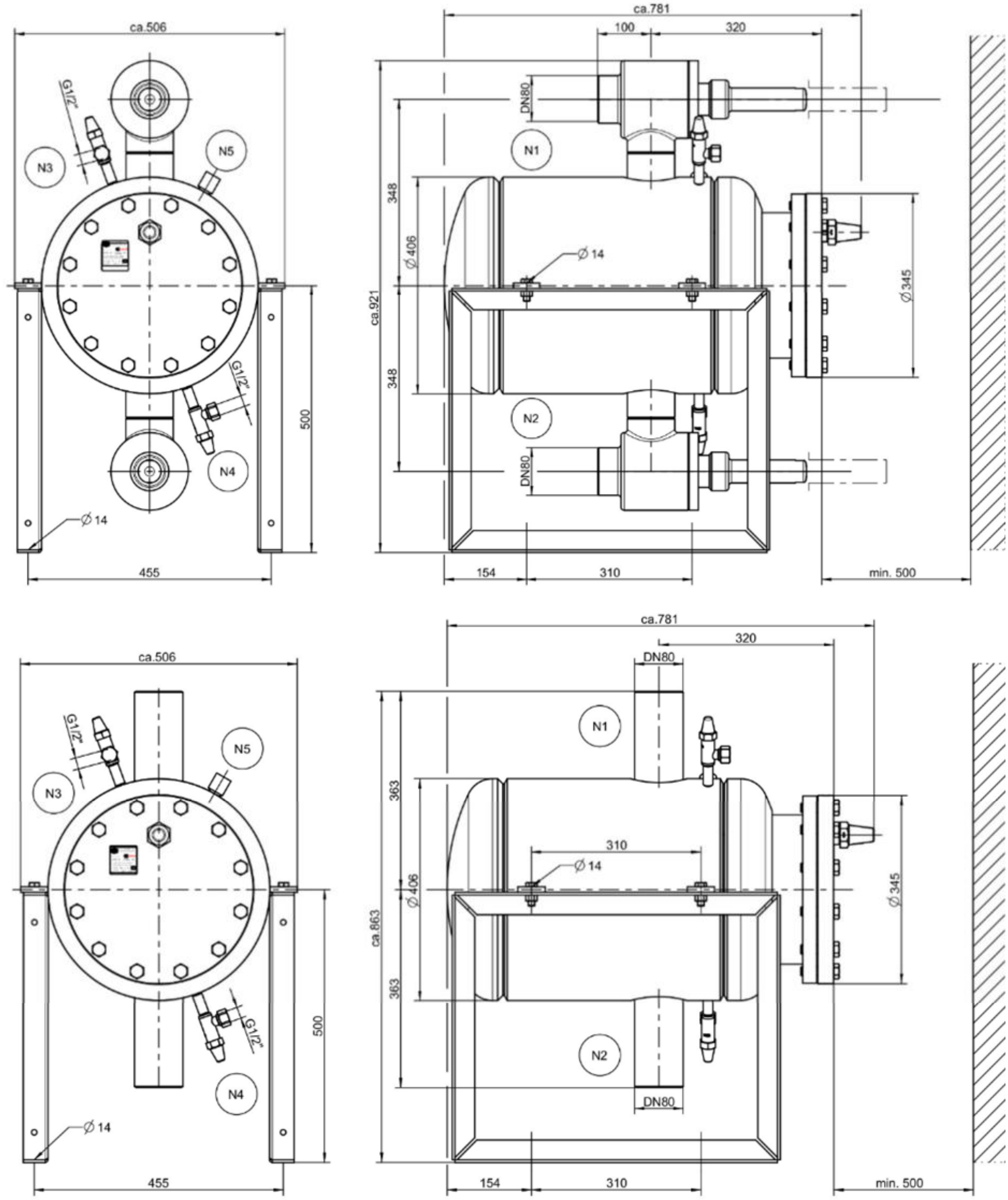

ca.506
G1/2"
N3
N5
N4
Ø 14
455
500
ca.781
100
320
DN80
N1
N2
348
Ø 406
ca.921
Ø 345
154
310
min. 500
ca.506
G1/2"
N3
N5
N4
Ø 14
455
500
ca.781
320
DN80
N1
N2
363
Ø 406
ca.863
310
Ø 14
Ø 345
154
310
min. 500

Fig. 3d: **HR4**

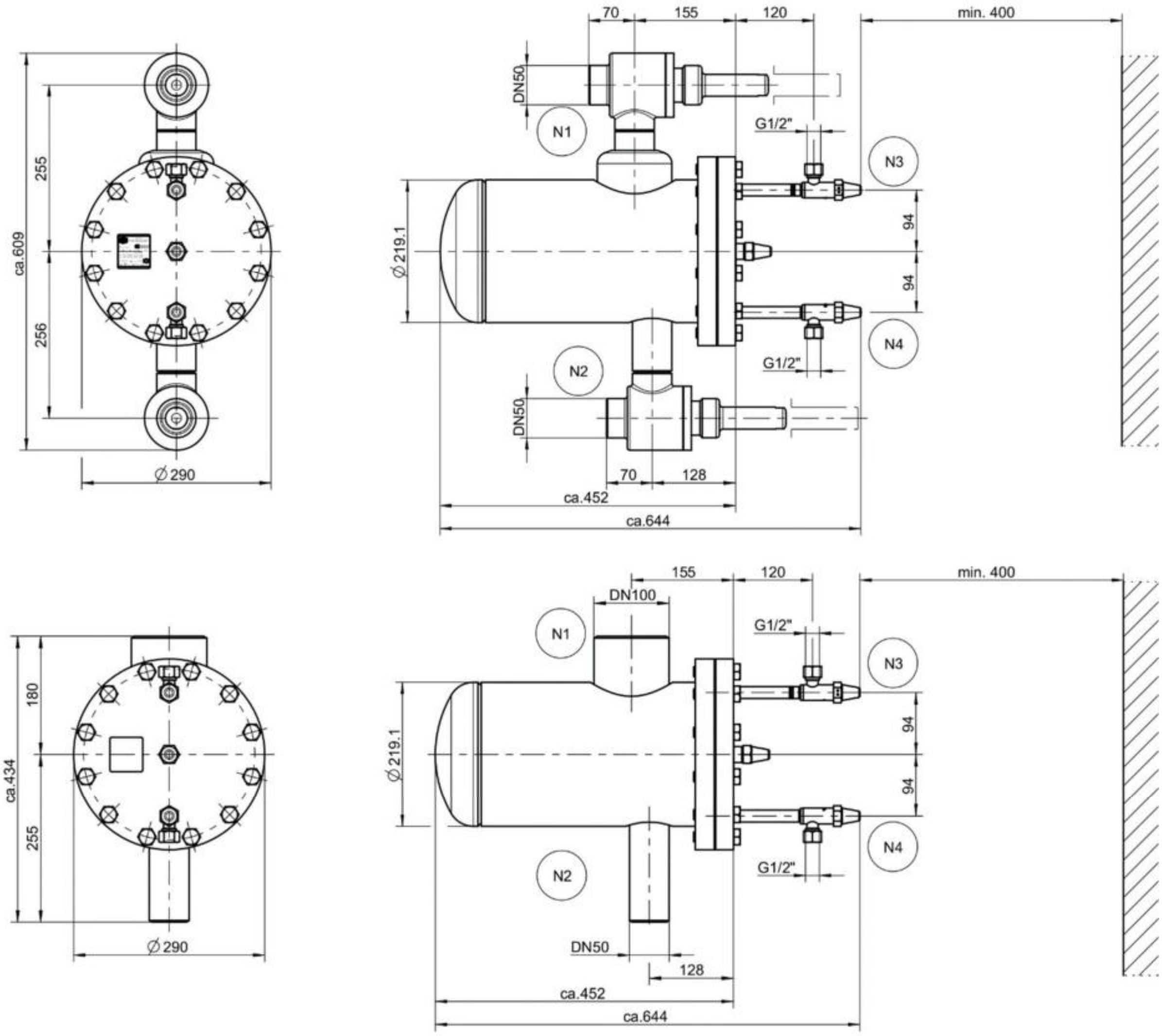
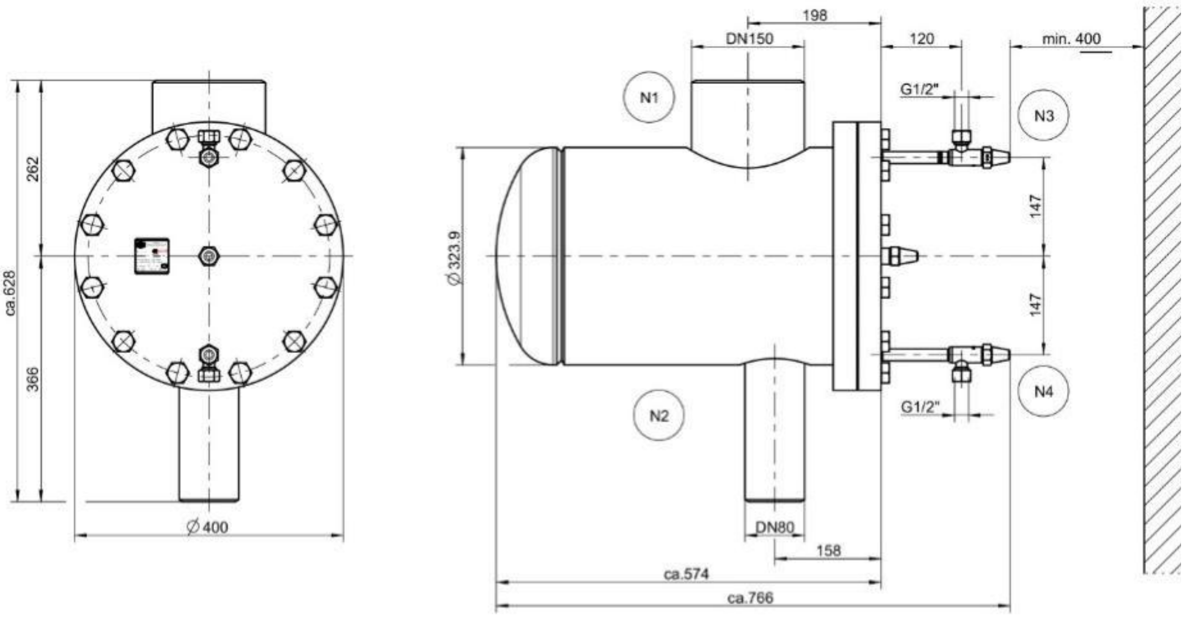

70
155
120
min. 400
DN50
N1
G1/2"
N3
255
ca.609
256
∅219.1
94
94
N4
N2
G1/2"
DN50
∅290
70
128
ca.452
ca.644
155
120
min. 400
DN100
N1
G1/2"
N3
180
ca.434
255
∅219.1
94
94
N4
N2
G1/2"
∅290
DN50
128
ca.452
ca.644

Fig. 3e: **HS 30**


262
366
ca.628
∅400
198
DN150
120
min. 400
N1
G1/2"
N3
∅323.9
147
147
N2
G1/2"
N4
DN80
158
ca.574
ca.766

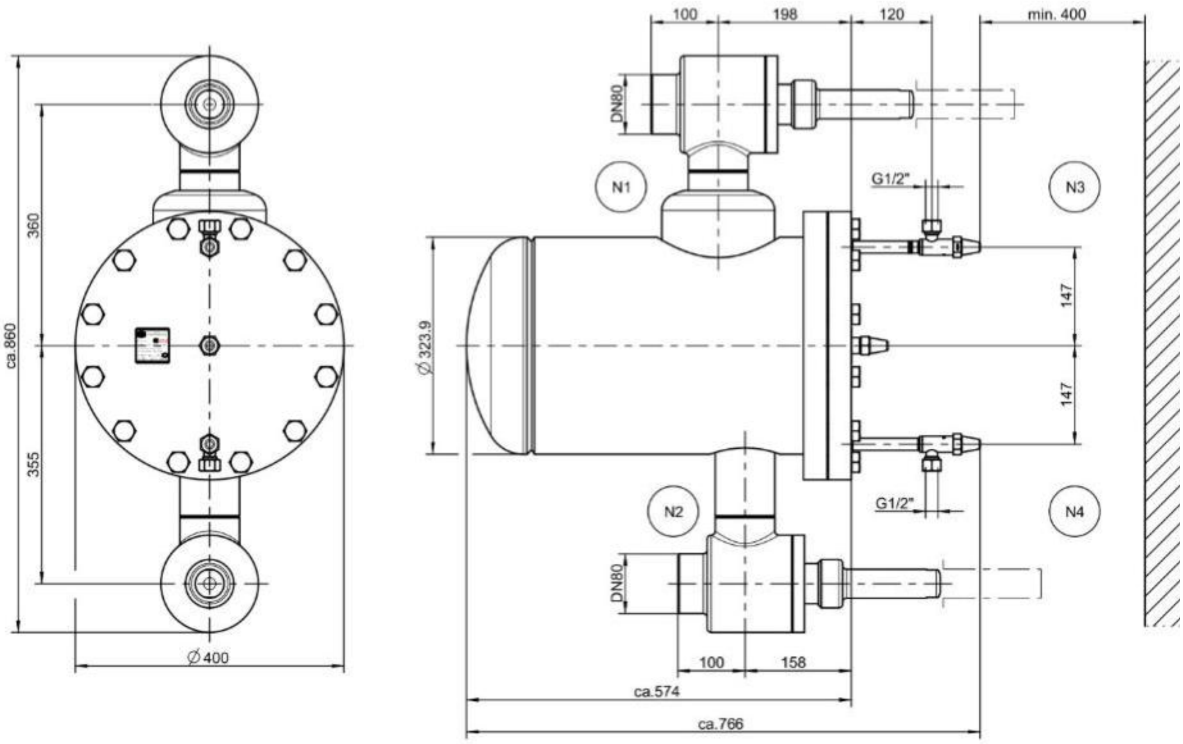

360
355
ca.860
∅400
100
198
120
min. 400
DN80
N1
G1/2"
N3
∅323.9
147
147
N2
G1/2"
N4
DN80
100
158
ca.574
ca.766

Fig. 3f: HS 40

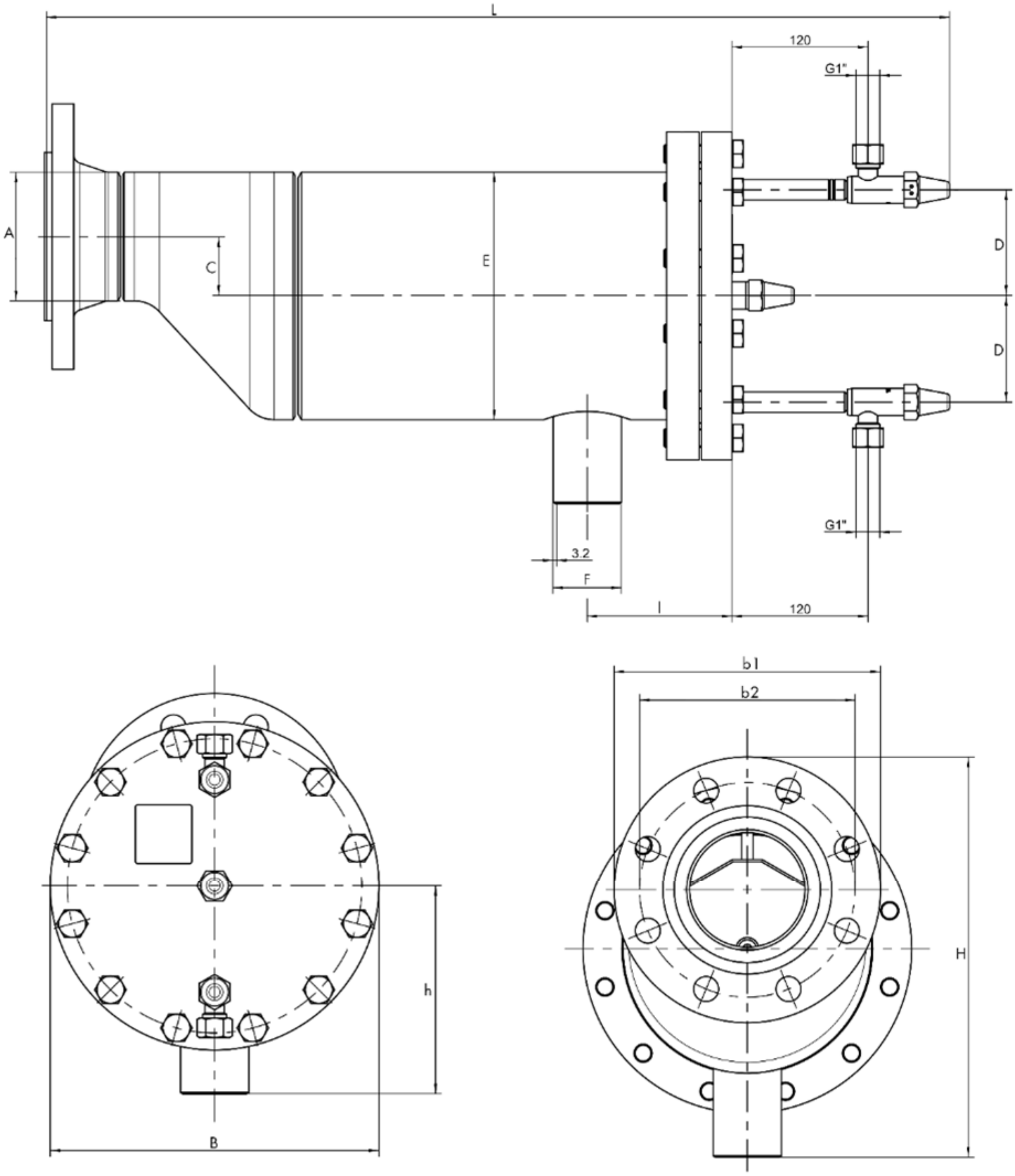


Fig. 3g: HSF

Dimensions in mm

	L (ca.)	B	H (ca.)	Ø A	C	D	Ø E	Ø F	I	h	b1	b2
HSF30 f100	797	290	353	114,3	52,4	94	219,1	60,3	128	184	235	190
HSF30 f150	807	290	359	168,3	25,4	94	219,1	60,3	128	184	300	250
HSF40 f150	951	400	483	168,3	77,8	147	323,9	88,9	158	255	300	250
HSF40 f200	956	400	487	219,1	52,4	147	323,9	88,9	158	255	360	310

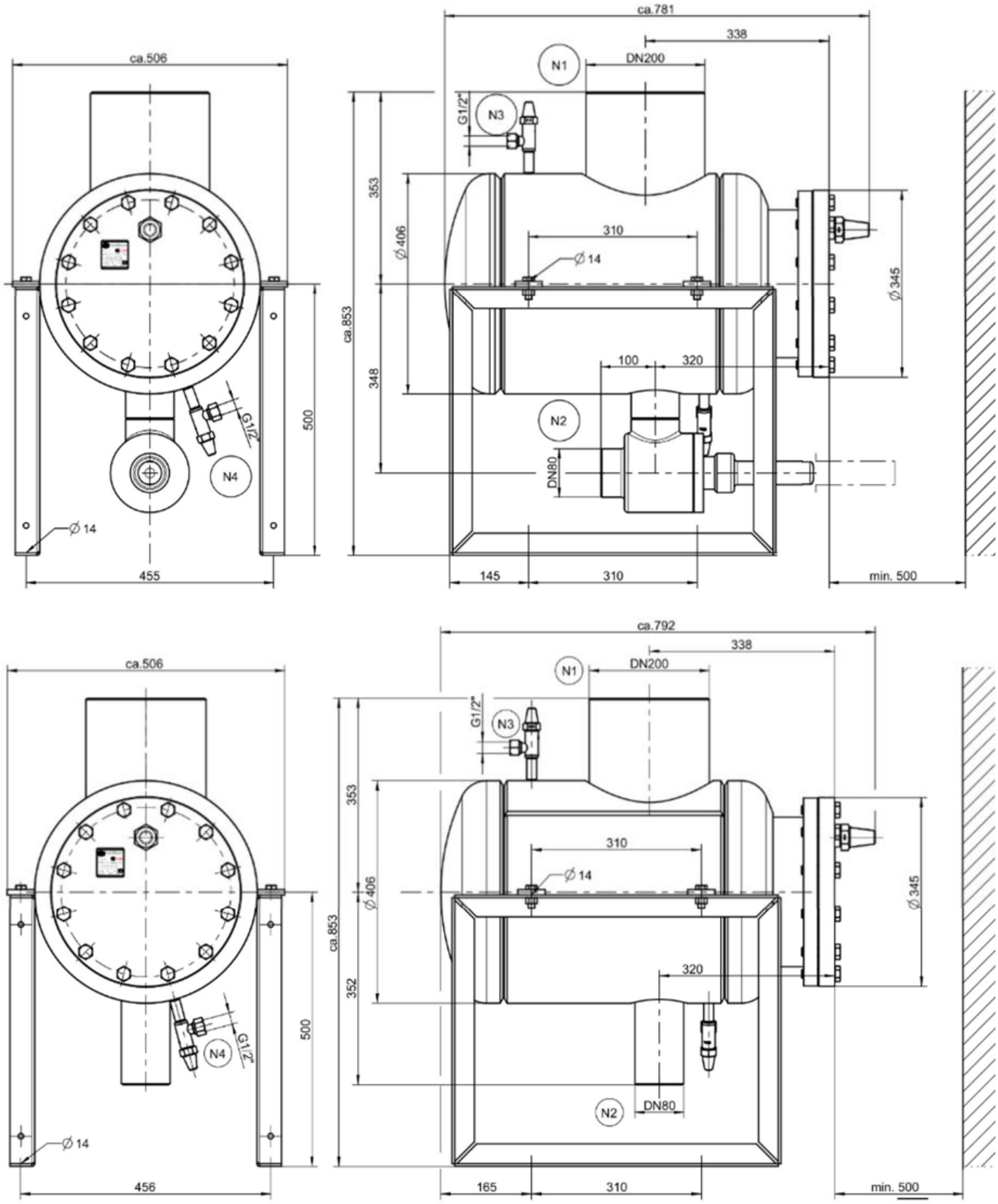

ca.781
338
N1
DN200
G1/2"
N3
353
Ø406
310
Ø 14
Ø 345
ca.853
348
100
320
N2
DN80
500
G1/2"
N4
455
145
310
min. 500
ca.506
ca.792
338
N1
DN200
G1/2"
N3
353
310
Ø 14
Ø406
Ø 345
ca.853
352
320
500
G1/2"
N4
N2
DN80
Ø 14
456
165
310
min. 500
ca.506

Fig. 3h: **HS50**

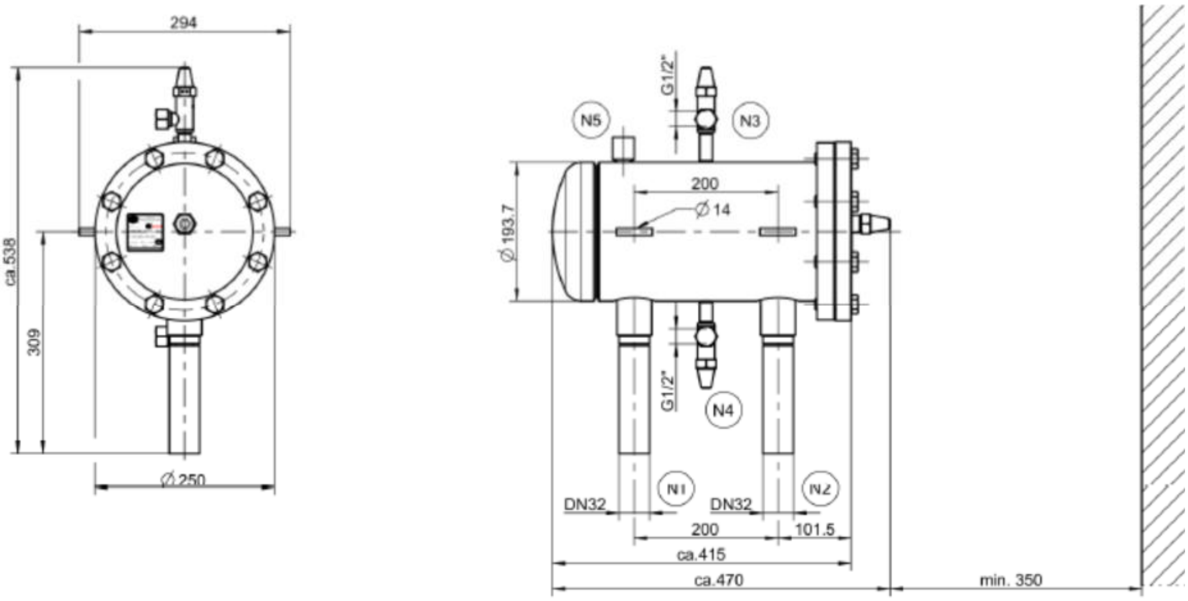


Fig. 3i: **WP2HR**

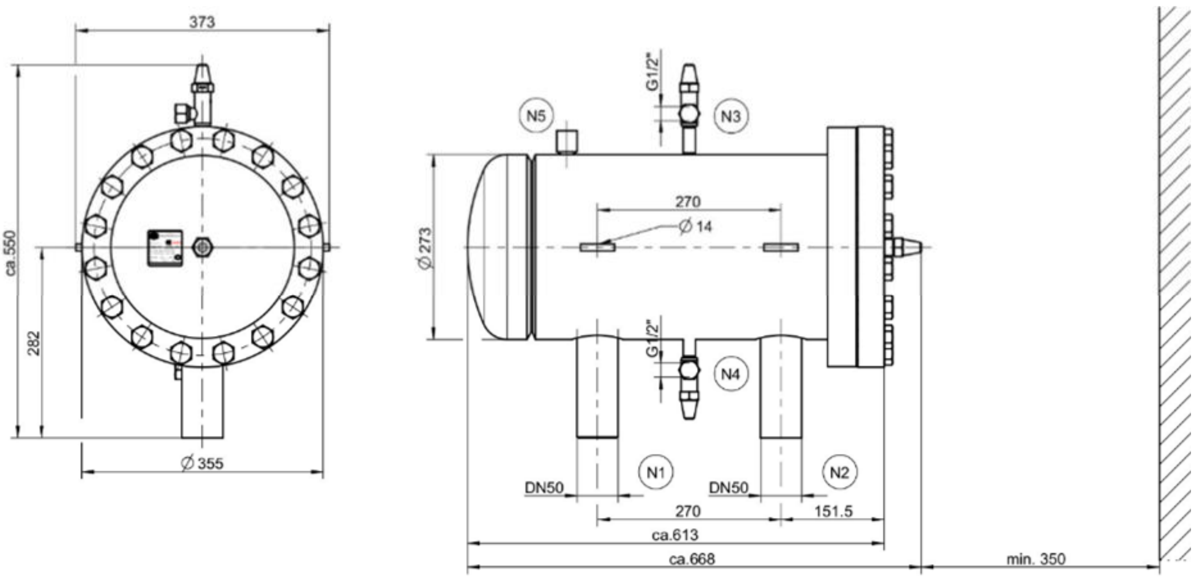


Fig. 3j: WP3HR

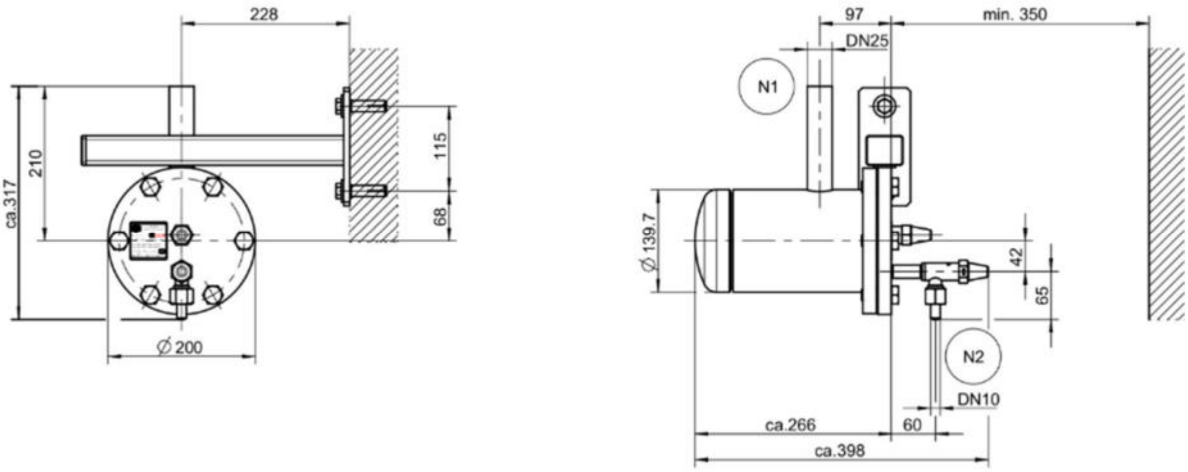


Fig. 3k: **HR1BW**

4.5 MODIFIED VALVE POSITIONS

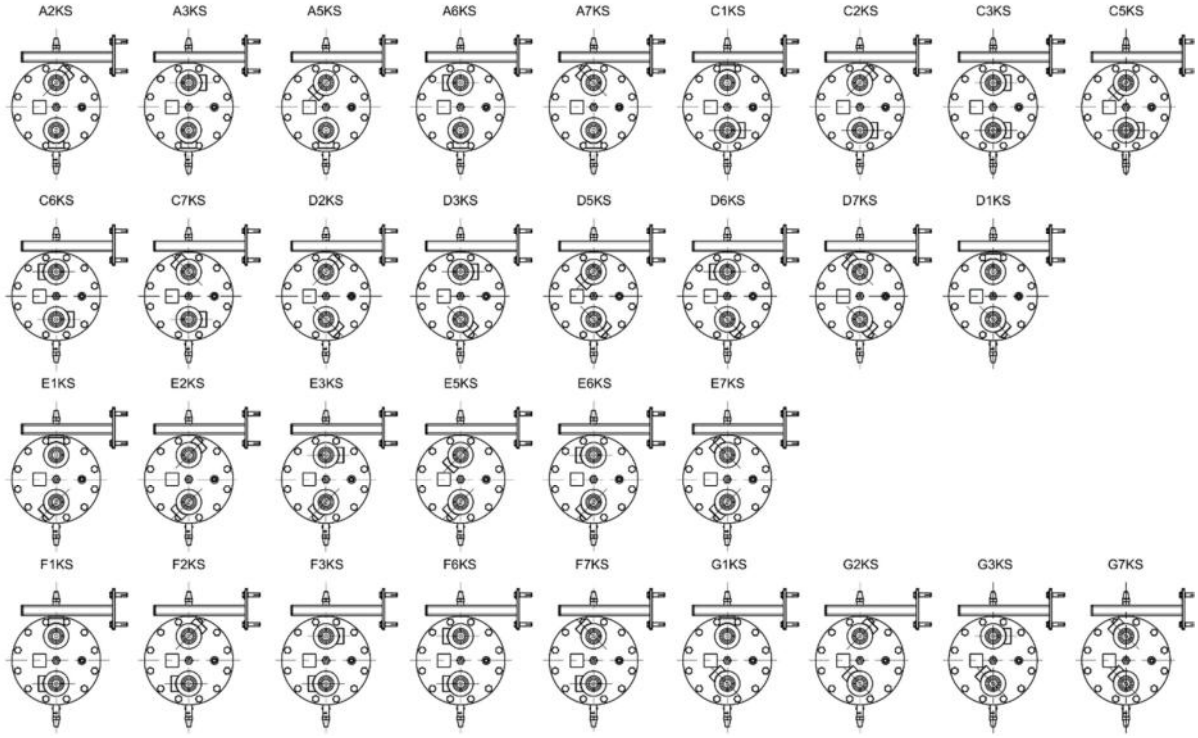


Fig. 4a: **HR 1 – 3**

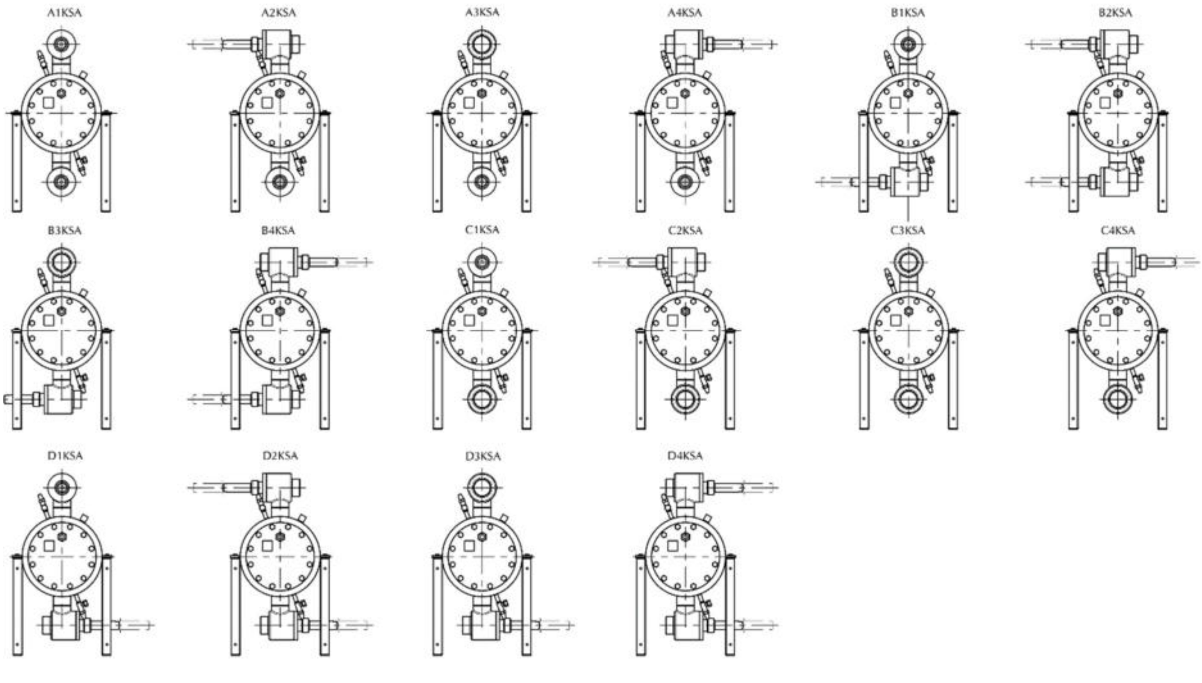


Fig. 4b: **HR4**

5. DESCRIPTION OF OPERATION

The high-pressure float regulator expands all liquid refrigerant condensed on the high-pressure side of the system to the low-pressure, but prevents any gas from flowing through the regulator. This simple mechanical operation enables a very energy efficient operation, eliminating the need for complicated electrical controls.

5.1 OPERATION WITHIN THE PLANT

5.1.1 Single stage plant design

The principle of a float regulation for a single stage plant is shown in fig. 5.

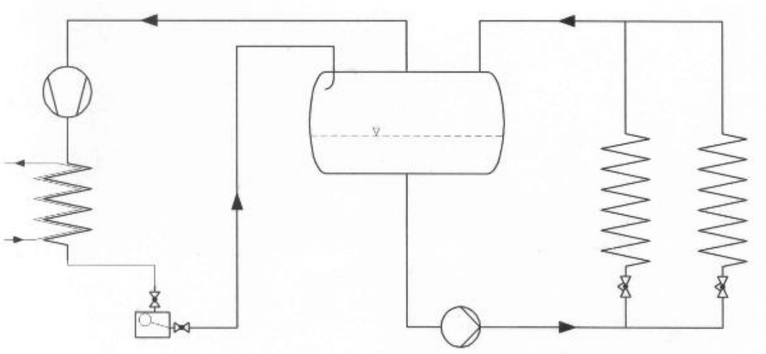


Fig. 5 Principle of a single stage plant

Any refrigerant liquid condensate that forms in the condenser will flow to the float regulator and will be expanded to the low-pressure side at constant enthalpy.

As a result of the liquid expansion there is a mixture of flash gas and liquid refrigerant in the liquid line from the regulator to the surge drum.

The resulting flash gas will be drawn from the surge drum by the compressor while the liquid feed to the surge drum will be distributed to the low side evaporators.

The condensing temperature varies according to the ambient temperature conditions, allowing an energy-saving operation.

Sub cooling of the liquid is not possible at normal operating conditions.

5.1.2 Two-stage plant design

The principle of a two-stage plant with float regulation is shown in fig. 6.

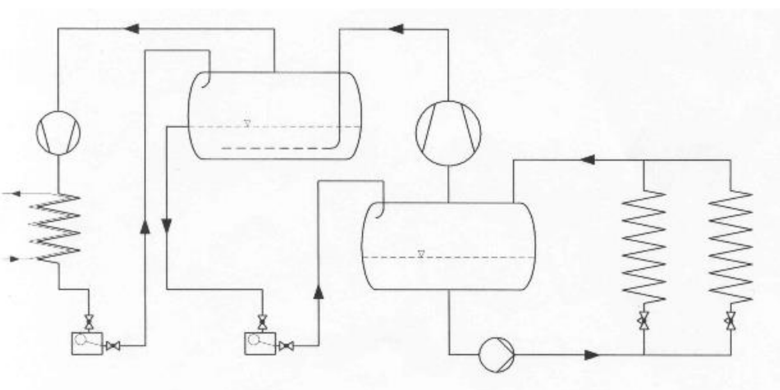


Fig. 6 Principle of a two stage plant

The system uses a float regulator between condenser and surge drum, this expands the liquid refrigerant to the intermediate pressure. A second regulator is used to expand the liquid refrigerant further to the low-pressure side of the system.

Two stage refrigeration systems with float regulation have an improved efficiency and avoid very high gas temperatures for second stage compression.

As all the liquid from the condenser and inter-mediate vessel up to the connection to the second float regulator is passed to the surge drum on the low pressure side, this has to be designed to accommodate the full amount of fluctuating refrigerant charge (low pressure side and excess of the intermediate side).

5.1.3 Hot Gas Defrosting of evaporators

It is the sole responsibility of the system designer to select and design the host gas defrost system. Particularly capacities, required defrost time and piping arrangement considering pressure losses for the particular application, need to be carefully evaluated. There-fore the following recommendations can only support the task, but do not replace careful assessment of the system design.

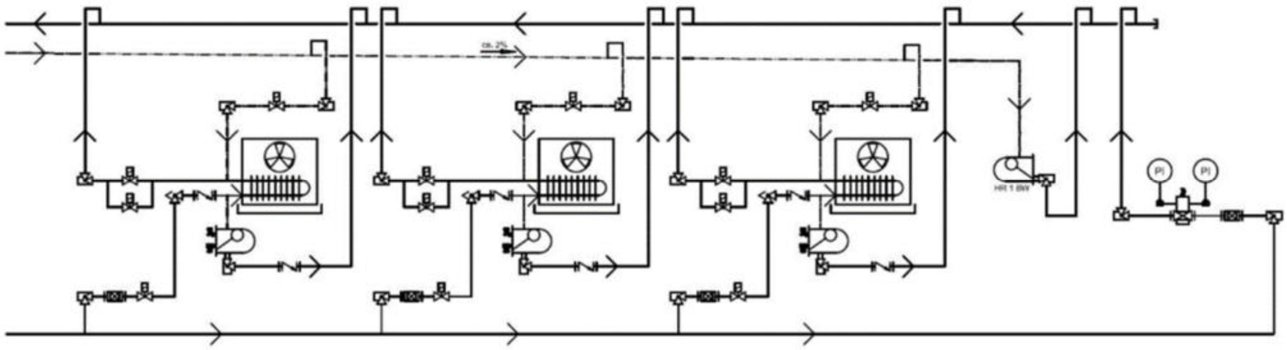
For common defrost periods (ca. 30 min) the high side float regulator has to be sized for 1,5 - 2 times the capacity of the evaporators that are defrosted at the same time. If shorter defrost periods are required, the capacity has to be increased up to 3 – 4 times the capacity of the evaporators that are defrosted at the same time.

The conventional method of defrosting evaporators will use one high side float regulator behind each evaporator that drains condensate in the common pump return line. This method is used particularly for evaporators with large capacities.

In Fig. 7A a HS high side float right underneath the evaporator outlet will ensure gas can vent easily and the float housing is filled with liquid refrigerant at all times. A check valve that is mounted behind the regulator will prevent a bypass flow of the evaporator during normal operation. The pressure difference of this check valve must be carefully selected and needs to be higher than pressure difference between incoming line to the evaporator and condensate return line behind the high side float, considering pressure losses, e.g. of the evaporator coils.

This installation is recommended with evaporators that allow free draining of condensate. Since no gas is bypassed, this represents the most economic way to defrost evaporators.

Fig. 7a Evaporators with HS



When the evaporator cannot drain freely it is required to pass a certain amount of gas at the end of the cycle, so remaining liquid accumulated in the lower coils is eliminated.

Because any bypassed gas will result in a loss of overall system efficiency, it is highly recommended to use free draining evaporators.

To create the gas bypass needed, an external vent line is connected to the top service valve with a solenoid valve that opens at the beginning of the defrost cycle to warm up the drip pan and at the end of the cycle to push out the remaining liquid refrigerant at the bottom of the evaporator.

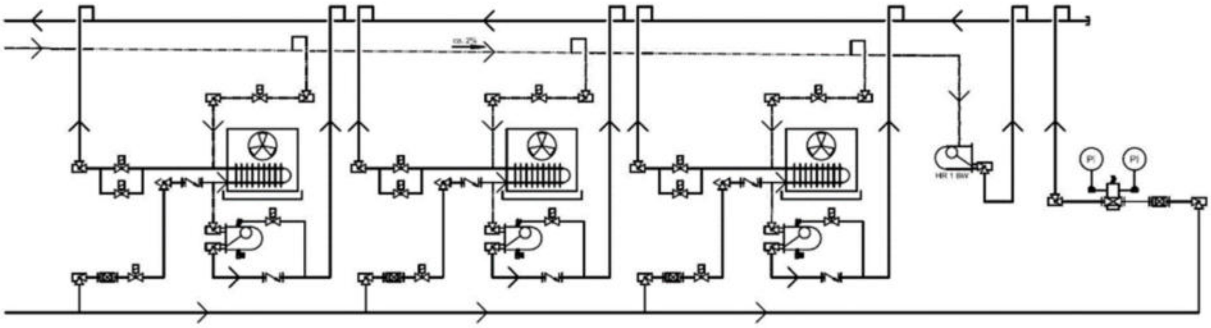


Fig. 7b Evaporators without free draining of the condensate with check valve

A check valve behind the high side float as mentioned above is necessary to prevent refrigerant is pumped in bypass to the evaporator.

If the pressure during the normal refrigeration cycle can exceed the pressure that will open the check valve (e.g. when using back pressure regulators) you should use an automatic operated valve instead of a check valve as per Fig. 7c).

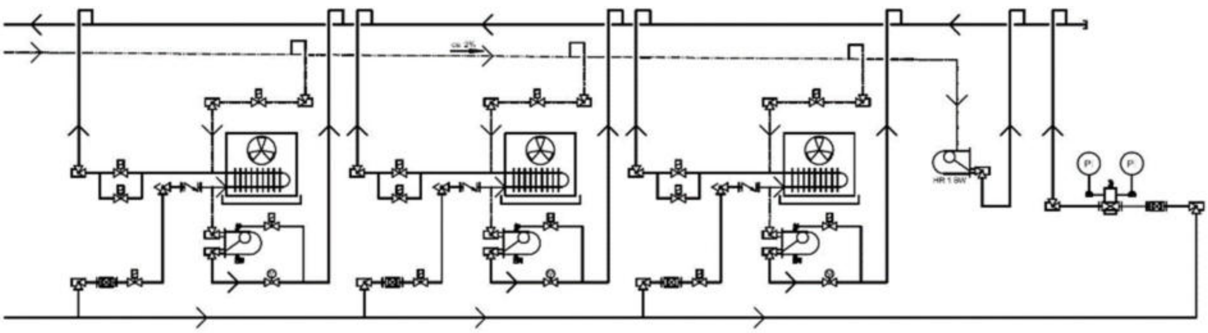


Fig. 7c Evaporators without free draining of the condensate and automatic valve

This automatic operated valve will open at the beginning of the defrost cycle and allow for proper venting of the float housing. It closes when the defrost cycle is finished.

When it is required to install the high side float valve above the evaporator outlet (max. 3m / 9ft) or in a far distance (max. 30m / 90ft), it is required that the pressure in the housing needs to be lowered. This can be accomplished with an internal low pressure nozzle or an external vent line as described before. When an internal low pressure nozzle is used, a check valve behind the high side float is not suitable, because it will take a period of time until sufficient gas is bled through the low pressure nozzle and passed through the check valve. While pressure is built up and gas is released by the check valve this can cause chattering of the check valve and takes more time depending on the height to overcome.

For fast condensate drainage of evaporators the following cost-effective arrangement, according to fig. 7d, has worked well.

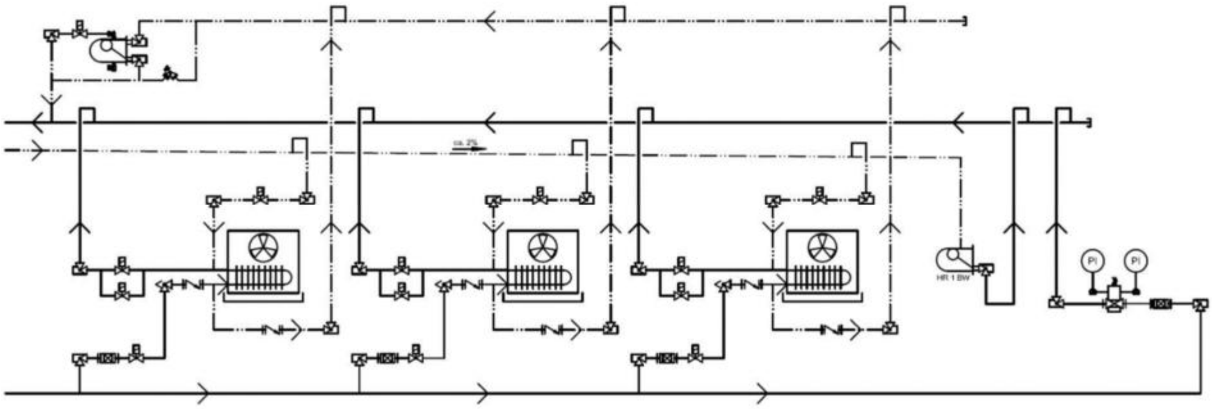


Fig. 7d Installation of evaporator groups

To drain condensate from the evaporators a high side float valve with closed low pressure nozzle should be installed at the end of the condensate drain line (see top left in Fig. 7D). This float valve should be sized for the capacity of evaporators that can defrost at the same time (as described above 1,5 to 4 times the capacity per evaporator).

The line to the common high side float should be mounted above the pump return line with the connections of each evaporator condensate drain being executed with an elbow to the top of the common drain line to avoid liquid is pushed backwards into the condensate lines that are not operated.

When the solenoid valve closes upon finishing of the hot gas cycle, a gas buffer is formed that will prevent any liquid refrigerant is pushed through the regulator during normal operation

Excessive pressure between the liquid condensate and the pump return line should be avoided by use of a by-pass line with an overflow valve.

In all above described cases it needs to be ensured that there are no liquid traps (e.g. at the end of the hot gas main line) as this can cause sudden evaporation / slug of liquid. If this is possible an additional float regulator is needed at the lowest point of the defrost line to drain any trapped liquid.

It is recommended to use a gradient of app. 1 – 2% for the hot gas line to a small high side float (HR1BW) ac-cording (see fig. 7d) to collect and drain any condensate at the end of the line.

As always heat intake into the high side float should be avoided, as this will create too much flash gas. Particularly outside installation will therefore require insulation.

5.1.4 HR1BW for oil return

Alternatively the HR1BW can be used for an oil return. Therefore the HR1BW should be placed at the lowest spot of the oil separator.

Any oil that accumulates will automatically be returned to the compressor without any gas passing through.

Since oil is permanently returned by the HR1BW the oil charge can be reduced.

After stand-still the solenoid valve in the line between HR1BW and compressor can be opened only after a few minutes, because any refrigerant that may have condensed will immediately evaporate during operation.

5.1.5 Recovery Effect

The installation of a HP-receiver must generally be avoided.

When the float regulator is selected too small, refrigerant will back-up into the condenser. This back up has the result that the effective condenser surface will be decreased and the condensing pressure will raise until the float regulator is again capable to release the ac-cumulated condensate. With a high-pressure receiver installed in between the two components this very helpful characteristic cannot be used, since the receiver will be filled first before any condensate will build up in the condenser.

Caution: If too much liquid migrates to the high-pressure side (this can be checked by sensing the sub cooling of condensate) the low-level alarm of the LP surge drum may be activated.

⚠ If the maximum allowable differential pressure is exceeded, e.g. at high condensate tempera-tures, the outlet mechanism of the regulator may become blocked!

5.2 FLOAT REGULATION

Liquid condensate flows into the regulator housing lift-ing the float ball. This movement is transmitted to the moving part of a slide valve block, which in turn propor-tionally exposes the mating seat orifice releasing con-densate to the surge drum.

Since the float has to overcome friction, there is a pro-gressive exposure of the orifice area.

As the liquid level drops, the slide block moves back over the orifice closing the outlet.

When the float ball is down at its lowest position the precisely machined surfaces of slide block and orifice area will seal tightly. Movement of the float depends on the diameter and weight of the ball as well as the densi-ty of the liquid refrigerant.

For refrigerants with low density we have alternative SK-balls to be integrated in the HS/HR typ regulators.

With the WP-HR and HR4-SK the ball float is open at the bottom. Due to gas formation within the ball it will move upwards, exposing a part of the orifice area. This is why high-pressure float regulator WP-HR an HR4-SK **are not to be mounted underneath the condenser.**

5.3 FUNCTION OF THE LOW PRESSURE NOZZLE

To enable any liquid condensate to flow to the regulator by gravity, it would be necessary to arrange the regulator underneath the condenser.

To permit an installation with the regulator above the condenser, all HR and WP HR float regulators, with the exception of the HR1BW, are equipped with an internal low-pressure. HS-regulators may also be ordered with low-pressure nozzle (optional).

This low pressure nozzle connects the gas space in the housing with the outlet connection. Due to the pressure difference between high and low pressure side, the gas is drawn to the low-pressure side resulting in a slight under pressure in the housing.

This effect allows that gases are drawn off that form over a vertical distance from the condenser of up to 3 m and a horizontal distance of up to 30 m.

In addition this allows the small amount of flash gas, which can form in the liquid feed line or during plant standstill to be bled away.

ⓘ There is no additional purging line required!

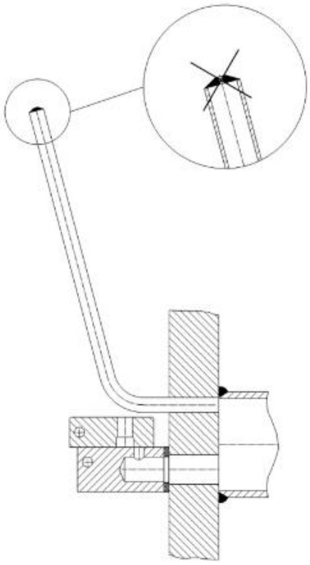
During standstill of the plant system the pressure will slowly equalize allowing the entire refrigerant charge to transfer to the coldest part of the system. (During winter-time this can be the condenser)
If it is not desired that the pressure equalize, the regulator must be ordered without respective with closed low-pressure nozzle!

Factory selection of the low-pressure nozzle is made in such a way that the theoretically calculated loss of capacity due to gas by-pass is less than 1% of the nominal capacity.

5.3.1 Plant with closed low pressure nozzle

HR-float has always an integrated low pressure nozzle that can be closed if necessary. Standard HS regulator can be ordered without low pressure nozzle (execution of the HS according to fig. 8b).

When the pressure equalization during standstill of the refrigeration plant is not desired, e.g. in connection with oil coolers of ammonia screw compressors, the HR regulator must be ordered with closed low-pressure nozzle, see fig. 8a. (These special orders will be delivered with an identifying label “closed low pressure nozzle”).



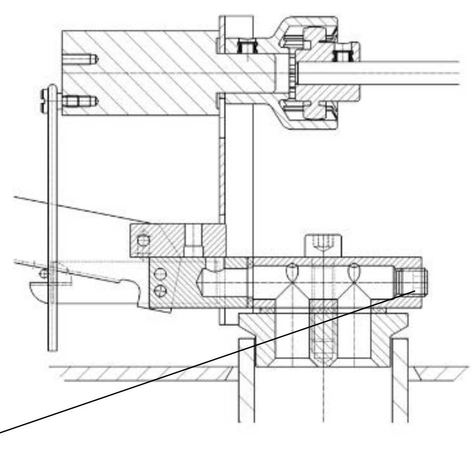


Fig. 8a HR regulator with closed low pressure nozzleFig. 8b HS regulator without low pressure nozzle

5.3.2 HS regulators without low pressure nozzle

HS regulator models HS31 – HS33, HS41 – HS43 as well as HS51 and HS53 are delivered without low pressure nozzle.

When the HS regulator is mounted as close as possible underneath the condenser, there is no need for a low pressure nozzle. Any gas bubbles can rise back to the condenser through a generously sized connection between regulator housing and condenser, where they will be condensed.

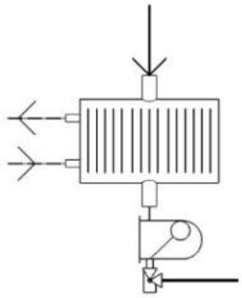


Fig. 9a

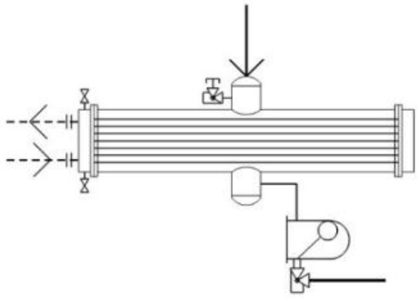


Fig. 9b

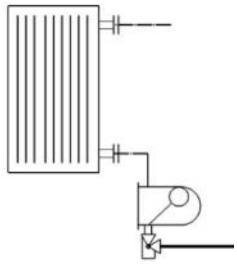


Fig. 9c

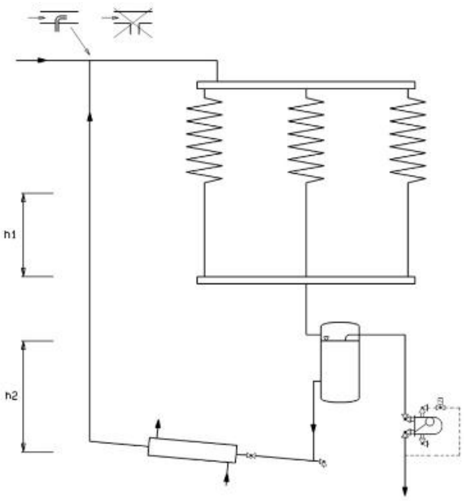
When using HS regulators without low pressure nozzle it should be considered that the connection to the condenser should have the same dimension as the top connection of the regulator housing.

The line should be as short as possible avoiding resistances caused by elbows, reducers or valves.

A gas bubble should be able to rise back to the condenser.

5.3.3 Installations with oil coolers

Fig. 10 shows the principle installation of a plant with oil cooler. Purging of the regulator housing has to be carried out with an external vent line.



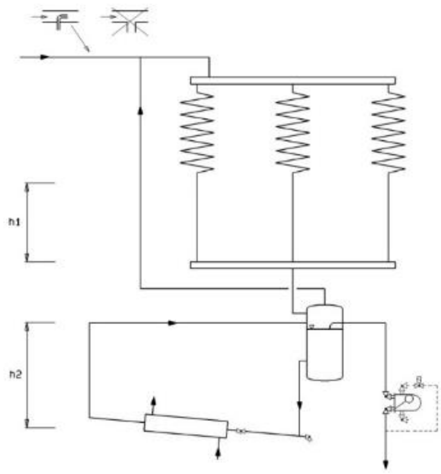


Fig. 10a Principle installation with oil coolers Fig. 10b

A separate set of controls is to be fitted from the top purge connection. After the EE3/EE6 regulating valve a solenoid valve has to be installed in the line returning to the low-pressure drum. (The line size should be the same as the regulating valve). The solenoid valve has to be closed during plant standstill preventing equalisation of the system pressure.

When used with refrigerant cooled oil coolers care must be taken to ensure that a sufficient liquid refrigerant feed to the oil cooler is maintained at all times. The high-pressure receiver must therefore be positioned above the oil cooler.

Heights h1 and h2 shown in fig. 10 have to be correctly sized. It has been observed in practice that these heights are insufficient. Height h1 was not large enough to balance any pressure fluctuations and height h2 did not exceed the pressure drop in the liquid line.

6. HINTS FOR PLANNING

6.1 GENERAL

High-pressure regulation within a plant is achieved by expanding condensed refrigerant liquid. This is particularly favourable with plants that have a central surge drum or with evaporators operating very energy efficient. Simple mechanical operation gives a high degree of reliability, maintaining the liquid condensate drainage at all-time without further regulating effort. In contrast to low-pressure regulators the entire fluctuating refrigerant charge is located in the central surge drum.

6.2 SELECTION CRITERIA

For selection of WITT high-pressure float regulators please refer to our selection program that can be downloaded from our website www.th-witt.com and our brochure “Float regulators for refrigeration plants and heat pumps”.

WITT high pressure float regulators are characterised by the following design features:

- Independent from a minimum pressure difference
- Independent from a minimum capacity
- The maximum flow is dependent on the pressure difference and the dimensions of housing respective connections
- The maximum allowable pressure difference is dependent on the specific weight of the liquid refrigerant

6.3 LOCATION

6.3.1 General

Due to the low-pressure nozzle design, the high-pressure regulator can be positioned above the level of the condenser. A max. vertical distance of 3 m and a horizontal distance between regulator and condenser of up to 30 m are possible. These dimensions are not valid for the HR1BW (and HS regulators without low pressure nozzle), which cannot be installed above the condenser and the model WPHR as well as HR4-SK-H that must not be installed below the condenser. The WPHR and HR4-SK-H must be mounted 1 – 3 m above the condenser so that rising gases support the lifting of the open float ball.

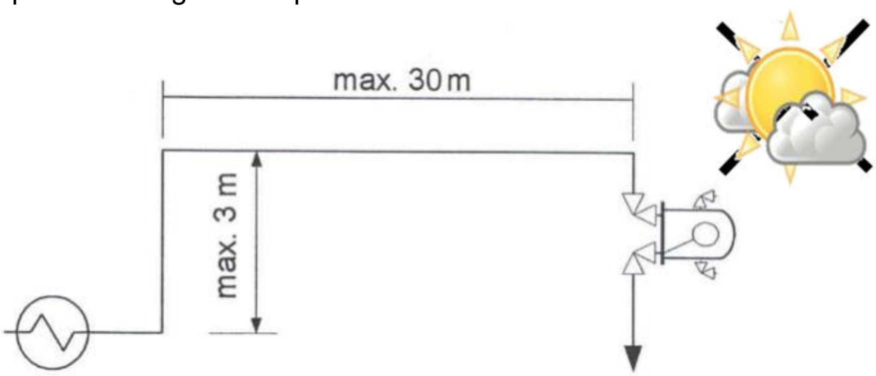


Fig. 11 Arrangement of the high pressure float regulator

The regulator can be positioned and installed near to the low-pressure side of the refrigerant plant, so the length of cold piping that requires insulation can be kept to a minimum. Note: It is important that the liquid refrigerant feed pipe work should not be exposed to high ambient temperatures or excessive pressure drop.

6.3.2 Parallel arrangement of condensers

⚠ Parallel installation of condensers or condenser outlets with a common liquid line or receiver should be avoided under all circumstances. A separate high-pressure float regulator behind each condenser outlet has to be installed to ensure a trouble-free operation (s. Fig. 12b)

It has been observed in practice that also the recommended suction head of the manufacturer is sometimes not sufficient to compensate for the fluctuations in liquid level at parallel arranged condensers! Particularly with small pressure differences (s. Fig. 12a) the feed height has to be increased..

If the parallel arrangement of condensers with a common collector has to be selected, special care must be taken that only equally sized models of condensers are in-stalled in parallel and that they are arranged symmetrically. This is to ensure the pressure drop in the condensers and in the lines to the common liquid line or receiver are approximately the same. The feed hight from the condenser outlet to the top of the common liquid line or receiver will be indicated in the manual of the condenser manufactor. The lines from the condenser shall be connected with an elbow from the bottom to the common collector line. The common collector line should be seized generously to make sure there is always sufficient liquid to feed the high side float regulator

⚠ When different condenser types are installed or an asymmetric arrangement is made the different operating conditions will result in a backup of liquid refrigerant in one of the condensers while letting by-pass of discharge gas through the others.

⚠ A purging line of the common liquid line or receiver collector line must be connected above the condenser at the highest point of the hot gas inlet

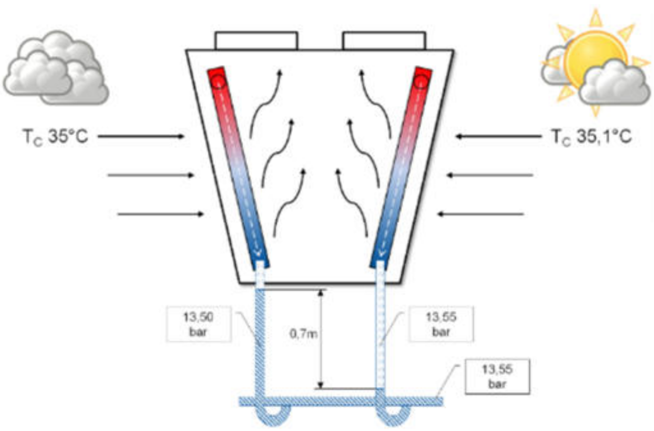


Abb. 12a

Pressure differences with parallel
Condensers outlets

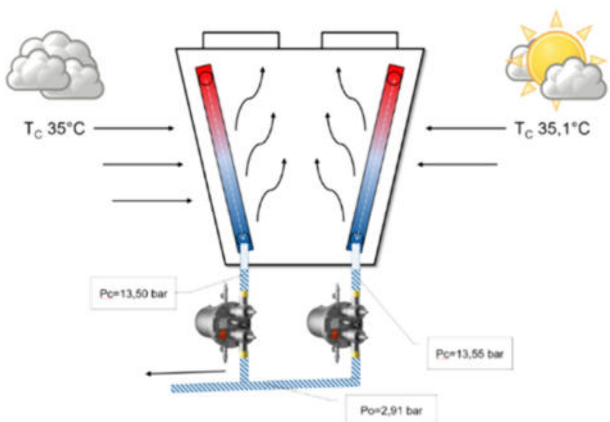


Abb. 12b

Operation with one highside-
float regulator per condenser outlet

6.3.3 Parallel Installation of float regulators

Parallel installation of float regulators is particularly favourable in case of part load or low capacity operation. For parallel arrangement install the regulators according to the schematic below. To avoid a loss of efficiency with multiple low-pressure nozzles, it is advisable to close the low-pressure nozzle of the top mounted regulator and to replace it with an external purging line with solenoid valve control.

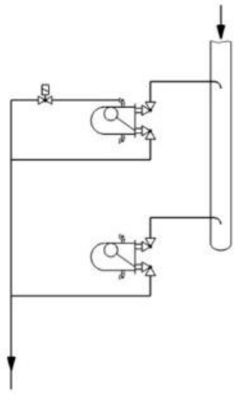


Fig. 13 Parallel installation of float regulators

6.4 LIQUID FEED LINE

6.4.1 General

The liquid feed line shall be sized so that the velocity of the liquid refrigerant does not exceed 1 m/s. This will be achieved when piping has the same diameter as the connection at the WITT inlet valve.

By maintaining this velocity you will ensure that flash gas is kept to a minimum.

⚠ Under no circumstances shall the liquid feed line be installed uninsolated when piped through warm areas, beside machines, or exposed to direct sunlight.

⚠ Internal filters or dryers are not permitted in the liquid feed line!

6.4.2 Connection to a pressure vessel

When the liquid feed line has to be connected to a pressure vessel, e.g. receiver, feed vessel or an intermediate cooler, the installation shall follow the schematic below to prevent any HP gas becoming entrained in the liquid line (see fig. 14a).

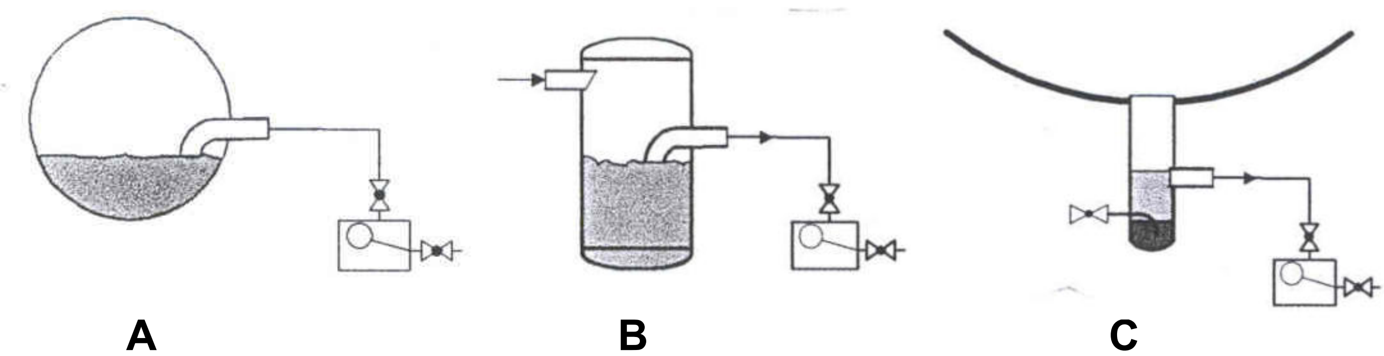


Fig. 14a Proper connection to a HP vessel

The following two connection arrangements must not to be used, as in fig. 14b **D** gas will be entrained due to vortexing and in fig 14b **E** the entrained gas will be drawn into the liquid.

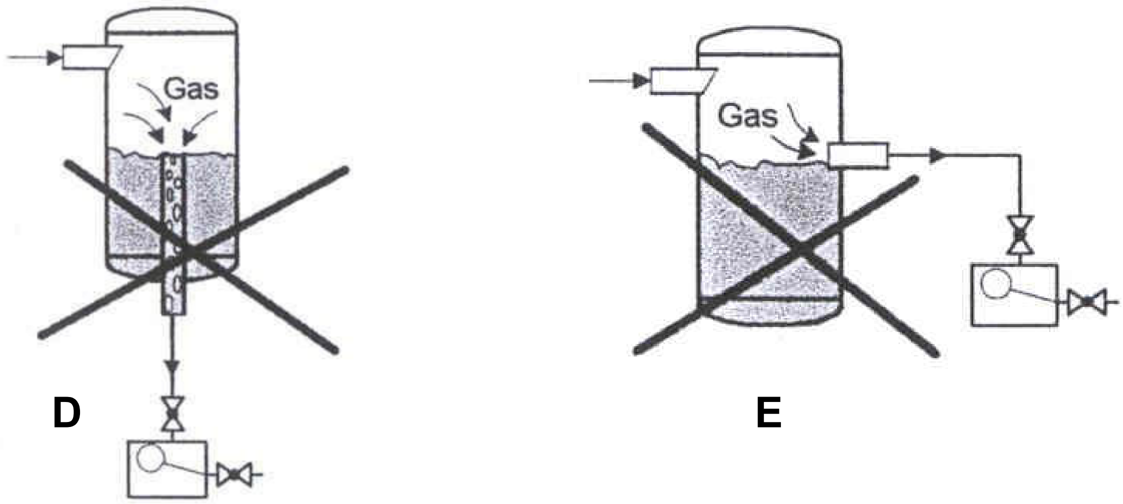


Fig. 14b False connection to a high pressure vessel

6.4.3 Automatic valves in the liquid feed line

The use of automatic valves in the liquid feed line should generally be avoided. If they are absolutely nec-essary, it is recommended to use e.g. electrically or pneumatically operated full bore ball valves.

Any valves depending on a pressure difference (e.g. pilot valves) are unsuitable because of the lack of pressure difference between condenser and float regulator.

6.4.4 Connection to plate condensers

When HS regulators without low pressure nozzle can-not be used (e.g. the regulator cannot be placed underneath the condenser), consideration should be given to the following:

Particularly attention has to be paid to applications with plate-type condensers, which use a low refrigerant charge. Care has to be taken to avoid any gas is flowing to the regulator.

As the internal pressure difference within the plate channels fluctuates a sufficiently laid-out siphon (duck neck) drain connection has to be used.

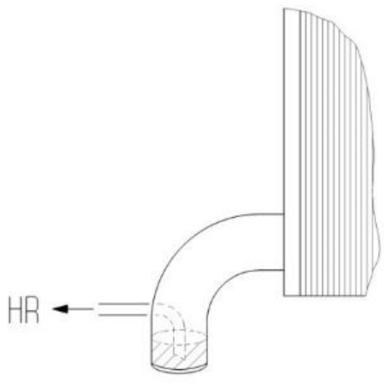


Fig. 15a Schematic of the siphon connecting to a plate condenser

6.4.5 Connection of flanged version to plate condensers

HS flanged float regulators can be mounted directly to the flange connection of the plate condensers.

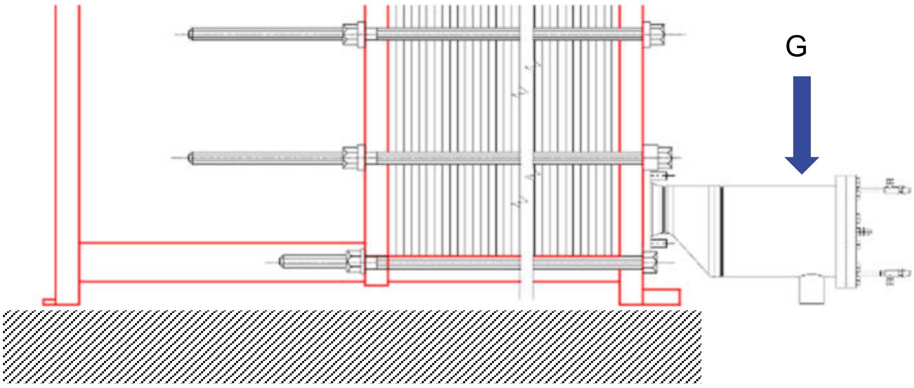


Abb. 15b: Connection of a HS float regulator in flange version

When mounting the HS float regulators, pay particular attention to the increased torque on the flange connections of the plate apparatus. To avoid possible leaks at the flange connection, the weight of the HS float regulator with flange must be completely absorbed. The outlet nozzle must point 90° downwards.

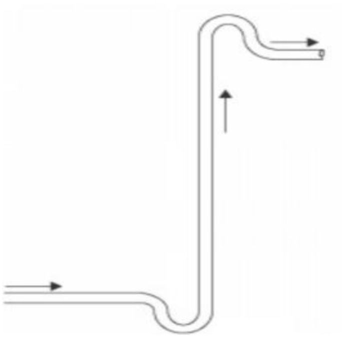
6.5 Low pressure line from the regulator

After the regulator there is a mixture of gas and liquid refrigerant in the LP line. This line should be sized so that the gas velocity of the liquid is 15 – 25 m/s.

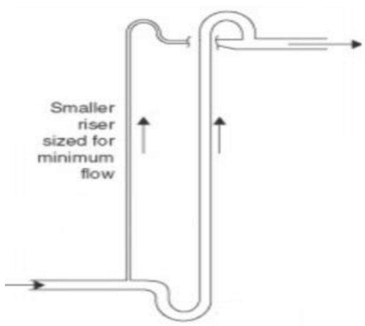
The inlet-velocity into the surge drum shall not exceed an average of 10 – 15 m/s.

In the case of vertical installation (riser), special care must be taken when dimensioning the pipe to the above mentioned conditions!

Exemplary versions of vertical installation (riser):



Riser for 100 % Load



Double Riser for x % partial Load

The pressure difference between HP and LP side shall be more than 1,5 bar to compensate for the pressure drop in the low-pressure line. (The following equation explains this further)

The pressure difference at the high pressure float regulator is calculated per:

$\Delta p_{HR} = (pc - p0) \pm \Delta p_{stat.supply} - \Delta p_{losses}$

whereas Δp_{losses} can normally be neglected, as long as there is no liquid in the injection line, because of the following equation:

$\Delta p_{losses} = \pm \Delta p_{stat.LP\text{-}Line} - \Delta p_{friction}$

(These equations are only for liquid refrigerant!)

To prevent liquid hammer in the low-pressure line, it should not be installed with a large vertical riser.

If this cannot be avoided, there shall be a liquid ”U” trap every 5 – 8 m. The connection of the low-pressure line to the surge drum shall be arranged to avoid any danger of liquid being entrained in the dry suction line to the compressor (see fig. 5 and fig. 6).

7. TRANSPORT AND STORAGE

All connections are protected with yellow plastic caps to prevent any dirt, debris or water contaminates the regulator. For safe transportation during delivery the float ball is locked in position by turning the lever upwards (lever, respective the hole in the lever is facing upwards). Storage shall be dry and protected from any dirt or debris.

8. INSTALLATION

⚠ Any work on float regulators must be carried out by trained and knowledgeable personnel experienced in installation and service of refrigeration systems!

8.1 PREPARING FOR INSTALLATION

Before the float regulator can be installed the following functions should be carried out

- Unpack the float regulator and check for damages during shipping and the correct scope of equipment supplied. In case of any damages inform your supplier immediately.
- Check the information provided on the nameplate with your order requirements, respective order confirmation: is type and refrigerant correct, is the low-pressure nozzle closed, if ordered, etc.
- Remove plastic caps or other sealing immediately prior to (and not before) installation of the regulator.
- Check whether the regulator pipe connections match the piping connections required.
- The piping system is to be clean and free of any moisture.

⚠ The HR float regulator has undergone a pressure test with **mineral refrigerant machine oil** in the factory. If the regulator will be used in sys-tems where contamination with mineral oil is not allowed, i.e. in cases with ester oil in the system, the residual oil must be removed adequately and cleaned by use of solvents.

8.2 FIXING INSTRUCTIONS

Align the float regulator in a horizontal position, so that the inlet and outlet nozzles are in alignment with each other (see Fig. 1a - 1d).

ⓘ Provide sufficient space, so that the internal float ball can be exchanged and the valves are accessible.

⚠ Under no circumstances should any attachments be welded to the float regulator housing. Such welding will make the certificates and manufacturers warranty void!

⚠ Make sure the installation is stress free when welding the float regulator to the pipework!

It is important to consider the stress in the pipe work during system temperature pull down!

WITT valves should be half open and cooled with a wet cloth during welding. When welding to the connections of the WP HR, HR4, HS or to the connections without valves, make sure the heat of welding will not damage the O-ring at the outlet. All HR-regulators, above size HR 2 the housing is equipped with a safety valve connection.

⚠ When the installation is complete, turn the lever downwards to unlock the transportation-securing device of the float. The hole in the lever shall point downwards for “automatic operation”.

9. COMMISSIONING

9.1 PRIOR TO COMMISSIONING

The refrigeration system must be pressure tested, have completed a successful vacuum test and be charged with refrigerant.

⚠ It is not permitted the control unit is exposed to the high test pressure. Therefore the high side pressure regulator should be excluded from the pres-sure testing on site (it has already undergone a leak- and pressure test at the manufacturer). If it is necessary to include the regulator in the pressure test, the control unit must be removed during the duration of the pressure test.

The inlet- and outlet valves must be fully open.

Turn the lever in automatic position (hole in the lever pointing downwards).

Protect the valve spindle with the supplied cap.

9.2 COMMISSIONING

Ensure that all non-condensable gases are removed from the system. It is recommended to purge the system thoroughly during start up. (Please refer to “Purging” in Chapter 11.5).

Check that the condensing temperature is stable or increasing slowly (if you observe it is increasing, the installation must be purged again).

If the liquid refrigerant draining from the condenser is sub cooled, there is too much air or non-condensable gases in the system.

When the plant stops check that the water-cooled respective evaporative condenser temperature after system pressure equalisation cannot drop below freezing point (danger of freeze-up!).

10. OPERATION

The high-pressure regulator operates automatically and does not require further attention.

11. SERVICE AND MAINTENANCE

The low friction slide block offers low wear and continuous self-cleaning of the orifice area, which normally requires no further maintenance. Nevertheless, the replacement of the pusher stones after about 10 years or 80,000 operating hours should be made.

Before opening the high side float regulator any refrigerant need to be taken out.

⚠ When the high-pressure float regulator HR is to be maintained, the housing must be completely depressurised and the entire refrigerant must be removed, before loosening any screws and opening up!

⚠ During opening up a sudden boiling of residue refrigerant may occur. Therefore wear the required safety clothing! Do not remove all the screws until you are sure no residue refrigerant or pressure exists.

Upon re-assembly take care that all gaskets are in place and in good condition. It is recommended to replace all gaskets each time the float regulator has been opened!

If you have to disassemble any safety devices for maintenance or repair make sure that on completion the re-assembly and proper functions are checked!

11.1 Functioning check

All float regulators are provided with a lever that can be operated externally to lift the float. The regulator can be opened or closed that way to check that it is functioning correctly.

11.2 Replacing the float ball

Follow all national and local safety requirements and codes of practice when removing the float. Please take particular care of the following:

- Check the plant room layout and exit doors so you can evacuate the area quickly in case of an emergency.
- Seek assistance to handle and remove the float
- Wear the correct protective safety clothing, as a minimum use safety goggles and gloves, in case of NH3 have a safety gas mask within easy reach.

When exchanging the float please carry out the following steps:

- Close the inlet valve
- Lock the float by turning the lever upwards
- Wait until all refrigerant is released to the low pressure side
- Now close the outlet valve
- Drain any remaining refrigerant and oil carefully through the bottom mounted drain valve EA 10 GB
- If necessary purge the regulator housing with nitrogen
- For access remove the housing of types HR 1 to HR 3,
- Remove screw M 4 x 5, Pos. 55,
- Unscrew the cylindrical screws M 8 x 20, Pos. 52, out of the cover
- Remove guide bracket, Pos. 57 and tow bar, Pos. 56
- Exchange the entire control unit
- Replace the gasket, Pos. 32
- Re-assemble guide bracket, Pos. 57, tow bar, Pos. 56 and fix the control unit with the cylindrical screws Pos. 25.

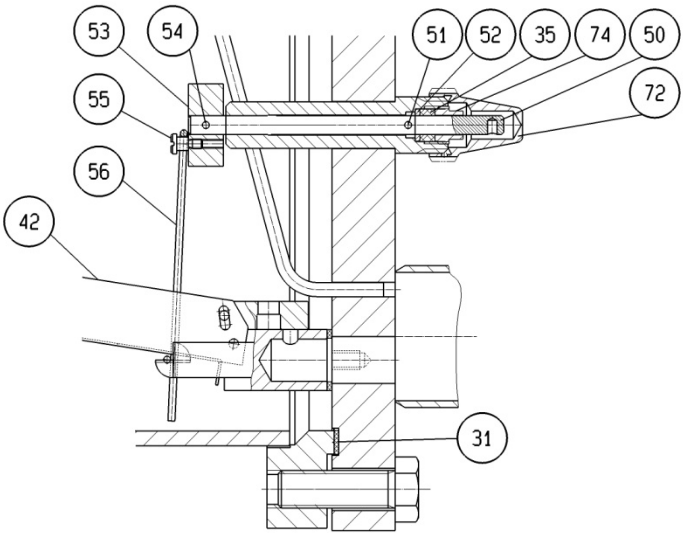


Fig. 16a

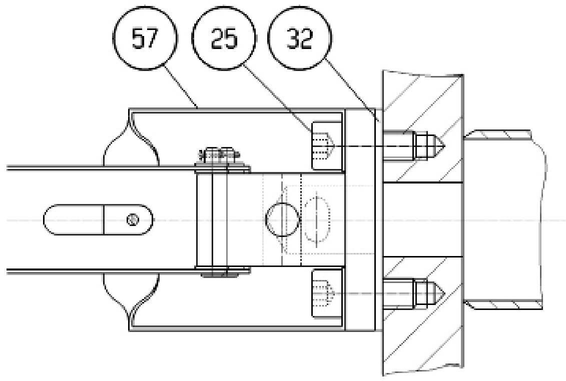


Fig. 16b

HR1 – HR3 (refer to Fig. 16a and 16b)

- Secure the tow bar, Pos. 56 with screw, Pos. 55 in the excenter, Pos. 53
- **Pay attention to the tow bar, it should be seated loosely in the guide bracket**
- Always re-install the regulator housing using a new cover gasket, Pos. 31. Proceed according to chapter 9 for commissioning and start-up.

HR4 und HS50 (see also sectional drawings 2b and 2d)

- In order to take the cover flange, pos. 11 off, you need to first remove the protective cap, pos. 72 and unscrew the gland, pos. 74 of the lever.
- Remove the cover plate hexagon screws, pos. 21 and take the cover off
- Remove the two hexagon socket screw (similar to pos. 25 of fig. 16b) and you can take the entire control unit out and exchange it.
- Always replace the gasket of the control unit (similar pos. 32 of fig, 16b) und the cover-gasket during re-assembly. Proceed per chapter 9.

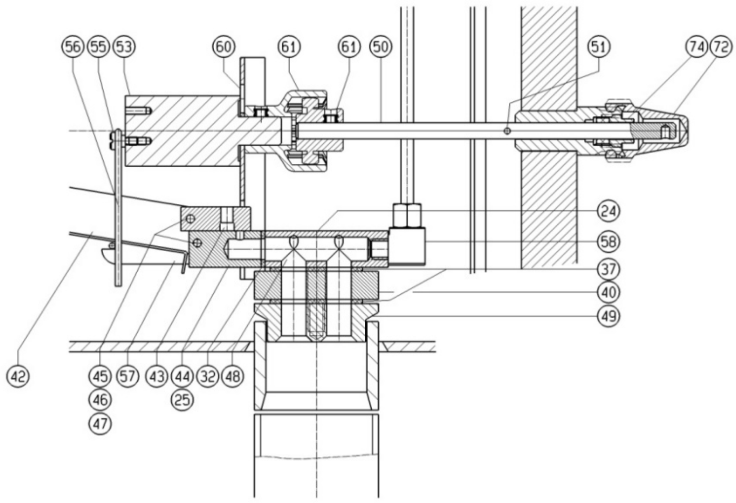


Fig. 16c

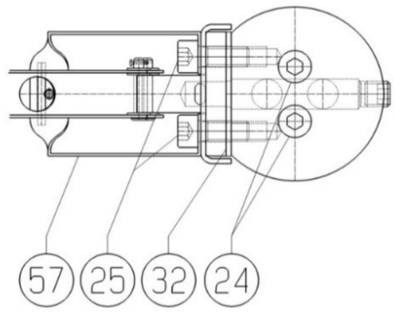


Fig. 16d

HS30 – HS40/ WPHR (see Fig. 2c, 2e and 16 c, 16 d)

- Take the cover flange, Pos. 11, off by removing screws, Pos. 21.
- When removing the cover flange, the lever will be removed from the coupling
- Remove the two hexagon socket screws, Pos. 25 and you ran remove and exchange the entire control unit
- Always replace the gasket of the control unit, pos. 37 and the gasket of the cover flange, pos. 31 when re-assembling the regulator. Proceed per chapter 9.

11.3 Replacing the lever packing

⚠ Please make sure the regulator housing is depressurised before replacing the packing.

You can replace the lever packing without opening the regulator housing.

- After removal of the protective cap, Pos. 72, unscrew the gland, Pos. 74 and replace the packing Pos. 35.
- Re-assemble the gland, Pos. 74 and check for leakages.

11.4 Replacement of the valve packing

The valves can be back seated which means the stem packing can be replaced in a fully open position.

It is still recommended that you depressurise the regulator housing before carrying out this work (see 11.2). The replacement of the lever packing has to be carried out as described above (11.3)!

11.5 Purging

Air or any other non-condensable gases can harm the entire refrigeration plant, particularly the high-pressure float regulator. Most of the difficulties experienced are caused by this particular problem. Efficient purging is therefore very important.

When purging is necessary regularly or air intake cannot be excluded, e.g. shaft seals of compressors are operating in vacuum, an automatic purger is highly recommended!

The following sketch (fig. 17) shows the optional WITT gas purge equipment designed to be used for correct purging. The equipment consists of a special water container that can be positioned on the float and a hose with ½” threaded connection.

Screw in the threaded pin, Pos.93, at the intended location (at the HS and HR4 in the flange). Place the water container, Pos. 91 on the pin and connect the hose, Pos. 92, to the purge valve EE3/EE6 at the top. After the container has been filled with water you can carefully open the regulating valve EE3/EE6.

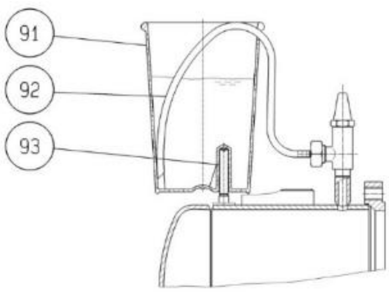


Fig. 17 Optional purge device HR / HS

As long as air or non-condensable gas bubbles continue to rise to the surface the housing is being purged.

Attention: Ammonia is very good soluble in water and creates no bubbles.

Purging must be carried out carefully as the water may over a period of time evaporate allowing ammonia to atmosphere also. The regulator should only be fitted with this air purger in a frost-free location to avoid the water freezing.

Purging should only be carried out under super-vision!

Upon completion of purging, the water should be checked and neutralized if required before safe disposal.

11.6 Enlarging the low pressure nozzle

The hole of the low pressure nozzle is delivered from the work shop in such a way that the theoretical calculated value of the capacity loss due to the gas-bypass is less than 1% of the nominal capacity. With common design of the piping system any gases that may form over a distance of up to 30 m and height differences of up to 3 m shall be drawn off.

When increased gas formation occurs it is possible to increase the low-pressure nozzle orifice size by drilling it out step by step.

Before carrying out this modification please make sure the plant has correctly been purged!

The efficiency of the plant will fall the more the low-pressure nozzle orifice is increased.

The housing should be drained and purged as de-scribed before, before any screws are loosened.

Upon taking the cover/housing off, the function of the regulator can be observed and checked.

The hole (orifice) on the top of the small tube works as a low pressure nozzle.

For HR1 – 3 the small tube is connected to the cover, with HR4, WPHR and HS-regulators you disassemble the tube from the screw connection.

It is recommended to increase the hole step by step.

If the high-pressure float regulator is operated mainly under part load conditions, it is possible to restrict the low-pressure nozzle orifice diameter.

12. TROUBLE SHOOTING

Although the float regulation is a simple mechanical design in some cases problems occur in refrigeration plants.

Our long term experience has shown that in nearly all cases an increased amount of flash gas in the housing will have the effect of lowering the liquid level making it difficult for the ball to rise.

A temporary side glass with branch connections at the inlet-/outlet valves can be used to check the liquid level within the regulator housing.

The most common reasons for installation problems are explained in the following chapters:

12.1 AIR IN THE REFRIGERATION SYSTEM

With plants where large internal volumes exist on the evaporator side there are often quantities of remaining air and non-condensable gases in the system that are often underestimated. When using NH_3 the air will automatically collect in the float regulator housing. This volume of gas will exceed than capability of the low-pressure nozzle. Purging according to chapter 11.5 will resolve the problem in most cases.

12.2 GAS FORMATION IN THE LIQUID FEED LINE

There are several causes of this problem:

- The liquid feed line has been sized too small
- There are internal filters, etc.,
- The regulator is positioned too high above the condenser
- The liquid supply line is installed uninsulated in warm plant room environment

All these will contribute to an unacceptable level of flash gas in the liquid feed line, causing the low-pressure nozzle to become overloaded. If the above-mentioned conditions cannot be changed it is possible to increase the low-pressure nozzle orifice diameter so the gas can be released (see chapter 11.6).

12.3 PARALLEL OPERATION OF CONDENSERS

With parallel installation of condensers in a common feed line to the float regulator it has often be observed that the different line pressure drops causes flash gas formation in the feed line to the high-pressure float regulator.

Check the temperatures at each condenser outlet. If you observe sub cooling of the liquid refrigerant at one of the condenser outlets this will indicate that liquid is backing up inside the condenser. The entire plant is then operating in an unstable condition effecting the proper functioning of the high-pressure float regulator.

With the pipe work layout using a liquid head in the down leg of each condenser circuit according to chap. 6.3.2 the different pressure drops can be compensated. But it has to be realised as mentioned earlier the installed height H in some cases will not sufficient and should be increased accordingly.

If the above mentioned modifications cannot be achieved or do not have the desired effect, each condenser must be equipped with its own separate high-pressure float regulator.

12.4 AIRCOOLED CONDENSER

The above flash gas formation can occur with air-cooled condenser installations. Where separate banks of tube rows are loaded differently, e.g. if sunshine warms up part of one side or if the tube banks have different pressure drops.

By regulating each pipe row the different pressure drops can be compensated for.

12.5 PLATE TYPE CONDENSER

For plate in shell type condensers with thin channels that are loaded unequally from an internal hot gas connection between inlet a properly sized siphon is extremely important (see chapter 6.4.4)

12.6 USE OF HP LIQUID RECEIVERS

The use of a high-pressure receiver in the feed line will slow down or stop the self-recovery effect that is explained in chapter 5.1.5.

12.7 USE OF OIL COOLERS

When high-pressure float regulators with closed low-pressure nozzles are used in systems with refrigerant cooled oil coolers you must ensure that there is always sufficient liquid refrigerant in the HP receiver. The high-pressure receiver should be sufficiently sized so that the oil cooler can be supplied with refrigerant for at least 5 min., before refrigerant is returned from the condensers. **Caution:** Be aware under certain start-up conditions of the system the surge drum can rapidly empty of refrigerant.

When the regulator is installed per fig. 10b particular care should be taken that no gas can enter the regulator (see therefore chapter 6.4.2). It has been observed during start-up there is a lack of refrigerant liquid feed to the high-pressure float regulator.

When a blockage of the float ball is suspected, i.e. as the regulator is cold and the line to the solenoid valve is becoming frosted. Note: A frosted line to the solenoid valve does not necessarily indicate that the housing is filled with refrigerant. By throttling the refrigerant flow to the oil coolers with regulating valves it may be possible to achieve the required feed from the HP receiver.

13. FAULT ANALYSIS

Nr.	Erscheinung	Ursachen und Behebung
1	Regulator does not open during automatic operation	Too much air in the system
		Too small selected regulator?
		Closed inlet-/outlet valve?
		Too high pressure difference?
		Low-pressure nozzle too small or blocked?
		Moisture in the system, now pressure nozzle frozen?
		Slide regulation is blocked, e.g. with debris or due to corrosion
		Float ball is damaged
		Refrigerant oil to stiff (Viscocity >68 ISO VG)
2	Regulator does not close	False float ball (can be exchanged)
		Transport safety device blocks the float ball (hole in the lever shall face down)
		Slide block is worn (can be exchanged)
		Opening of the low pressure nozzle is too big (or: when connecting a solenoid valve line the low pressure nozzle is not closed)
3	Condensing pressure is too high without back-up	Condenser does not transfer any heat
		Too small condenser
		Capacity is too large during start-up
4	Too high condensing pressure because of back-up	Air in the system (see chap. 12)
		Gas in the supply line (see chap. 12.2)
		Parallel condensers (see chap. 12.3)
		Use of plate type condenser (see chap. 12.5)
		False connection of oil coolers (see chap. 12.7)
		Resistance in the supply line is too high (see chap. 6.4)
		The vertical distance is too high (the low pressure nozzle can be enlarged)
5	Heavy fluctuating pressure on the LP side	Too low refrigerant charge
		High friction at the slide block (look for any debris or corrosion)
		Float regulator is too big
6	Minimum level alarm on the LP side	See point 4
		Condenser is backed up with refrigerant (isolate one or more condensers)
		Too low refrigerant charge

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