All Seasons
CLIMATE COMFORT

Heating
Air Conditioning
Applied Systems
Refrigeration

S-CMT01 Mechanical training course

MCQ Screw compressors 3100/3200/4200/F4/F3

TOP SECRET
SECRET
INTERNAL USE ONLY

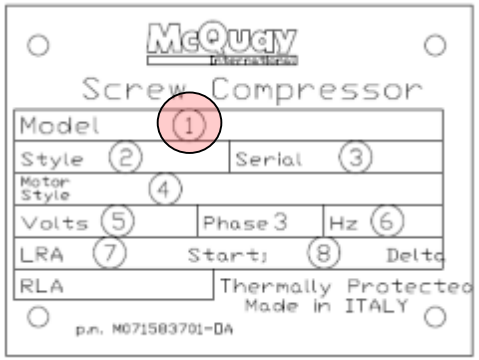
Mc Quay Compressor Nomenclature

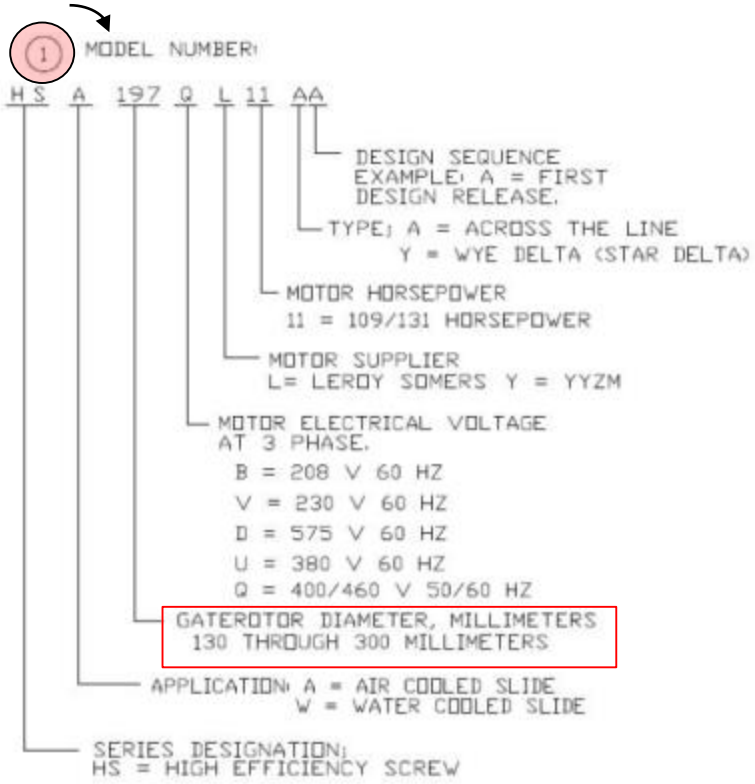
3100

3200

4200

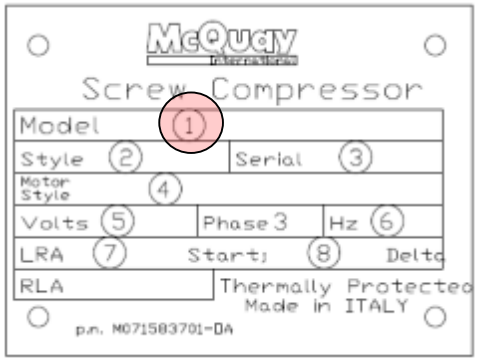
F3/F4





Mc Quay Compressor Nomenclature



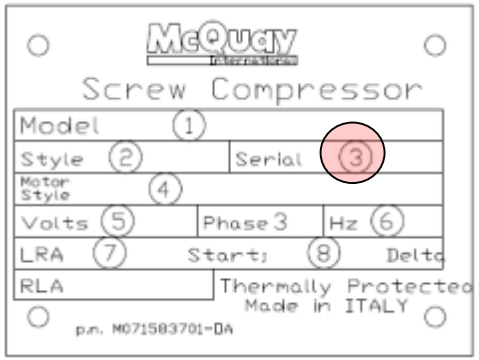



J&E Hall/spare parts	Mc Quay name	
	Air cooled	water cooled
HSS4221	HSA205	HSW205
HSS4222	HSA220	HSW220
HSS4223	HSA235	HSW235
HSS4224	HSA243	HSW243
HSS3216	HSA167	HSW167
HSS3218	HSA179	HSW179
HSS3220	HSA197	HSW197
HSS3221	HSA203	HSW203
HSS3118	HSA3118	
HSS3120	HSA3120	
HSS3121	HSA3121	
HSS3122	HSA3122	
HSS3123	HSA3123	
Assymetric		
F4XL	HSA269	
F4AL	HSA263	
F4AS	HSA241	
F3BL	HSA232	
F3BS	HSA215	
F3AL	HSA204	
F3AS	HSA192	

Mc Quay Name !

Mc Quay Compressor Nomenclature



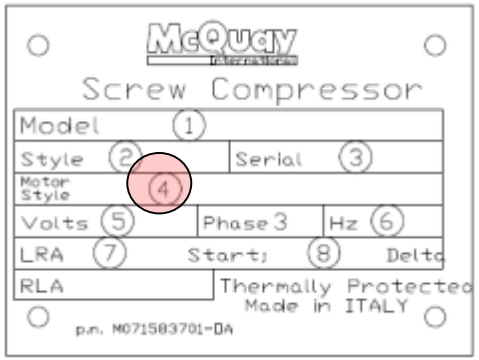
(3) SERIAL NUMBER

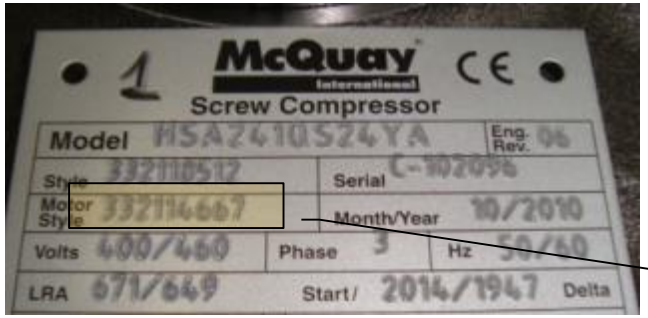
D 03 A 0 5 5 4 5 – 0 1

- ENGINEERING REVISIONS
- SERIAL NUMBER
- STEEL STAMPED NAMEPLATE
- MONTH
  - A = JANUARY
  - B = FEBRUARY
  - C = MARCH
  - D = APRIL
  - E = MAY
  - F = JUNE
  - G = JULY
  - H = AUGUST
  - J = SEPTEMBER
  - K = OCTOBER
  - L = NOVEMBER
  - M = DECEMBER
- YEAR 02 = 2002 03 = 2003 04 = 2004
- PLANT IDENTIFICATION. NUMBER STAUNTON = S CECCHINA = C

Mc Quay Compressor Nomenclature





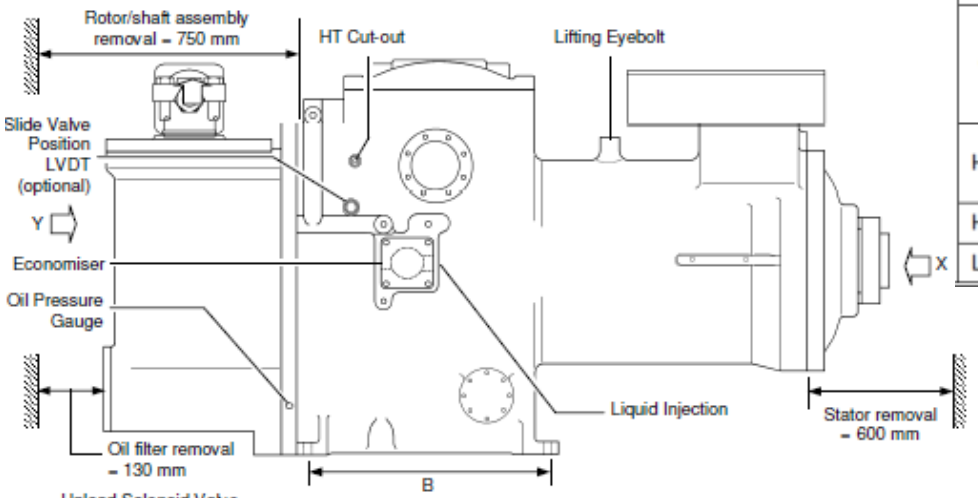
Supply voltage	Code	Compressor model
43kW/400-460V	M331314027	3100
60kW/400-460V	M331314047	
82kW/400-460V	M331314067	
82kW/400-460V	M330563267	3200
82kW/575V	M330563271	
82kW/230V	M330563259	
82kW/208V	M330563255	
82kW/380V	M330563263	
138kW/690V	M330870893	
138kW/400-460V	M330870887	
102kW/400-460V	M330559727	4200
145kW/400-460V	M350233701	
145kW/575V	M330559771	
188kW/690V	M331481782	
188kW/400-460V	M330481767	
82kW/400-460V	332101467	F3AS/L
82kW/208V	332101455	
125kW/400-460V	332121467	F3BS/L
180kW/400-460V	332114667	F4AS/L

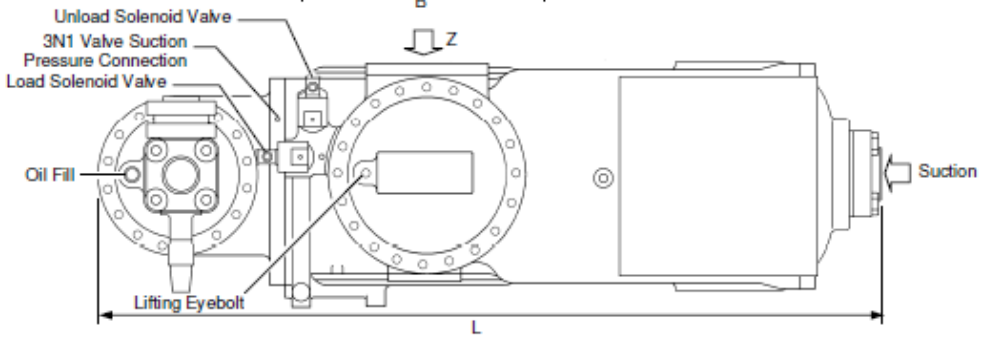
HSS 3100 series

HSA3118
HSA3120
HSA3121
HSA3122
HSA3123

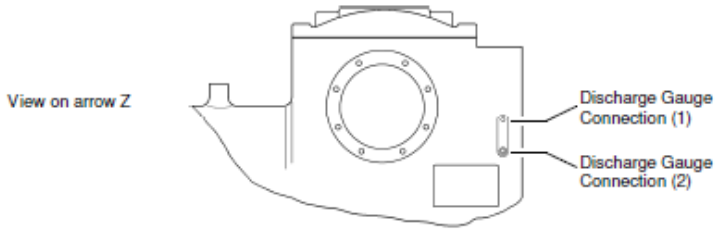
HSS 3100

1. Physical dimensions and connections



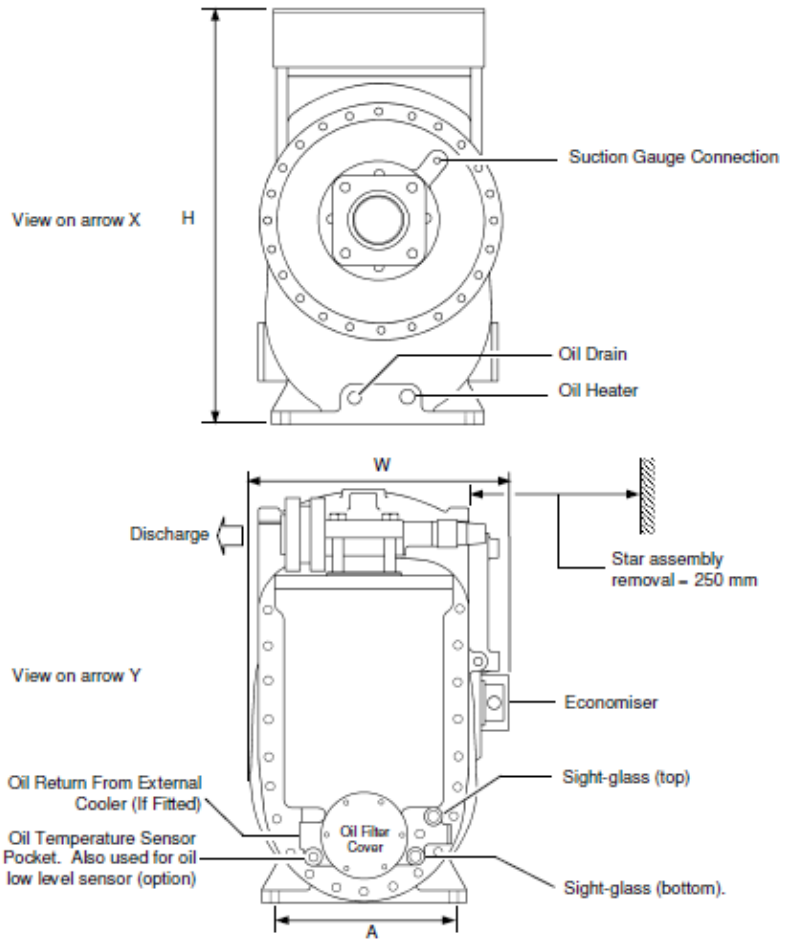


DESCRIPTION			SIZE
Overall	Length	L	1274 mm
	Height	H	643 mm
	Width	W	389 mm
Holding-down bolt centres		A	280 mm
		B	410 mm
Holding-down bolts		-	4 off M12 x 50 mm
Lifting eyebolts		-	2 off M16 x 2P x 26 full thread



HSS 3100

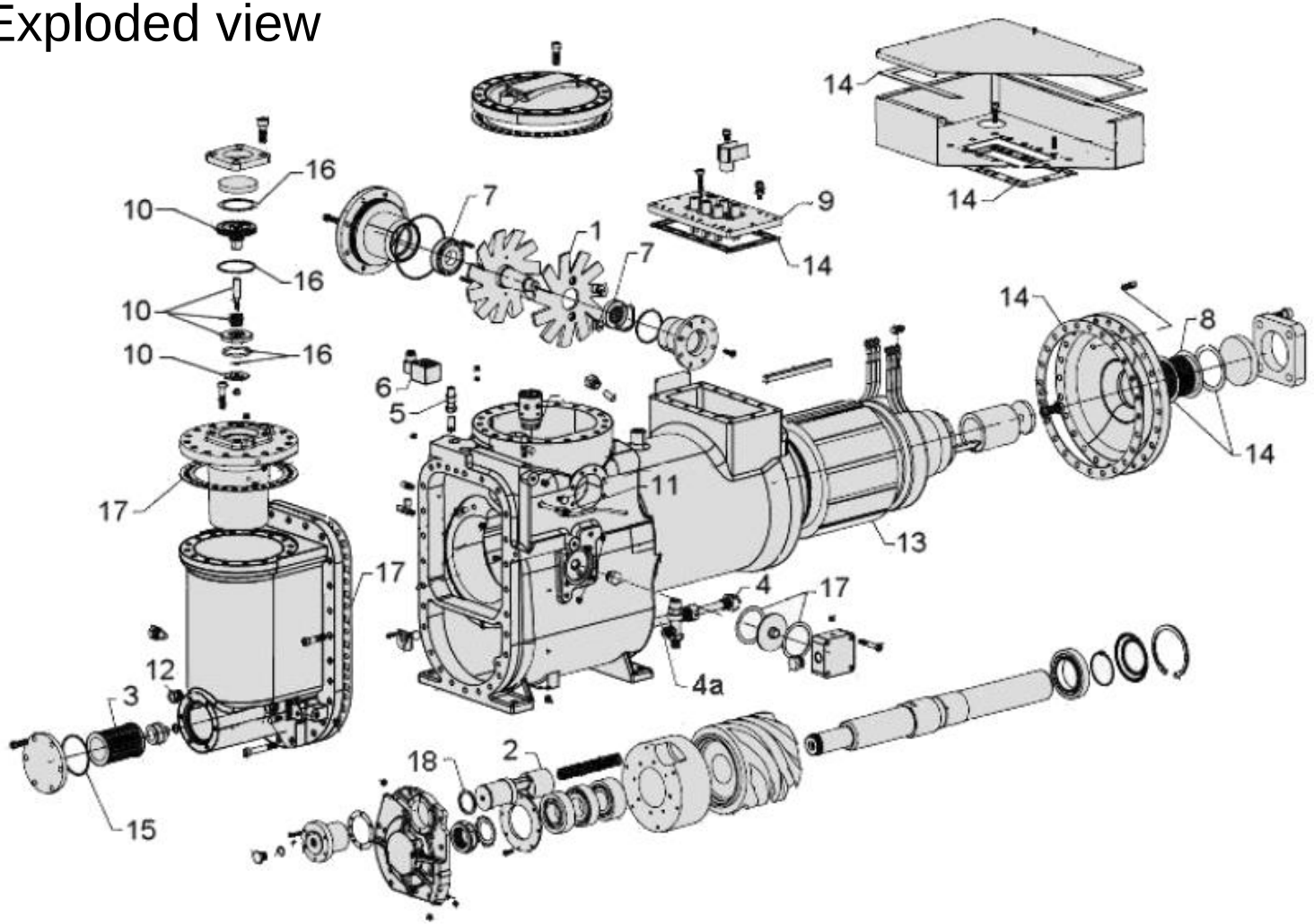
Physical dimensions and connections



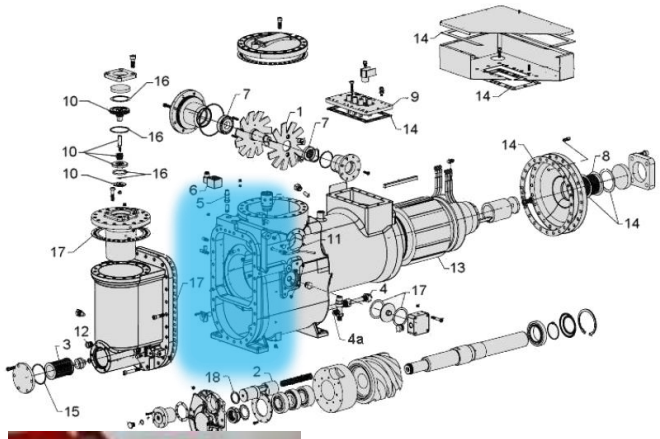
DESCRIPTION	NO OFF	SIZE
Suction	1	3" NB (3 1/8" OD)
Discharge	1	2" NB (2 1/8" OD)
Suction pressure gauge	1	1/8" NPT
Discharge pressure gauge (1)	1	1/8" NPT
Discharge pressure gauge (2)	1	1/8" NPT
Oil pressure gauge	1	1/8" NPT
3N1 three function valve	1	1/8" NPT
HT cut-out	1	1/8" BSP
Liquid injection	1	3/4" (16 UNF)
Economiser	1	7/8" (14 UNF)
Oil drain	1	1/2" NPT
Oil temperature sensor pocket/oil low level sensor	1	1/2" NPT
Oil return from external cooler	1	7/8" (14 UNF)

HSS 3100

1. Exploded view



HSS 3100 main components



Capacity Slide Piston Cover

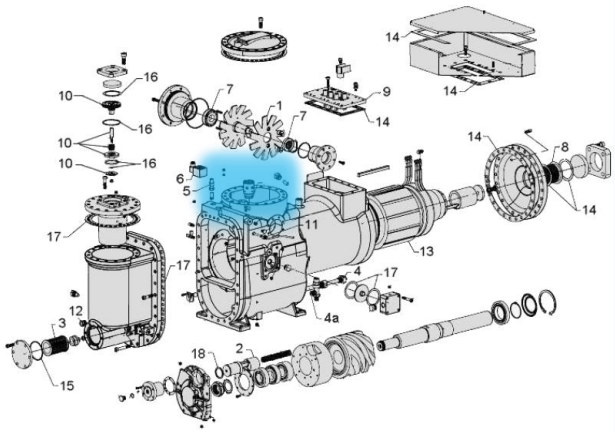
Discharge Port

Oil Sump

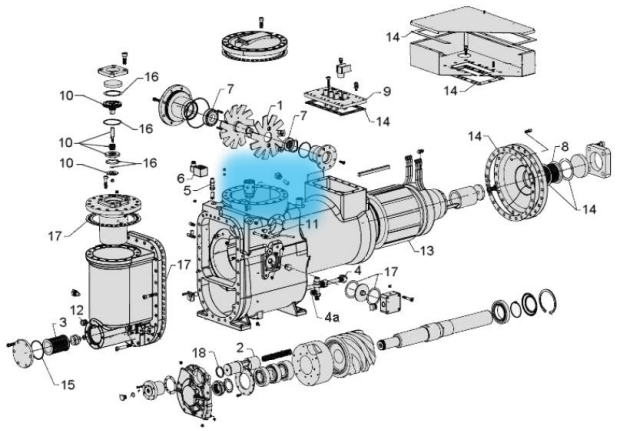
Main Bearing Cover

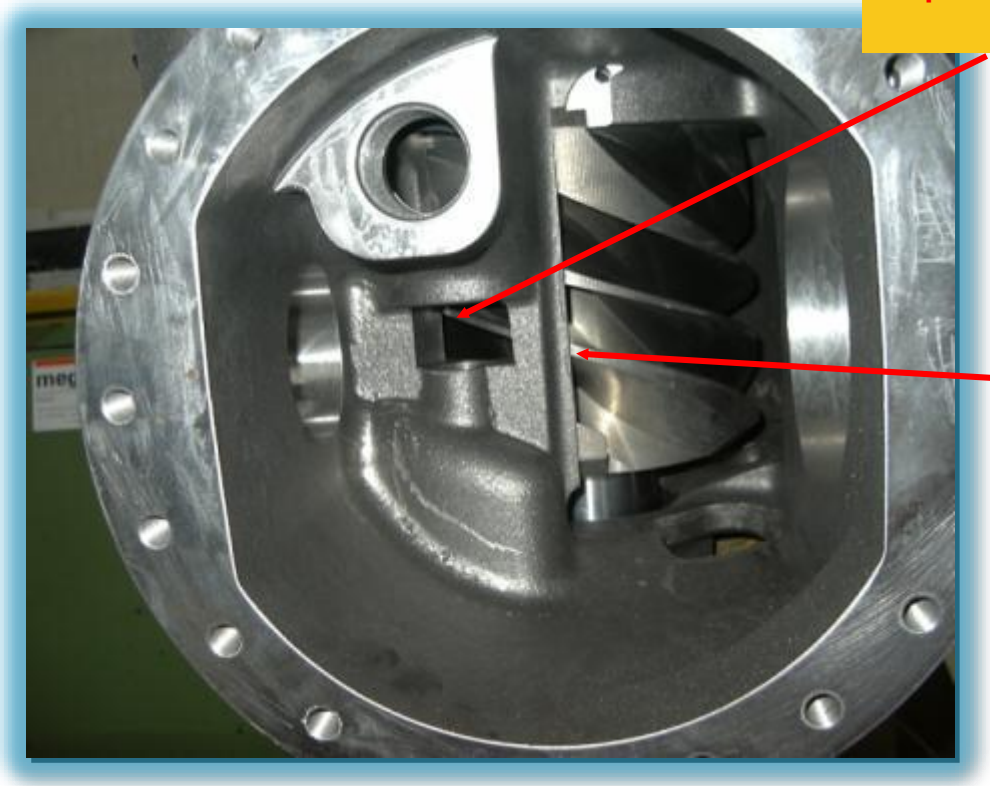
Oil Heater

HSS 3100 main components

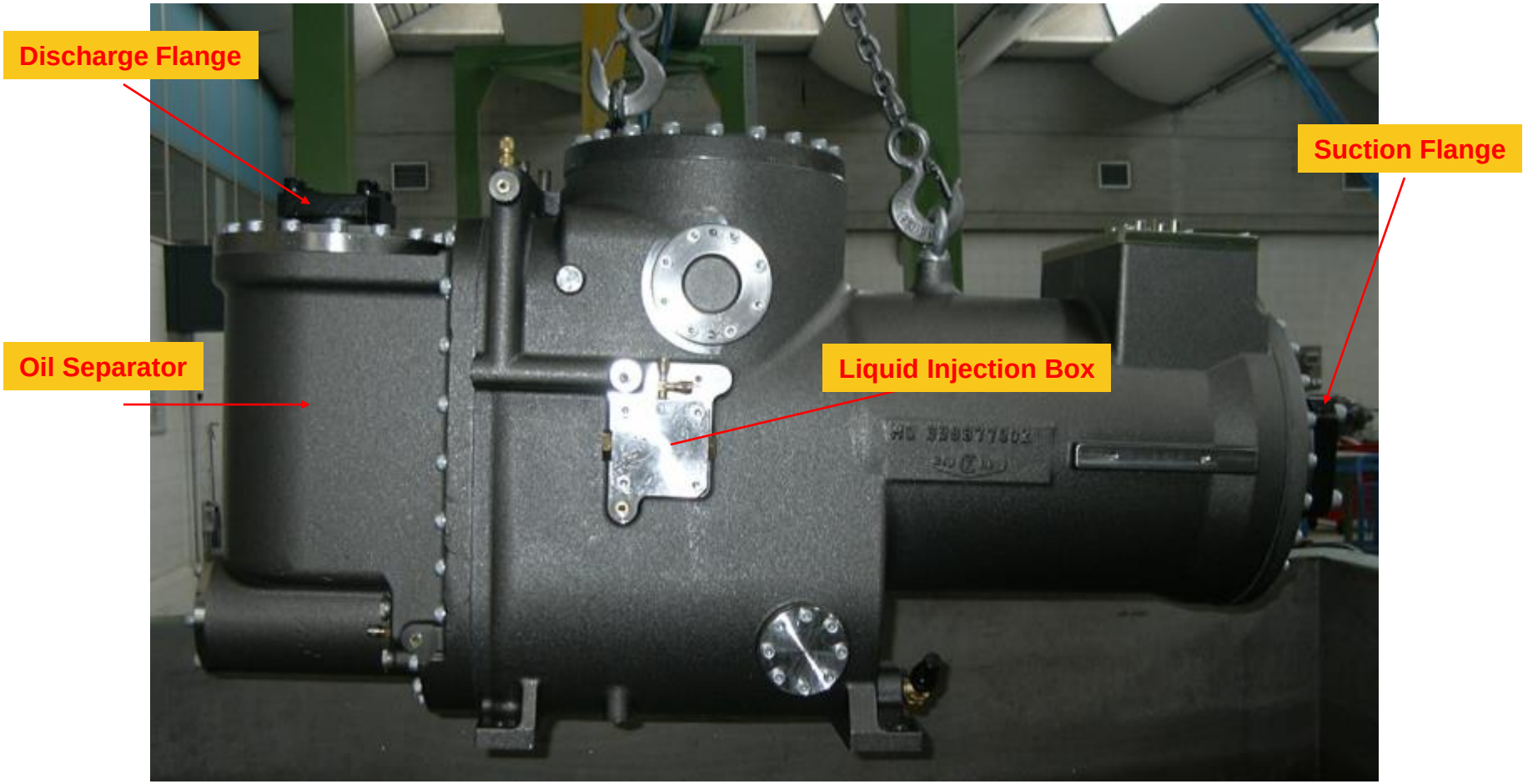


HSS 3100 main components

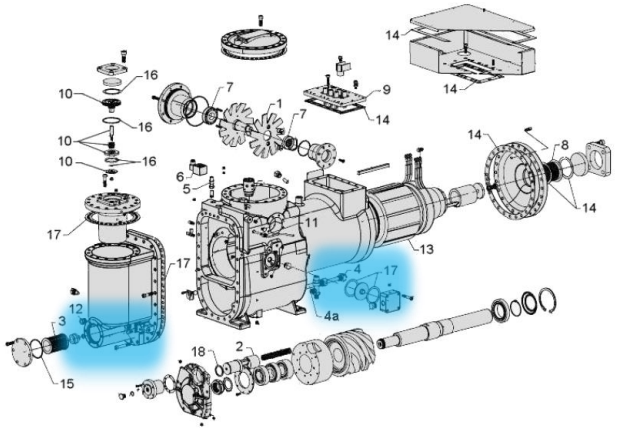




HSS 3100 main components



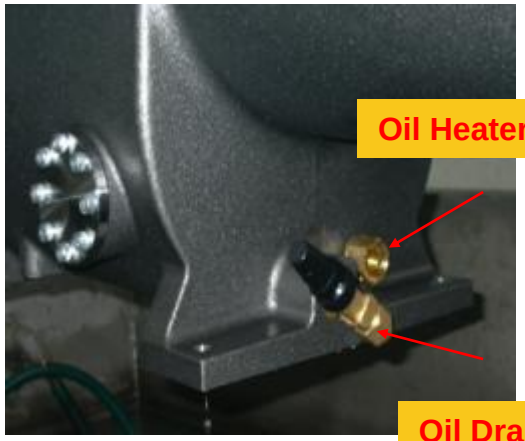
HSS 3100 main components



Economizer Port

Oil level glasses

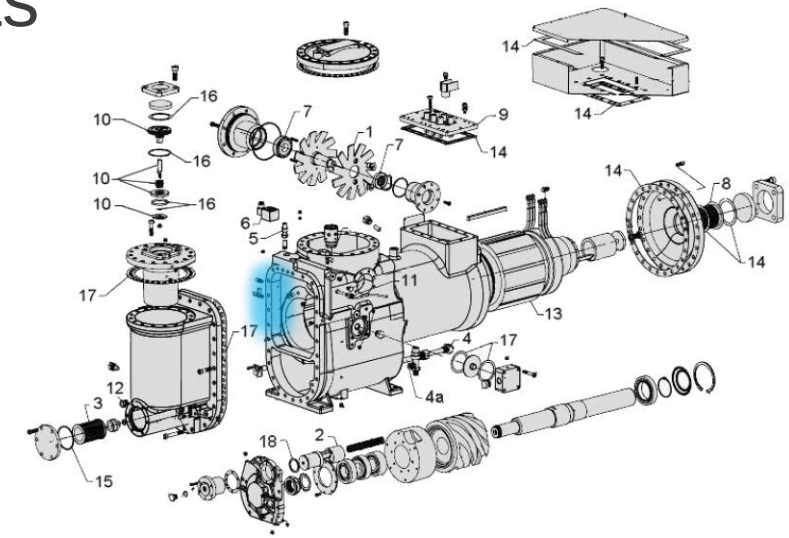
Oil Filter Cover



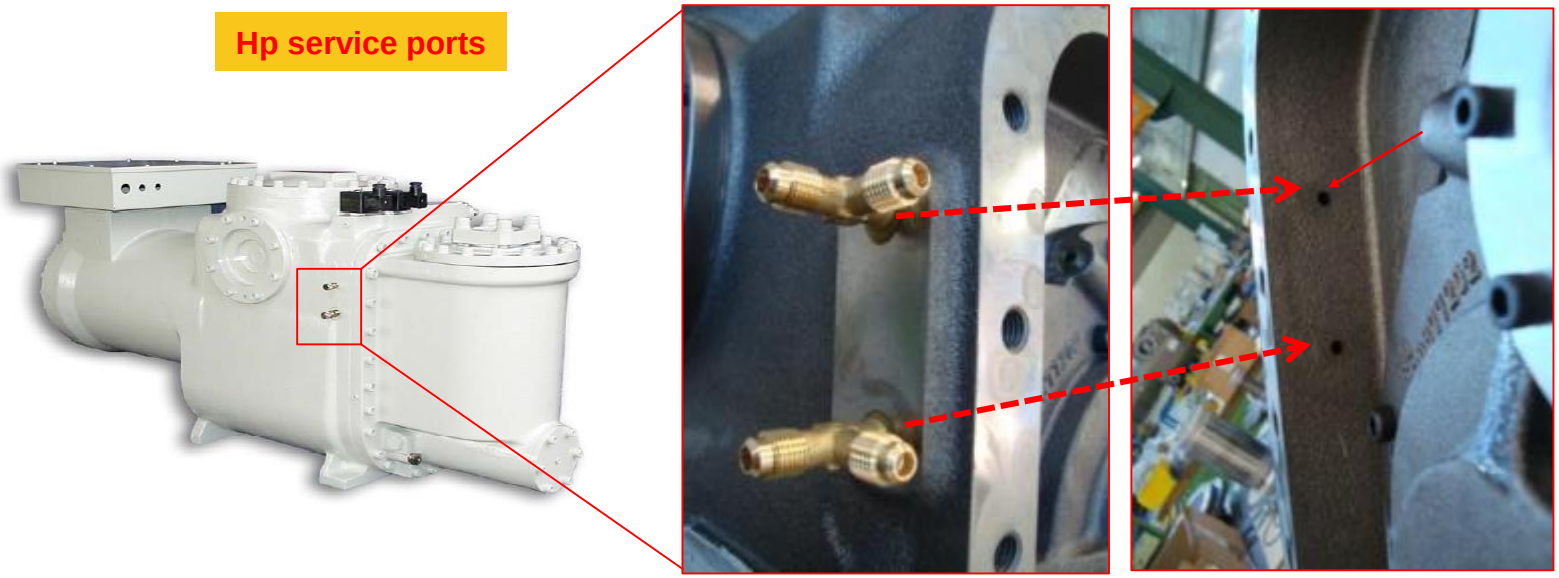
Oil Heater Pocket

Oil Drain Valve

HSS 3100 main components

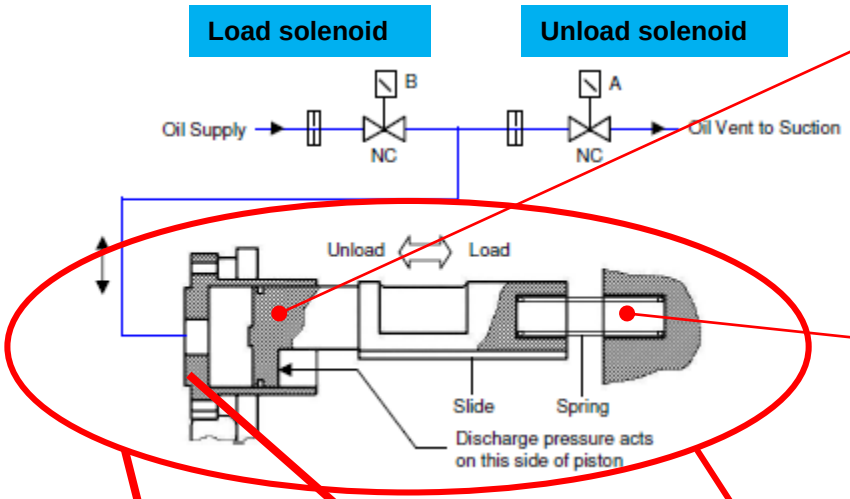


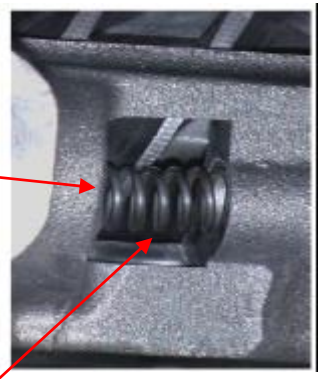
Hp service ports



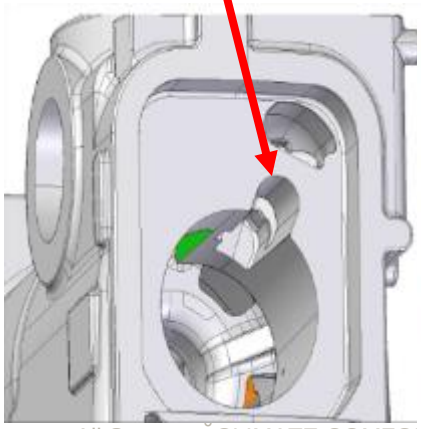
HSS 3100 main components

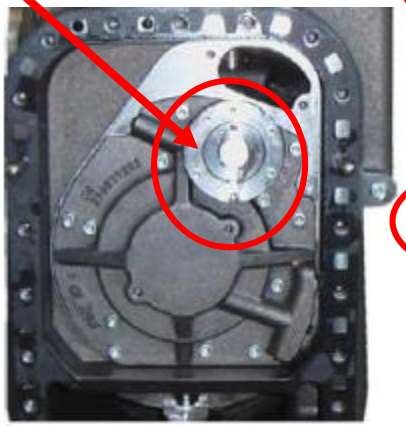
Capacity regulation system

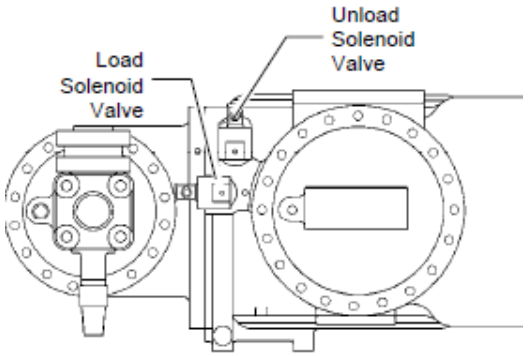




spring

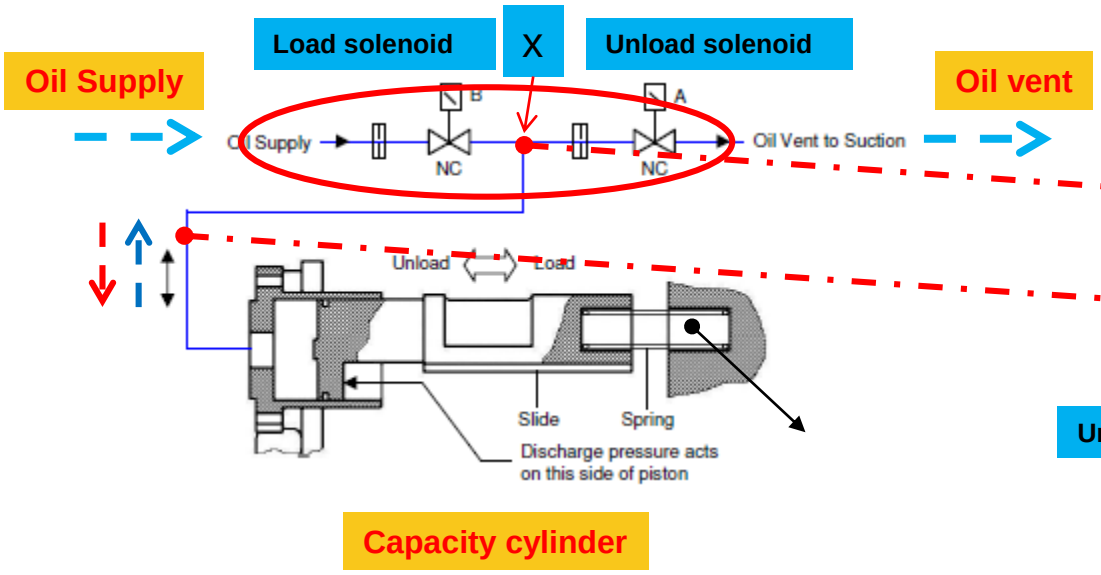




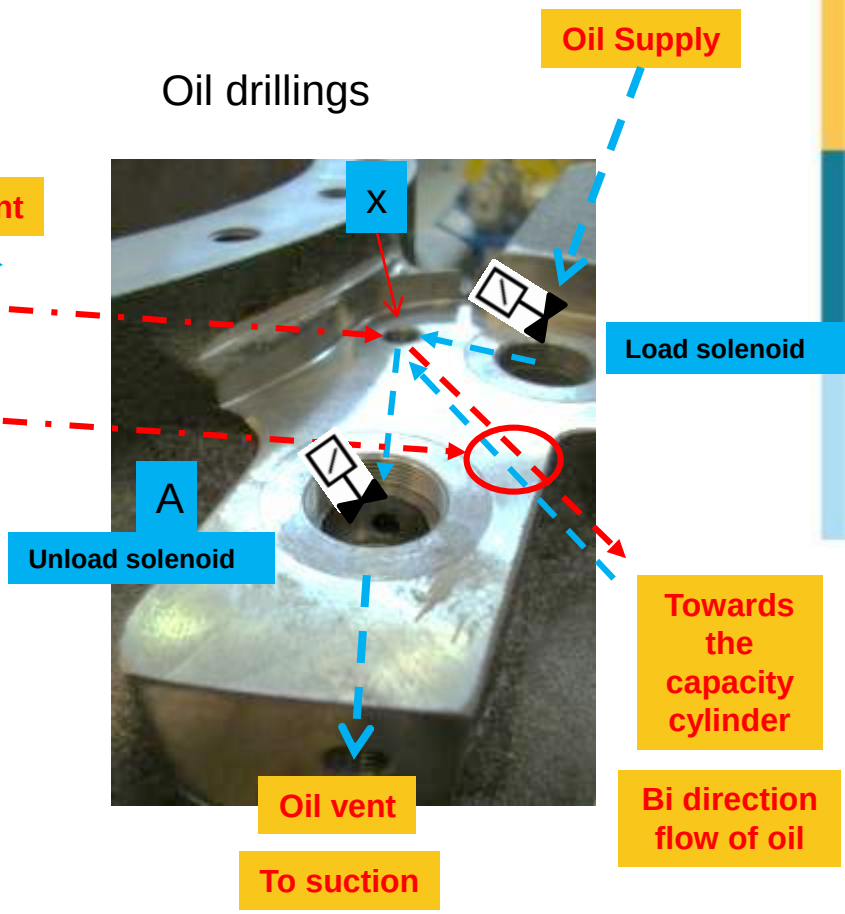


HSS 3100 main components

Capacity regulation system – oilways



Oil drillings



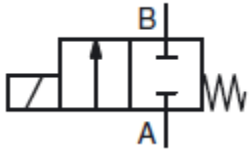
HSS 3100 main components

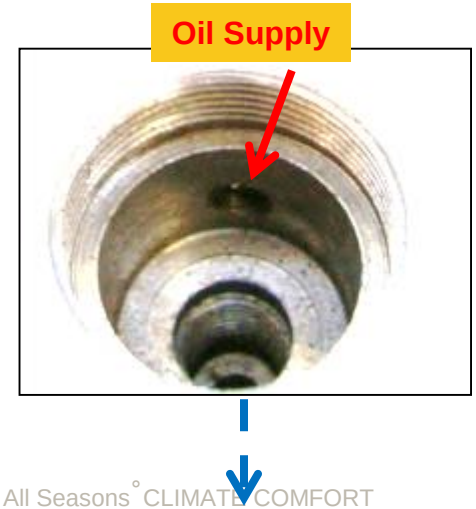
Capacity regulation system – solenoid system

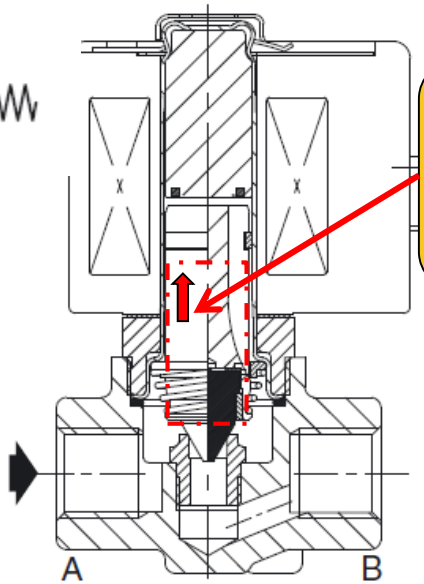
Solenoid is of normal closed type – when energised = flow

note the position of the orrifice in normal situation

NC

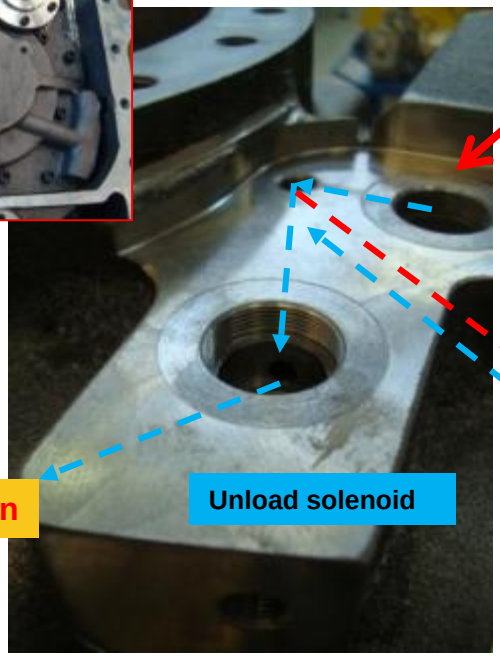


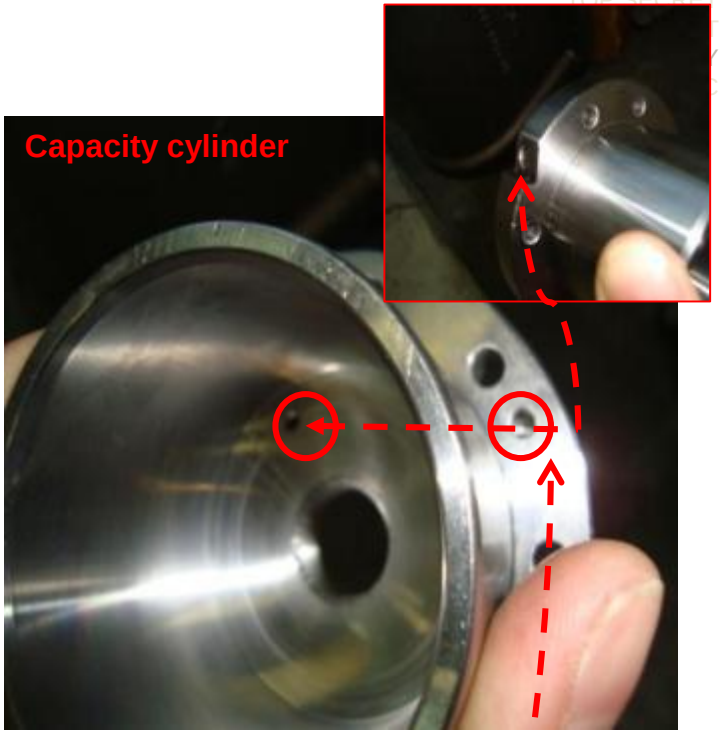


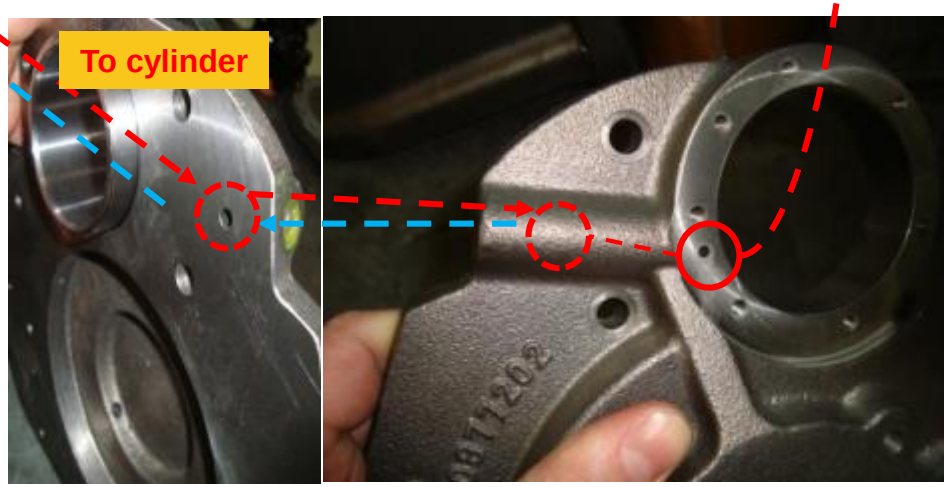


When energised plunjer will be move upwards = valve opens

HSS 3100 – Oil drills





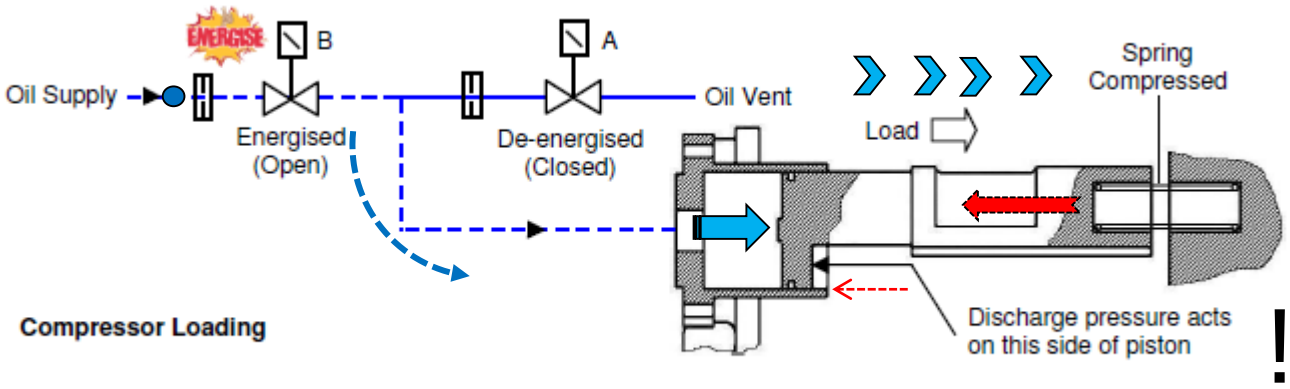


Main Bearing Cover,
Oil enters at the back, via corresponding holes the oil is conducted towards the caapcity piston

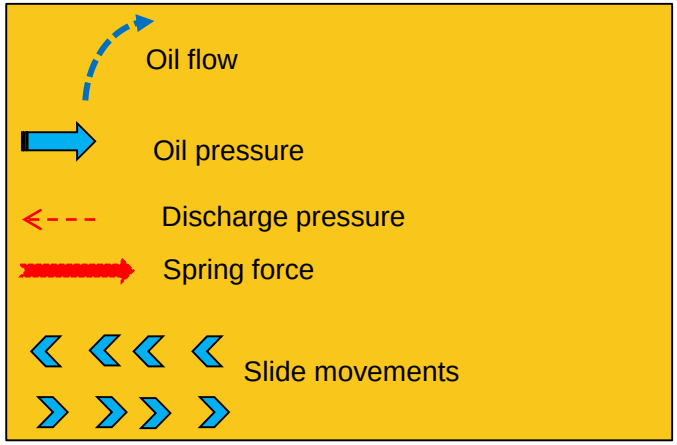
HSS 3100

Capacity regulation system – loading

Load solenoid OPEN | **Unload solenoid CLOSE**

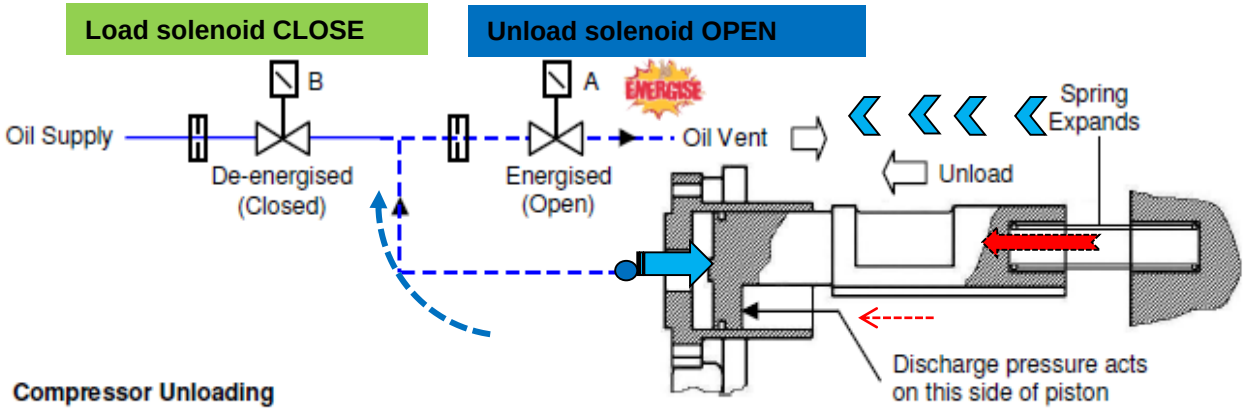


Cylinder Pressure > Discharge Pressure + Spring Force = Slide Valve Moves Towards Load

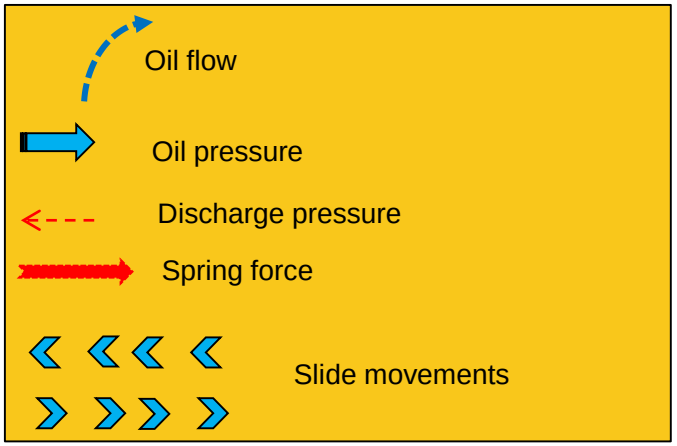


HSS 3100

Capacity regulation system – unloading



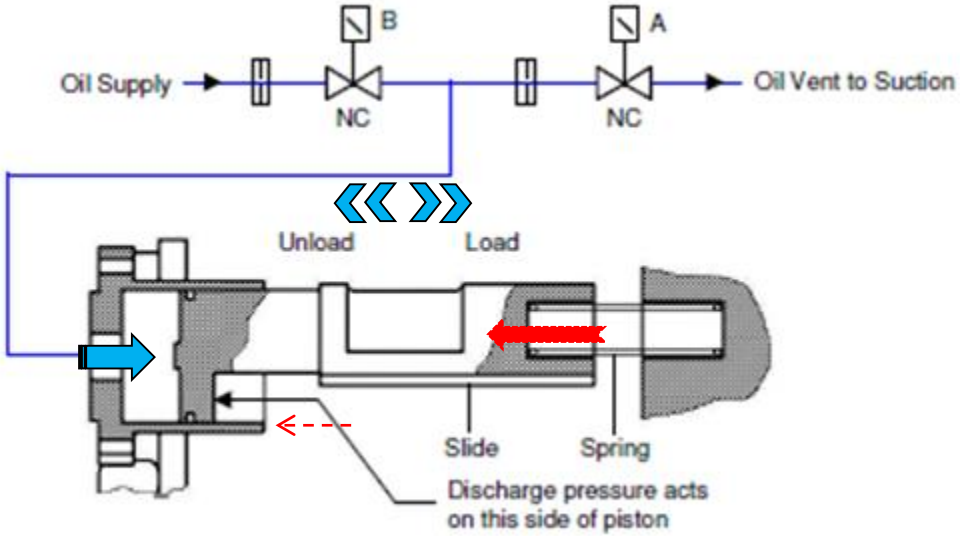
Spring Force + Discharge Pressure > Cylinder Pressure = Slide Valve Moves Towards Unload

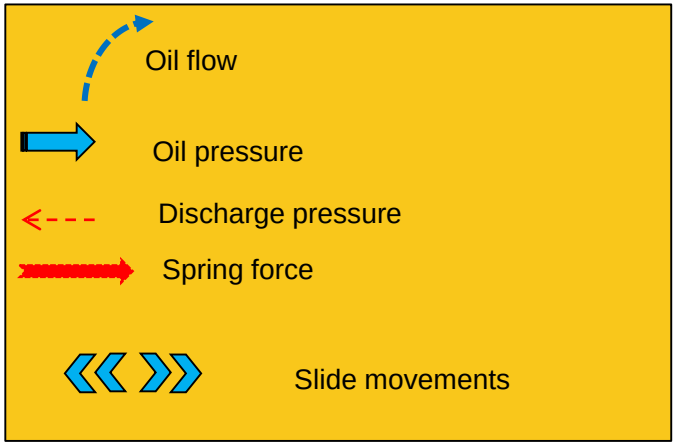


HSS 3100

Capacity regulation system – hold capacity

Load solenoid CLOSE **Unload solenoid CLOSE**





Cylinder pressure = Discharge pressure + spring pressure = slide stays in same position

HSS 3100

Capacity regulation system

Capacity action	Load valve B	Unload valve A
Load compressor	Open (pulse)	close
Unload compressor	Close	Open (pulse)
Hold compressor	Close	Close
Compressor on 100%	Fully open	close
Controlled stop	Close	Pulsed contineously until 25% (mini) position is reached
Controlled start	-	Fully open until chiller controler decides to load compressor
Emergency stop	Close	Pulsed contineously until 25% (mini) position is reached
Start after powercut	close	Keep 5 minutes open before start

HSS 3100

1. Capacity regulation test (fieldtest + workshop test)

   When performing?

   1. Compressor loads up unwanted to 100%
   2. Compressor cannot hold capacity
   3. Compressor doesn't load

2. Scope of tests:

   - Test 1 (a+b) - To check correct sealing of solenoids
   - Test 2 (field) - To check correct movement of capacity slides and test tightness of glyd rings (pressure test).
   - Test 3 (workshop) – detailed check for any leaks on the capacity system (glyd ring, main bearing plate involves dismanteling of compressor.

What do we need?

- Some special tools

7/16” long socket

- Nitrogen bottle with pressure regulating valve

- Manometers + hoses/ampère meter

Special blanking plugs, for field test

Pressure supply plug

Blank orifice plugs

Special oil way blanking plugs, for workshop testing

Only for hpi model !

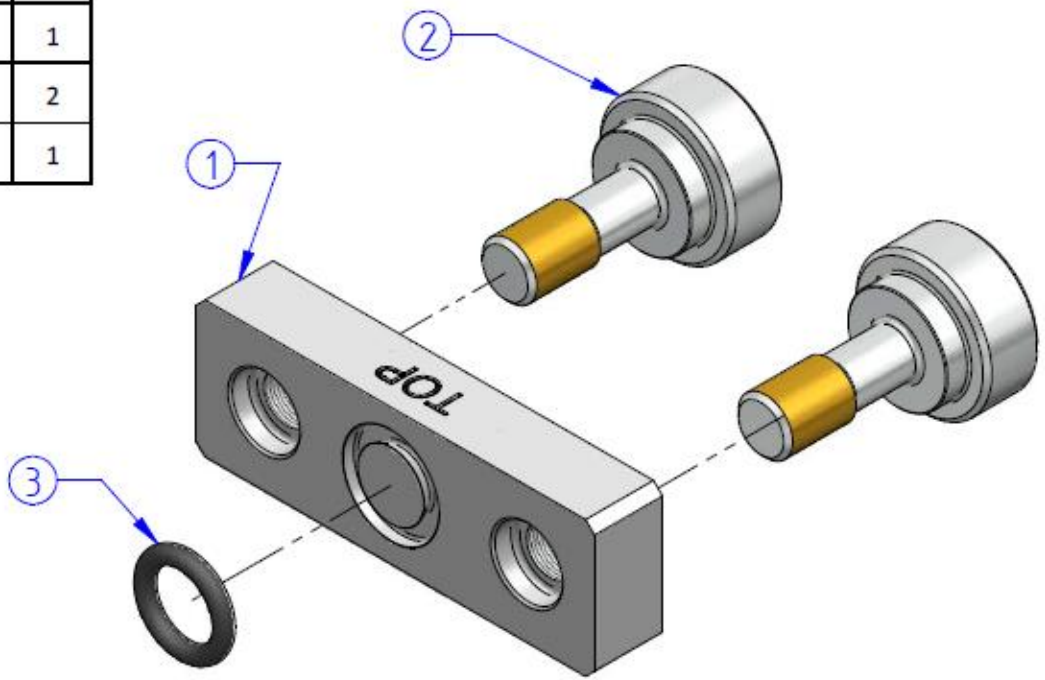
OR

1/16” NPT plug

HSS 3100 – special tooling – factory model

PART NUMBER	REV.	PART DESCRIPTION	RAW MAT'L DESCRIPTION	RAW MAT'L PART NO.
D000447	00	SLIDE TEST TOOL-HS3100		

POS.	CODICE	DESCRIZIONE	Qtà
1	**D000445**	BASETTA x SLIDE TEST	1
2	**D000446**	VITE SERRAGGIO BASETTA	2
3	**N/A**	O-R C2-207 ø13.87 x 3.53 - NBR70	1



DOC	M.E.	ENG	DRN	DATE	ECO	DESIGN SOURCE	CADD DRA. ATTACHED TO
			MB	26/05/11			

REVISION CHANGE HISTORY	REV.

DIMENSIONING AND TOLERANCING CONFORMS TO ASME Y14.5M-1994

TOLERANCE DATA UNLESS OTHERWISE SPECIFIED
X.- ± 0.50 ANGLES - 2°
X.X- ± 0.25
X.XX- ± 0.13
FINISH: 3.2 MICROMETERS ON MACHINED SURFACES

McQuay

ALL DIMENSIONS ARE IN MILLIMETRES

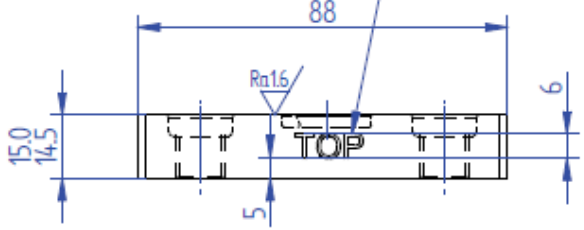
SCALE NTS | THIRD ANGLE PROJECTION

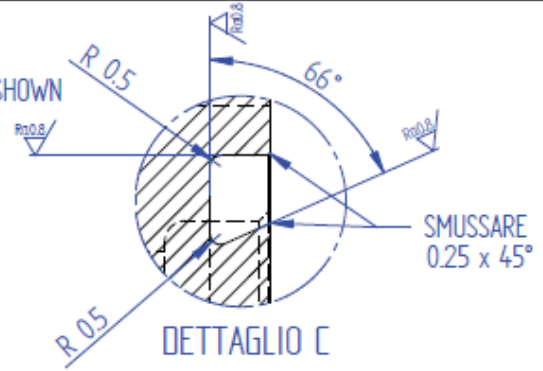
D000447	00	1 OF 1
DRAWING NUMBER	REV.	SHEET

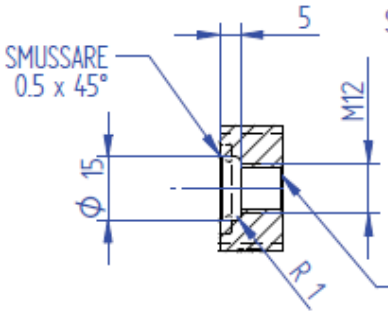
HSS 3100 – special tooling

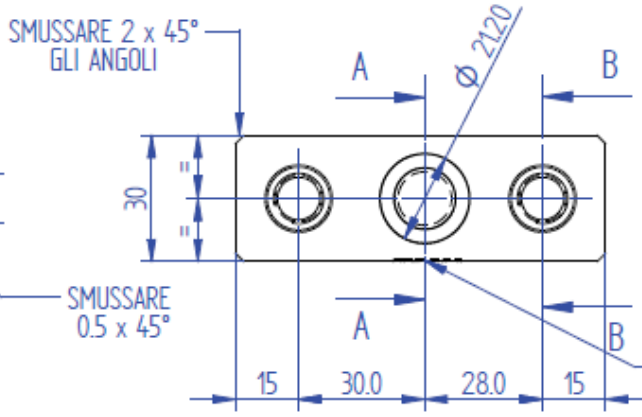
PART NUMBER	REV.	PART DESCRIPTION	RAW MAT'L DESCRIPTION	RAW MAT'L PART NO.
D000445	00	HS3100-SLIDE TEST FLANGE	STEEL PLATE	

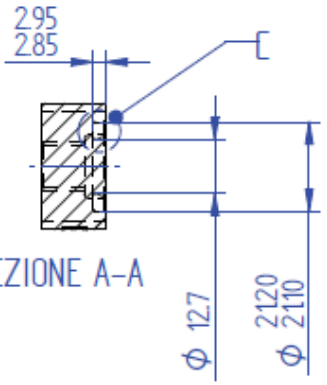
MATERIAL:
STEEL PLATE 15mm THK
C40 or EQUIVALENT











DOC	M.E.	ENG	DRN	DATE	ECO	DESIGN SOURCE	CADD DRA. ATTACHED TO
			MB	26/05/11			

REVISION CHANGE HISTORY	REV.

DIMENSIONING AND TOLERANCING CONFORMS TO ASME Y14.5M-1994

TOLERANCE DATA
UNLESS OTHERWISE SPECIFIED
X = ± 0.50 ANGLES = 2°
XX = ± 0.25
XXX = ± 0.13
FINISH: 3.2 MICROMETERS
ON MACHINED SURFACES

McQuay

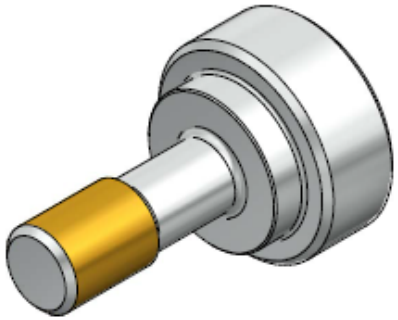
ALL DIMENSIONS ARE IN MILLIMETRES

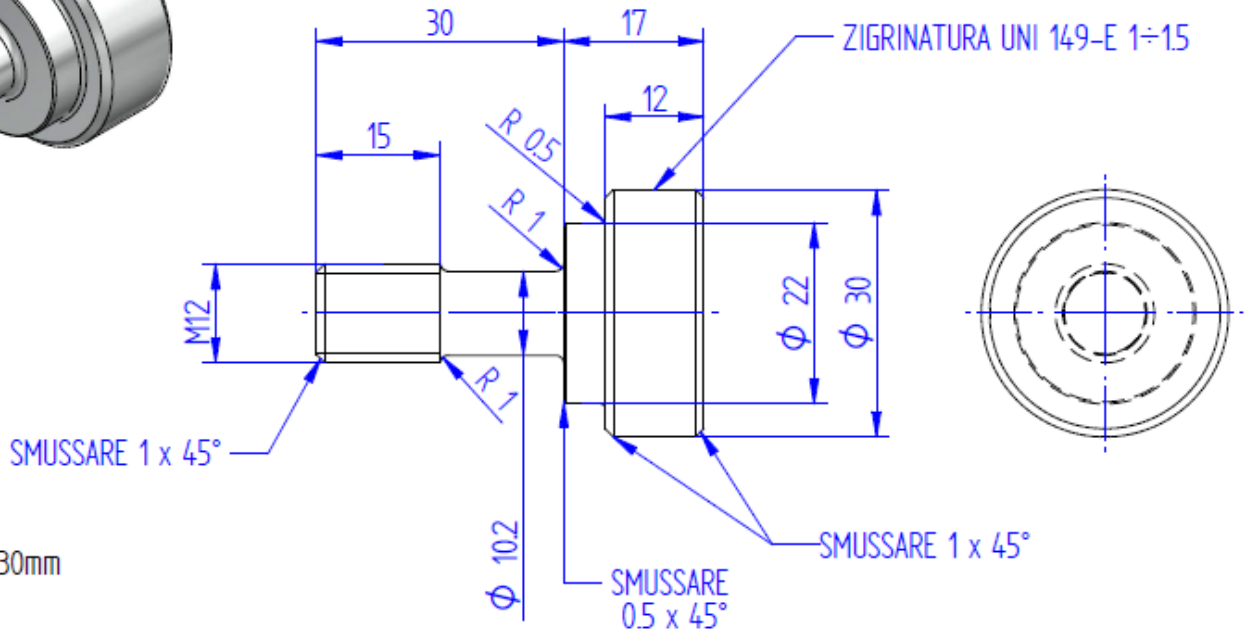
SCALE NTS | THIRD ANGLE PROJECTION

DRAWING NUMBER	REV.	SHEET
D000445 B	00	1 OF 1

HSS 3100

PART NUMBER	REV.	PART DESCRIPTION	RAW MAT'L DESCRIPTION	RAW MAT'L PART NO.
D000446	00	VITE SERRAGGIO BASETTA	STEEL BAR	





MATERIAL:
ROUND STEEL BAR ⌀30mm
C40 or EQUIVALENT

DOC	M.E.	ENG	DRN	DATE	ECO	DESIGN SOURCE	CADD DRA. ATTACHED TO
			MB	26/5/11			

REVISION CHANGE HISTORY	REV.

DIMENSIONING AND TOLERANCING CONFORMS TO ASME Y14.5M-1994

TOLERANCE DATA
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McQuay

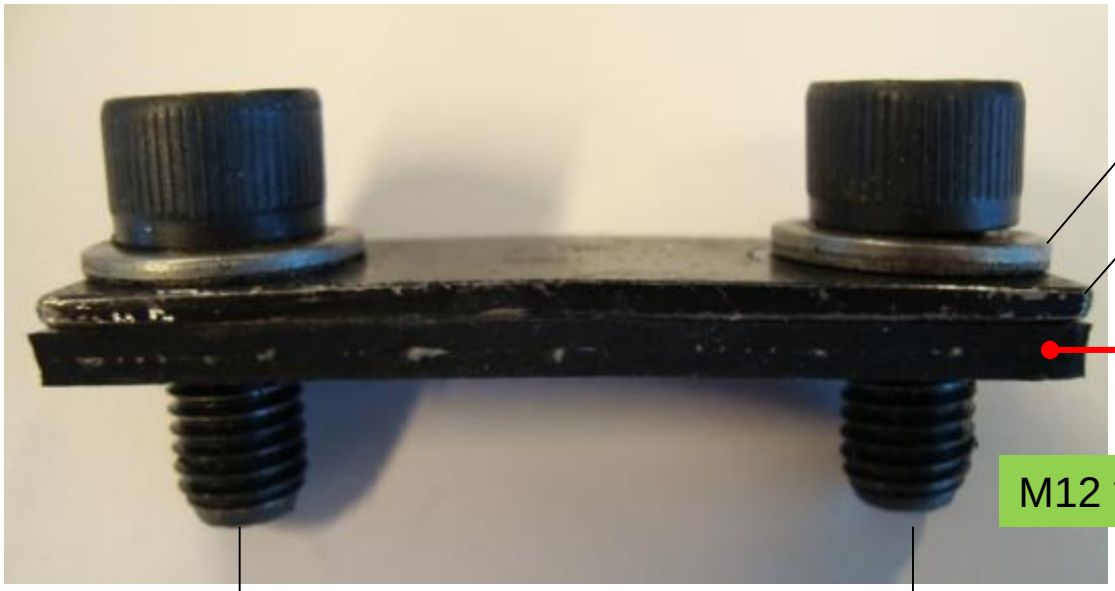
ALL DIMENSIONS ARE IN MILLIMETRES

SCALE NTS | THIRD ANGLE PROJECTION

DRAWING NUMBER	REV.	SHEET
D000446 B	00	1 OF 1

HSS 3100 special tooling

What do we need? – Self made model



HSS 3100

WARNING !!! – prior to opening of compressor

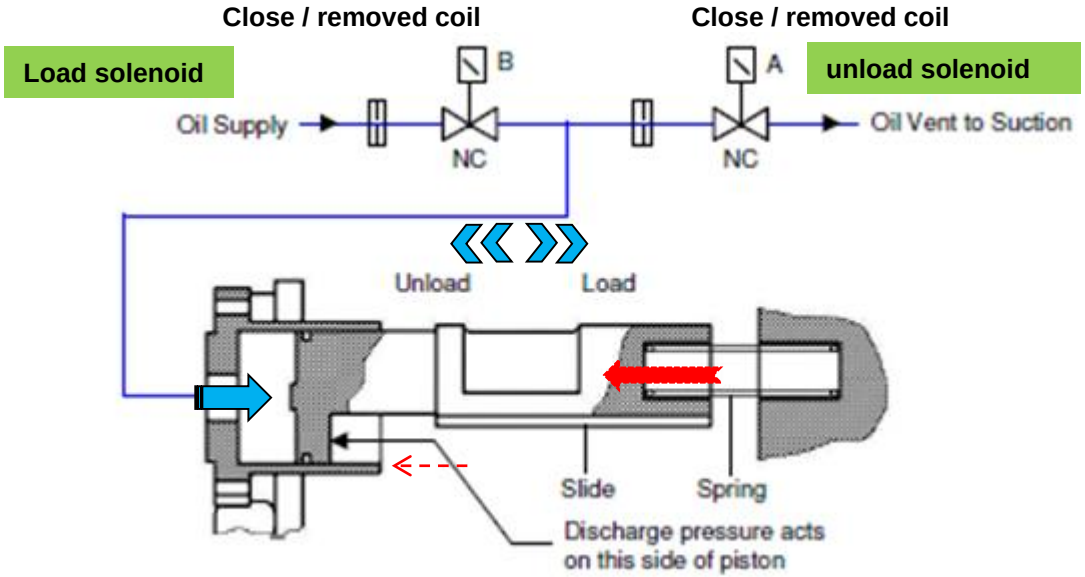
- Stop circuit involved / pumpdown
- separate compressor from refrigerant circuit
- recover all existing refrigerant – check pressure !
- disconnect compressor from power supply
- avoid compressor can start unwanted (fuses)

HSS 3100

Field test – Test 1 - a

Check of solenoids (test a) – compressor runing !

- Perform compressor capacity holding test – remove both coils from solenoids ,
- ➔ compressor should keep capacity – check with ampère clamp,



Cylinder pressure = Discharge pressure + spring pressure = slide stays in same position

Possible Result:

1) Current rise to max value ➔ Solenoid B (load) is leaking
2) Current is decreasing to min value ➔ Solenoid A (unload) is leaking

Proceed with visual check of solenoids stems ! (test – b)

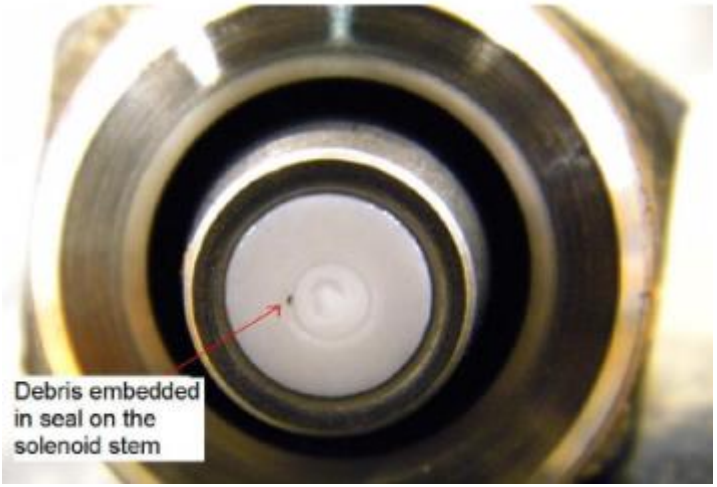
HSS 3100

Field test – Test 1 – b - check of solenoids

Remove the solenoids for visual check

Orifce must be present !

You should see small impact on the plastic – proving correct sealing towards orifce



Any pressence of debris = leak

HSS 3100

1. Field test – Test 2 – only **NON HPI** (checking slide movement + pressure test)
    1. Remove side cover of gate rotor.
    2. Remove solenoids stems.
    3. Remove orifices of the load and unload solenoid
    4. Install in the load location the special pressure supply plug
    5. Install in the unload loacation the blank plug + put the stem back.

       Remark: as an alternative the unloader orifice and stem can be kept in place (if we are sure solenoid is functioning ok.)

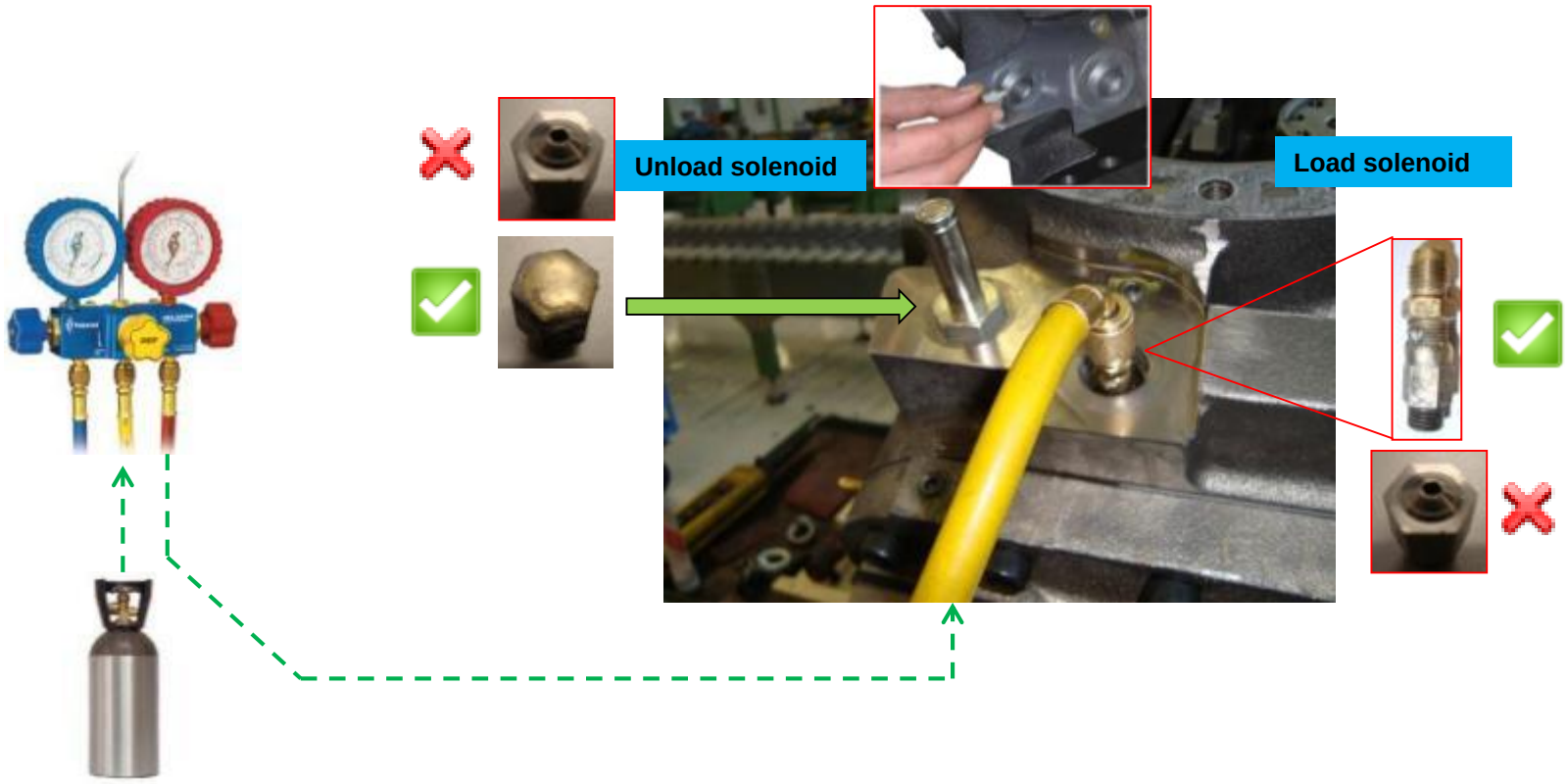
    6. Connect manometer – pressure bottle to the pressure supply plug on the load solenoid position.
    7. Allow pressure to the load position (max 6 bar)

To remove orifices use socket of 7/16” or M13

HSS 3100

Field test – Test 2 – variant NON HPI (checking slide movement)

Connect manometer – pressure bottle to the pressure supply plug on the load solenoid position.



HSS 3100 – Test 2 checking of slide movement

Min pos slide

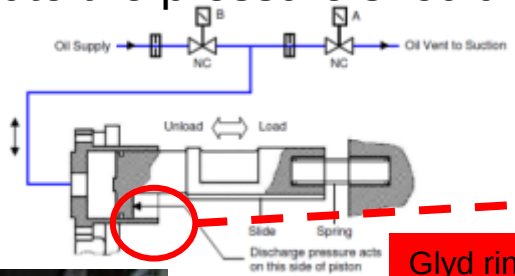
Max pos slide

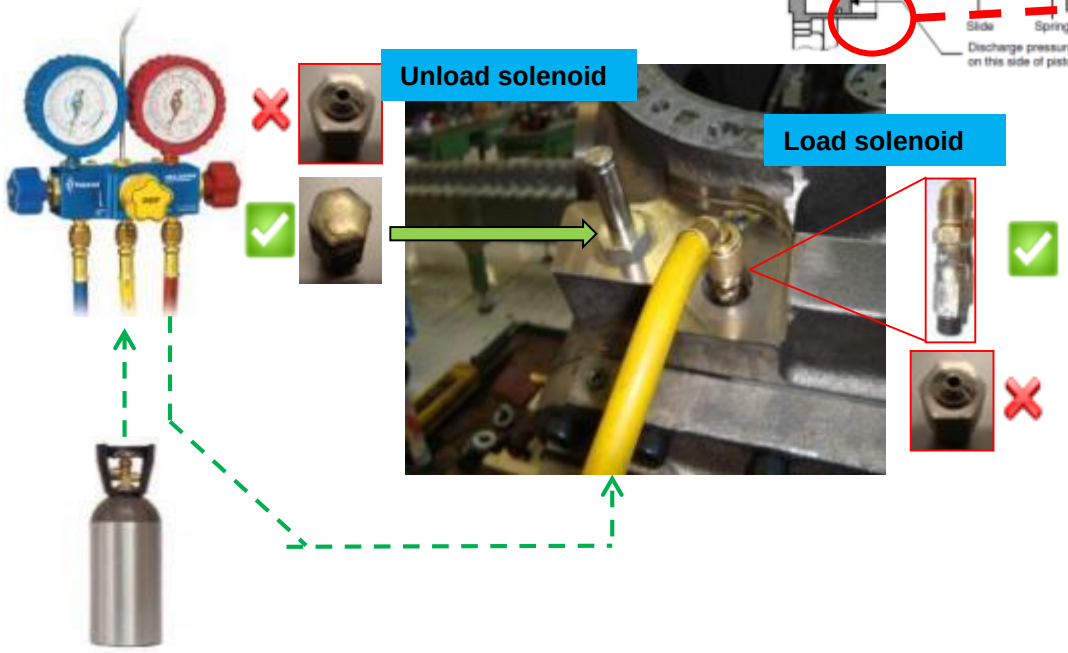
- Check movement of slide when adding pressure
- When releasing pressure, slide should return to min. pos due to spring pressure

HSS 3100

Field test – Test 2 – pressure test (non HPI)

By adding pressure to the load position (6 bars) the sealing of the glyd ring can be tested, after 1 minute the pressure should not drop more than 1 bar.





Glyd ring could be leaking? detailed pressure “test 3” needed !

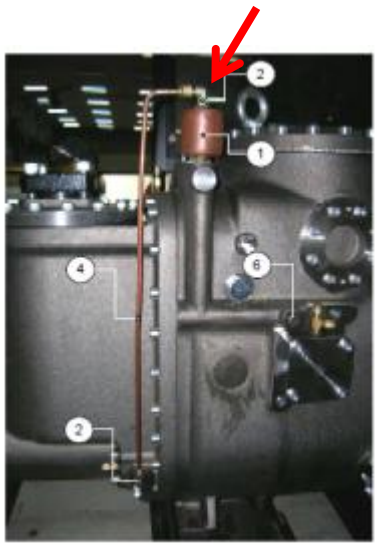
slide ➔ max pos

Pressurise to 6 bar for one minute, pressure loss not more than 1 bar

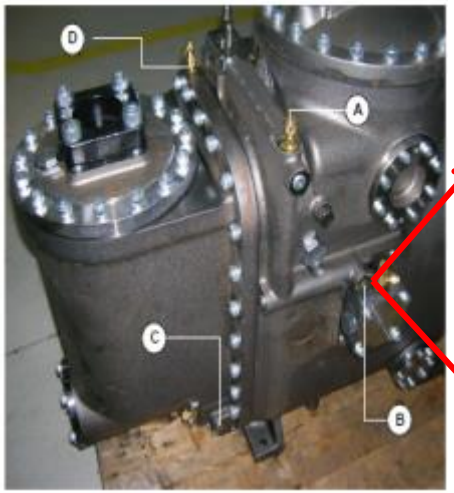
HSS 3100

REMARK for HPI model compressor – TESTS

1. For hpi models, an extra blank plug should be inserted to avoid internal oil pressure re-direction inside the compressor.
2. All of test principles stays the same.



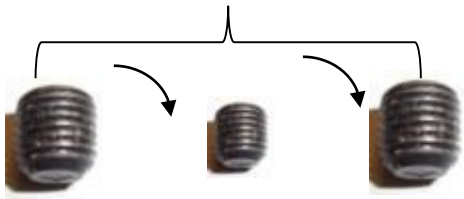
NON HPI model



HPI model – absence of oil pressure egalisation kit

Special blanking tool (factory)

OR



Remove M10 plug

insert 1/16” blank NPT plug

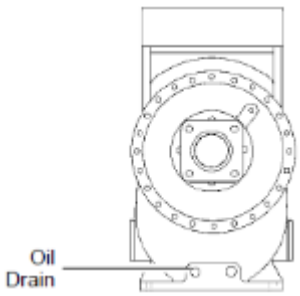
Close again with M10 plug

HSS 3100

Workshop test – Test 3 – detailed pressure test

1. Remove oil from compressor
2. Oil separator to be removed from compressor
3. Use special oil way blanking tool to block oil line from separator
4. Perform similar pressure as test 2
5. Locate leaks on main bearing plate or capacity cylinder

1



2

3

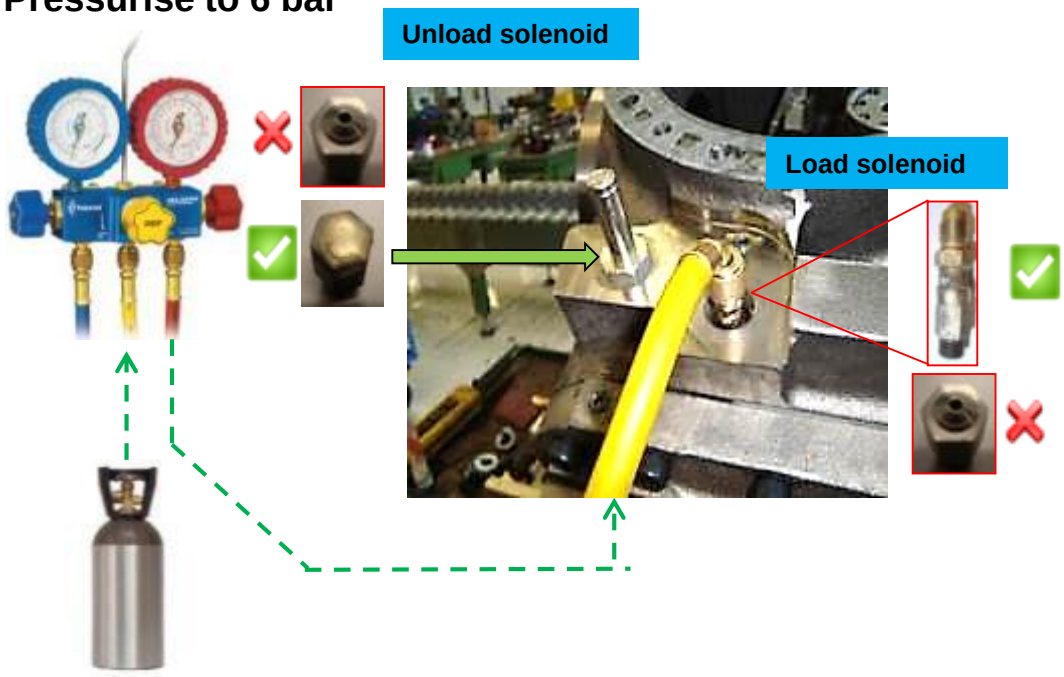
3

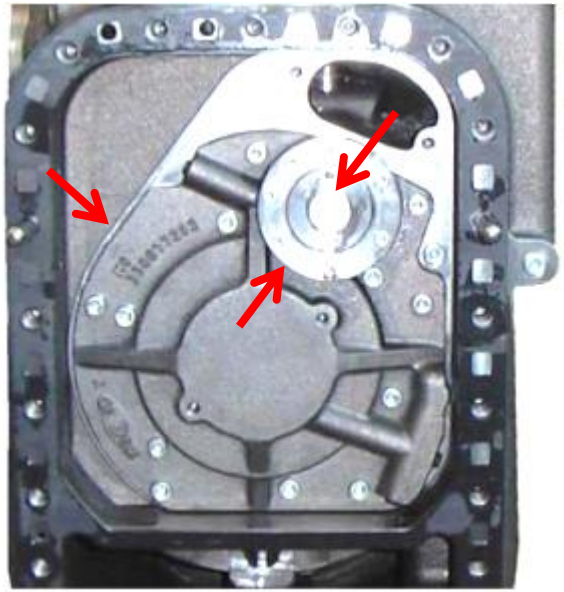
HSS 3100

Workshop test – Test 3 – detailed pressure test

Visual check for leaks

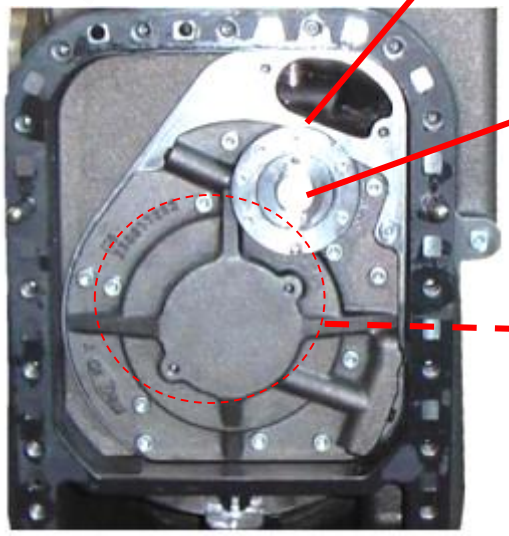
Pressurise to 6 bar



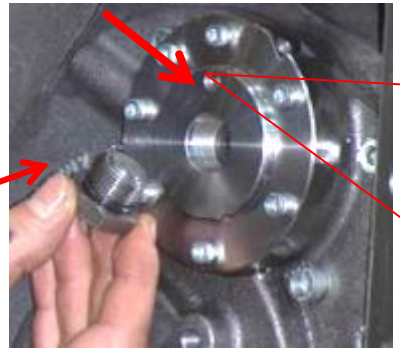


HSS 3100

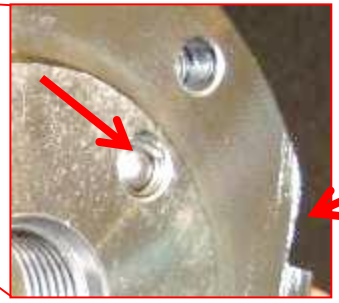
Workshop test – Test 3 – detailed pressure test – possible leak pos,



Gasket cylinder



O-ring central plug



Ball inserts on cylinder cover

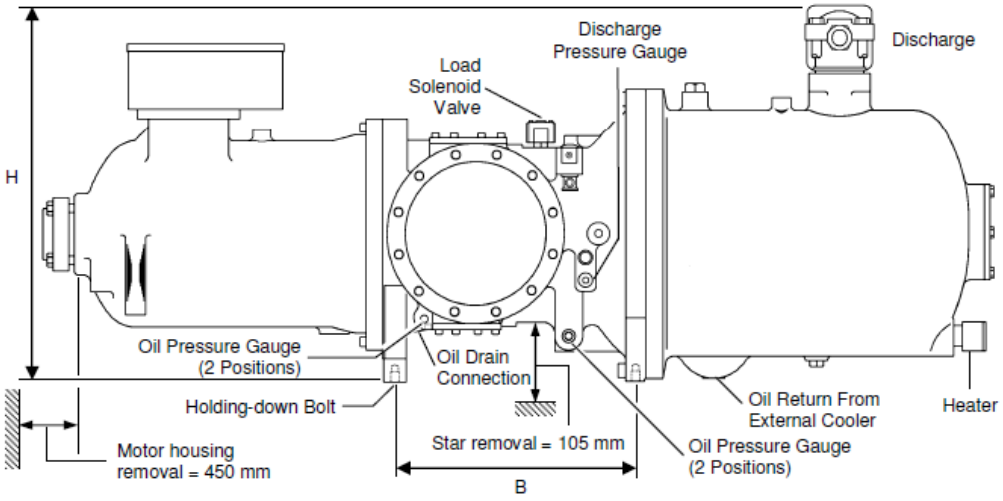
O-rings for main bearing cover plate

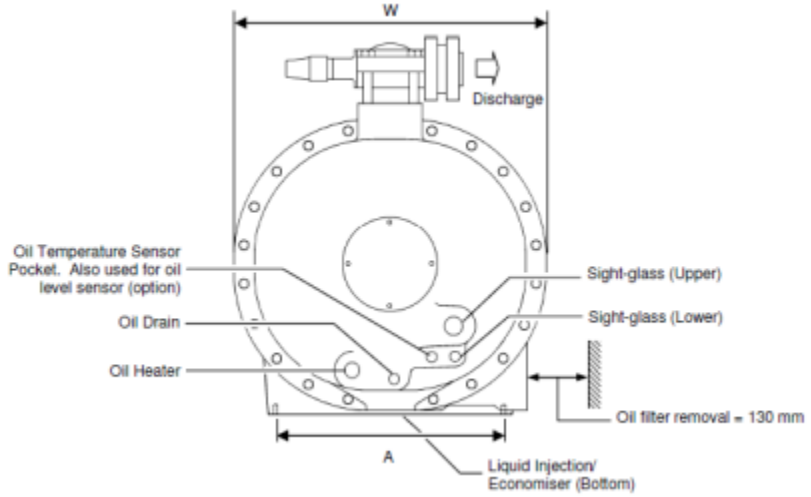
HSS 3200

HSA3216
HSA3218
HSA3220
HSA3221

HSS 3200

Physical dimensions and connections 82 KW version

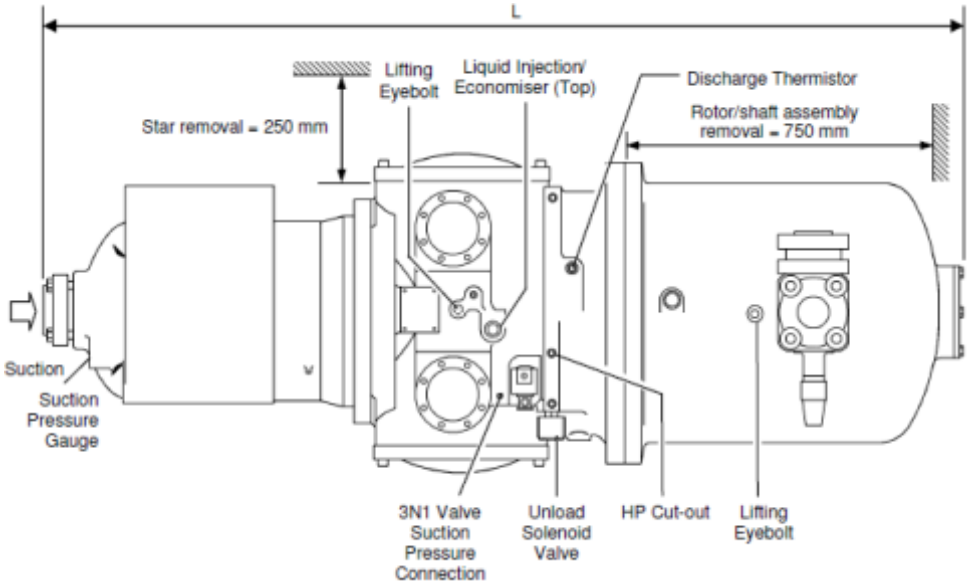




DESCRIPTION			SIZE
[1]Overall	Length	L	1661 mm
	Height	H	647 mm
	Width	W	565.6 mm
Holding-down bolt centres		A	380 mm
		B	420 mm
Holding-down bolts		-	4 x M12 x 1.75P x 21 full thread
Lifting eyebolts		-	2 x M16 x 2P x 27 full thread

HSS 3200

Physical dimensions and connections 82 KW version

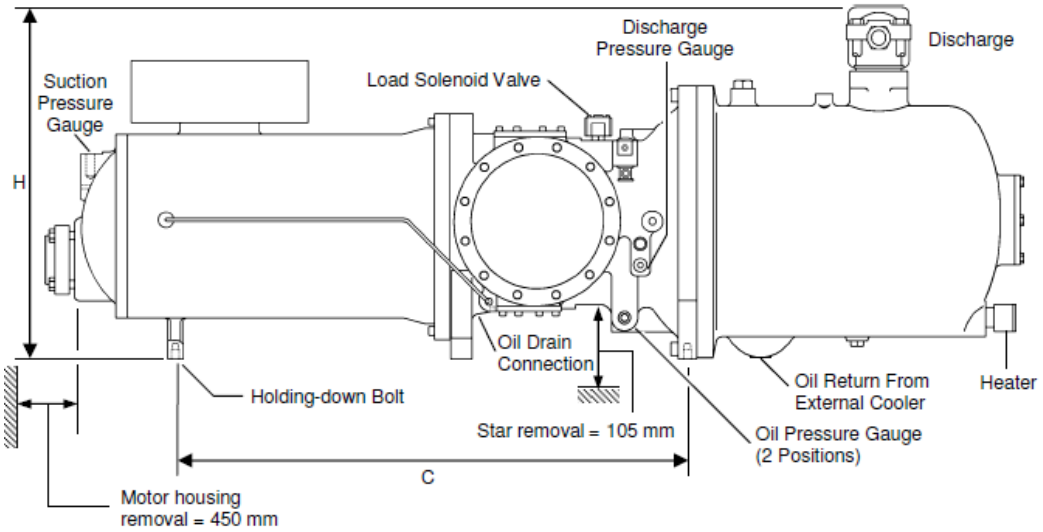


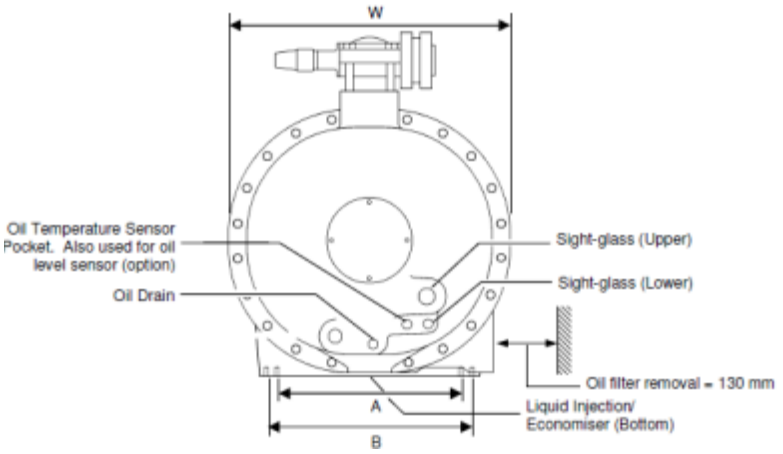
DESCRIPTION	NO OFF	SIZE
Suction	1	3" NB (3 1/8" OD)
Discharge	1	2" NB (2 1/8" OD)
Suction pressure gauge	1	1/8" NPT
Discharge pressure gauge	1	¼" NPT
Oil pressure gauge (2 positions)	1	¼" NPT
3N1 three function valve	1	1/8" NPT
HP cut-out	1	1/8" NPT
Liquid injection/economiser (top and bottom)	2	1 1/16" (12 UNF)
Oil drain	1	¾" (16 UNF)
Oil temperature sensor pocket	1	½" NPT
Oil return from external cooler	1	7/8" (14 UNF)

DESCRIPTION			SIZE
[1]Overall	Length	L	1661 mm
	Height	H	647 mm
	Width	W	565.6 mm
Holding-down bolt centres		A	380 mm
		B	420 mm
Holding-down bolts		-	4 x M12 x 1.75P x 21 full thread
Lifting eyebolts		-	2 x M16 x 2P x 27 full thread

HSS 3200

Physical dimensions and connections 138 KW version

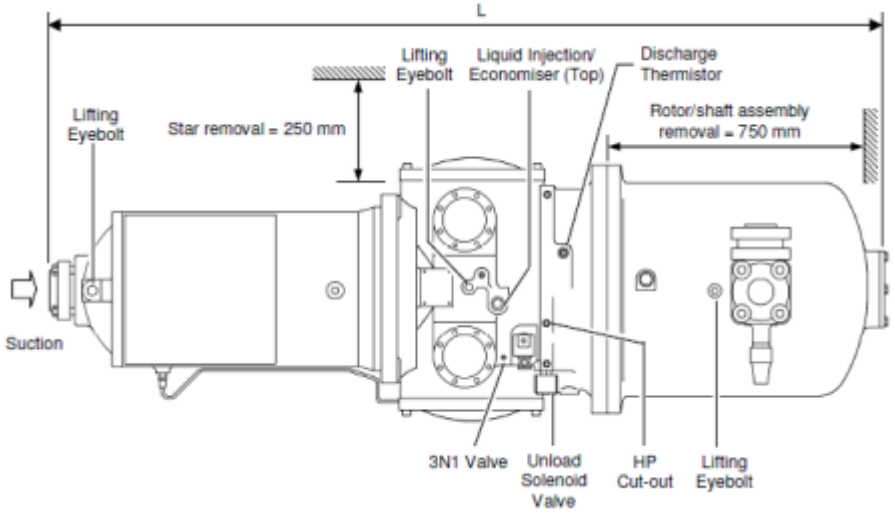




	DESCRIPTION			SIZE
Dimensions	[1]Overall	Length	L	1820 mm
		Height	H	647 mm
		Width	W	565.6 mm
	Holding-down bolt centres	Motor housing	A	320 mm
		Compressor	B	380 mm
		Compressor/motor housing	C	938 mm
	Holding-down bolts		-	4 x M12 x 1.75P x 21 full thread
	Lifting eyebolts	Motor housing	-	M20 x 2.5P x 35 full thread
		Compressor and separator	-	2 x M16 x 2P x 27 full thread

HSS 3200

Physical dimensions and connections 138 KW version

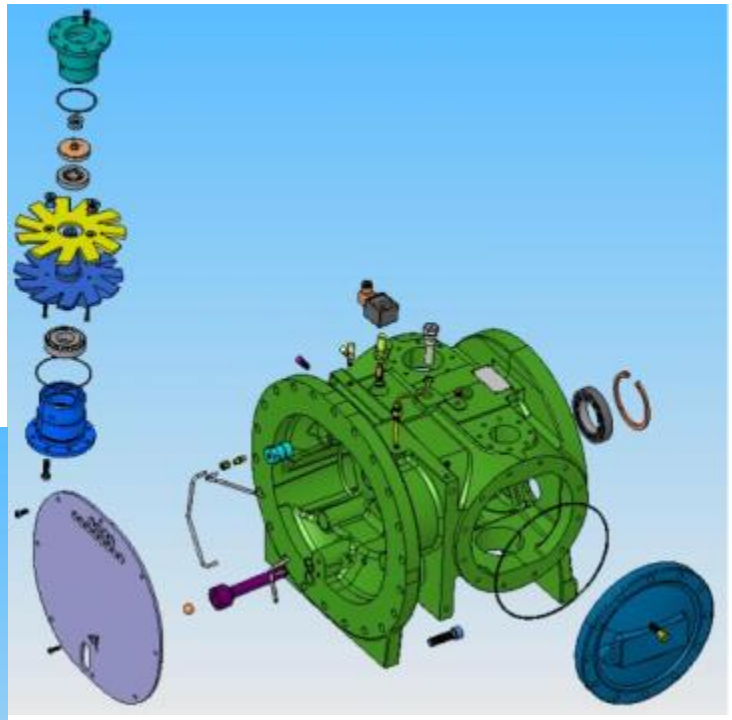


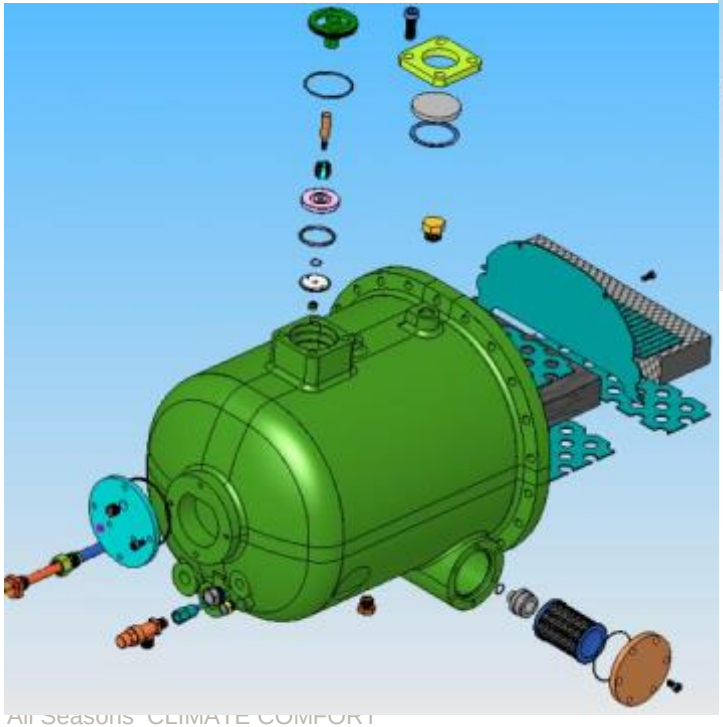
DESCRIPTION	NO OFF	SIZE
Suction	1	4" NB (4 1/8" OD)
Discharge	1	2" NB (2 1/8" OD)
Suction pressure gauge	1	1/8" NPT
Discharge pressure gauge	1	1/4" NPT
Oil pressure gauge	1	1/4" NPT
3N1 three function valve	1	1/8" NPT
HP cut-out	1	1/8" NPT
Liquid injection/economiser (top and bottom)	2	1 1/16" (12 UNF)
Oil drain	1	3/4" (16 UNF)
Oil temperature sensor pocket	1	½" NPT
Oil return from external cooler	1	7/8" (14 UNF)

	DESCRIPTION			SIZE
Dimensions	[1]Overall	Length	L	1820 mm
		Height	H	647 mm
		Width	W	565.6 mm
	Holding-down bolt centres	Motor housing	A	320 mm
		Compressor	B	380 mm
		Compressor/motor housing	C	938 mm
	Holding-down bolts		-	4 x M12 x 1.75P x 21 full thread
	Lifting eyebolts	Motor housing	-	M20 x 2.5P x 35 full thread
		Compressor and separator	-	2 x M16 x 2P x 27 full thread

HSS 3200

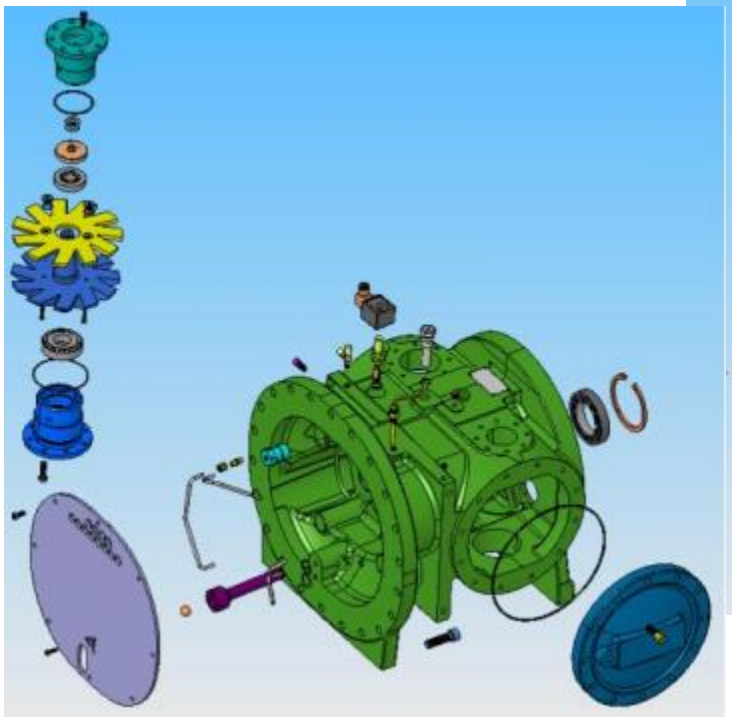
Exploded views

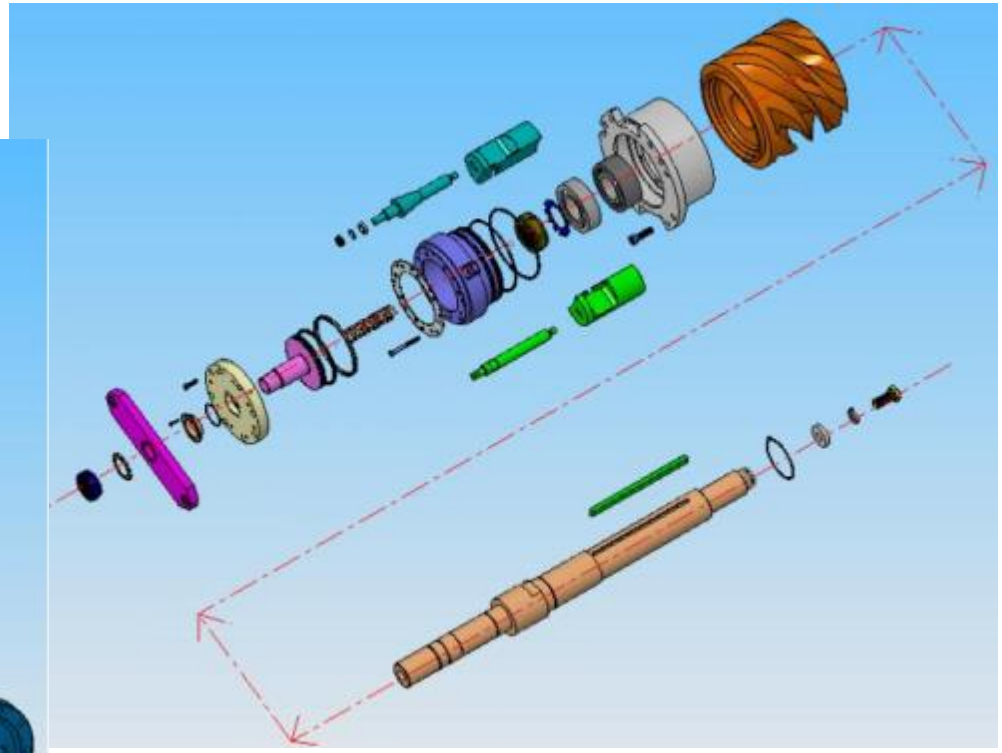




HSS 3200

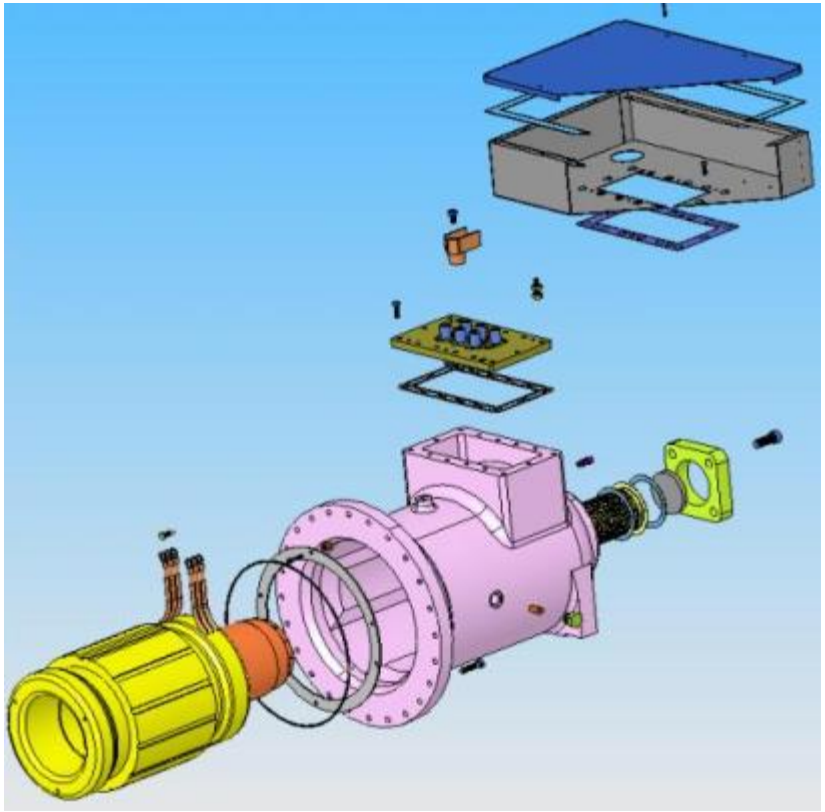
Exploded views





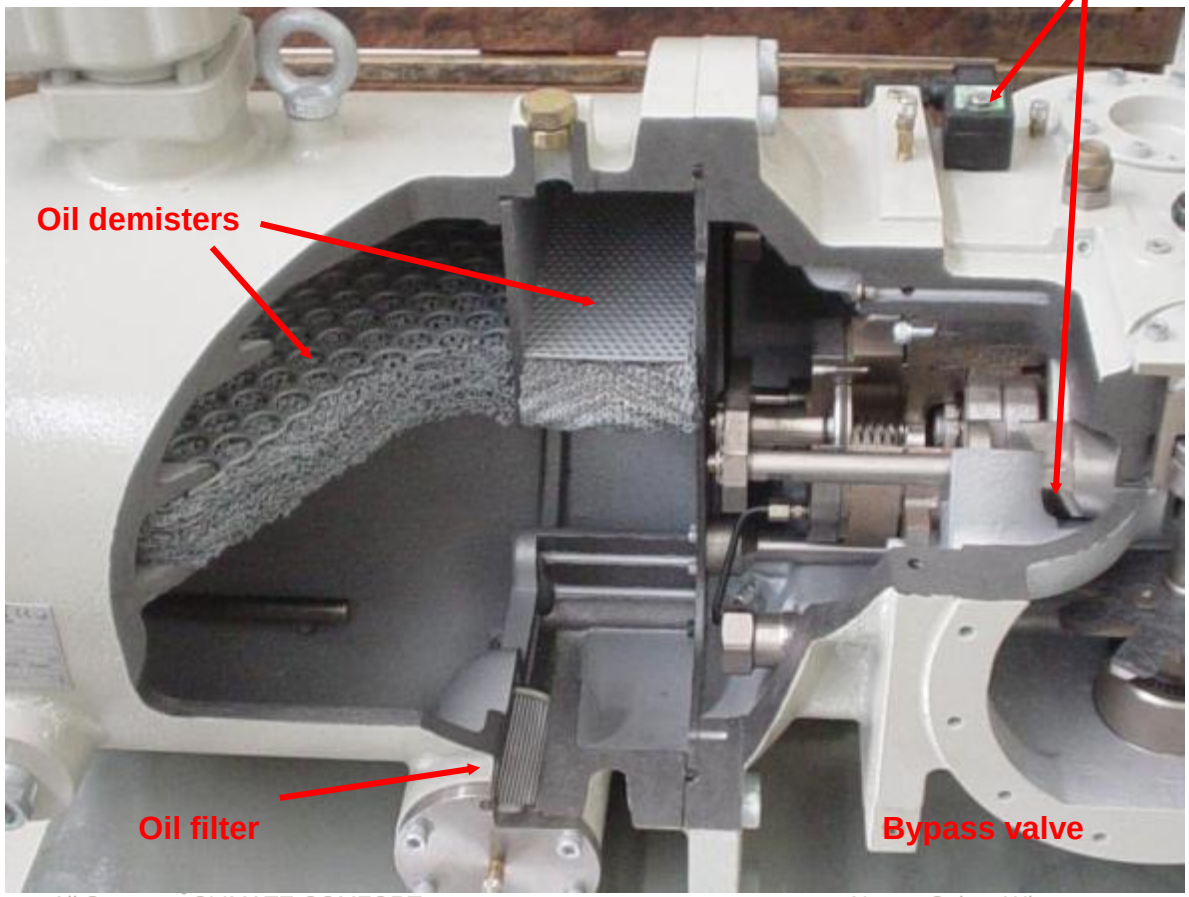
HSS 3200

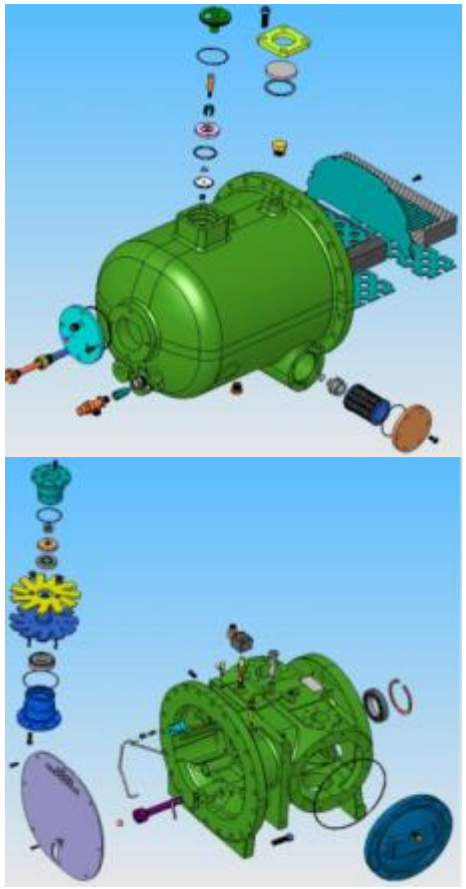
Exploded views



HSS 3200 main components

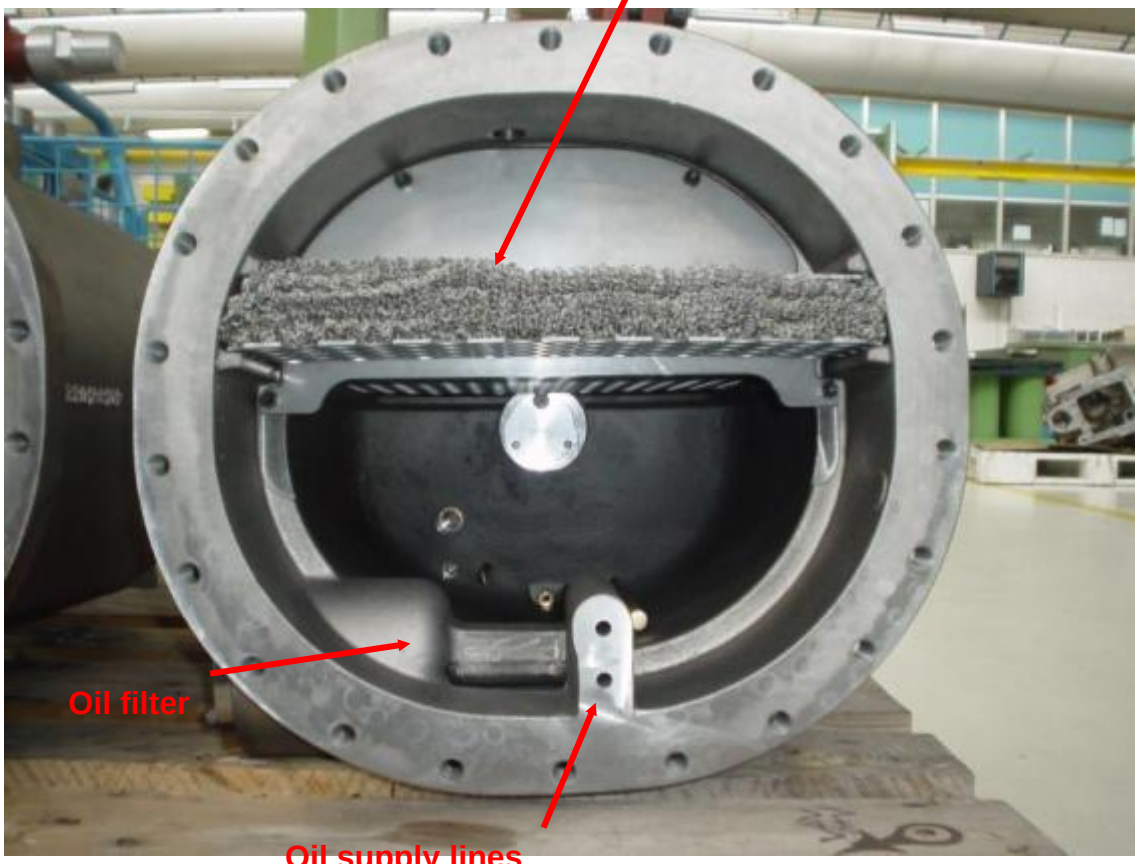
cut away view

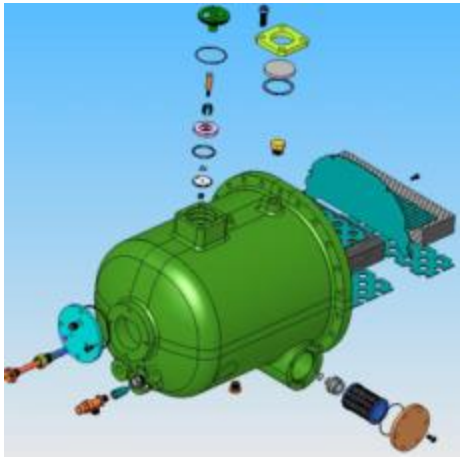




HSS 3200 main components

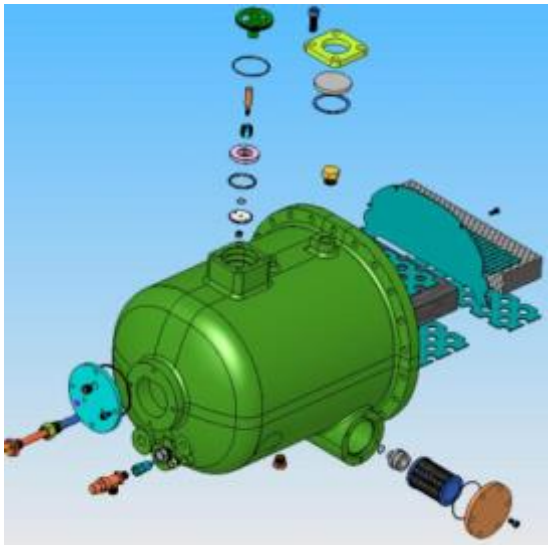
Cut away view





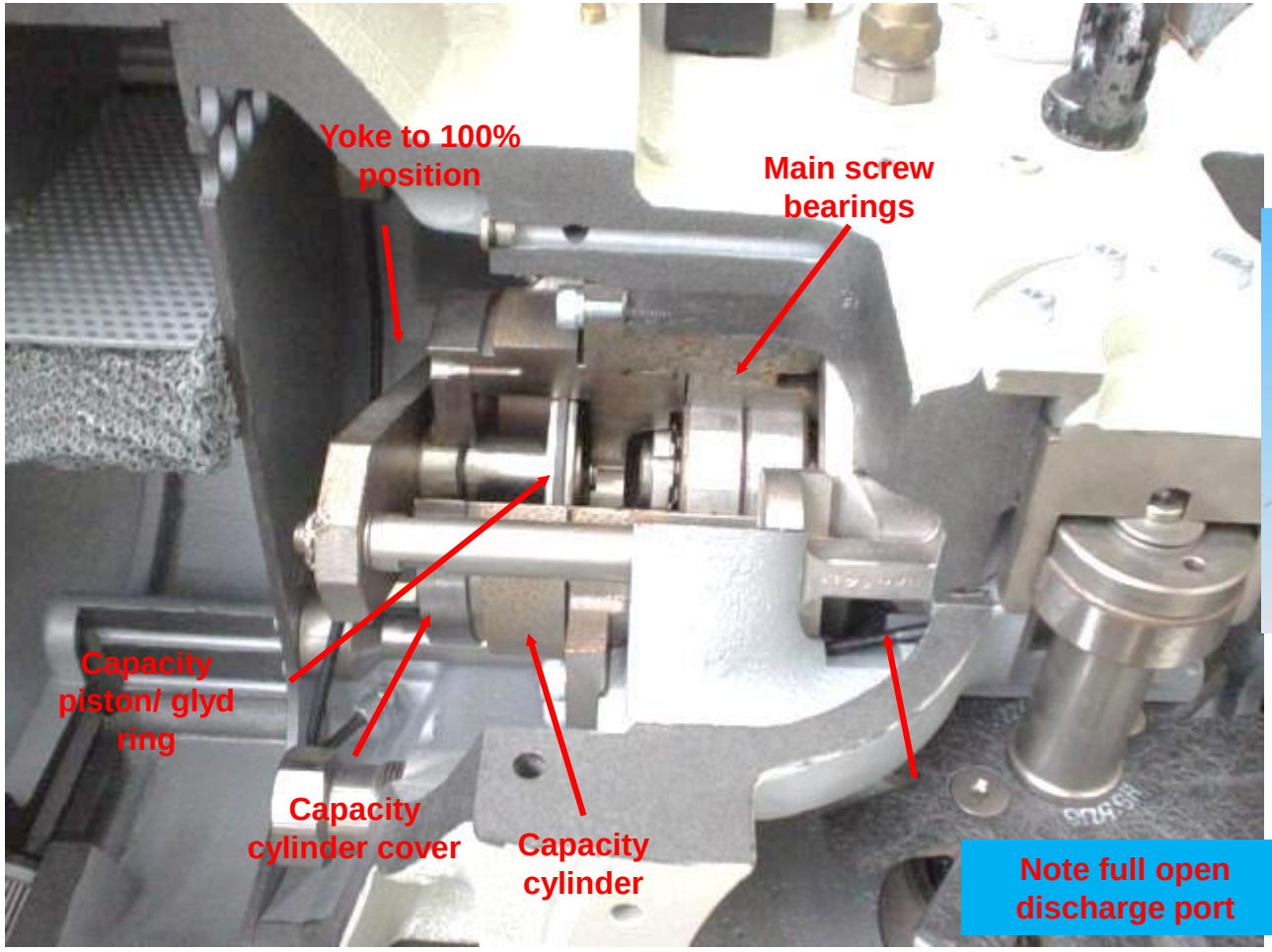
HSS 3200 main components

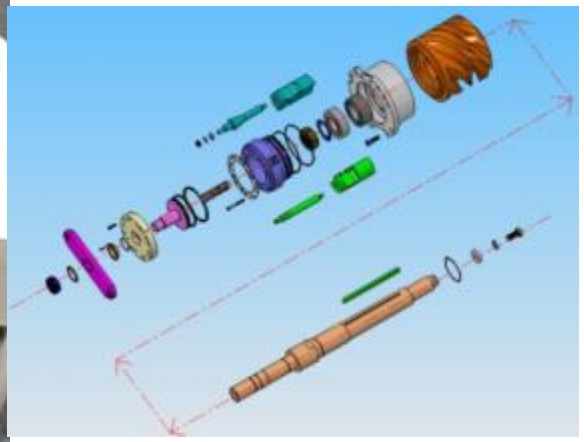
Cut away view oil separator



HSS 3200 main components

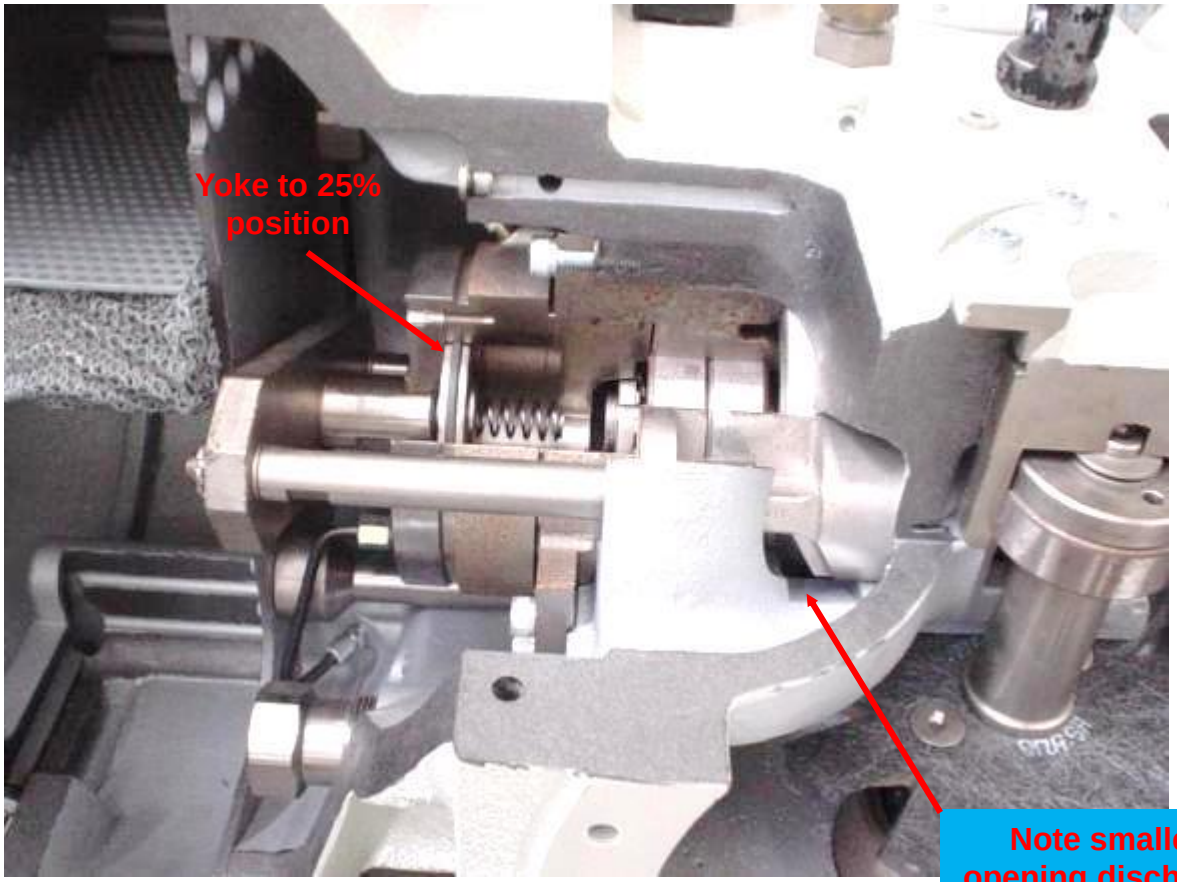
Cut away view capacity system @100%

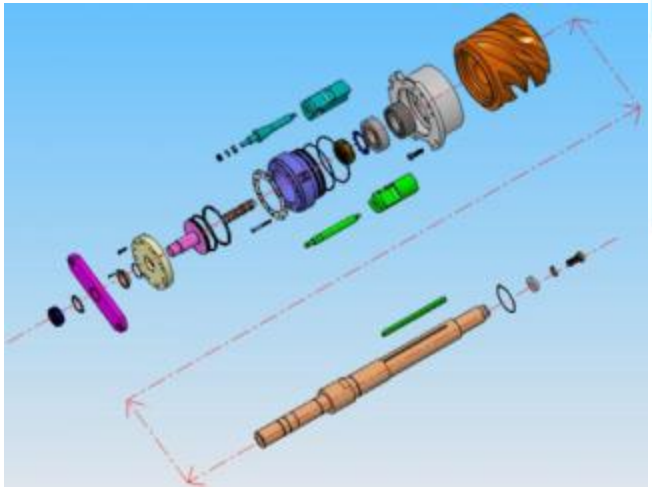




HSS 3200 main components

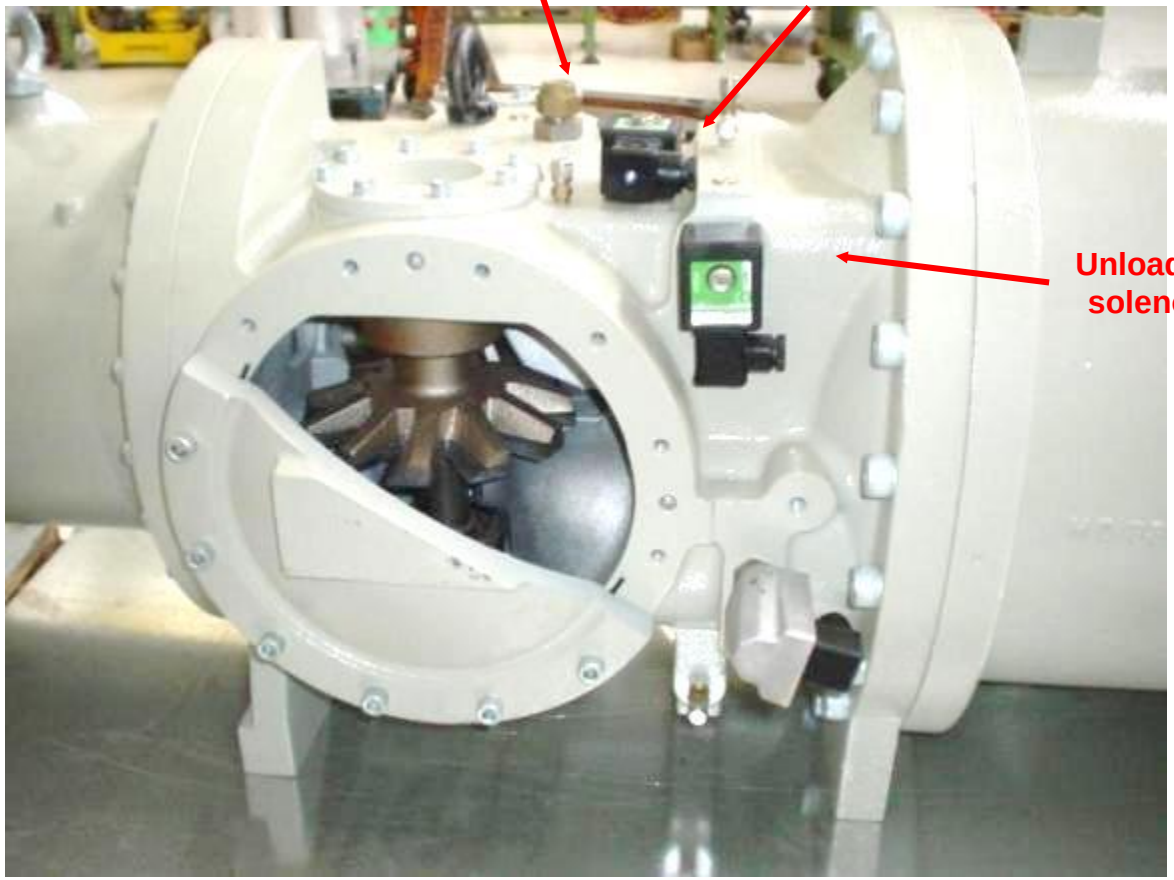
Cut away view – slide @ 25%

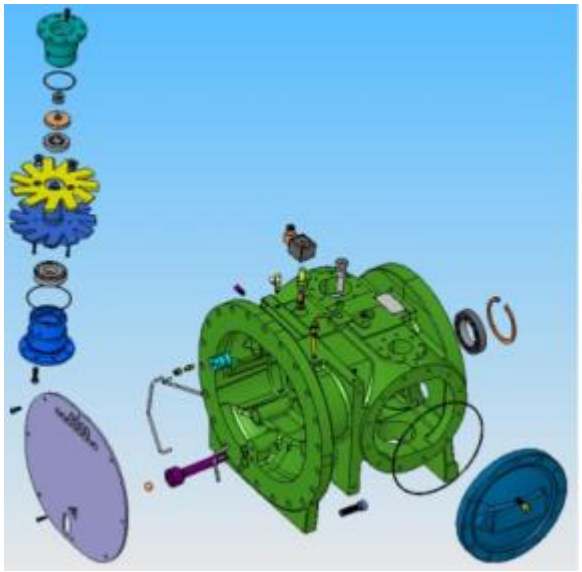




HSS 3200 main components

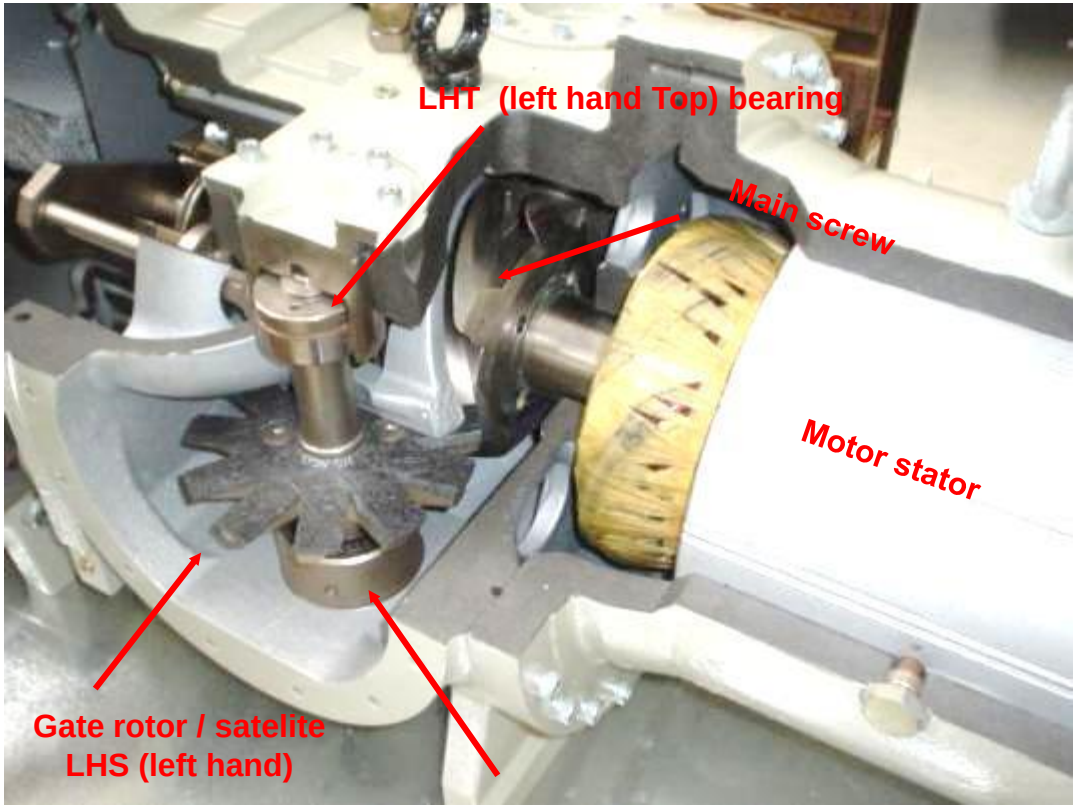
Cut away view

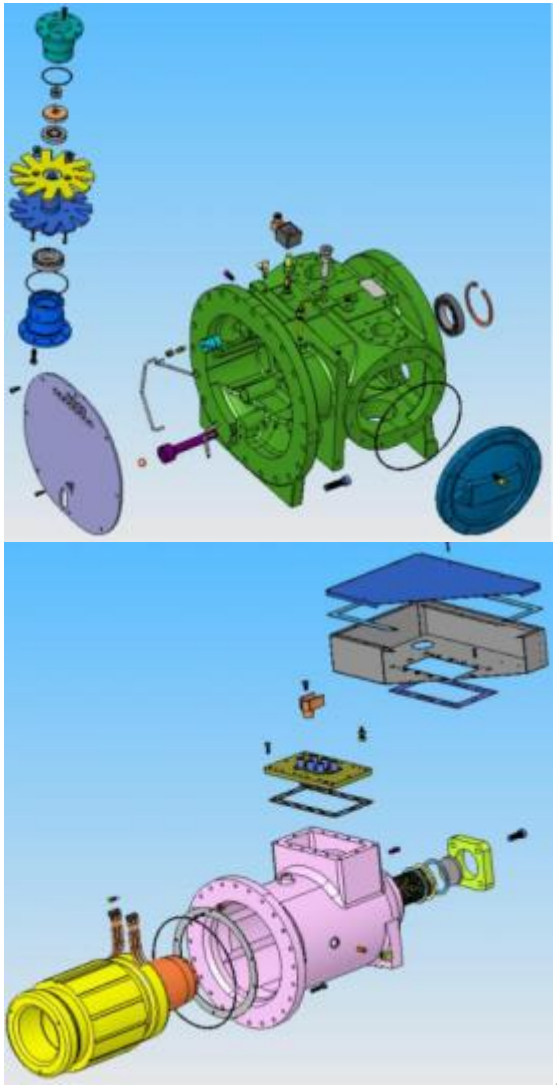




HSS 3200 main components

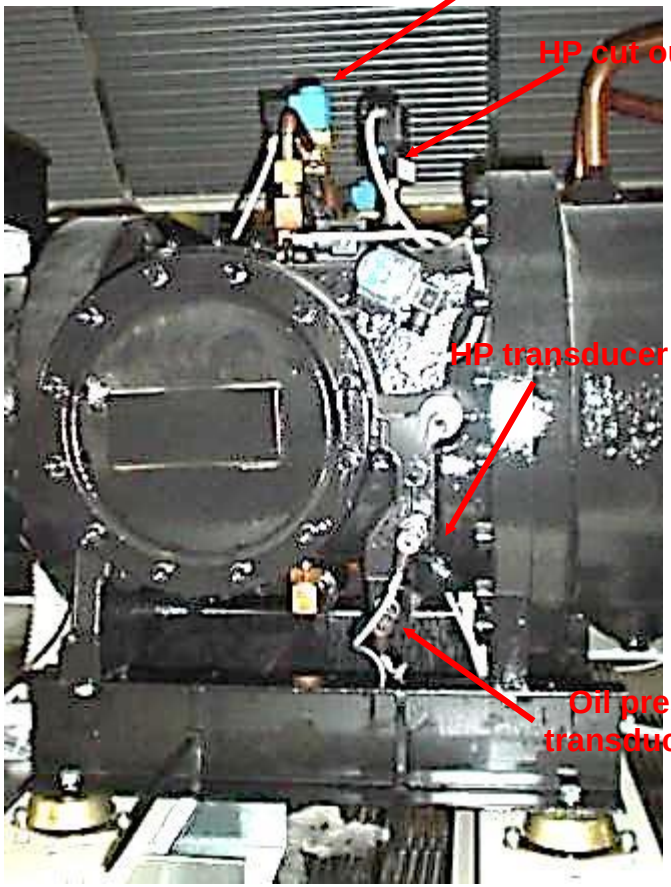
Cut away view – motor section



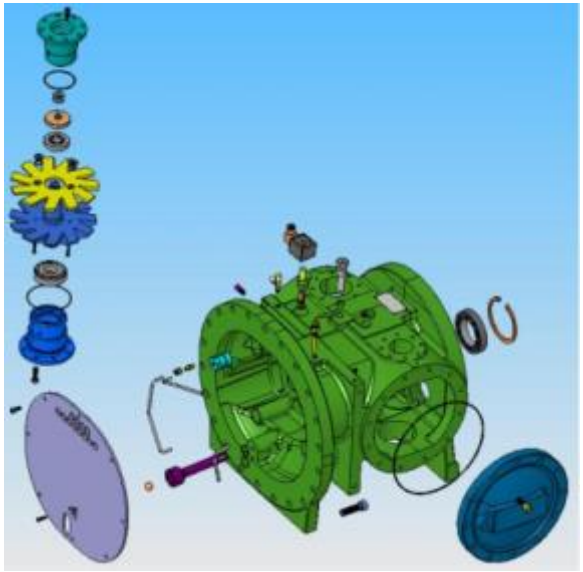


HSS 3200 main components

Cut away view

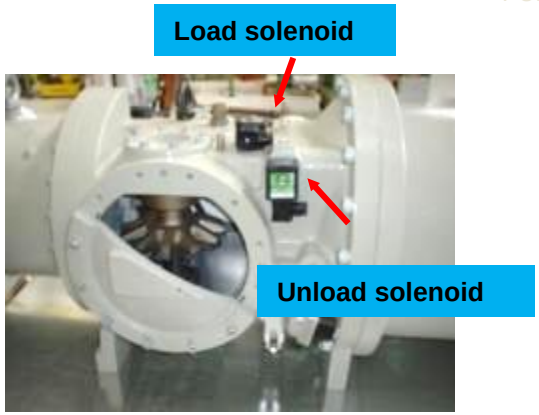


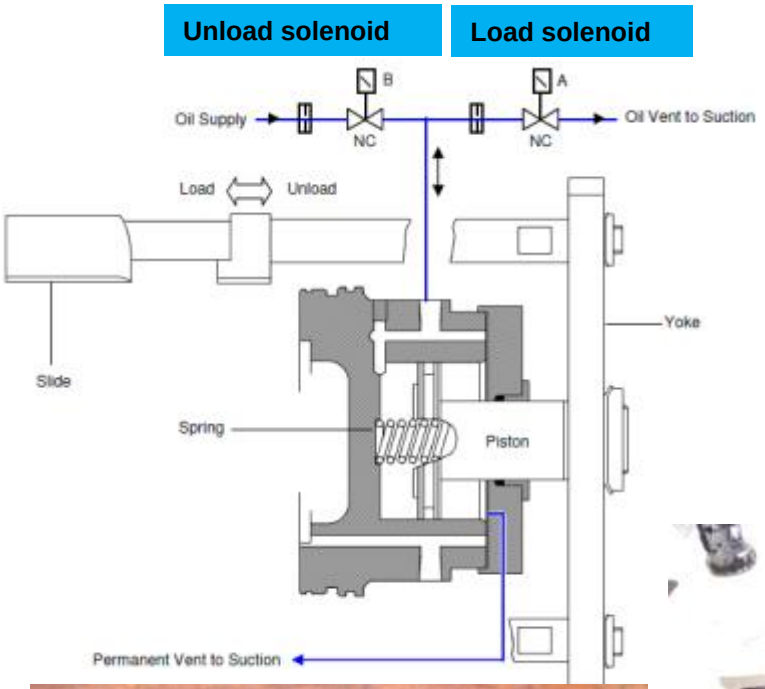
Liq injection/ economizer port

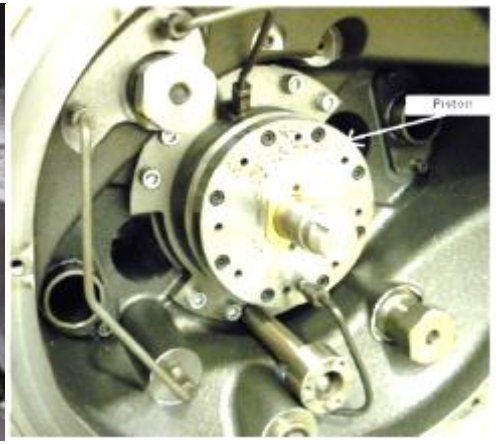


HSS 3200

Capacity regulation system - parts

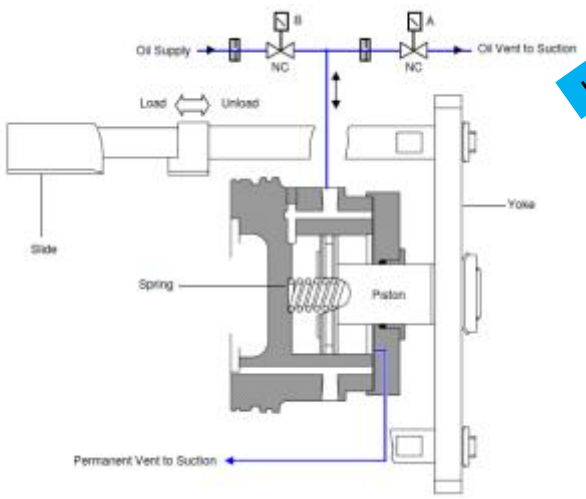


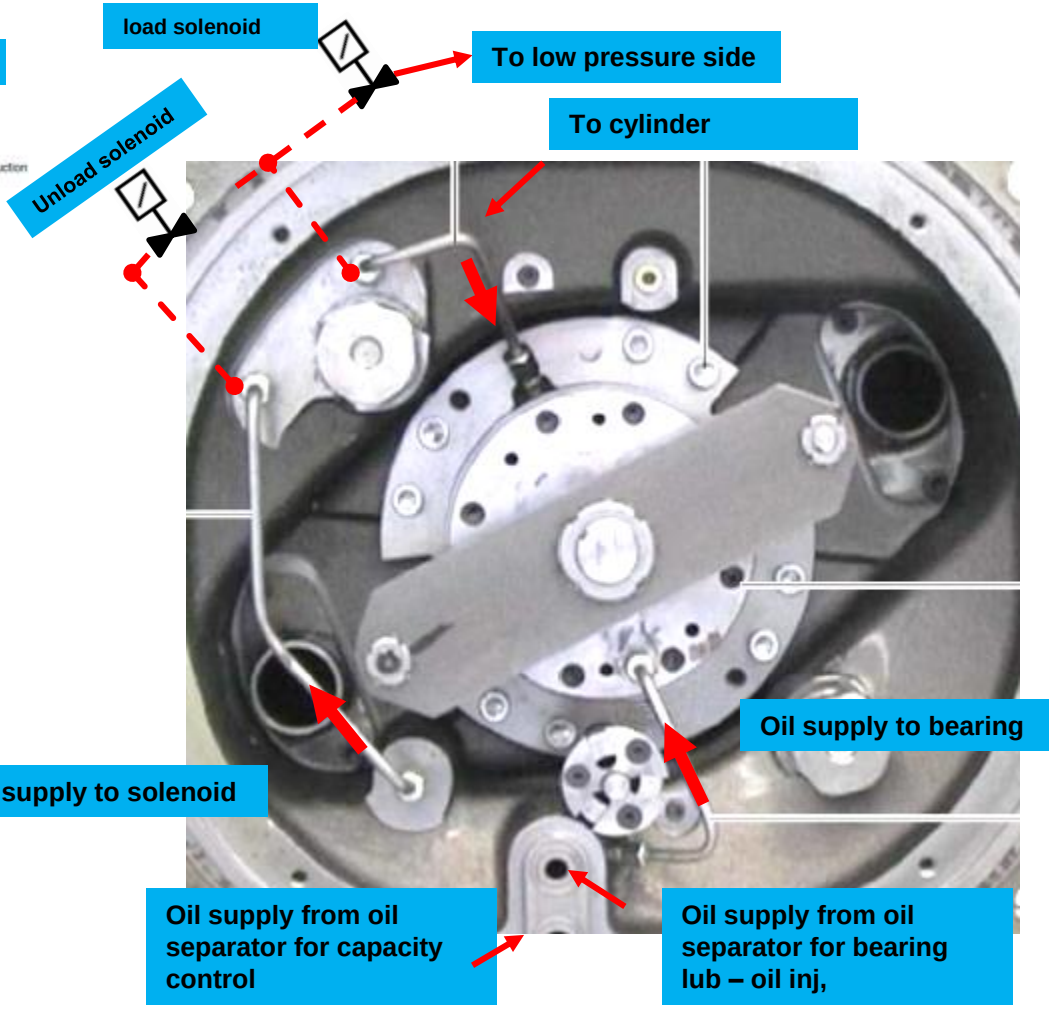




HSS 3200

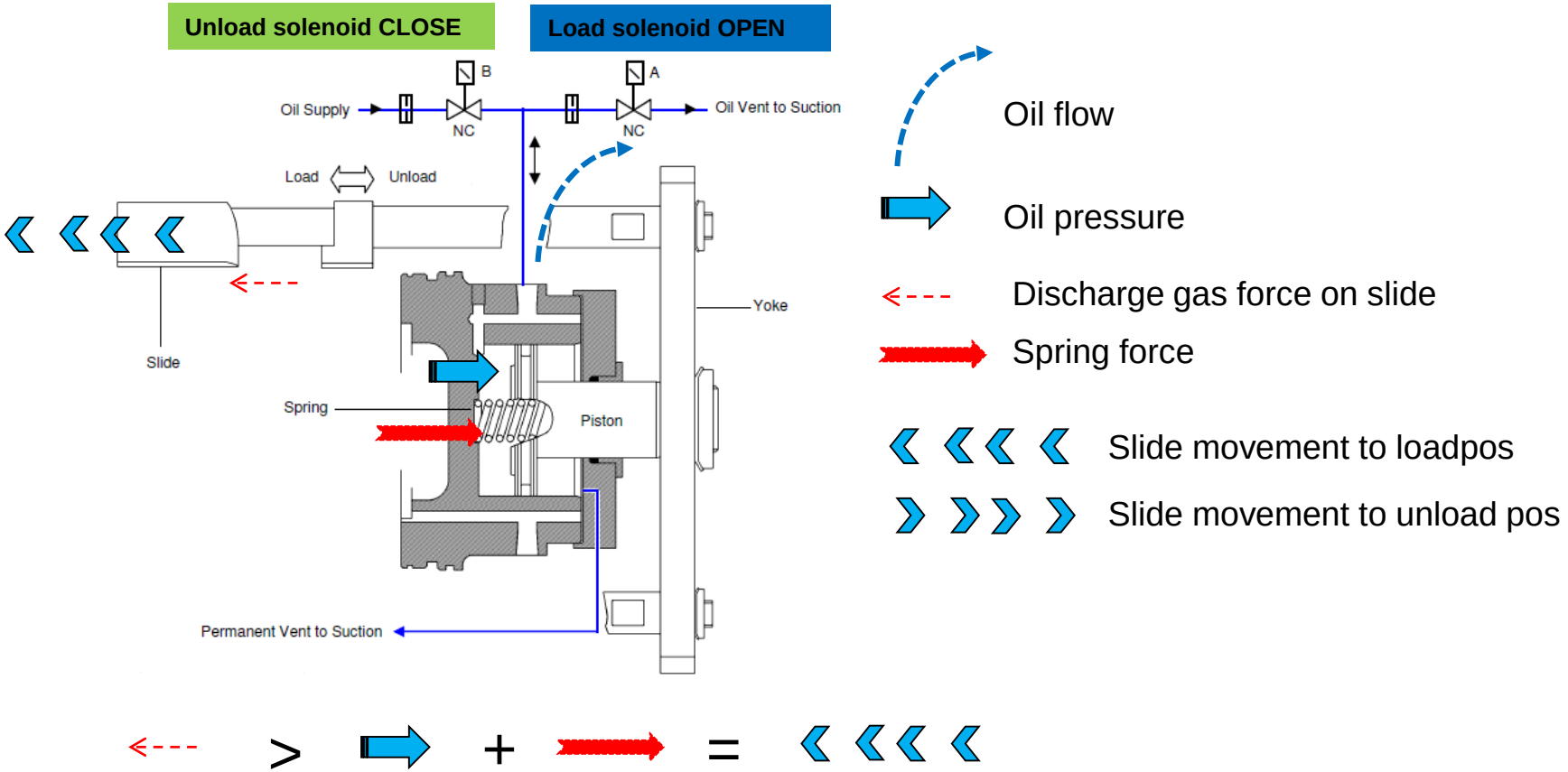
Capacity regulation system – oil distribution





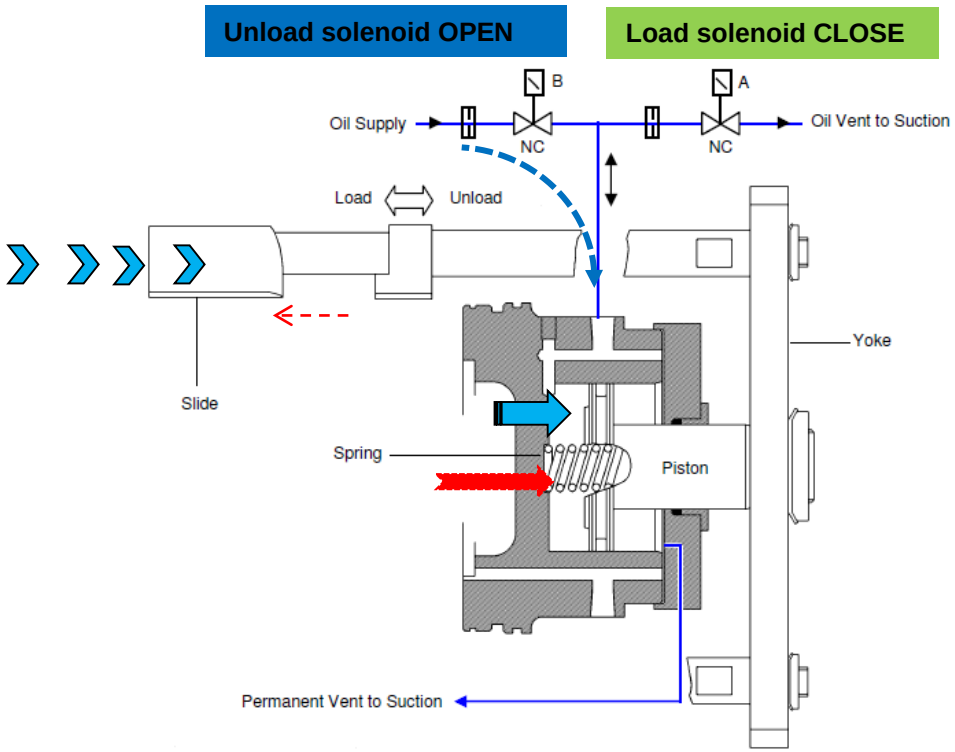
HSS 3200

Capacity regulation system – loading = oil venting !



HSS 3200

Capacity regulation system – unloading = oil supply !



Oil flow

Oil pressure

Discharge gas force on slide

Spring force

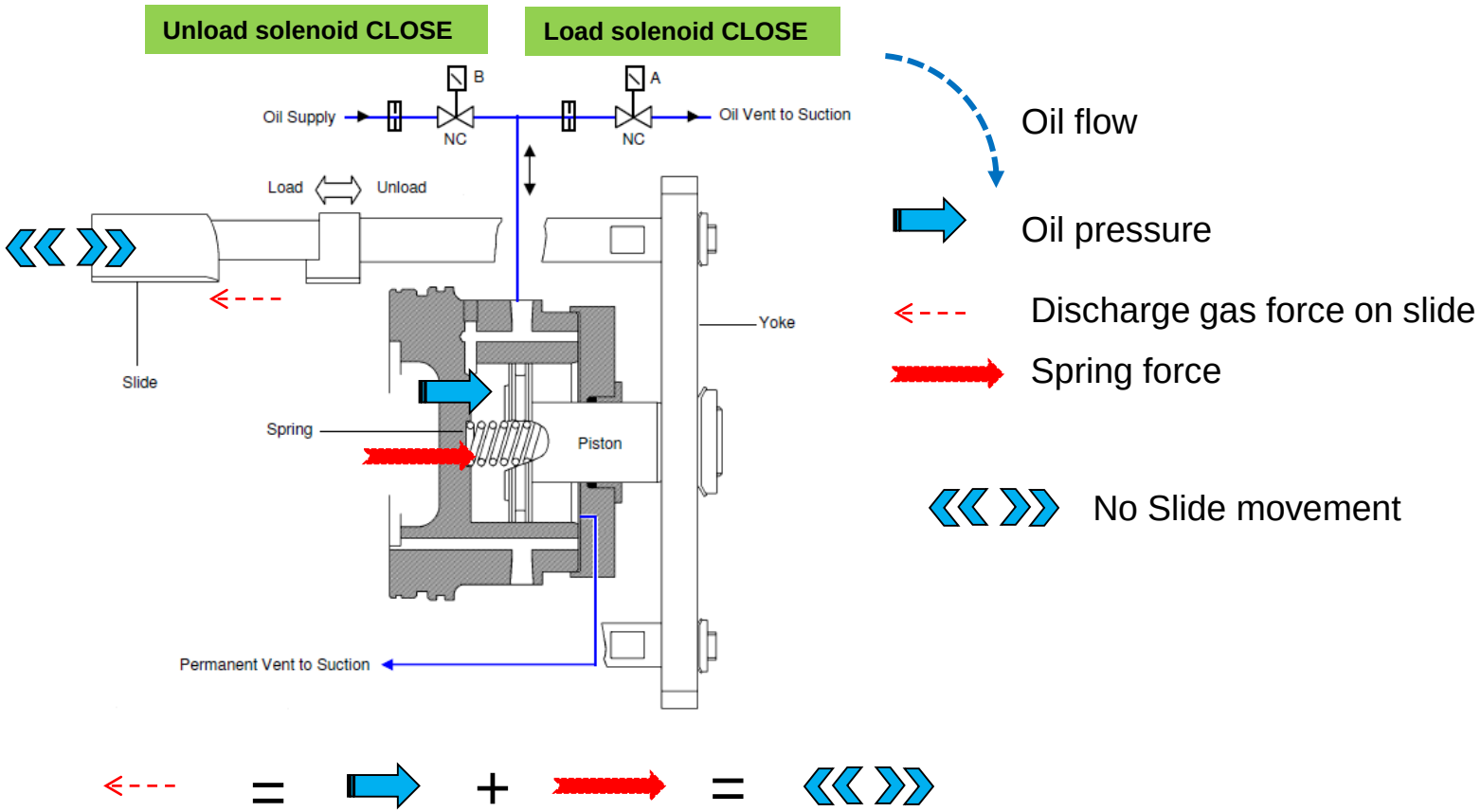
Slide movement to loadpos

Slide movement to unload pos

< + =

HSS 3200

Capacity regulation system – holding capacity



HSS 3200

Capacity regulation system

Capacity action	Load valve A	Unload valve B
Load compressor	Open (pulse)	close
Unload compressor	Close	Open (pulse)
Hold compressor	Close	Close
Compressor on 100%	Fully open	close
Controlled stop	Close	Pulsed contineously until 25% (mini) position is reached
Controlled start	-	Fully open until chiller controler decides to load compressor
Emergency stop	Close	Pulsed contineously until 25% (mini) position is reached
Start after powercut	close	Keep 5 minutes open before start

HSS3200

1. Capacity regulation test (fieldtest + workshop test)

   When performing?

   1. Compressor loads up unwanted to 100%
   2. Compressor cannot hold capacity
   3. Compressor doesn't load

2. Scope of tests:

   - Test 1 (a+b) - To check correct sealing of solenoids
   - Test 2 (field) - To check correct movement of capacity slides and test tightness of glyd rings (pressure test).
   - Test 3 (workshop) – detailed check for any leaks on the capacity system (glyd ring, main bearing plate – dismanteling of parts needed,

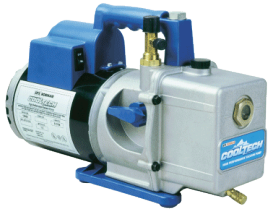
What do we need?

- Some special tools

7/16” long socket

- Nitrogen bottle

- Vacu pump, Manometers + hoses/ ampère meter



Special blanking plugs, for field test

Pressure supply plug

Blank orifice plugs

Special oil way blanking plate, for workshop test

HSS 3200

WARNING !!! – prior to opening of compressor

- Stop circuit involved / pumpdown
- separate compressor from refrigerant circuit
- recover all existing refrigerant – check pressure !
- disconnect compressor from power supply
- avoid compressor can start unwanted (fuses)

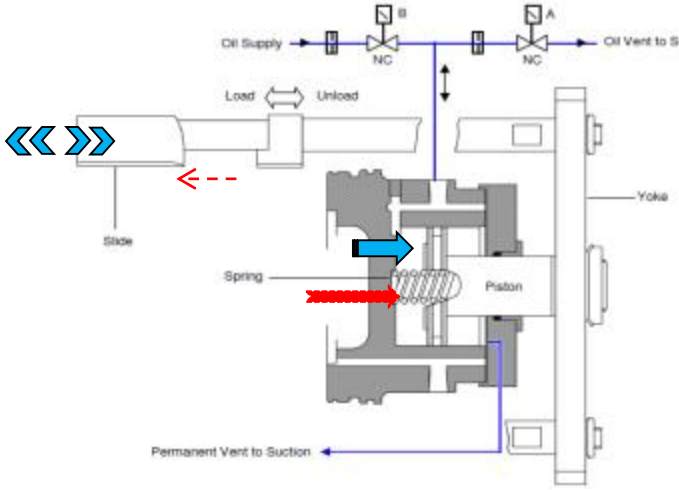
HSS 3200

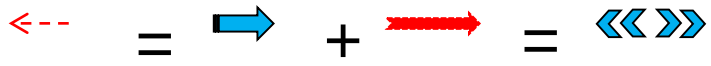
Field test – Test 1 a

Check of solenoids (test a) – compressor running!

- Perform compressor capacity holding test – remove both coils from solenoids ,
- ➔ compressor should keep capacity – check with ampère clamp,

Close / removed coil **Close / removed coil**





Discharge pressure = Cylinder pressure + spring pressure = slide stays in same position

Possible Result:

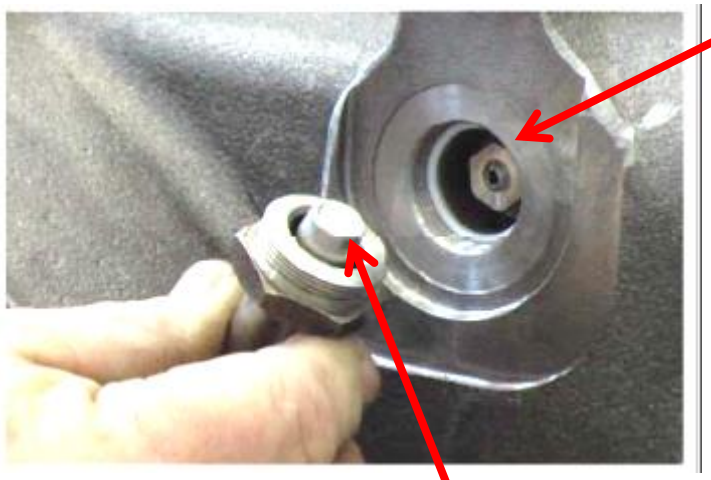
1) Current rise to max value ➔ Solenoid A (load) is leaking
2) Current is decreasing to min value ➔ Solenoid B (unload) is leaking

Proceed with visual check of solenoids stems ! (test – b)

HSS 3200

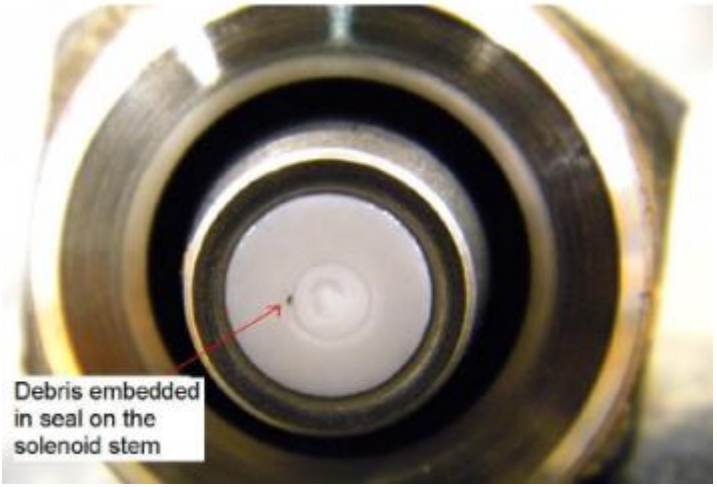
Field test – Test 1 b check of solenoids

Remove the solenoids for visual check



Orifce must be present !

You should see small impact on the plastic – proving correct sealing towards orifce



Any pressence of debris = leak

HSS 3200

Field test – Test 2 – checking slide valve movement.

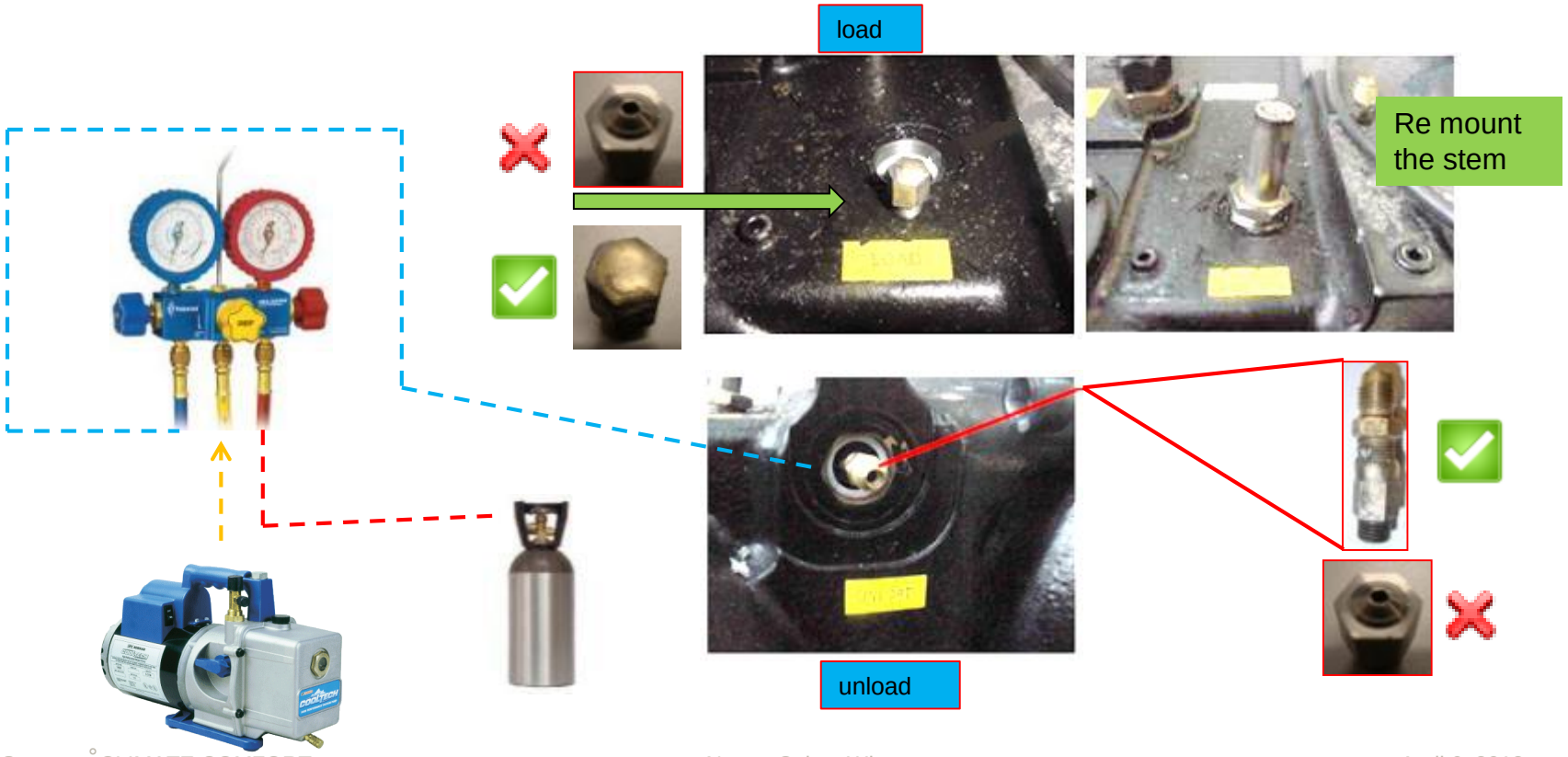
1. Remove both side covers of gate rotors
2. Remove solenoids stems.
3. Remove orifices of the load and unload solenoid
4. Install in the unload location (valve B) the special pressure supply plug
5. Install in the load loacation (valve A) the blank plug and re mount the solenoid stem.
6. Connect manometer – pressure bottle and vacu pump to the pressure supply plug on the unload solenoid position
7. Prior to test perform vacu on the unload position to remove any oil inside capacity system.
8. To test load movement perform vacuum on the unload position.
9. To perform pressure test allow pressure to the unload position (max 6 bar)

To remove orifices use socket of 7/16” or M13

HSS 3200

Field test – Test 2 – checking slide movement + pressure test

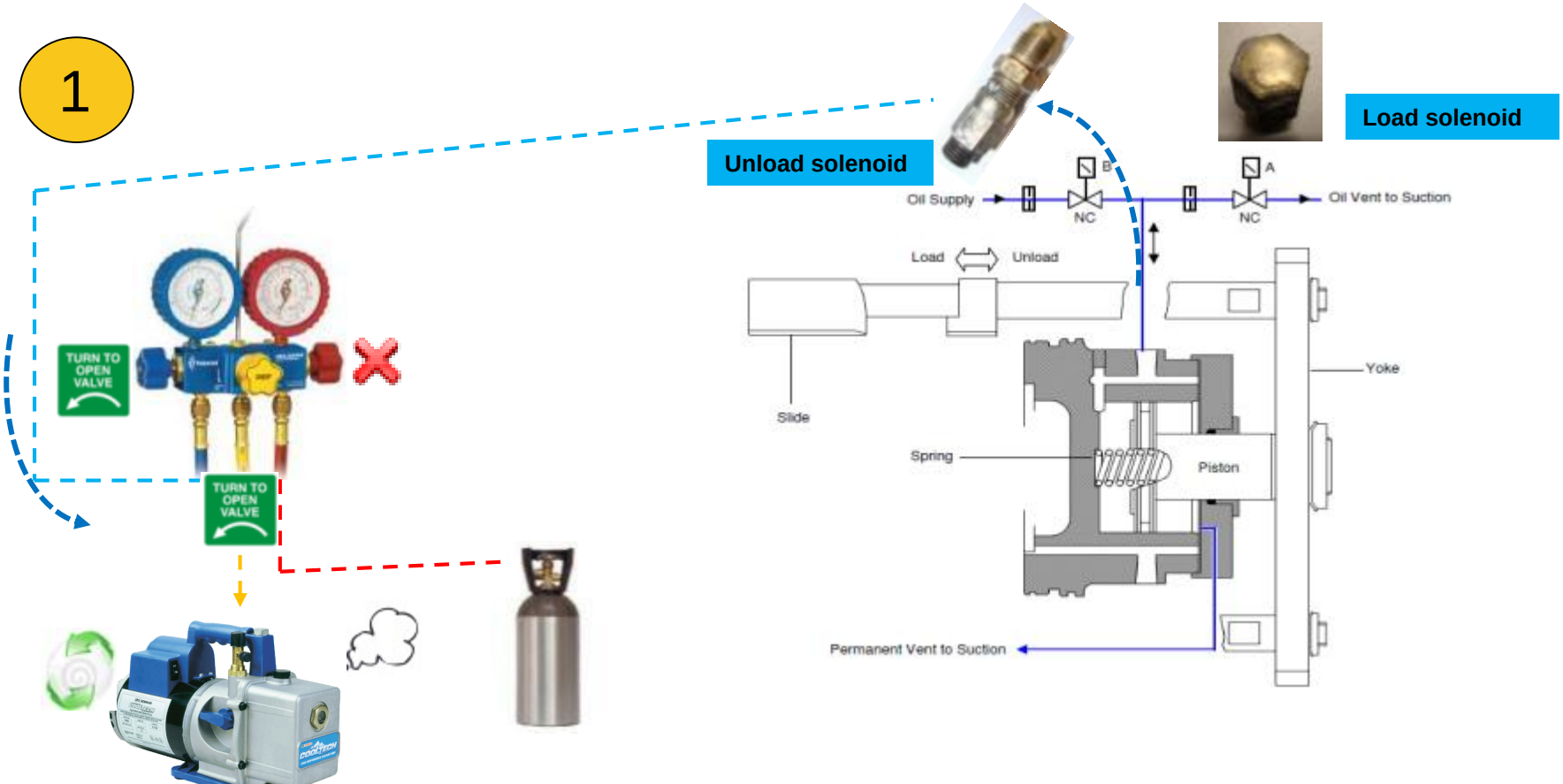
Connect manometer, vacu pump and pressure bottle to the pressure supply plug on the unload solenoid position.



HSS 3200

Field test – Test 2 – checking slide movement + pressure test

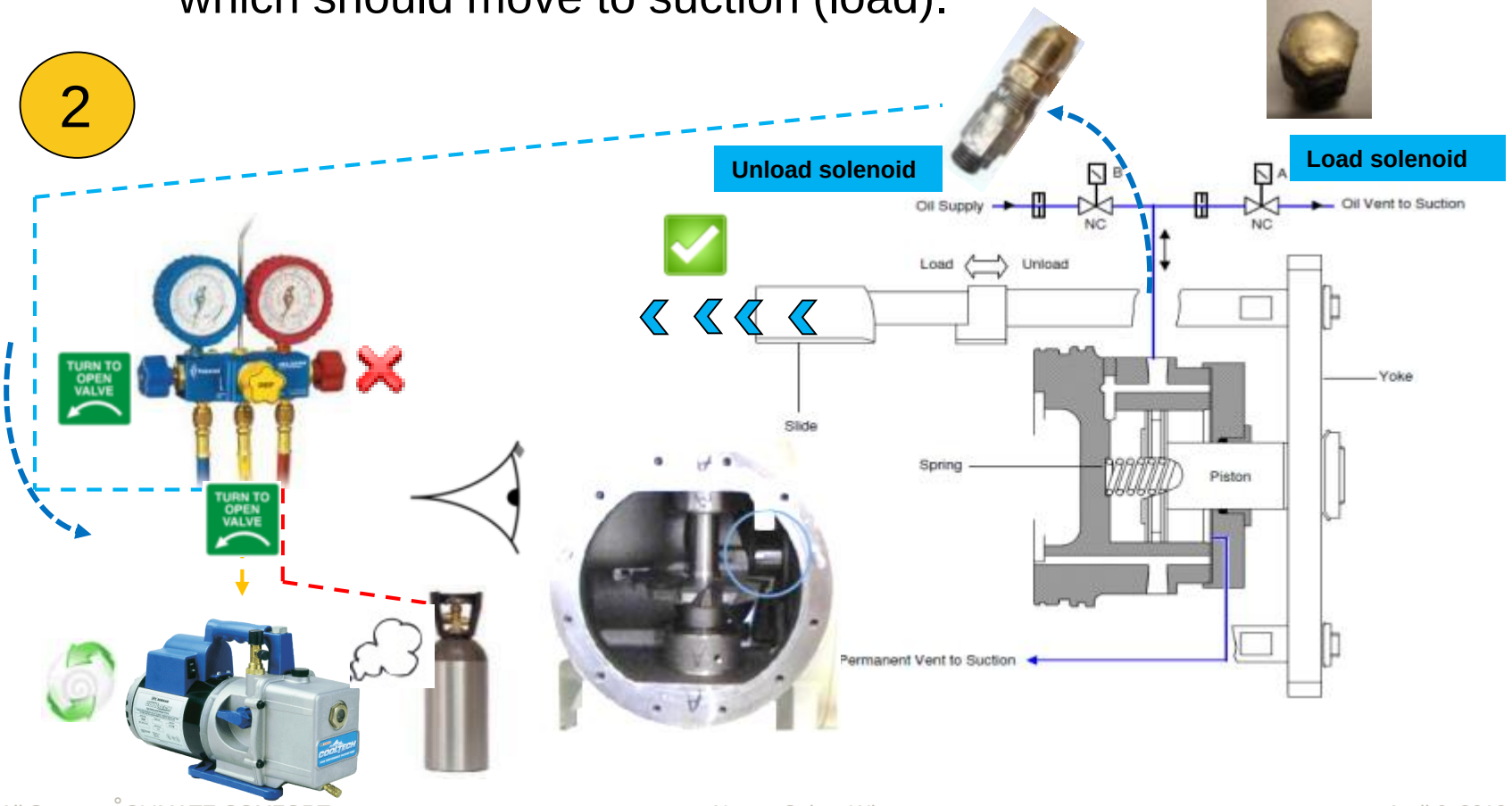
a. First perform vacuum in order to remove any exisiting oil



HSS 3200

Field test – Test 2 – checking slide movement + pressure test

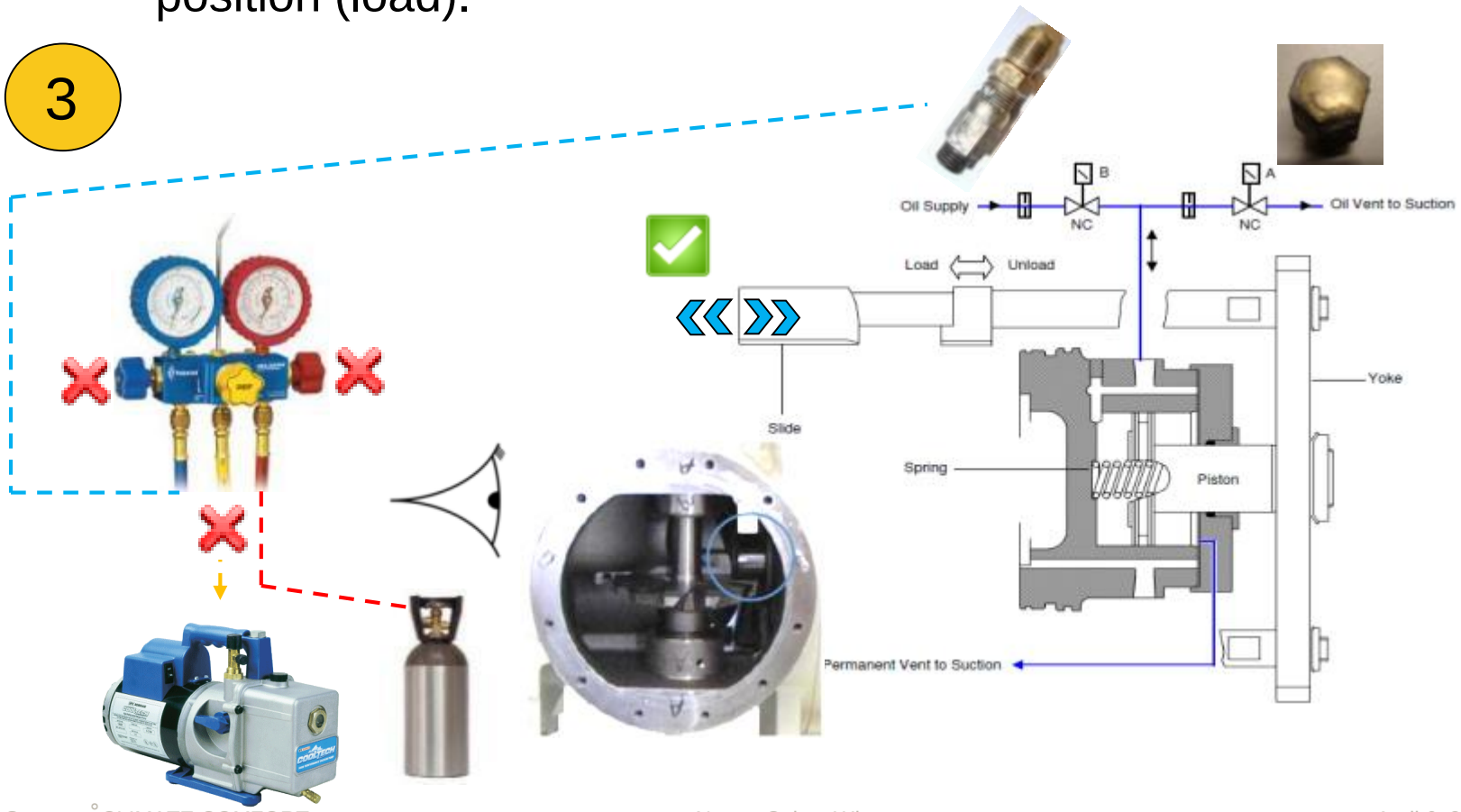
b. Continue perform vacuum in order to check movement of slide, which should move to suction (load).



HSS 3200

Field test – Test 2 – checking slide movement + pressure test

c. Stop vacuum , close LP/ vacu line, slide should stay in max position (load).



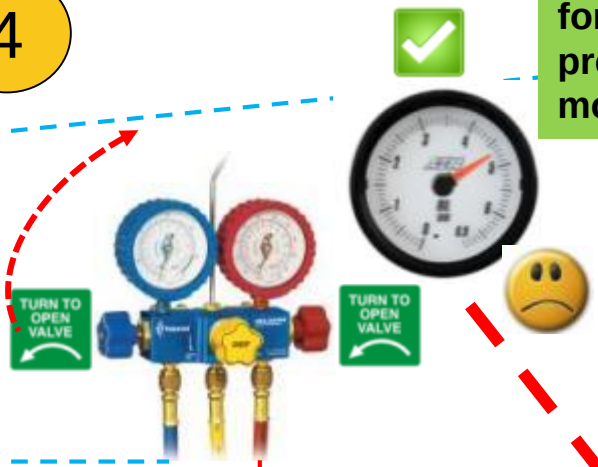
HSS 3200

Field test – Test 2 – checking slide movement + pressure test

d. Release vacuum , allow 6 bar pressure, slide should move to mix position (unload).

4

Pressurise to 6 bar for one minute, pressure loss not more than 1 bar



Glyd ring may be leaking, detailed pressure “test 3” needed !

HSS 3200

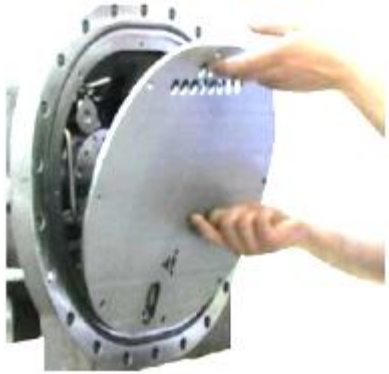
Workshop test – Test 3 –

1. Remove oil from compressor
2. Oil separator to be removed from compressor
3. Remove baffle plate
4. First Inspect for mechanical problem on capacity system.
5. Use special oil way blanking tool to block oil line from separator
6. Perform similar pressure as test 2 (point d, pressure test)
7. Locate leaks on main bearing plate or capacity cylinder

1

2

3

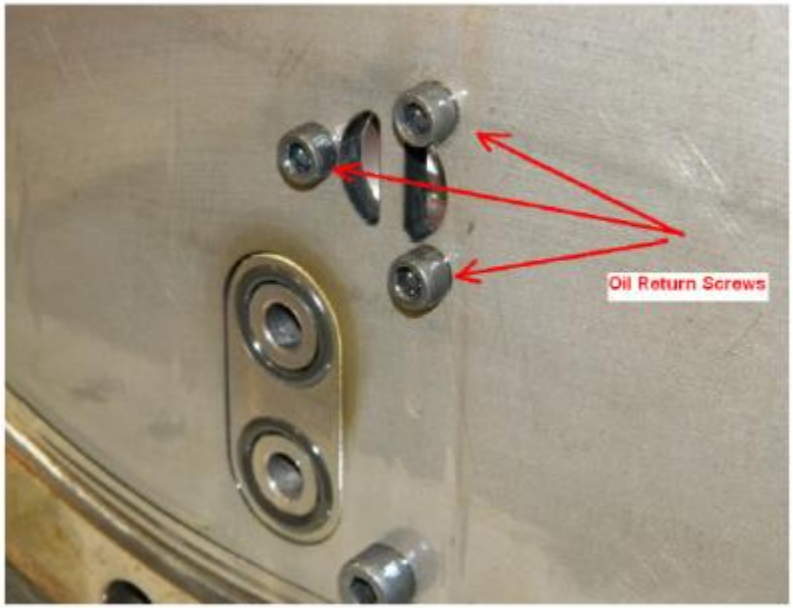


4

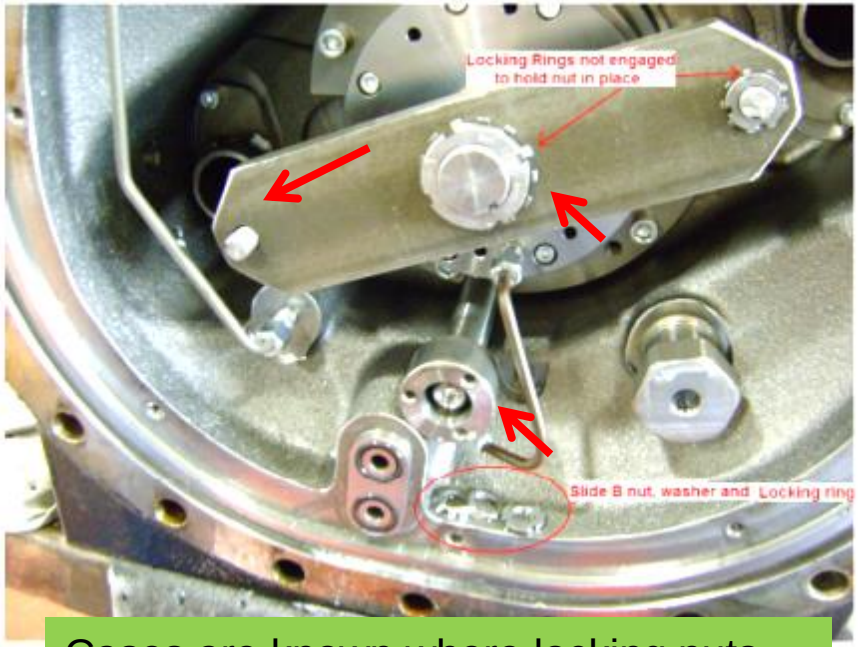
HSS 3200

Workshop test – Test 3 – visual inspection prior to pressure test.

Some issues are known on older series of 3200 compressor, prior to continue with pressure test, some visual checks to be performed.



When removing baffle plate note the presence of the oil return screws

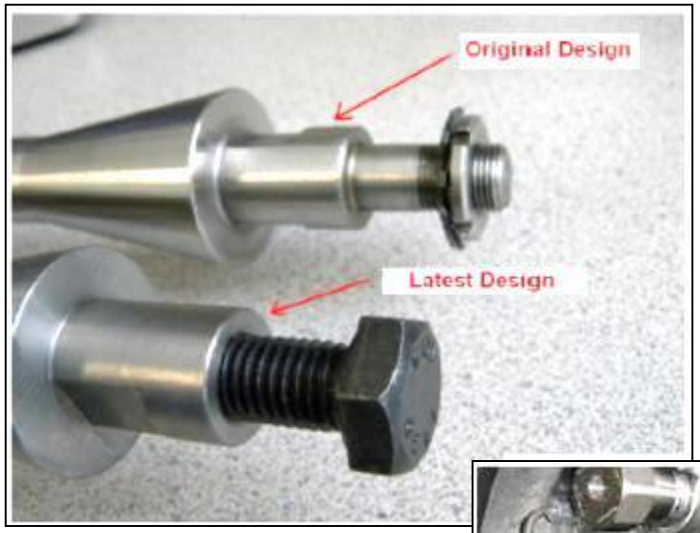


Cases are known where locking nuts became loose

HSS 3200

Workshop test – Test 3 – visual inspection prior to pressure test.

Improvement of fixtion of slides on new series 3200



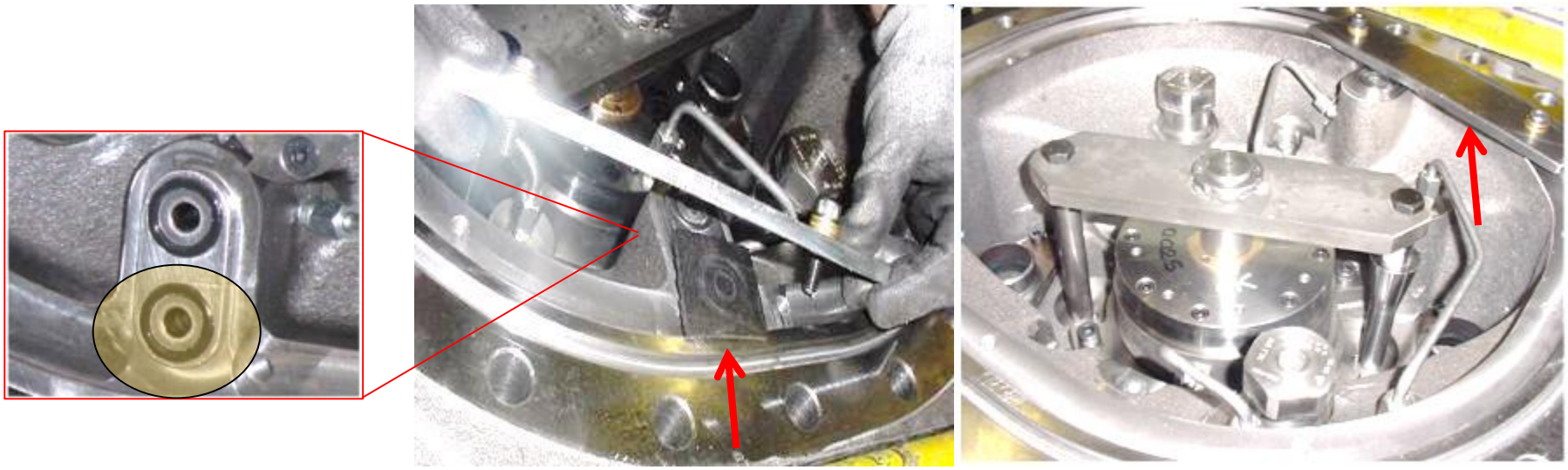
info

In case new slides are to be mounted, perpendicularity has to be verified and adjusted if needed!

HSS 3200

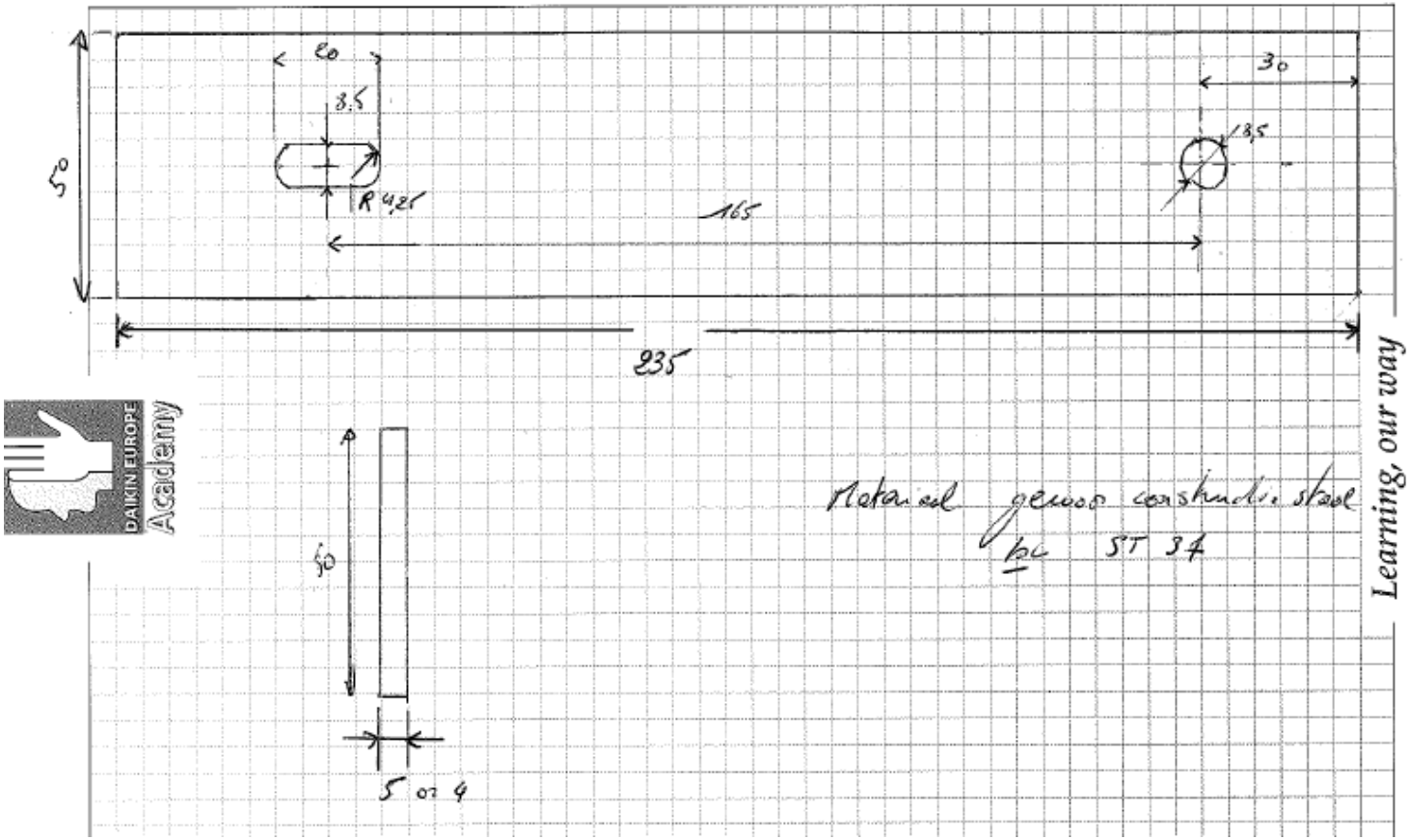
Workshop test – Test 3 – visual inspection prior to pressure test.

- Install special oil sypply blank plate
- => block oil supply line from oil filter => to avoid false leak during test



HSS 3200

1. Workshop test – Test 3 – special blank plate drawing

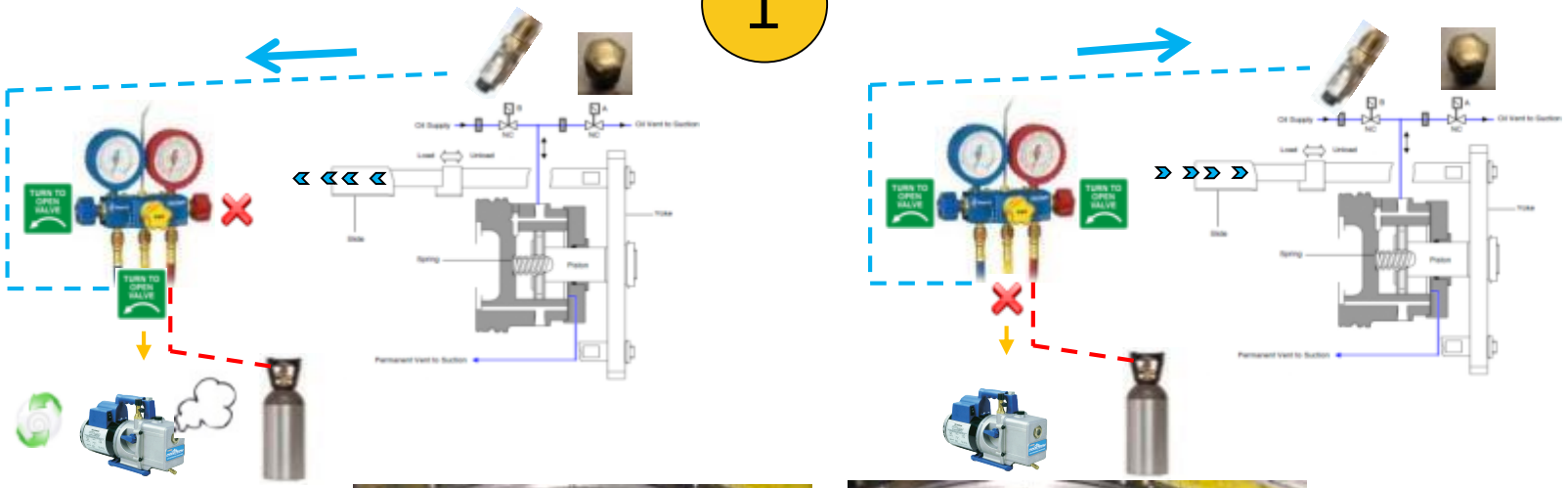


HSS 3200

Workshop test – Test 3 - detailed pressure test

a) Prior to pressure test, smooth functioning of capacity mechanism can be checked.

1



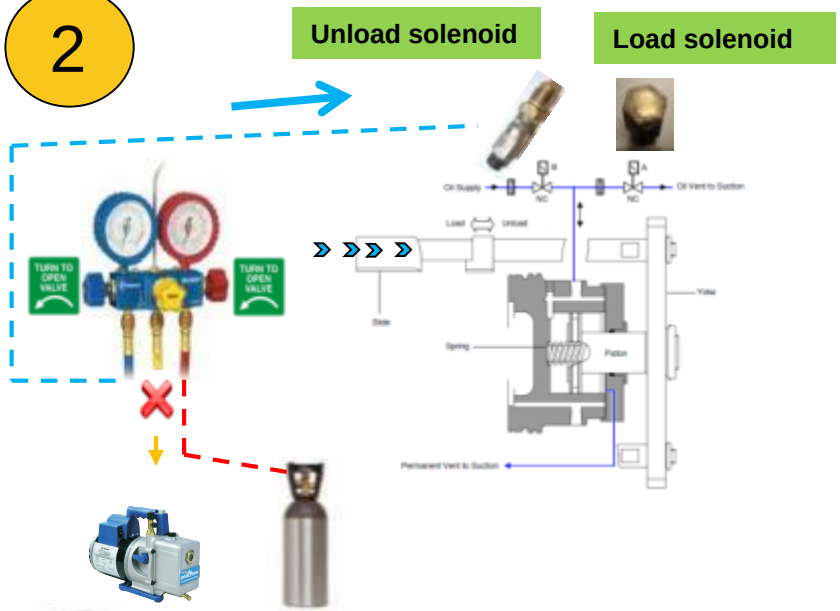
Visualy check movements are smooth

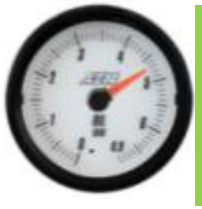
HSS 3200

Workshop test – Test 3 - detailed pressure test

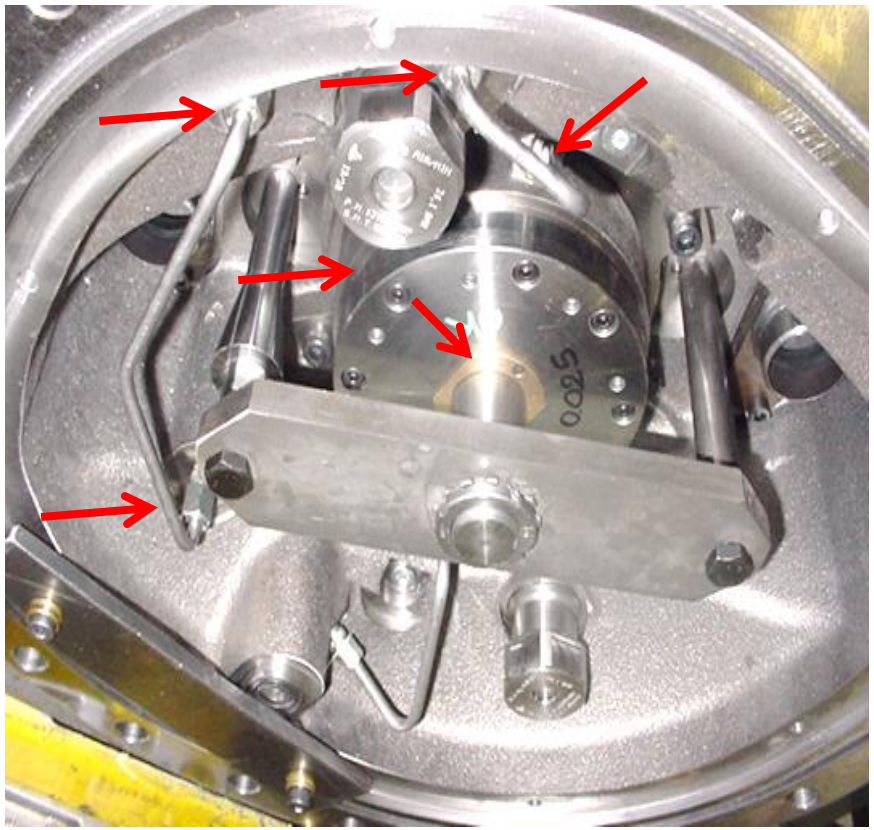
b) Pressure test, charge 6 bar of nitrogen into capacity cylinder.

2





Pressurise to 6 bar for one minute, pressure loss not more than 1 bar

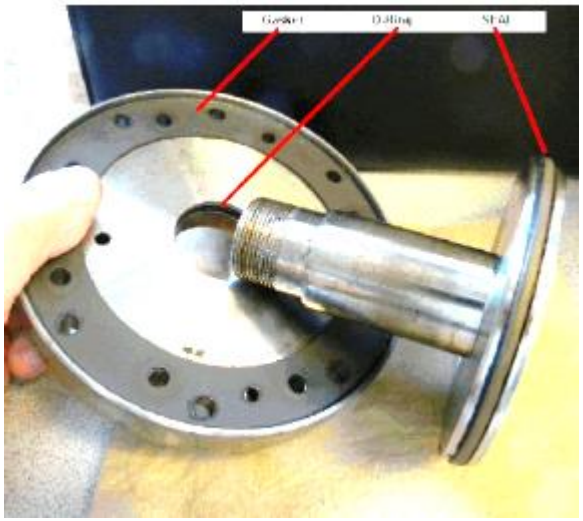


Visual check for leaks

HSS 3200

Workshop test – Test 3 - detailed pressure test

Sensible parts for leaking



O-ring

O-ring

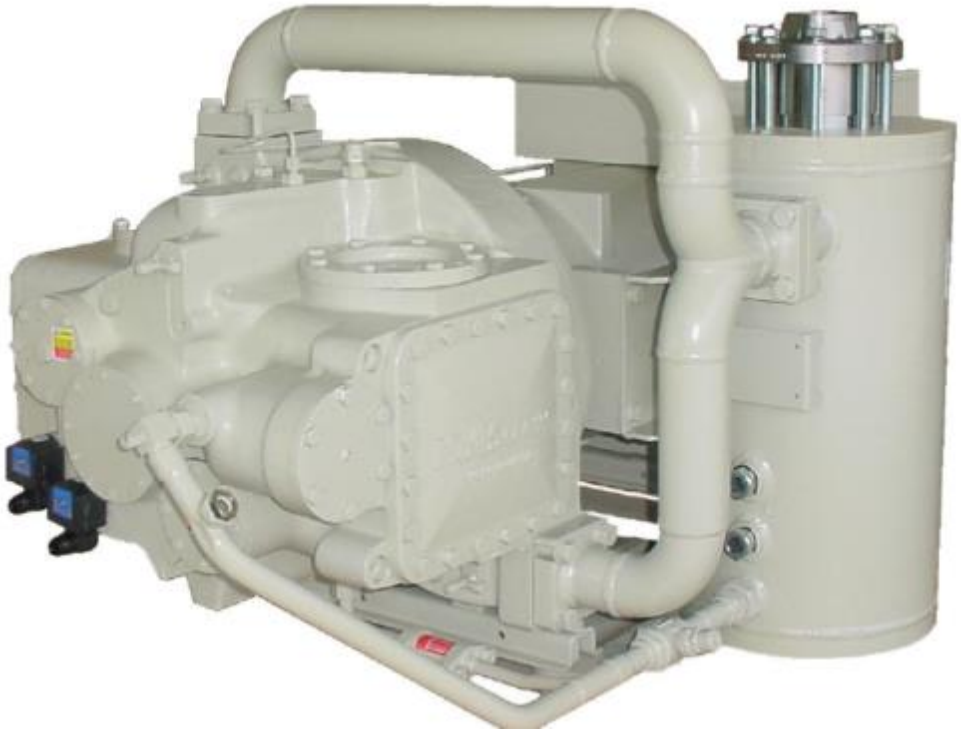
brass bush

Seal – glyd ring

The different oil connections
are potential leak positions

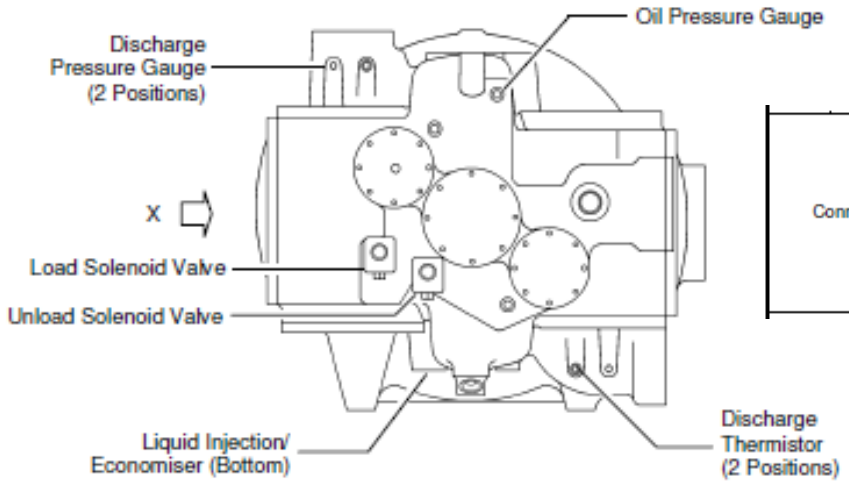
HSS 4200

HSS 4221 – HSA205
HSS 4222 – HSA220
HSS 4223 – HSA 235
HSS 4224 – HSA 243

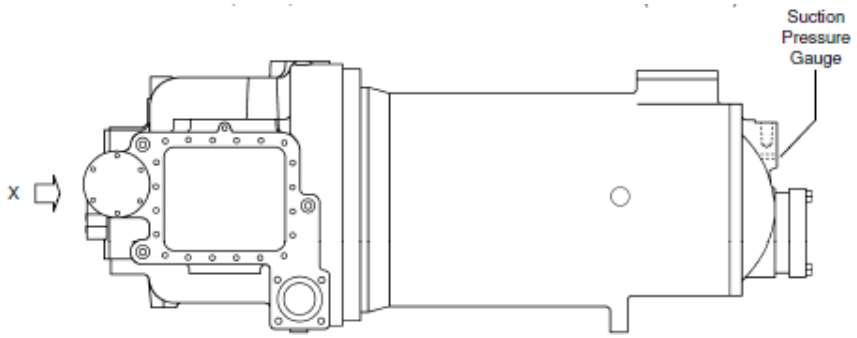


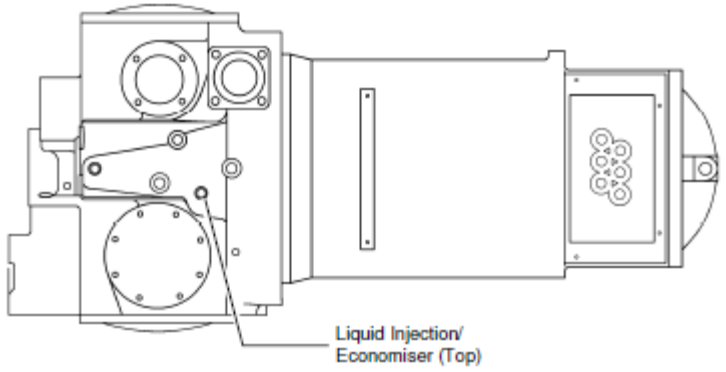
HSS 4200 series

Physical dimensions and connections



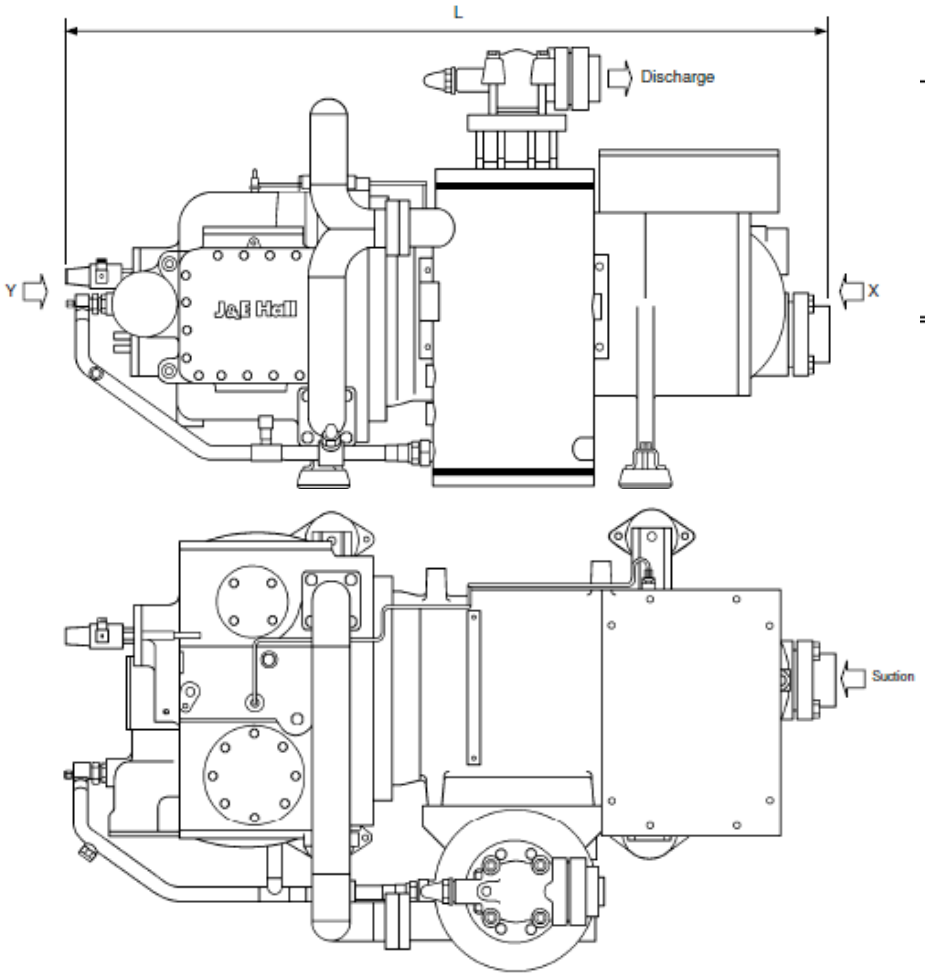
	Description	No Off	Size
Connections	Suction pressure gauge	1	1/8" NPT
	Discharge pressure gauge (2 positions)	2	1/8" NPT
	Oil pressure gauge	1	1/8" NPT
	Liquid injection/economiser (top and bottom); refer to 5.2	2	1 1/16" (12 UNF)





HSS 4200 series

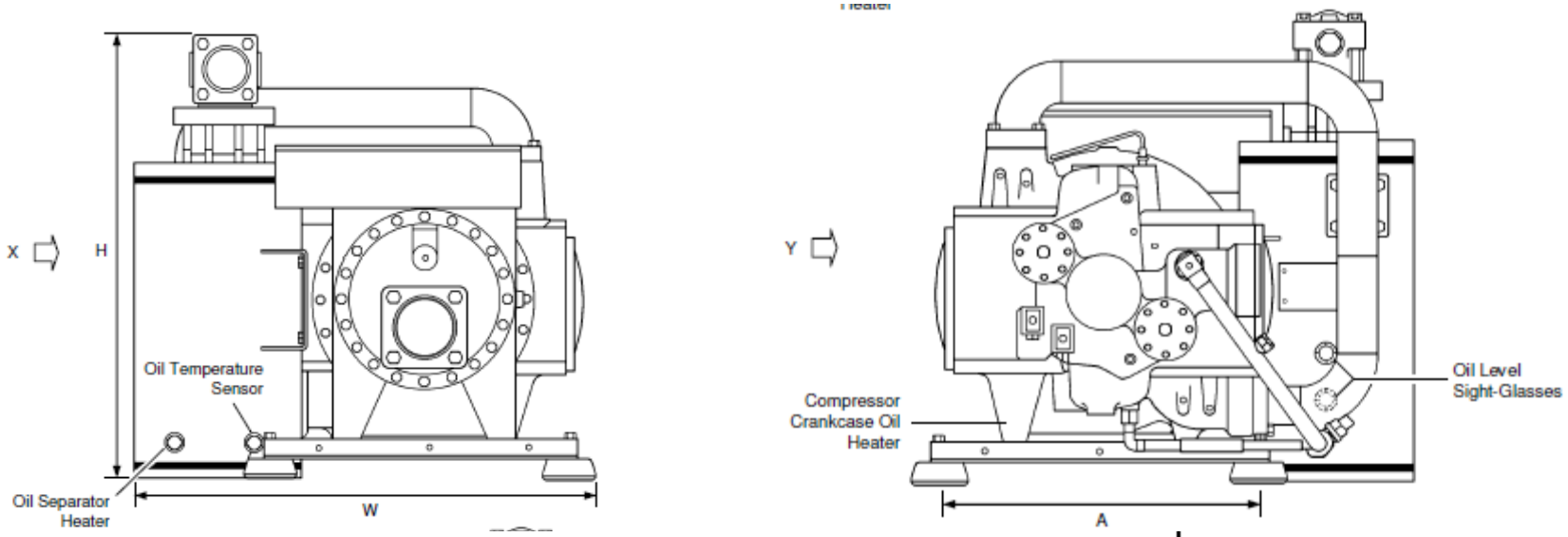
Physical dimensions and connections



DESCRIPTION			SIZE
Overall	Length	L	1555 mm
	Height	H	875 mm
	Width	W	923 mm
Holding-down bolt centres		A	597 mm
		B	652 mm

HSS 4200 series

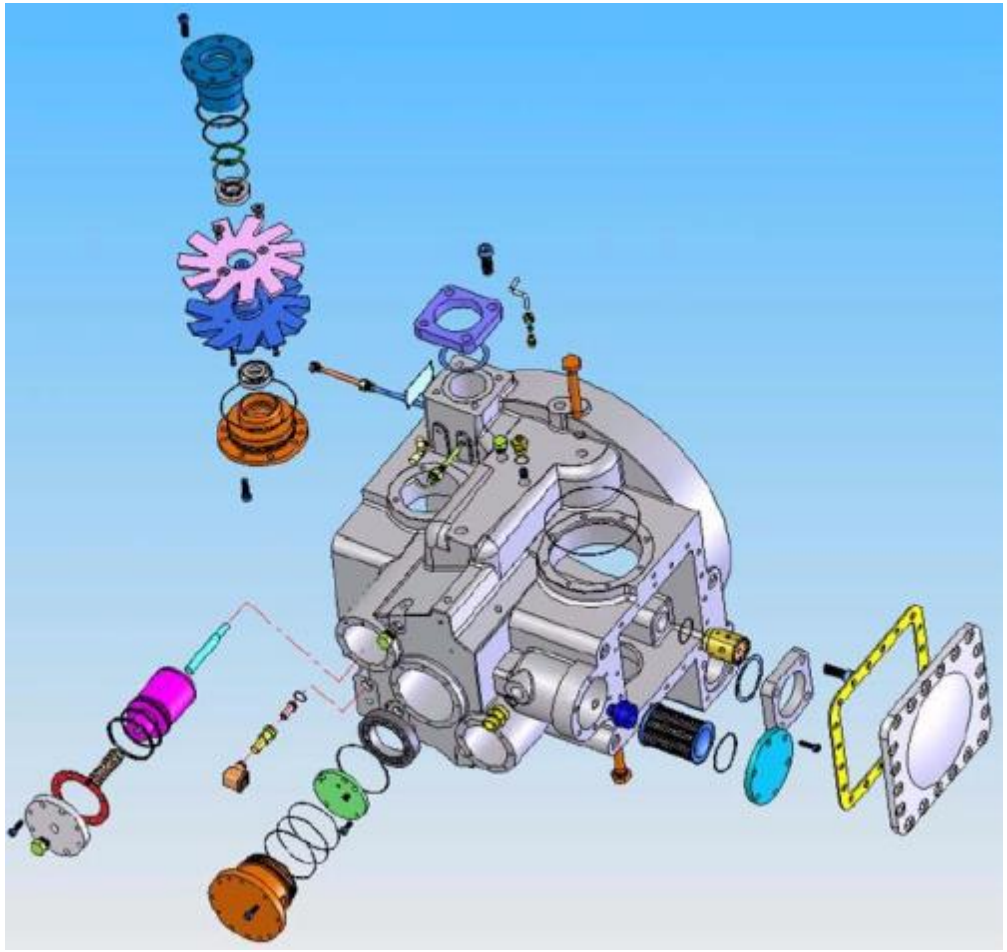
Physical dimensions and connections



DESCRIPTION		NO OFF	SIZE
Compressor suction (suction stop valve not shown)		1	4" NB (4 1/8" OD)
Oil separator discharge		1	Refer to certified drawing
Oil filling and oil drain		1 each	¼ NPT
Oil separator charge		20 litre (approx)	
Oil heaters	Compressor casing	400 W	
	Oil separator	150 W	
Total weight (compressor and oil separator)		With 102/145 kW motor – 1100 kg (approx)	
		With 188 kW motor – 1120 kg (approx)	

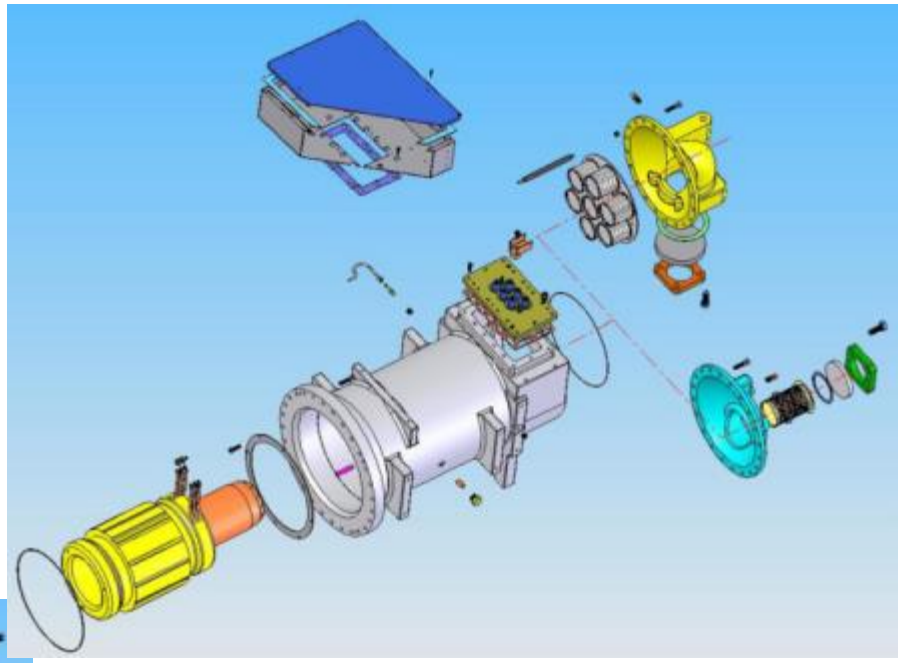
HSS 4200 series

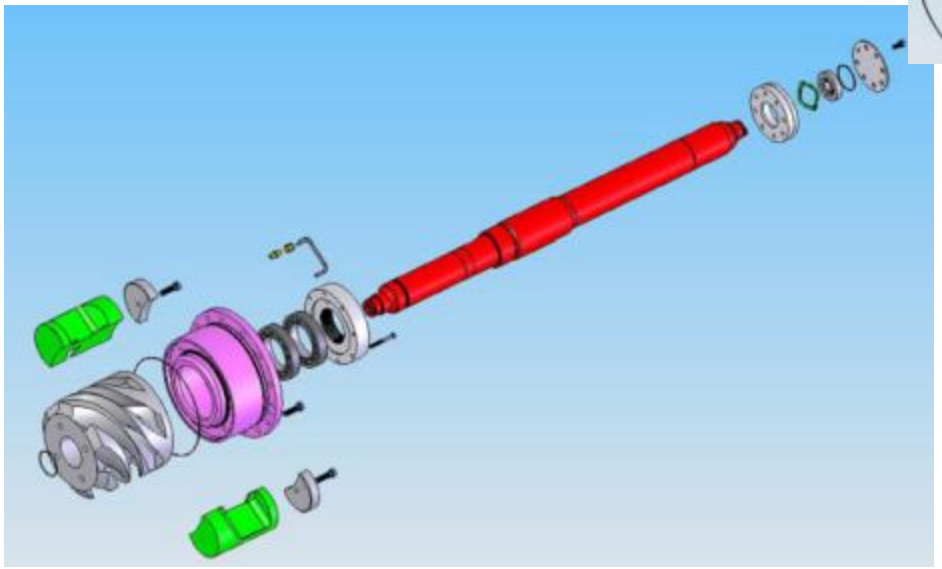
Exploded views



HSS 4200 series

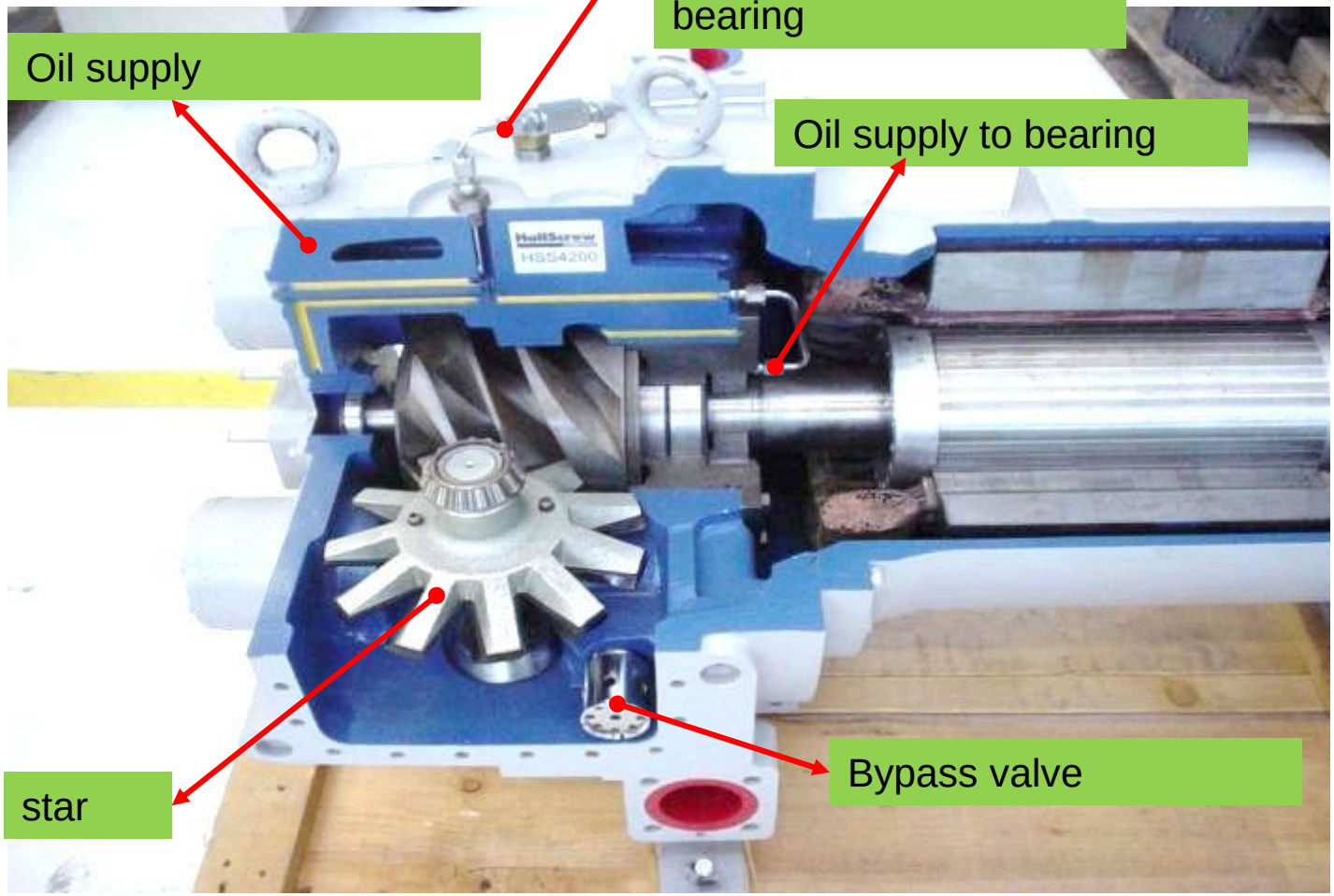
Exploded views





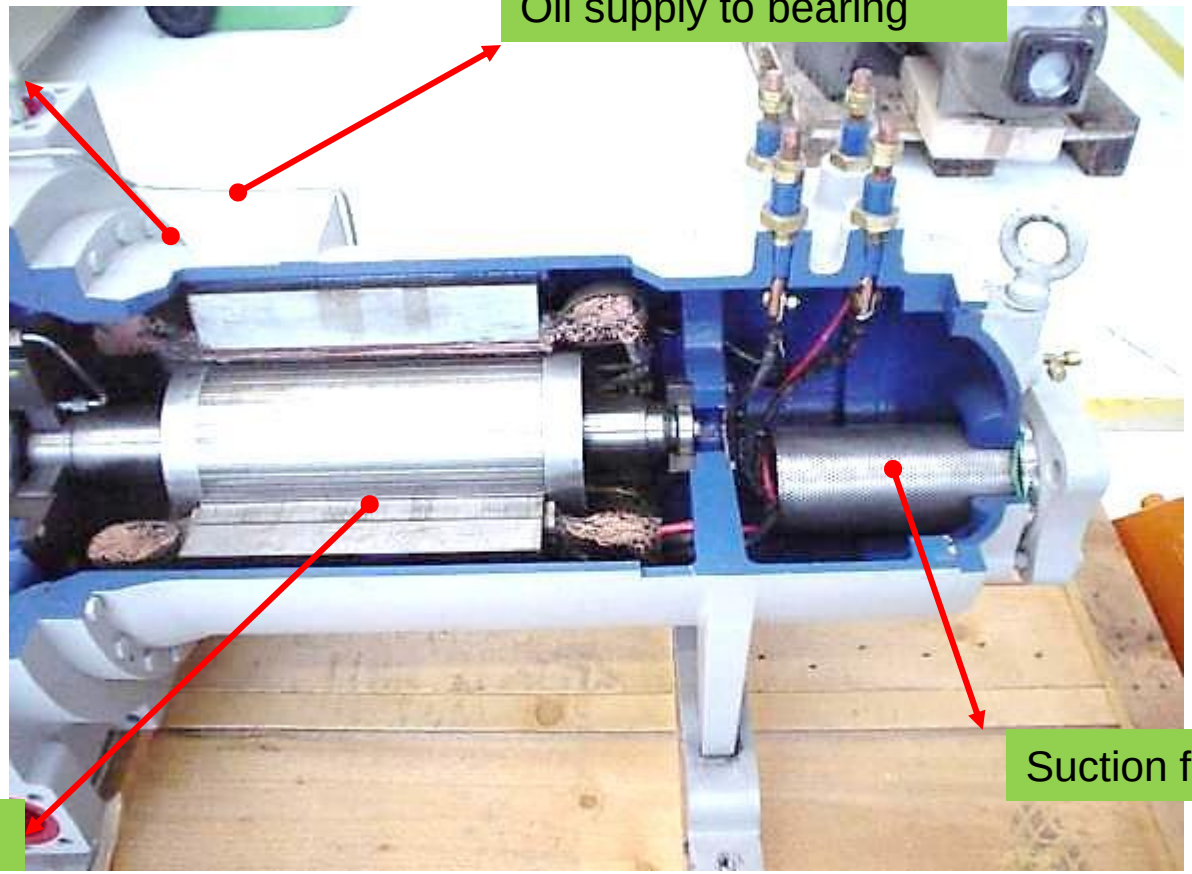
HSS 4200 main components

Cut away view



HSS 4200 main components

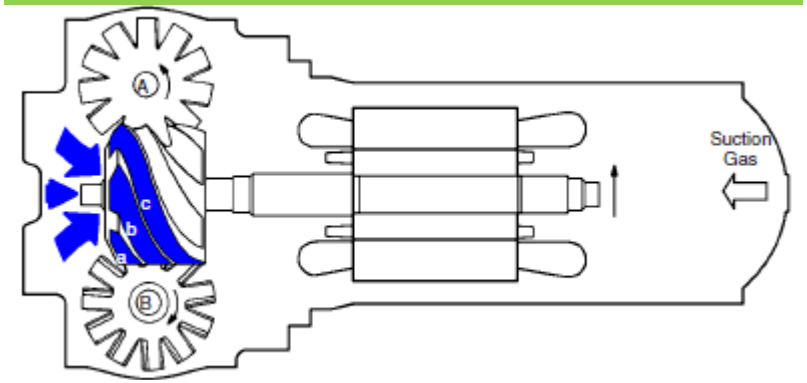
Cut away view

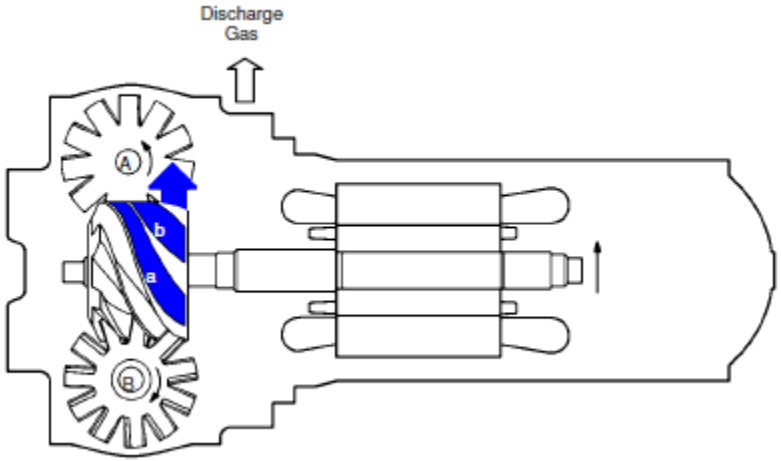


HSS 4200 main components

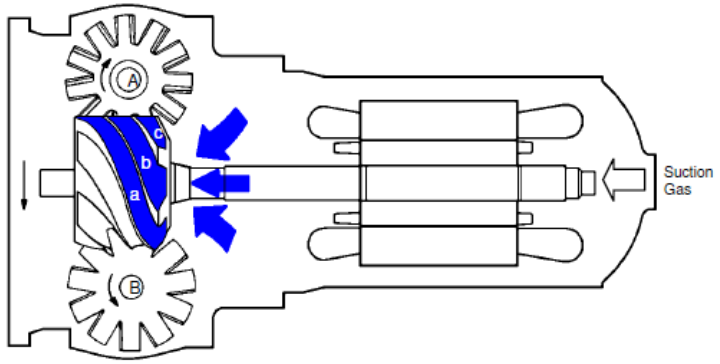
Capacity regulation system - 4200 different gas circulation

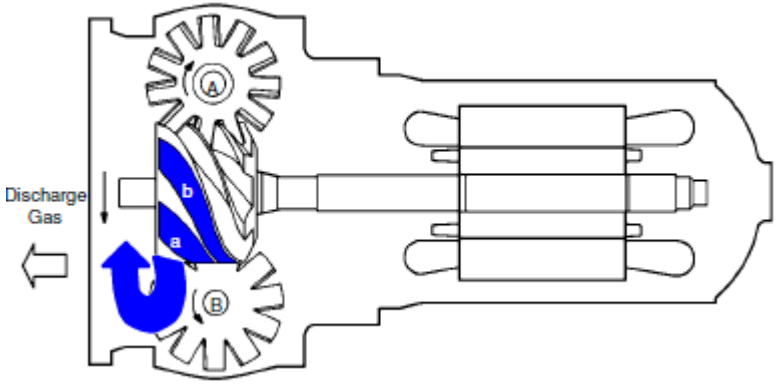
4200 runs opposite way, gas enters screw at the end of compressor





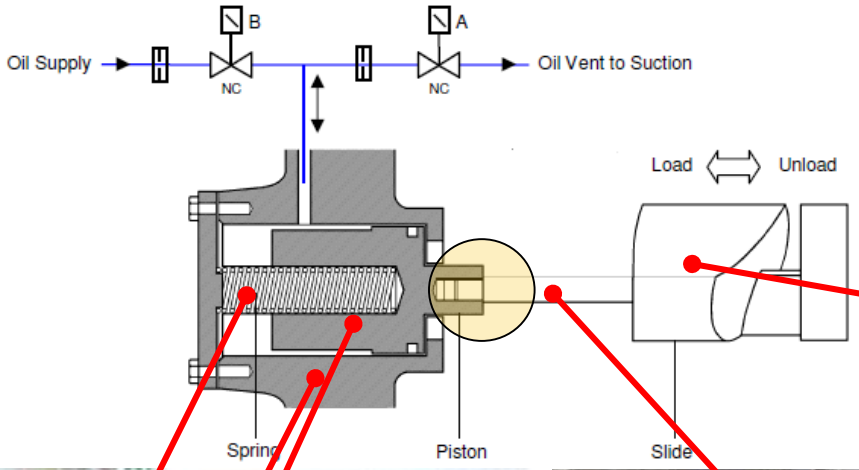
3200

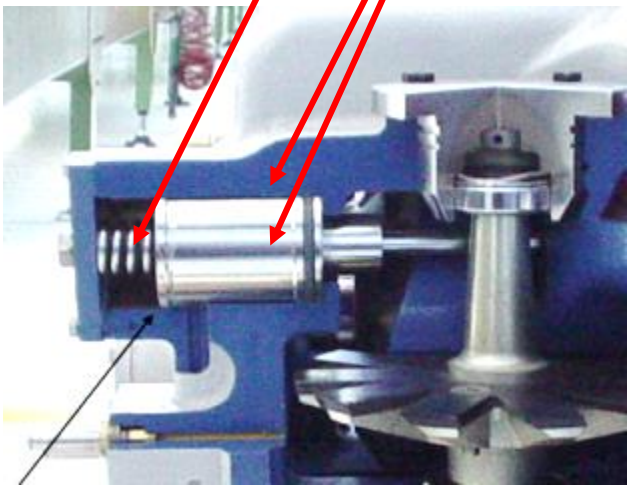


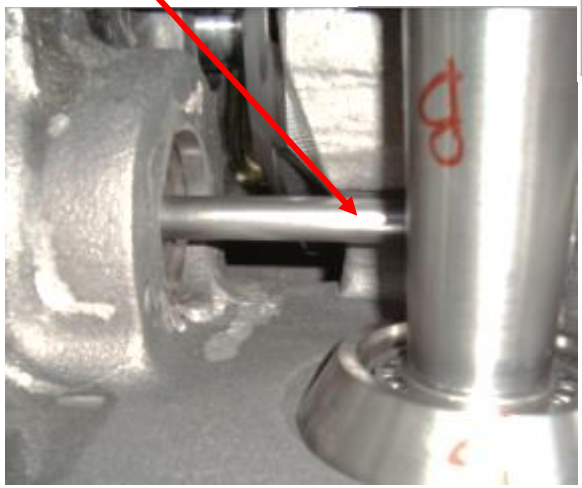


HSS 4200 main components

Capacity regulation system - parts



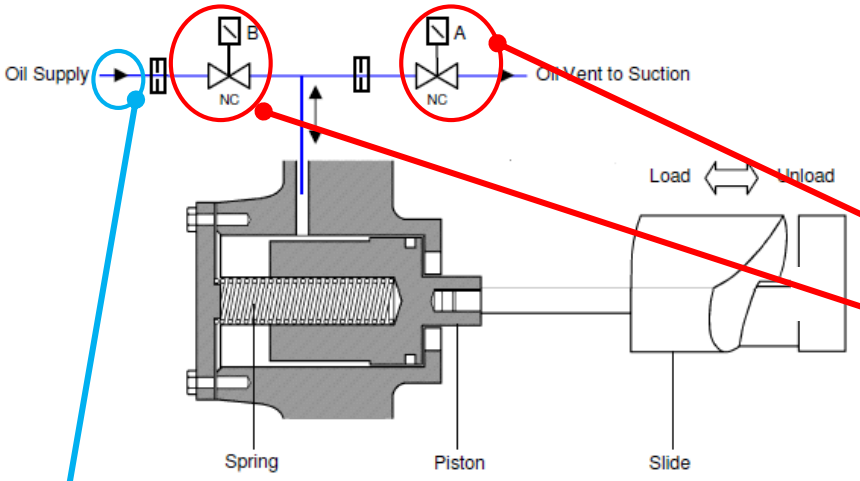




Note that flute is not mechanical connected to the capacity piston

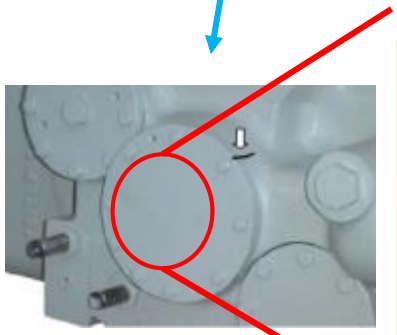
HSS 4200 main components

Capacity regulation system - parts



load solenoid

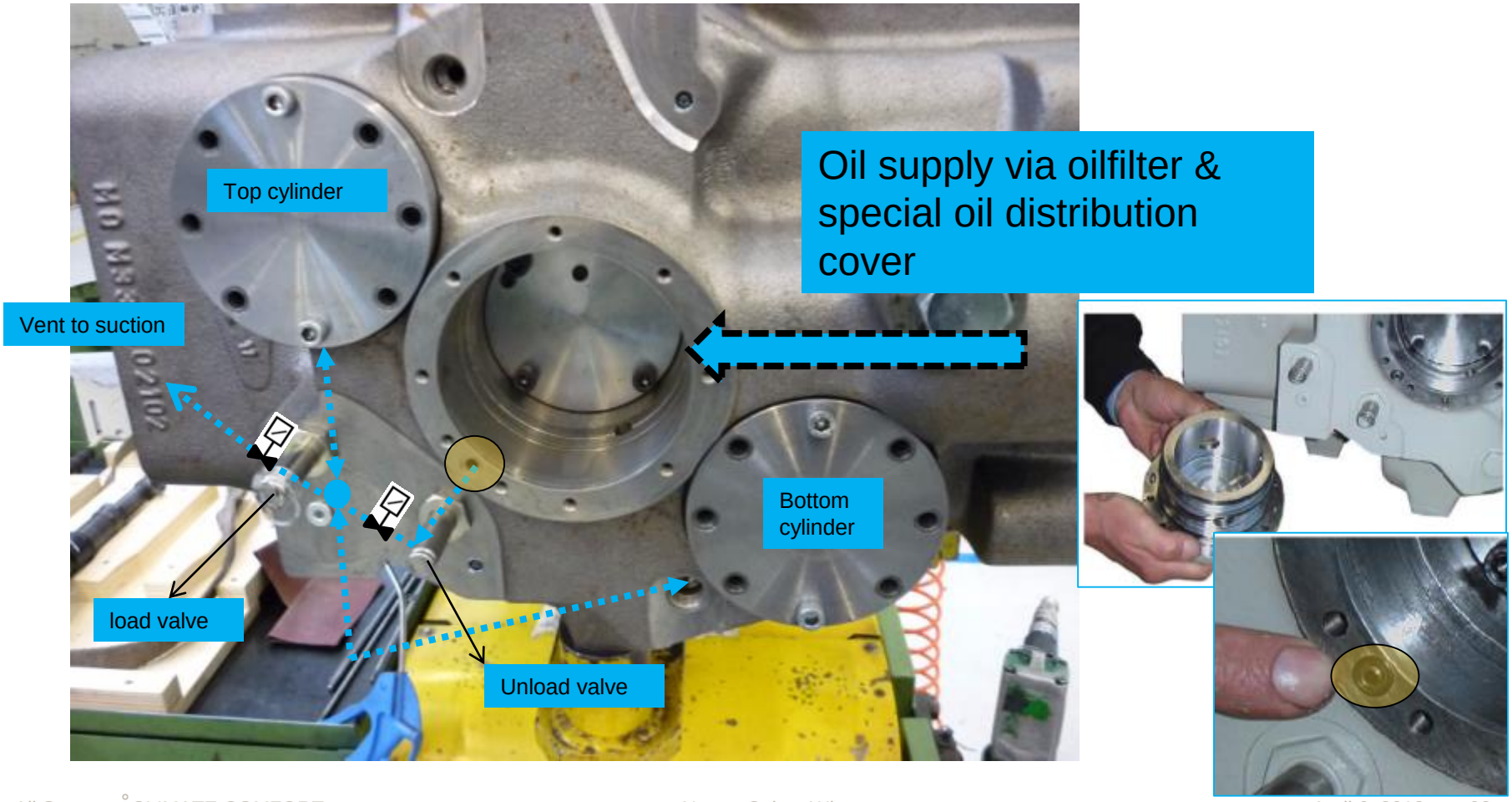
Unload solenoid



Oil line to unload valve

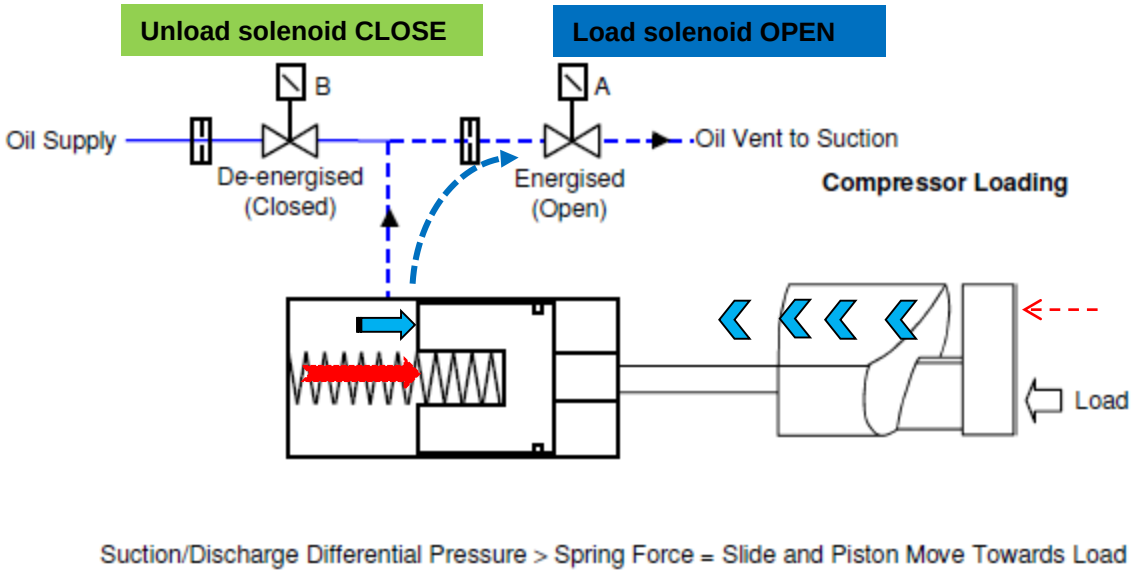
HSS 4200 main components

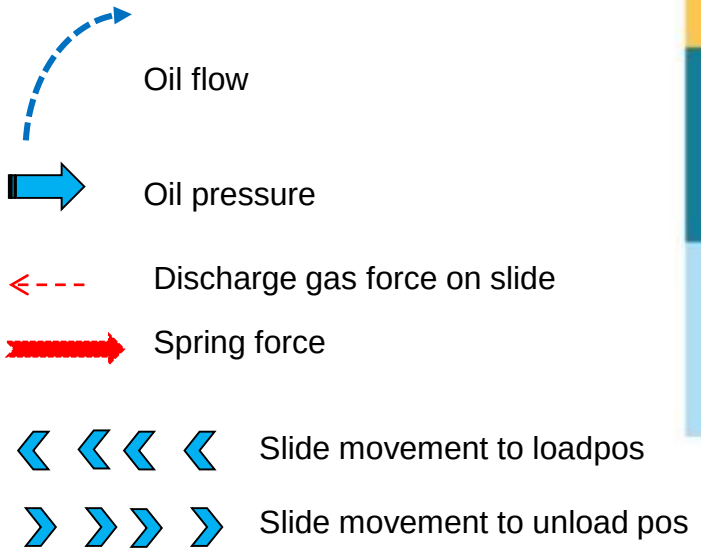
Capacity regulation - internal oilway drillings



HSS 4200 series

Capacity regulation system – load – vent oil

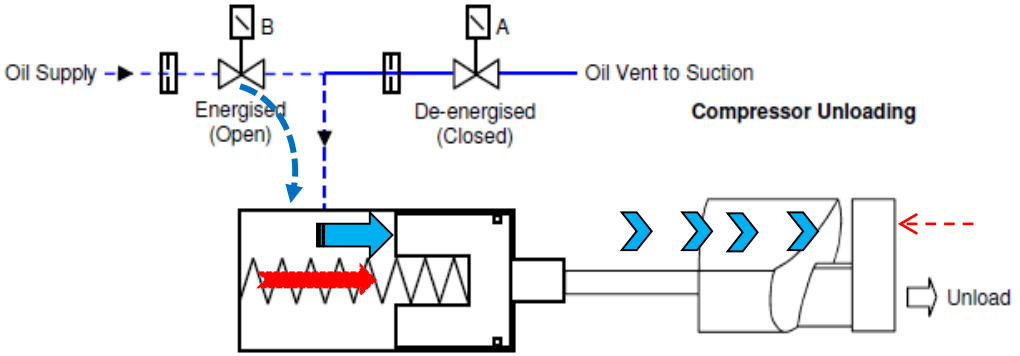




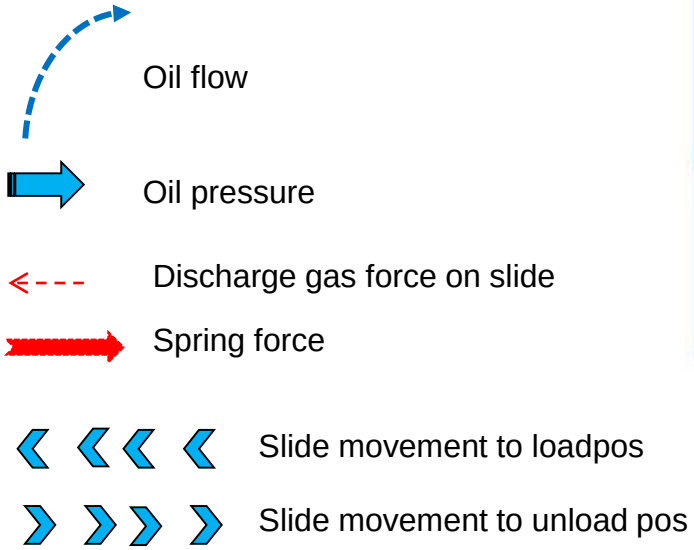
HSS 4200 series

Capacity regulation system – unload – supply oil

Unload solenoid OPEN | **Load solenoid CLOSE**

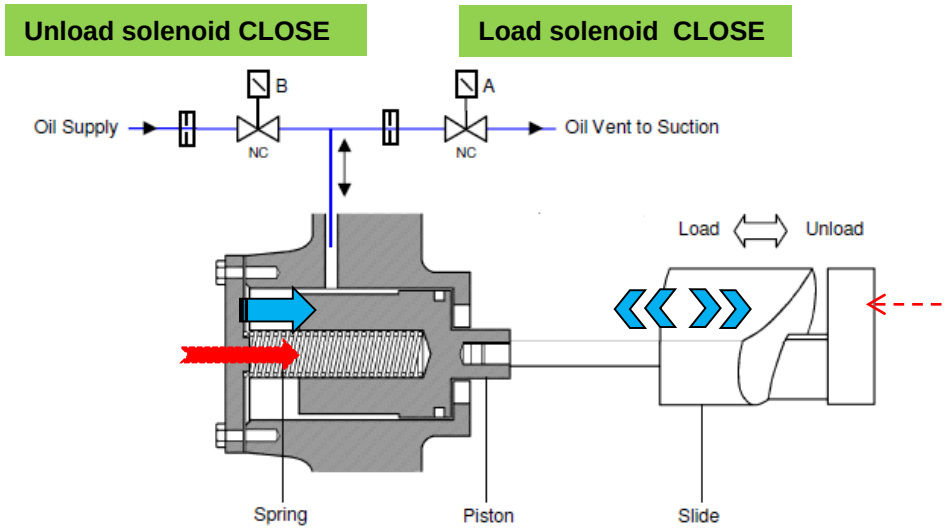


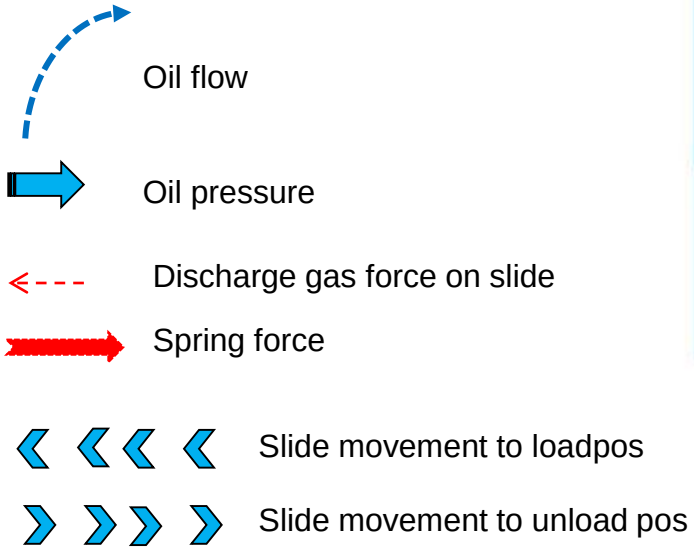
Oil Pressure + Spring Force > Suction/Discharge Differential Pressure = Slide and Piston Move Towards Unload

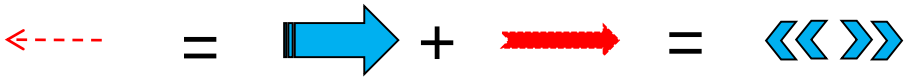


HSS 4200 series

Capacity regulation system – holding capacity







HSS 4200

Capacity regulation system

Capacity action	Load valve A	Unload valve B
Load compressor	Open (pulse)	close
Unload compressor	Close	Open (pulse)
Hold compressor	Close	Close
Compressor on 100%	Fully open	close
Controlled stop	Close	Pulsed contineously until 25% (mini) position is reached
Controlled start	-	Fully open until chiller controler decides to load compressor
Emergency stop	Close	Pulsed contineously until 25% (mini) position is reached
Start after powercut	close	Keep 5 minutes open before start

HSS 4200 series

1. Capacity regulation test (fieldtest + workshop test)

   When performing?

   1. Compressor loads up unwanted to 100%
   2. Compressor cannot hold capacity
   3. Compressor doesn't load

2. Scope of tests:

   - Test 1 (a+b) - To check correct sealing of solenoids
   - Test 2 (field) - To check correct movement of capacity slides and test tightness of glyd rings (pressure test).
   - **Test 3 (workshop) – not necessary , 4200 capacity regulation parts can directly be accessed / NO oil separator on the compressor**.

What do we need?

Special blanking plugs, for field test

Pressure supply plug

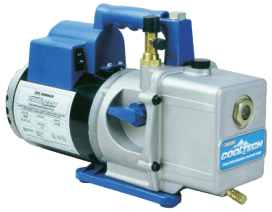
Blank orifice plugs

- Some special tools

7/16” long socket

- Nitrogen bottle

- Vacu pump, Manometers + hoses/ ampère meter



HSS 4200 series

WARNING !!! – prior to opening of compressor

- Stop circuit involved / pumpdown
- separate compressor from refrigerant circuit
- recover all existing refrigerant – check pressure !
- disconnect compressor from power supply
- avoid compressor can start unwanted (fuses)

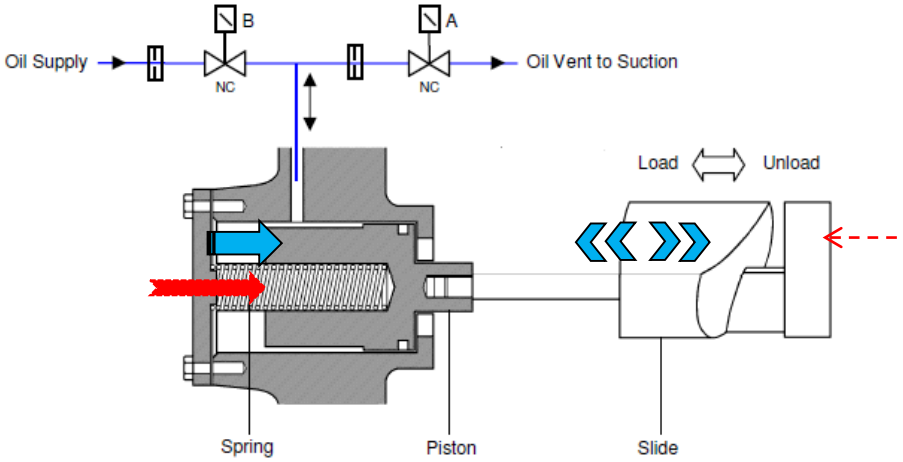
HSS 4200

Field test – Test 1 a

Check of solenoids (test a) – compressor running!

- Perform compressor capacity holding test – remove both coils from solenoids ,
- ➔ compressor should keep capacity – check with ampère clamp,

Unload solenoid CLOSE **Load solenoid CLOSE**



Possible Result:

1) Current rise to max value ➔ Solenoid A (load) is leaking
2) Current is decreasing to min value ➔ Solenoid B (unload) is leaking

Proceed with visual check of solenoids stems ! (test – b)

Discharge pressure = Cylinder pressure + spring pressure = slide stays in same position

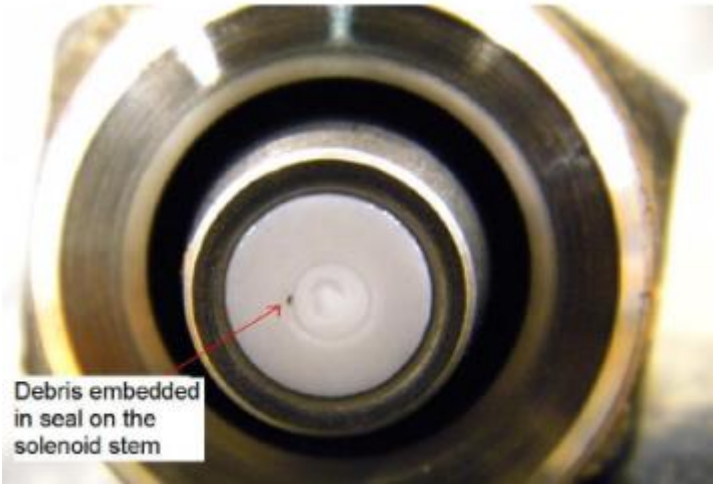
HSS 4200 series

Field test – Test 1 b check of solenoids

Remove the solenoids for visual check

Orifce must be present !

You should see small impact on the plastic – proving correct sealing towards orifce



Any pressence of debris = leak

HSS 4200 series

To remove orifices use socket of 7/16” or M13

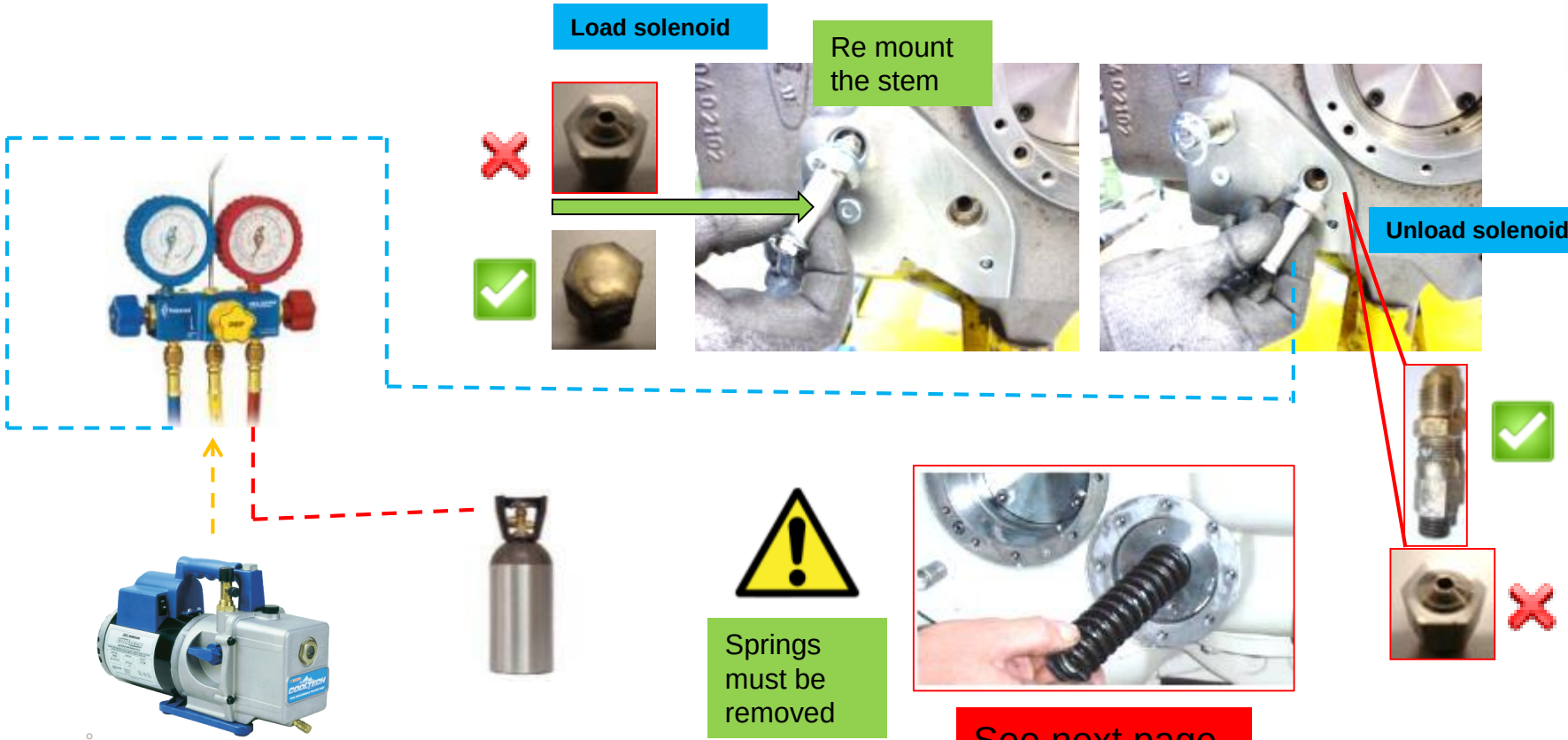
Field test – Test 2 – checking slide valve movement + pressure test.

1. Remove both side covers of gate rotors
2. Remove solenoids stems.
3. Remove orifices of the load and unload solenoid
4. Install in the unload location (valve B) the special pressure supply plug
5. Install in the load loacation (valve A) the blank plug and re mount the solenoid stem.
6. IMPORTANT TO CHECK MOVEMENT OF SLIDES – SPRINGS MUST BE REMOVED FROM PISTONS !!!
7. Connect manometer – pressure bottle and vacu pump to the pressure supply plug on the unload solenoid position
8. Prior to test perform vacu on the unload position to remove any oil inside capacity system.
9. To test load movement perform vacuum on the unload position.
10. To perform pressure test allow pressure to the unload position (max 6 bar)

HSS 4200 series

Field test – Test 2 – checking slide movement + pressure test

Connect manometer, vacu pump and pressure bottle to the pressure supply plug on the unload solenoid position.

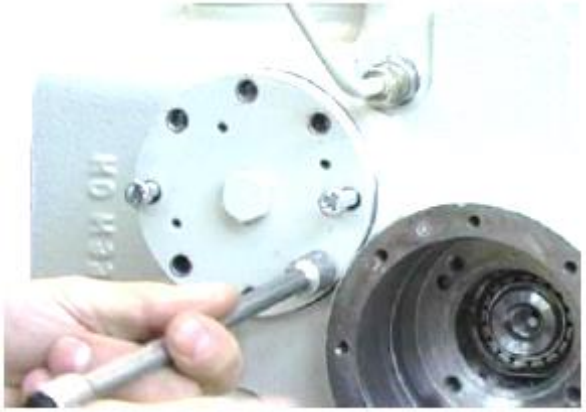


HSS 4200 series

Removal of springs capacity pistons.

Remove 2 bolts

Put two long bolts in place



Remove existing bolts

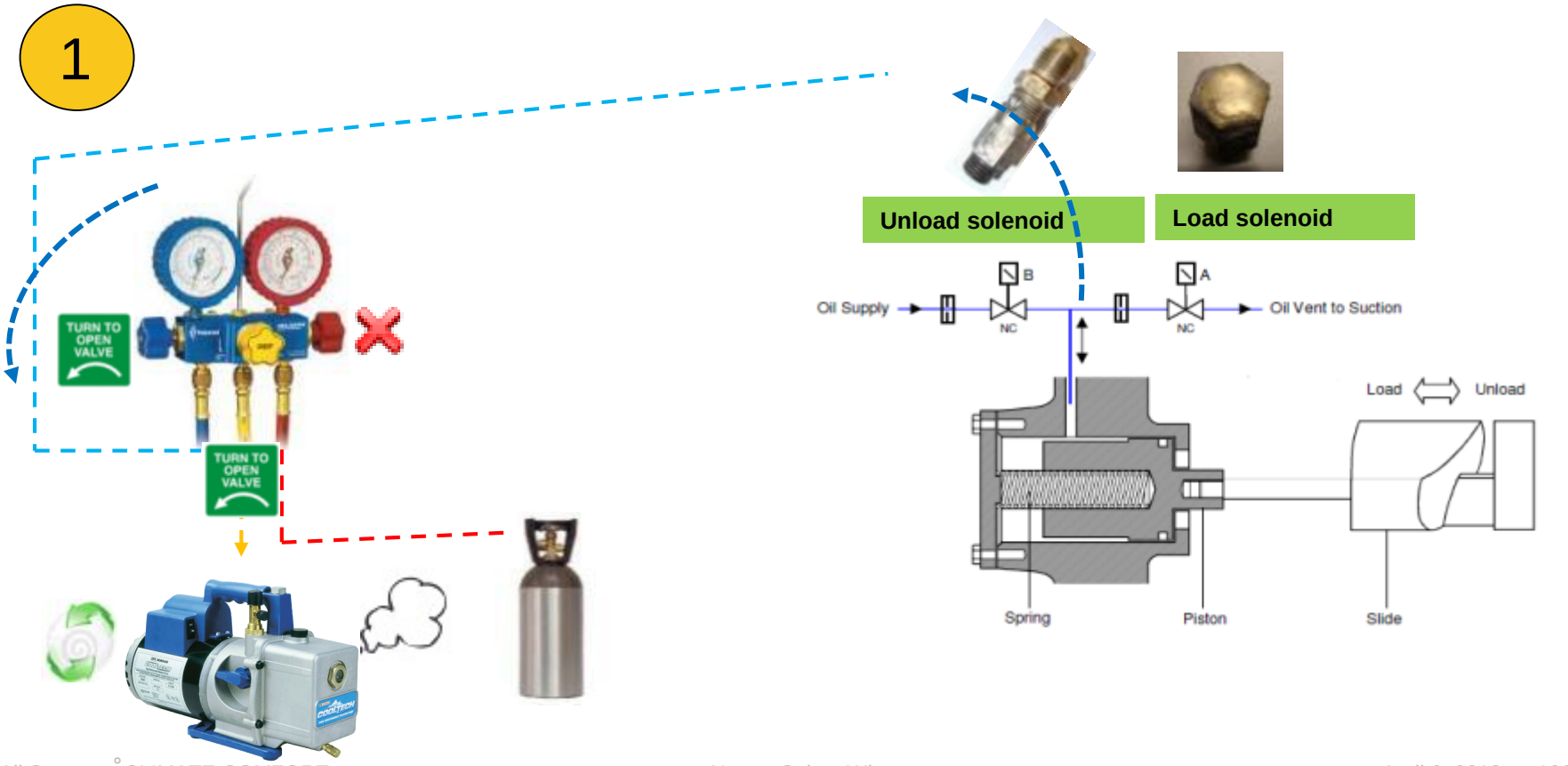
Remove spring

Re assemble without spring

HSS 4200 series

Field test – Test 2 – checking slide movement + pressure test

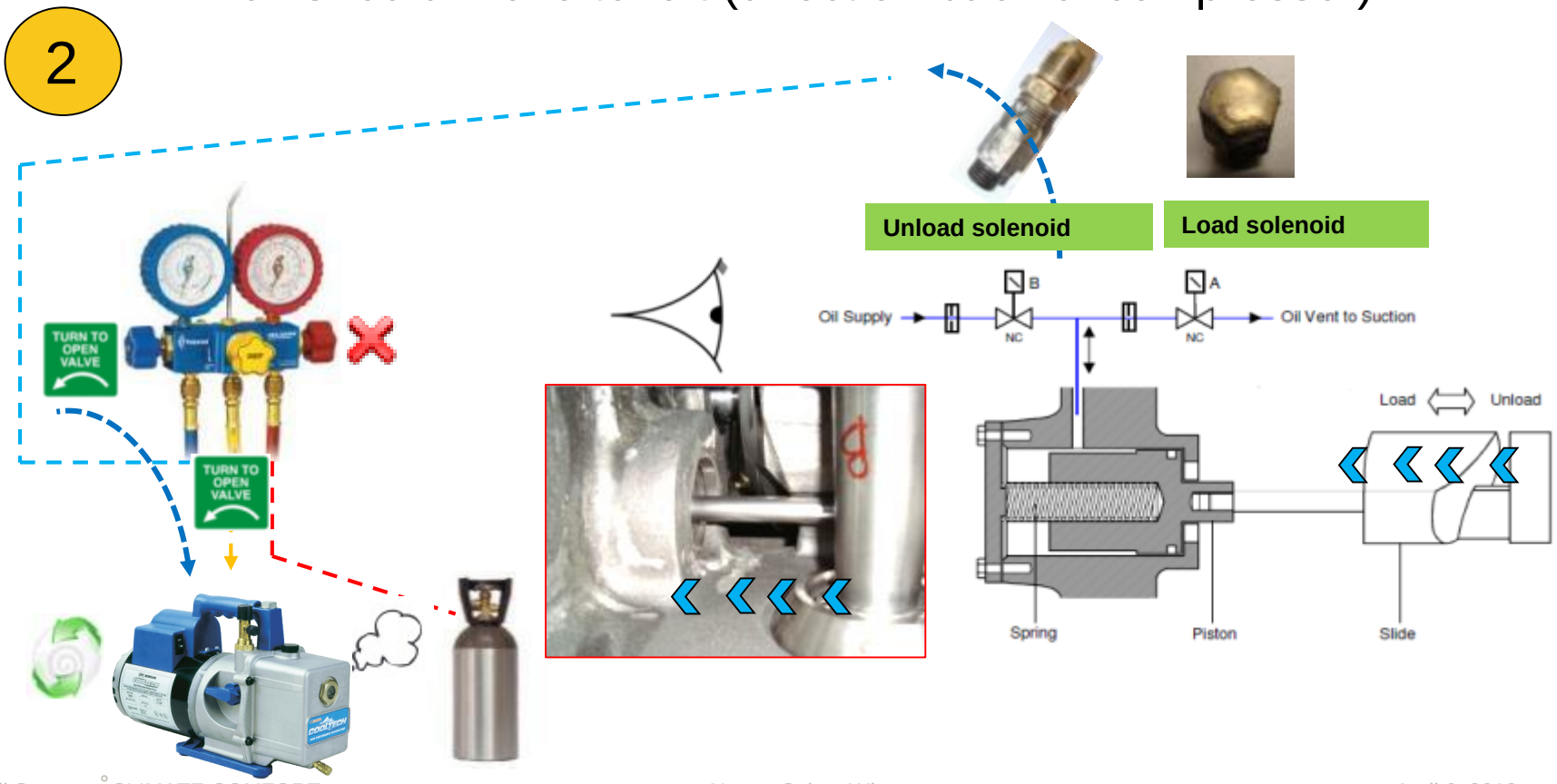
a. First perform vacuum in order to remove any exisiting oil



HSS 4200 series

Field test – Test 2 – checking slide movement + pressure test

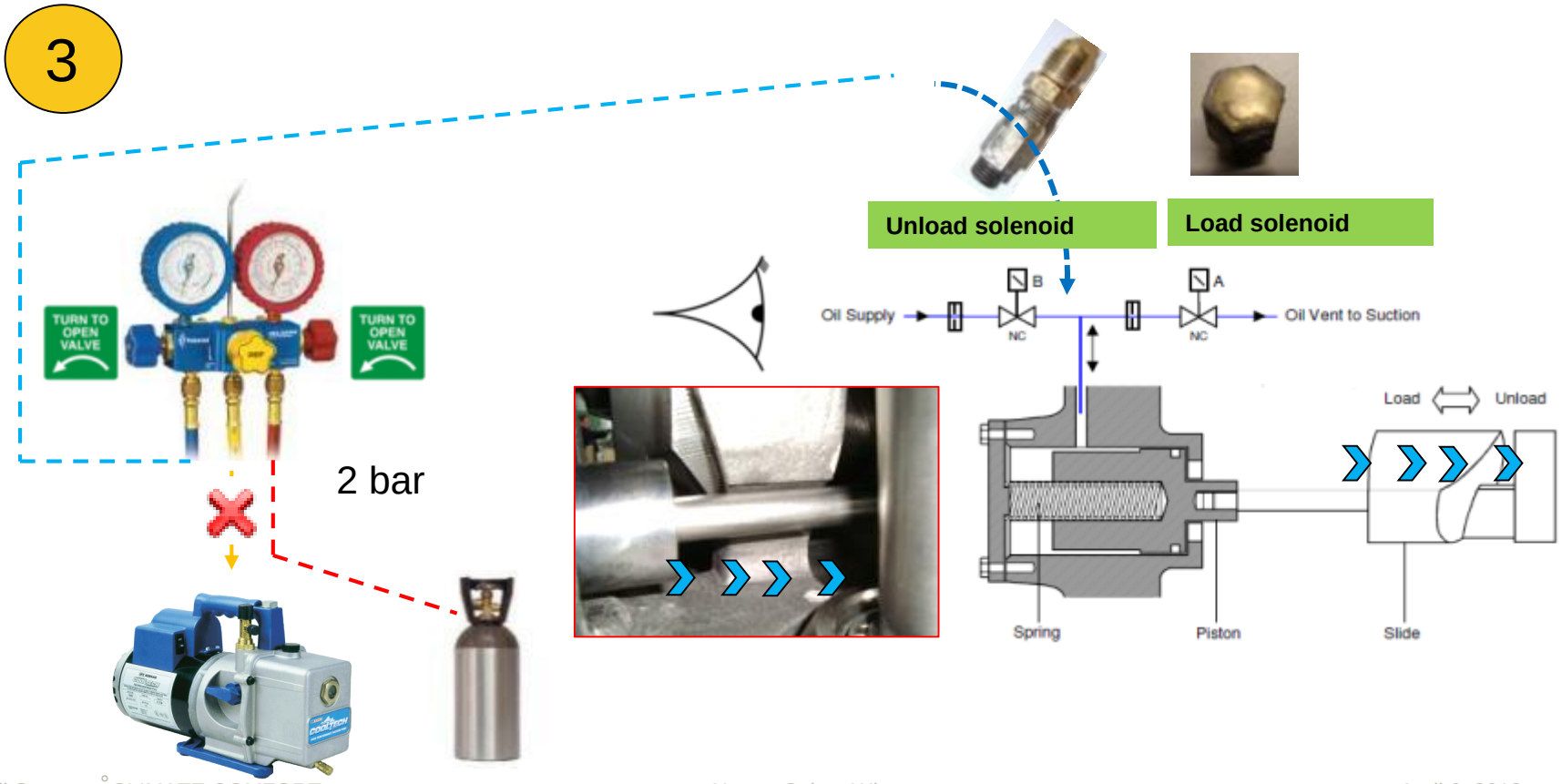
b. Continue perform vacuum in order to check movement of piston, which should move to left (direction back of compressor)



HSS 4200 series

Field test – Test 2 – checking slide movement + pressure test

c. Apply pressure to check movement of piston to unload position (2 Bar)



HSS 4200 series

Field test – Test 2 – pressure test Gyd ring

d. Apply pressure to check movement of piston to unload position (2 Bar)

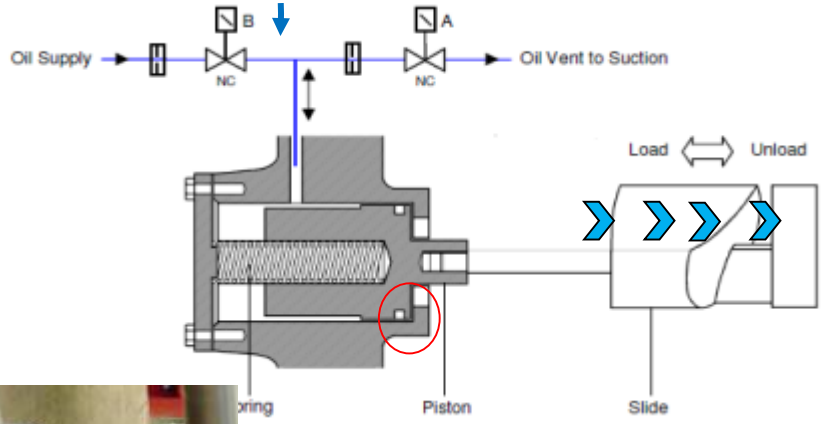
4

Pressurise to 6 bar for one minute, pressure loss not more than 1 bar

6 bar

Glyd ring is leaking - Replace

Unload solenoid **Load solenoid**



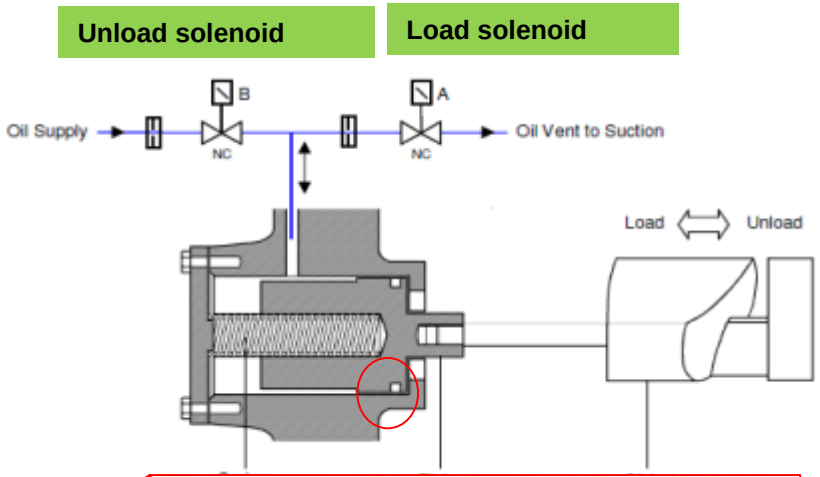
HSS 4200 series

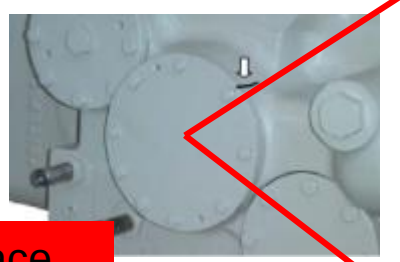
Field test – Test 2 – pressure test Gyd ring

d. If leak is assumed also check visually O – ring oil supply begind main bearing cover!

4

Pressurise to 6 bar for one minute, pressure loss not more than 1 bar



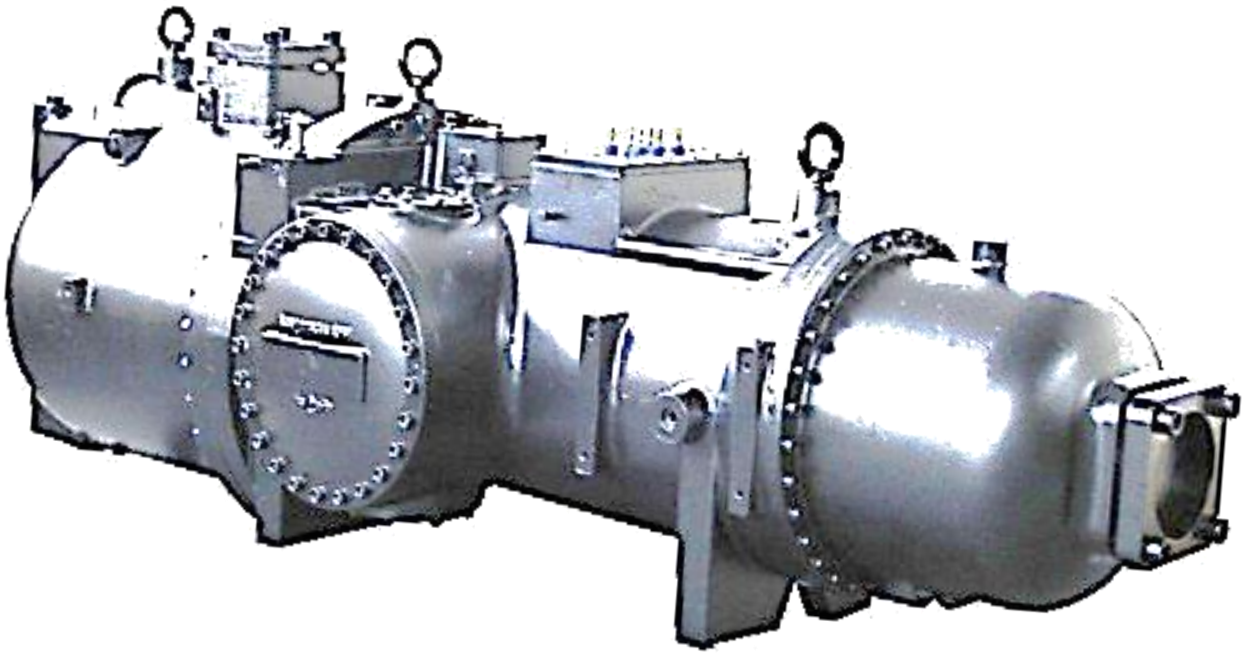


Glyd ring is leaking - Replace

First remove Pressure !

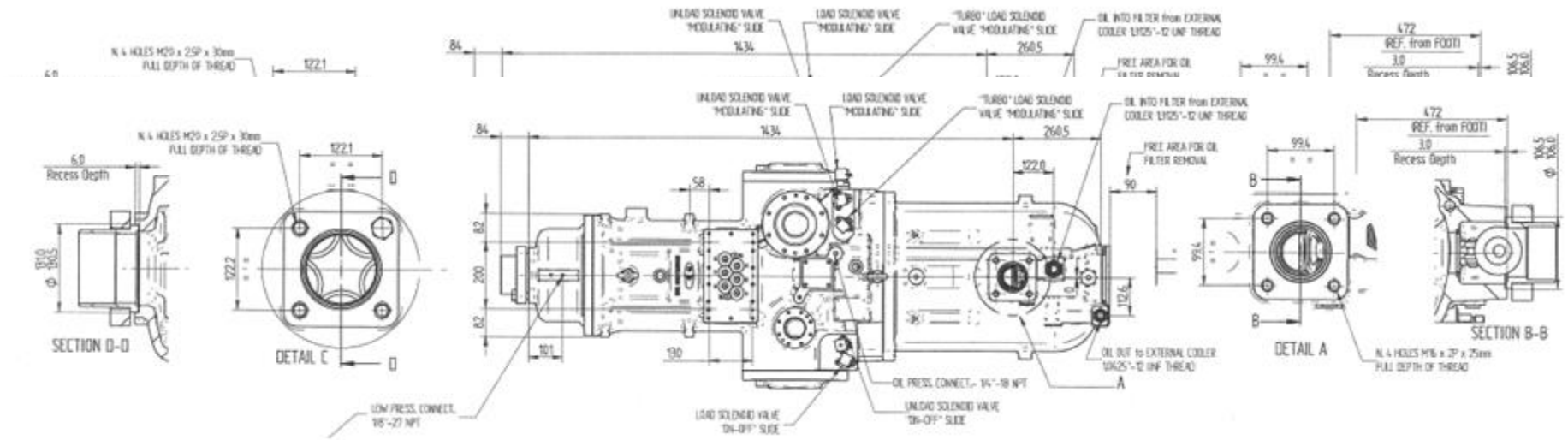
F4/F3 series

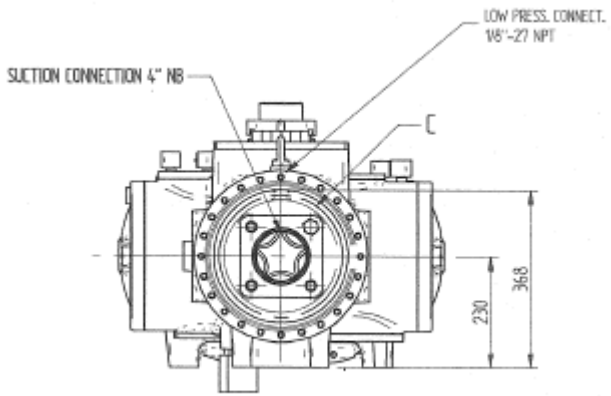
HSA269 /F4XL
HSA263/F4AL
HSA241/F4AS
HSA232/F3BL
HSA215/F3BS
HSA204/F3AL
HSA192/F3AS

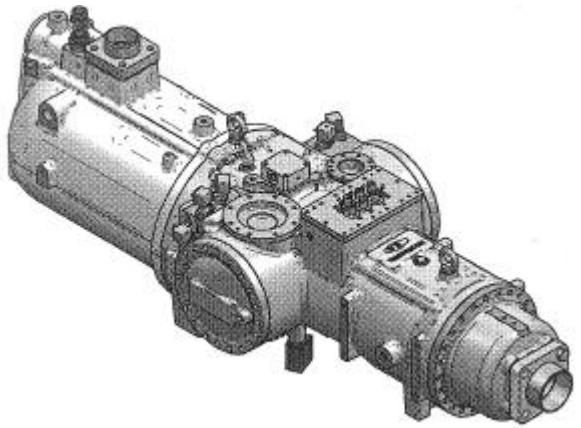


F4/F3 series

Physical dimensions and connections F3A

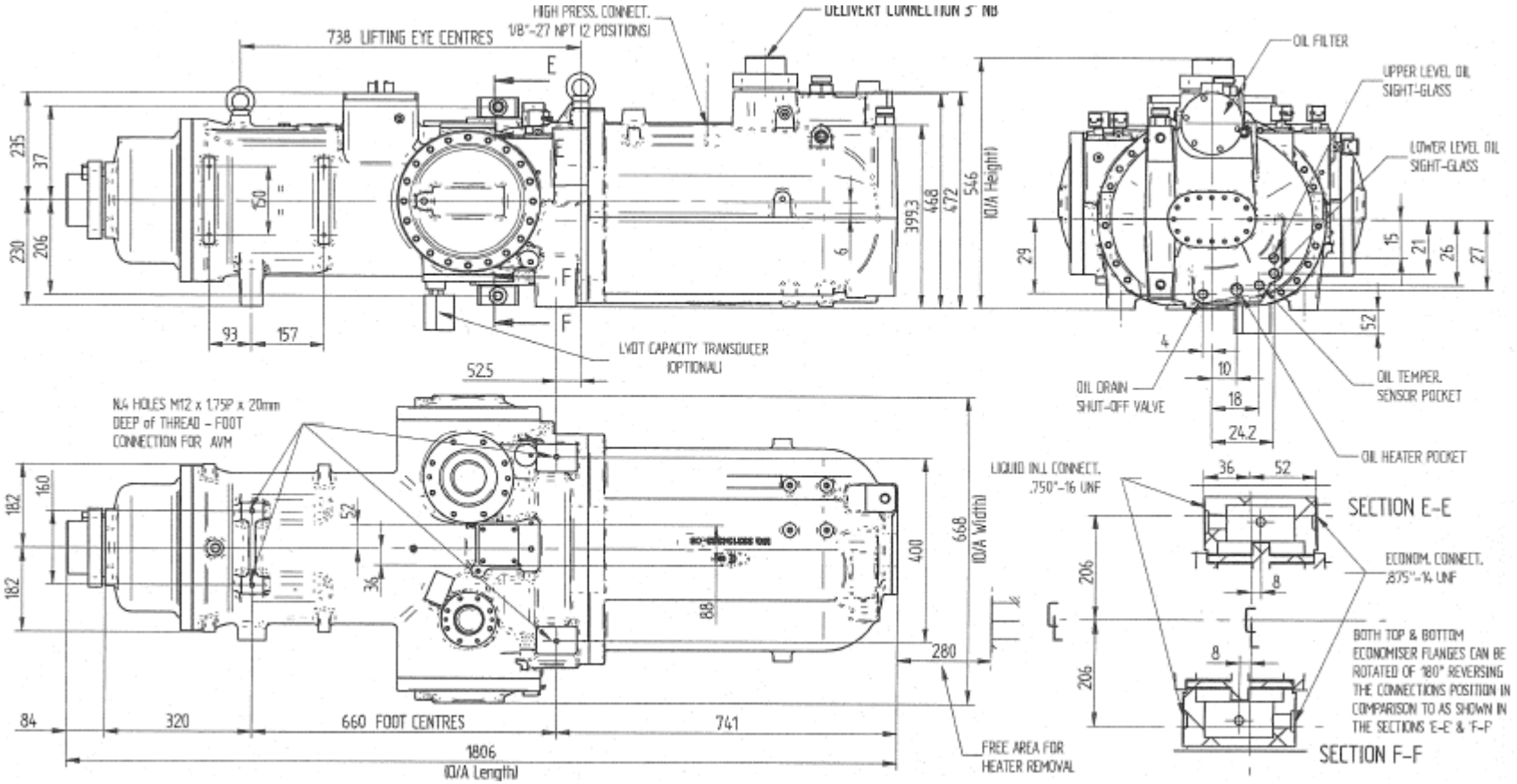






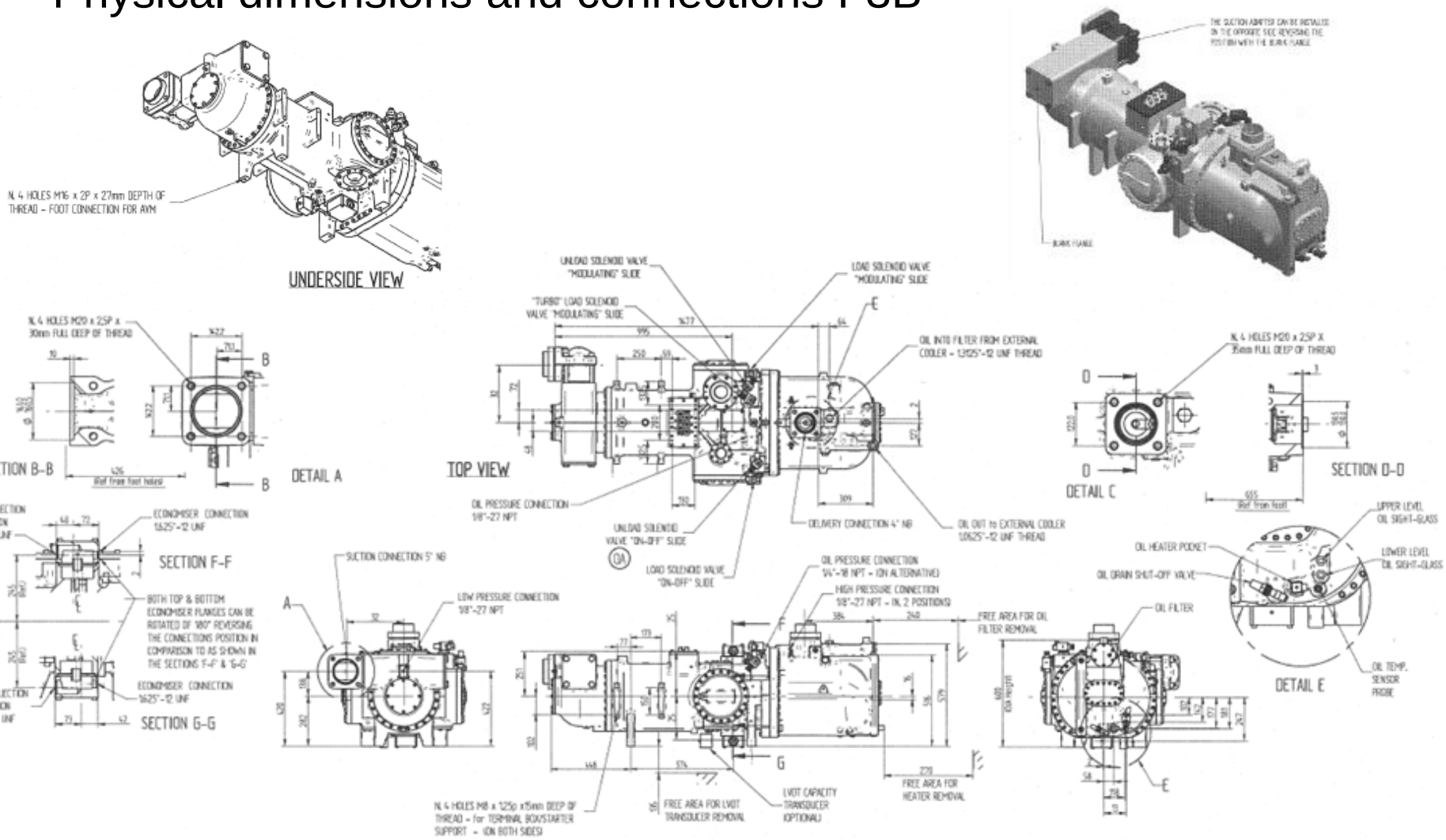
F4/F3 series

Physical dimensions and connections F3A



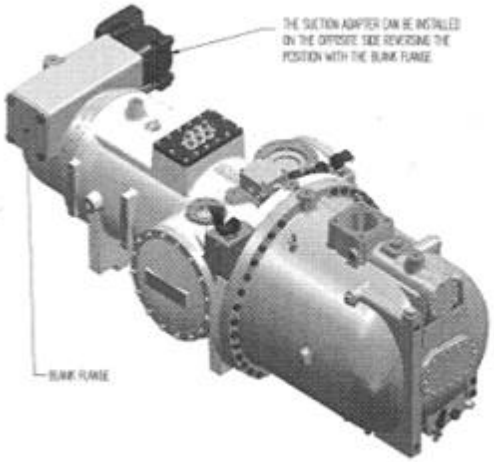
F4/F3 series

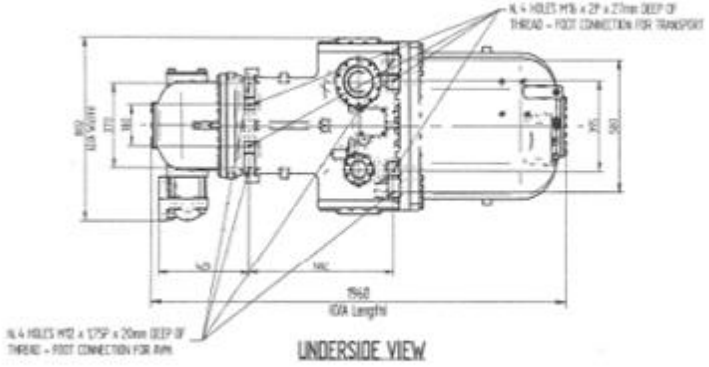
Physical dimensions and connections F3B

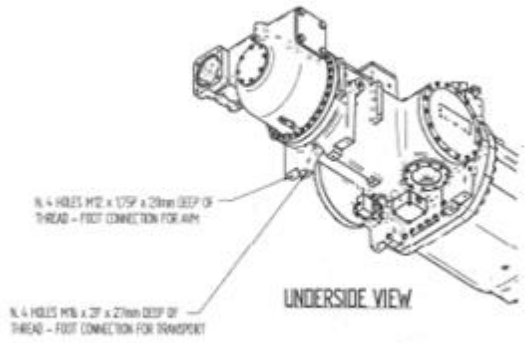


F4/F3 series

Physical dimensions and connections F4A

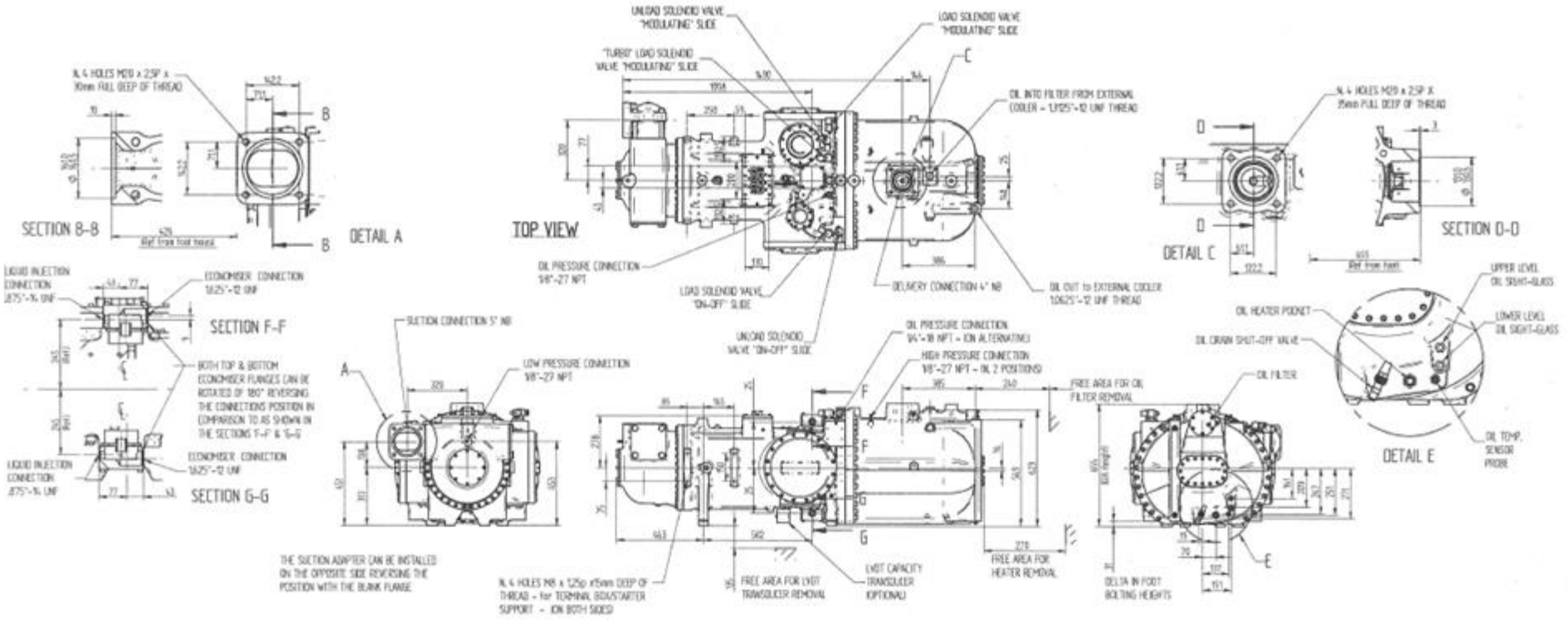




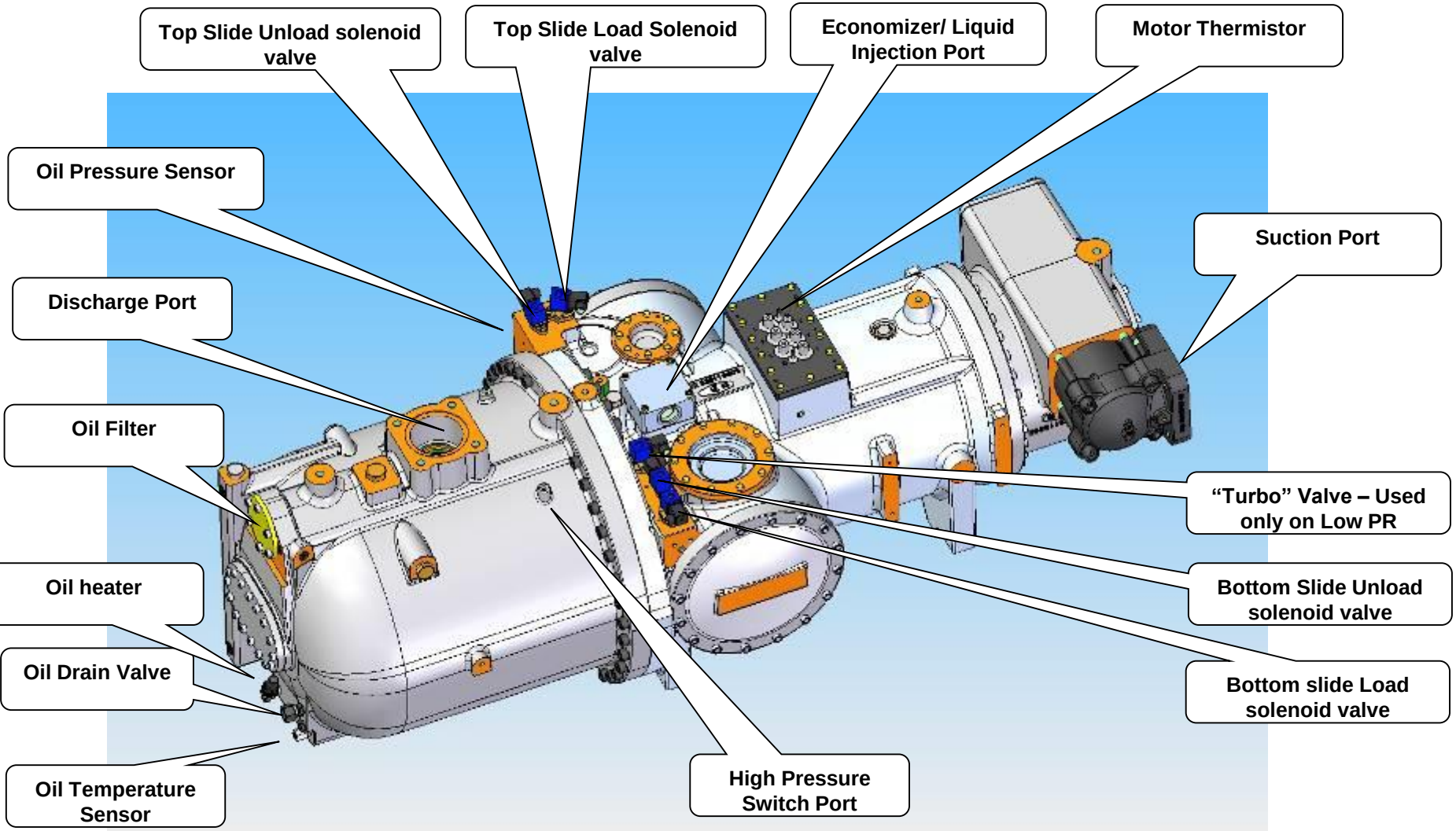


F4/F3 series

Physical dimensions and connections F4A

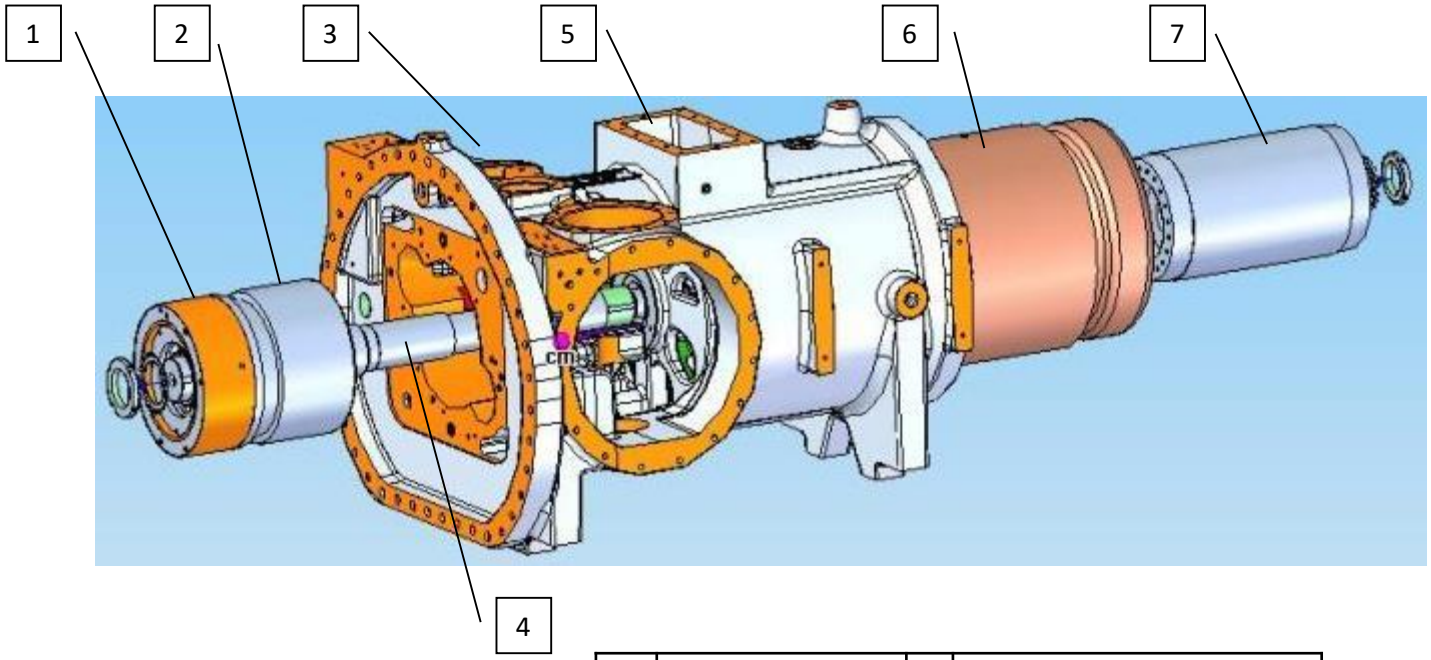


F4 series - connections



F4/F3 series

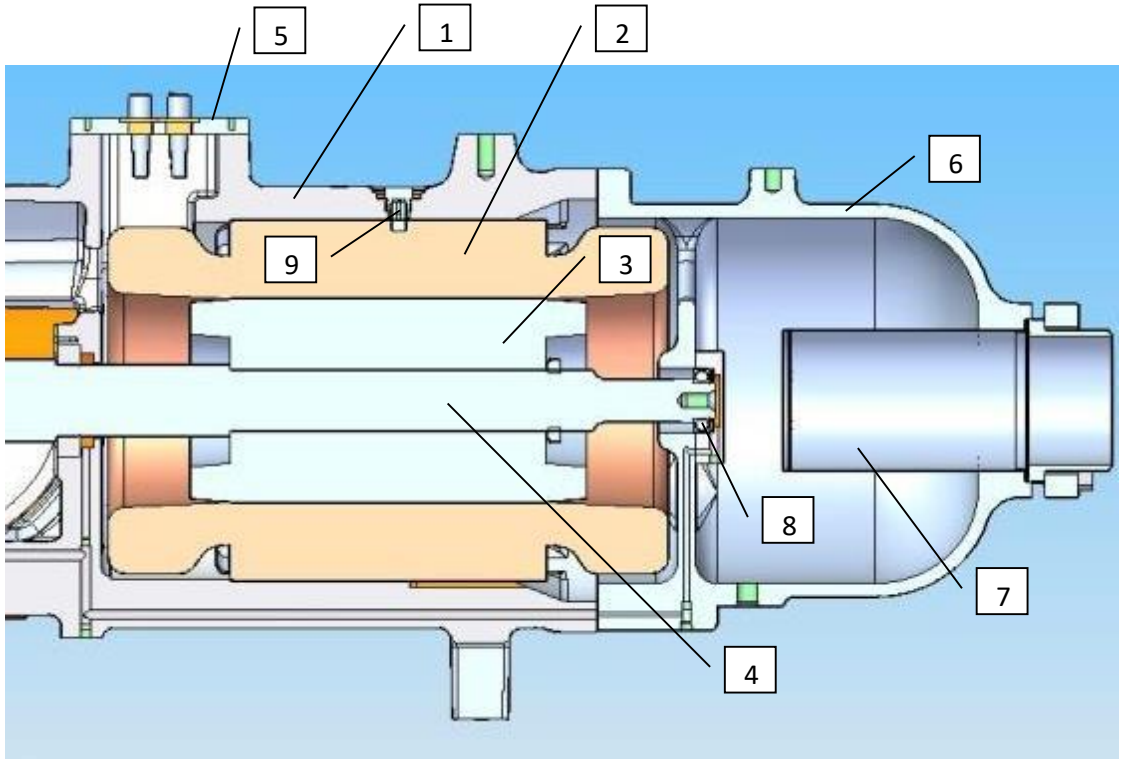
Exploded view – limited to F4 model



1	Main Bearing	5	Motor Terminal Connection
2	Screw Rotor	6	Stator
3	Main Casing	7	Rotor
4	Screw Rotor Shaft		

F4/F3 series

Exploded view motor sectonF4/F3



1	Motor Housing	6	Suction End Cover
2	Stator	7	Suction Strainer
3	Rotor	8	Third/Rear Bearing
4	Screw Rotor Shaft	9	Dowel Rod
5	Motor Terminal Plate		

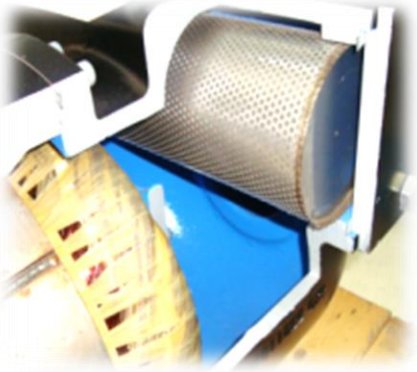
F4/F3 main components

Cut away pictures F4/F3

Oil filter

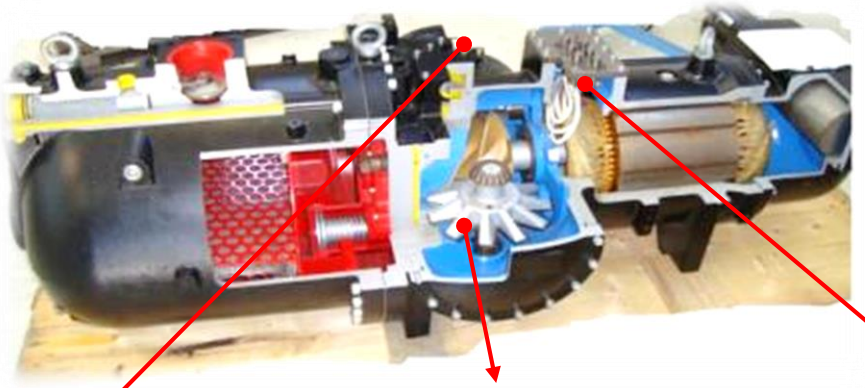
Non return valve

Suction filter



F4/F3 main components

Cut away pictures F4/F3



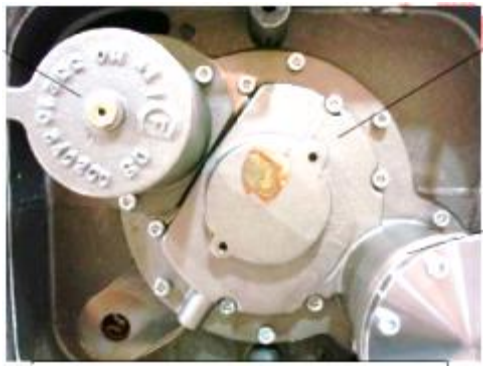
LHB star rotor

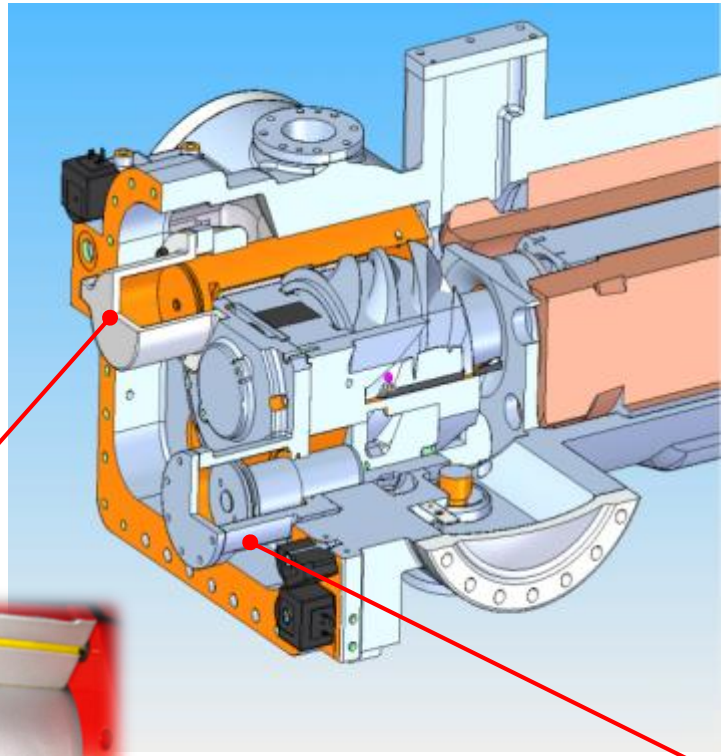
RHT star rotor

Terminal plate

F4/F3 main components

Cut away pictures



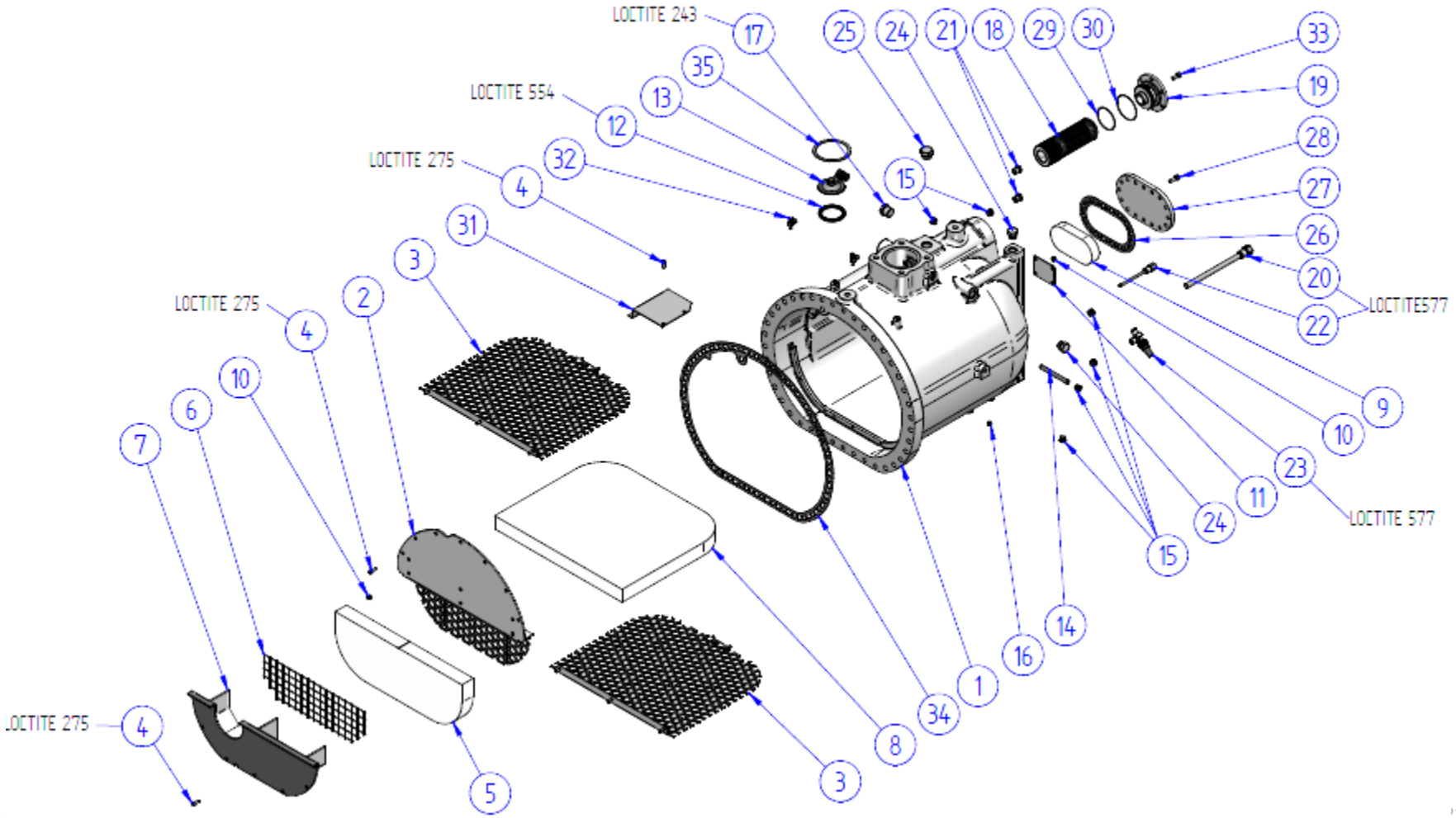


On/off slide

Modulating slide

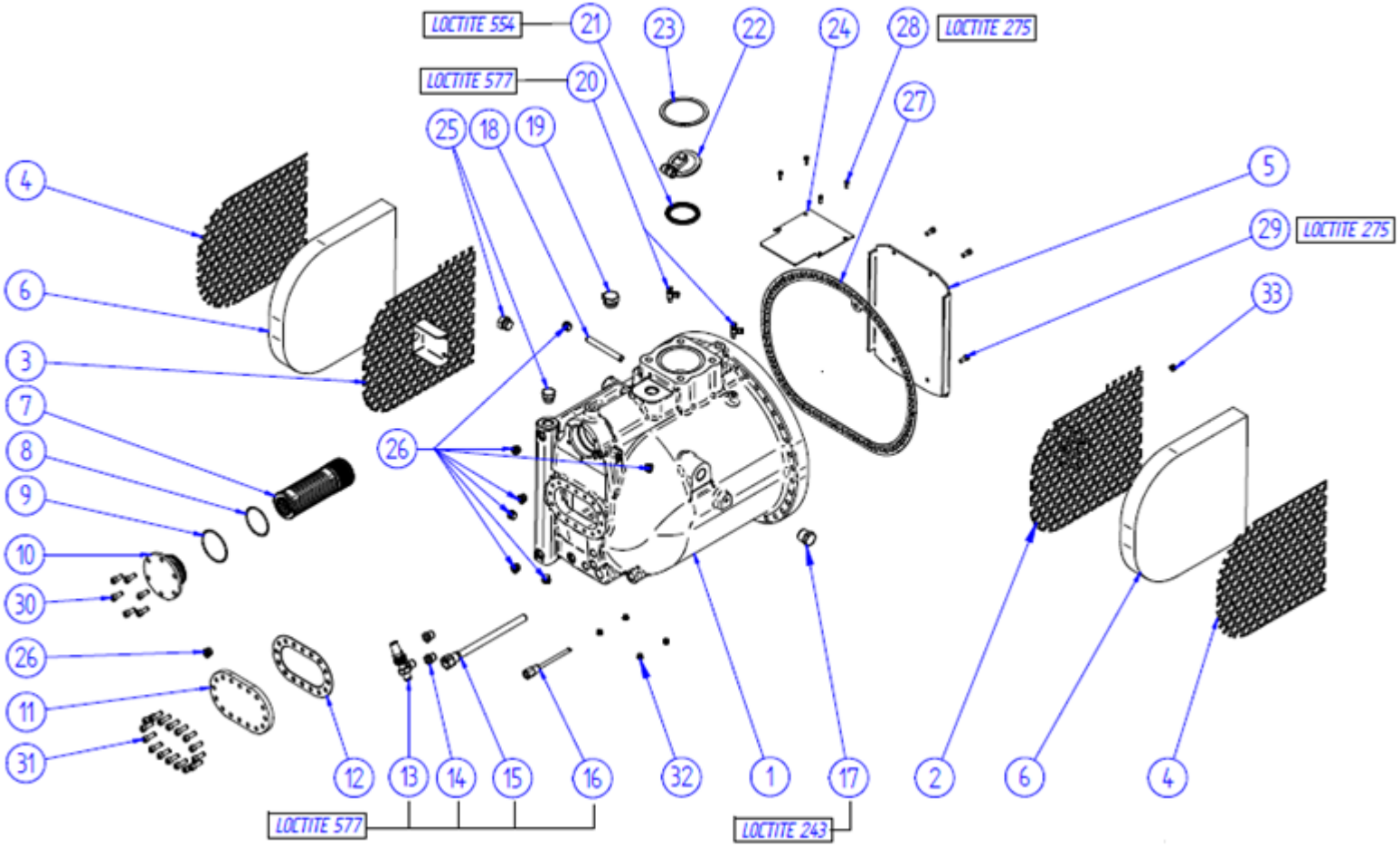
F4/F3 series

Exploded view – limited to F4AL+XL



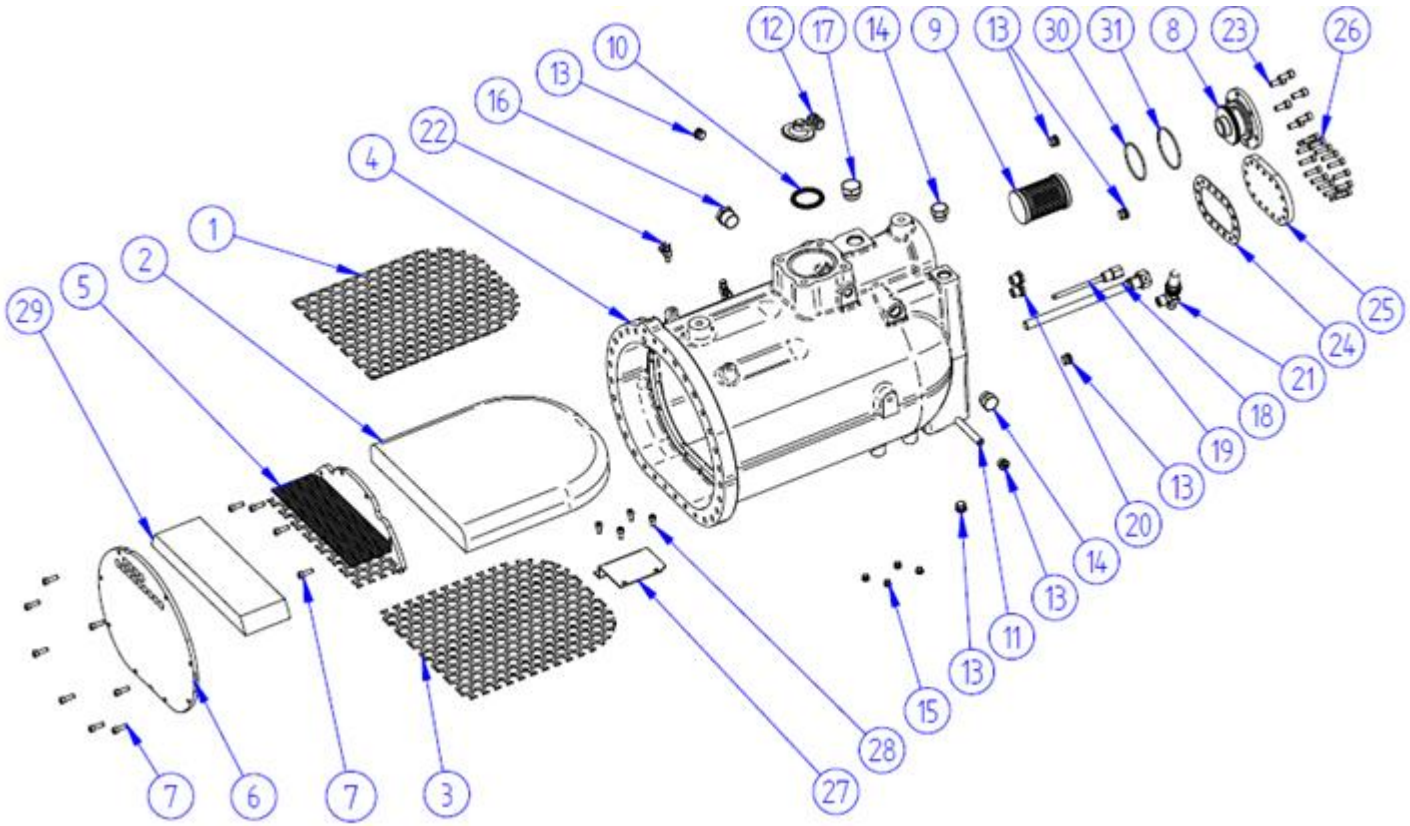
F4/F3 series

Exploded view – limited to F3B



F4/F3 series

Exploded view – limited to F3A

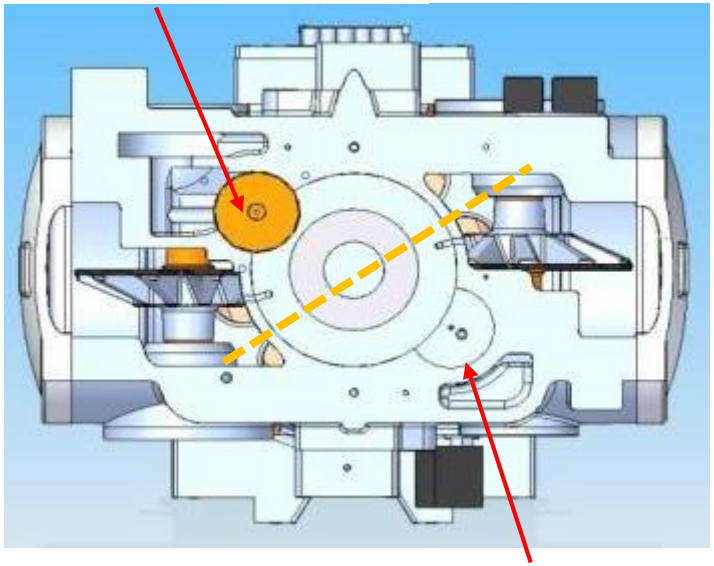


F4/F3 series – assymetric

Capacity regulation system

Non Modulating slide valve

0 or 100%



Modulating Process

25-100% load

Compression processes function independently from one another.

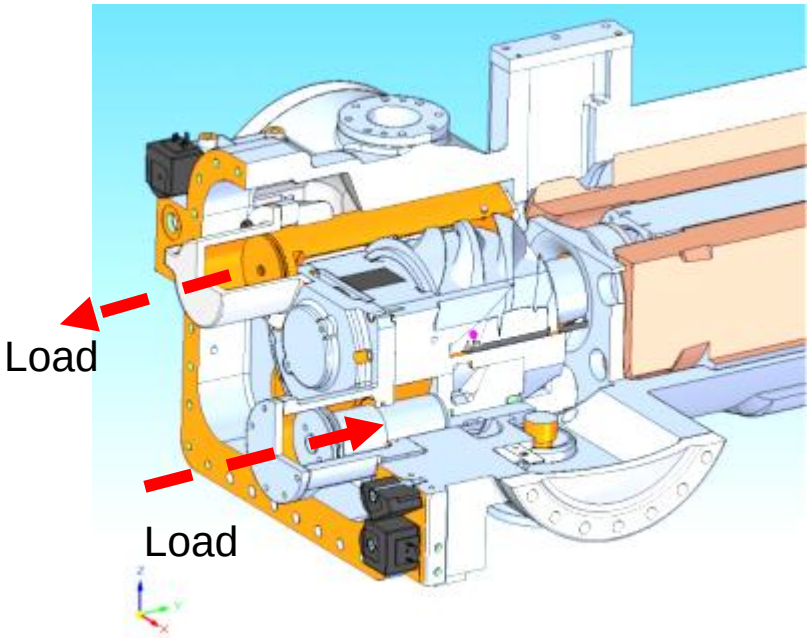
The two processes are termed:-

'Modulating', where the slide moves in small increments between its minimum and maximum load position. Thus delivering anything from 12.5% to 50% of **the compressors** full load capacity.

'Non-Modulating' – On/off , where the slide will move from minimum to maximum (and vice versa); not stopping in the mid position. Delivering either 0% or 50% of **the compressors** full load capacity.

F4/F3 series – assymetric

Capacity regulation system



The direction of each slides movement when loading/unloading is opposite to one another.

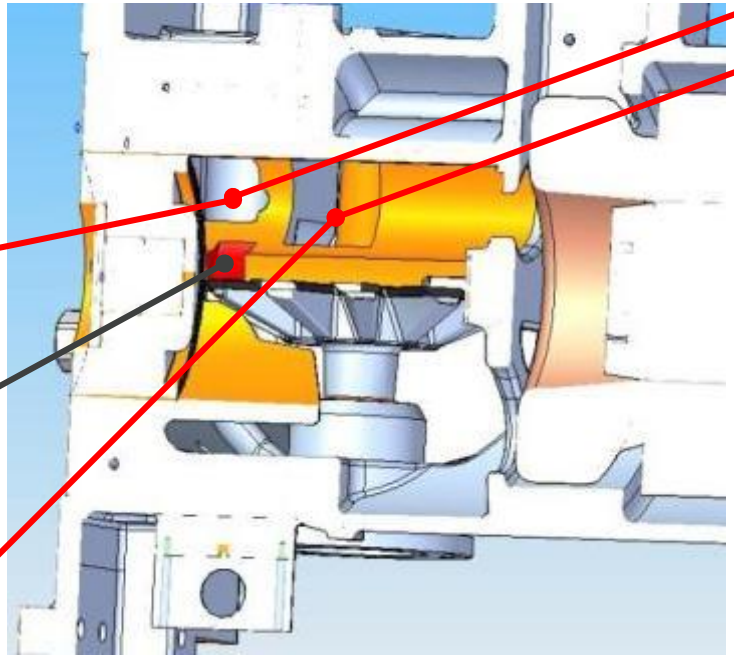
- Modulating:
  - Loading towards suction
  - Unloading towards discharge
- Non-Modulating
  - Loading towards discharge
  - Unloading towards suction

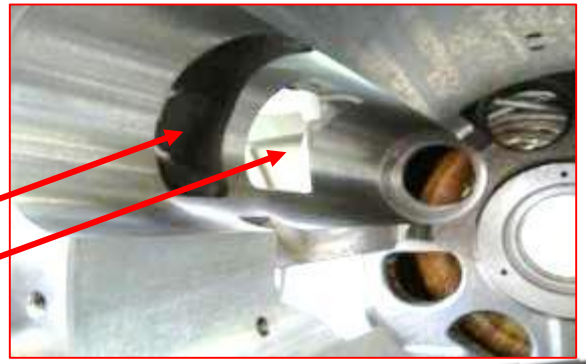
F4/F3 series – assymetric

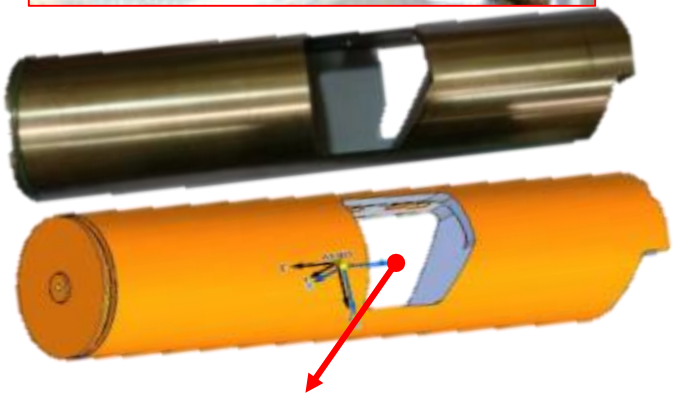
Capacity regulation system

a) Non modulating (on/off) slide

View from inside bore looking at non-modulating slide bore







Cut out provides of the slide

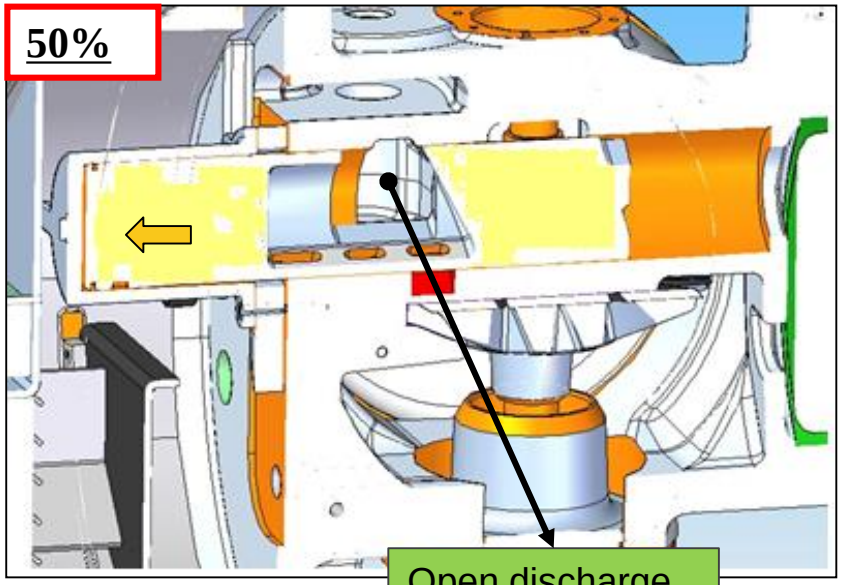
0-50% total compressor cap.= bypass of flute gas to suction (slide in unload position)

62.5-100% total compressor cap.= Connects flute to discharge chamber (Slide in load position)

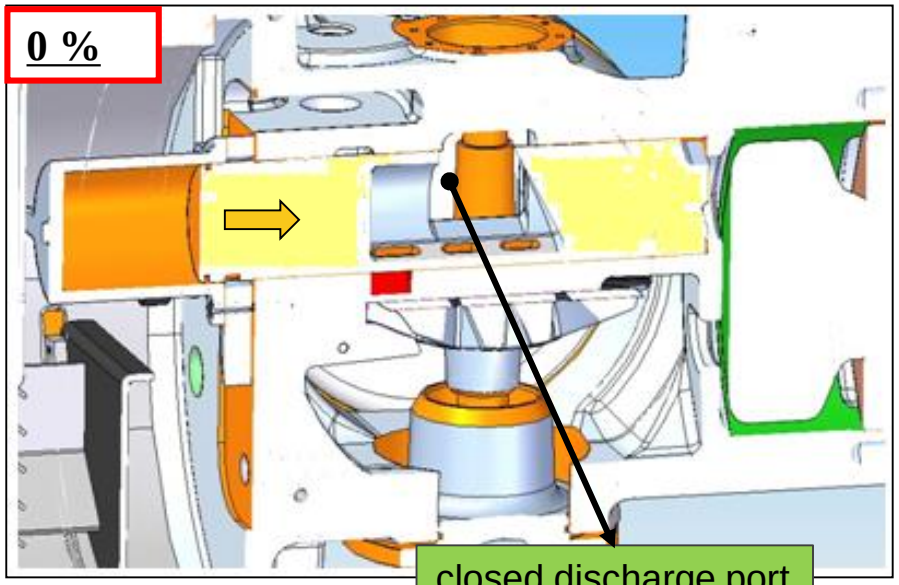
F4/F3 series - assymetric

Capacity regulation system

a) Non modulating (on/off) slide – detail



At full load the cut-out in the non-modulating slide aligns the flute to the discharge port and will deliver **50%** of the total capacity of the compressor.



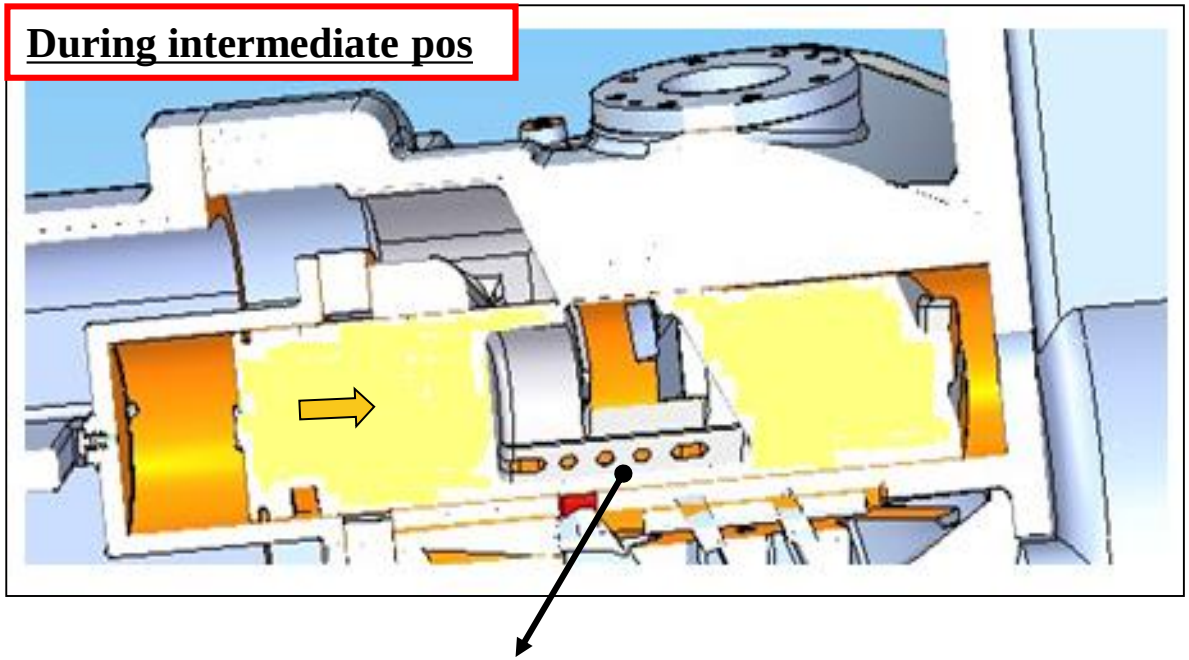
At minimum load suction gas that enters the flute will bypass through cut out in the slide directly back into the suction gallery (the gas is not compressed at all).

F4/F3 series – assymetric

Capacity regulation system

a) Non modulating (on/off) slide – detail

During intermediate pos

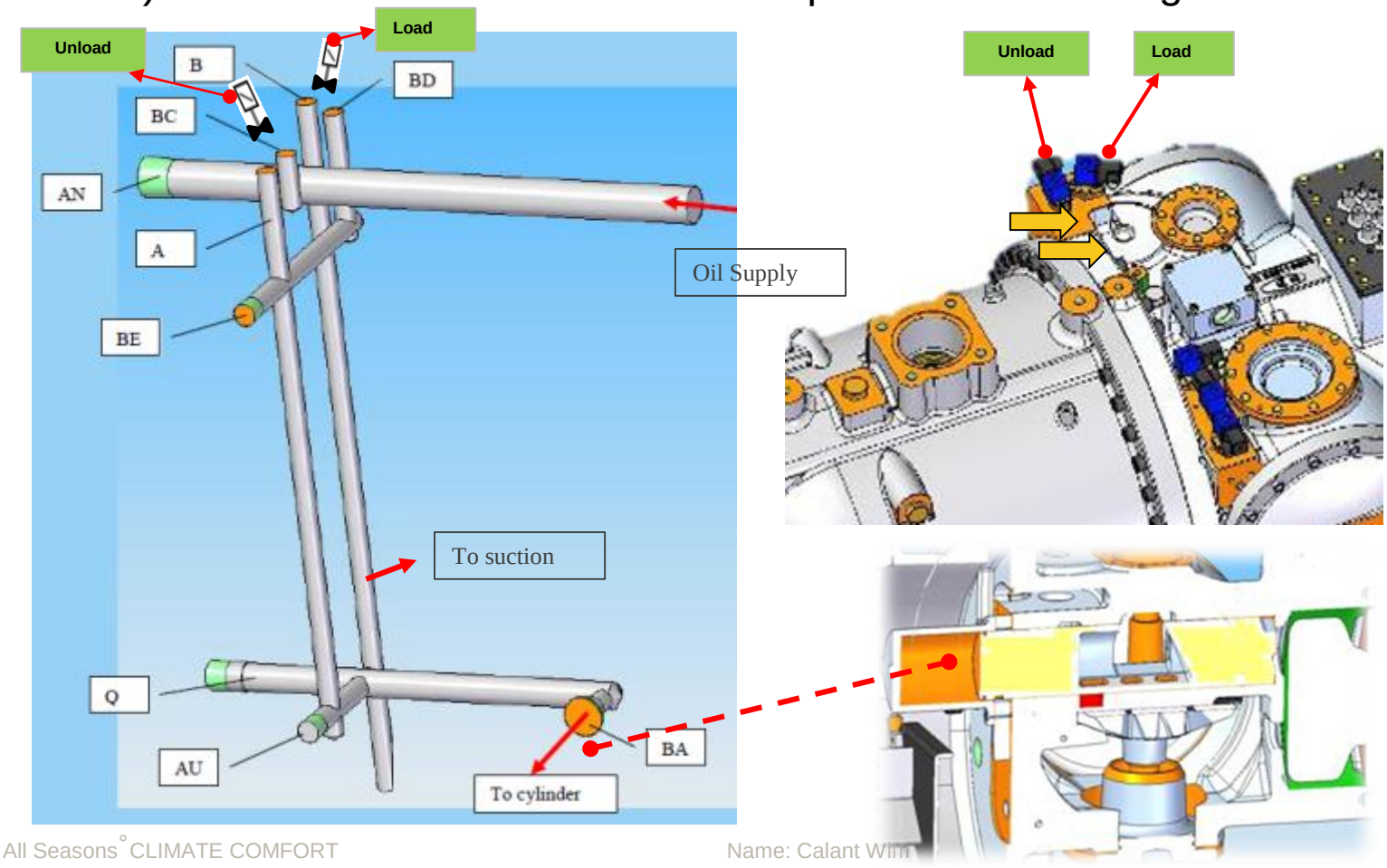


Note holes in lower section of non modulating slide allow gas from the flute to escape from the fixed port at all times when the slide is moving mid way between min and full load.

F4/F3 series – assymetric

Capacity regulation system –On/Off slide

a) Non modulation slide - control operation - oil drillings -



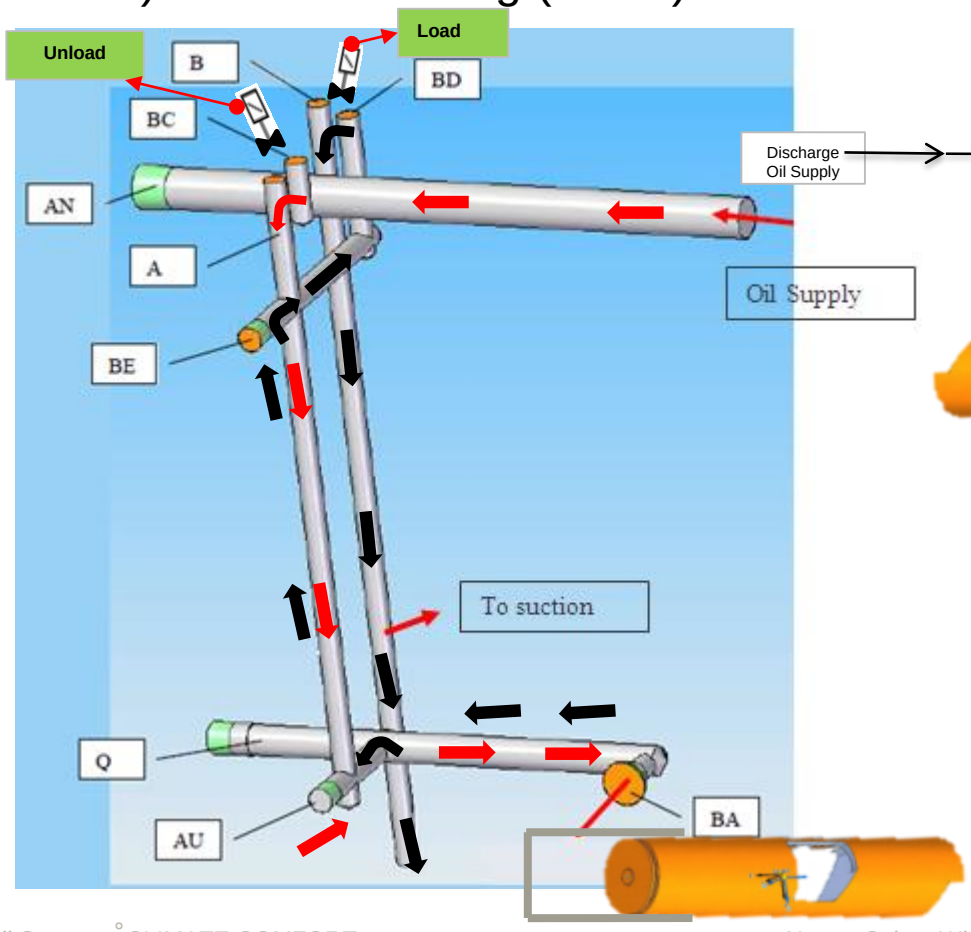
F4/F3 series – assymetric

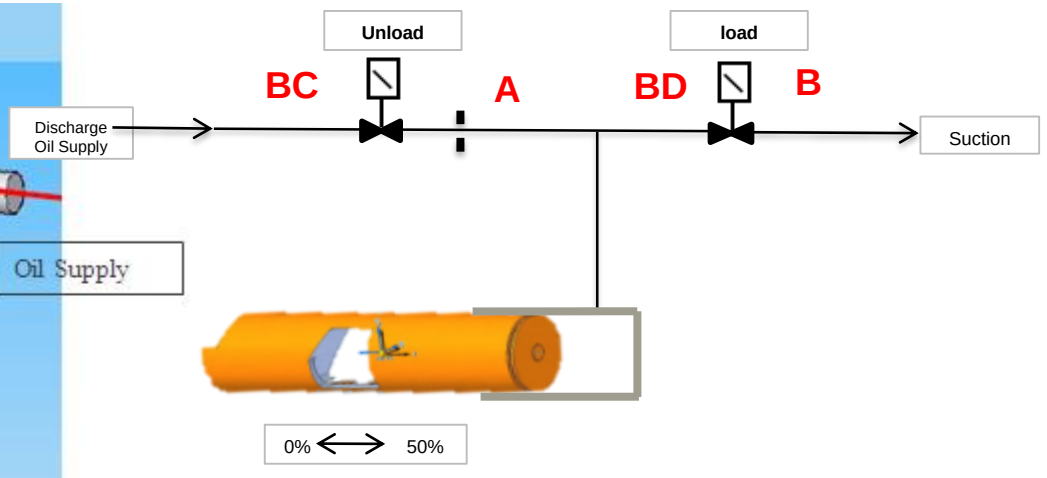
Oil flow for load

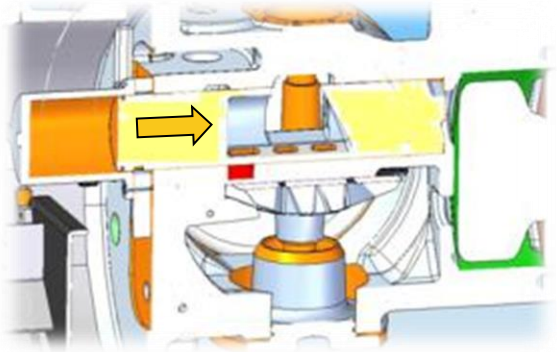
Oil flow for unload load

Capacity regulation system

a) Non modulating (on/off) slide – detail - schematic



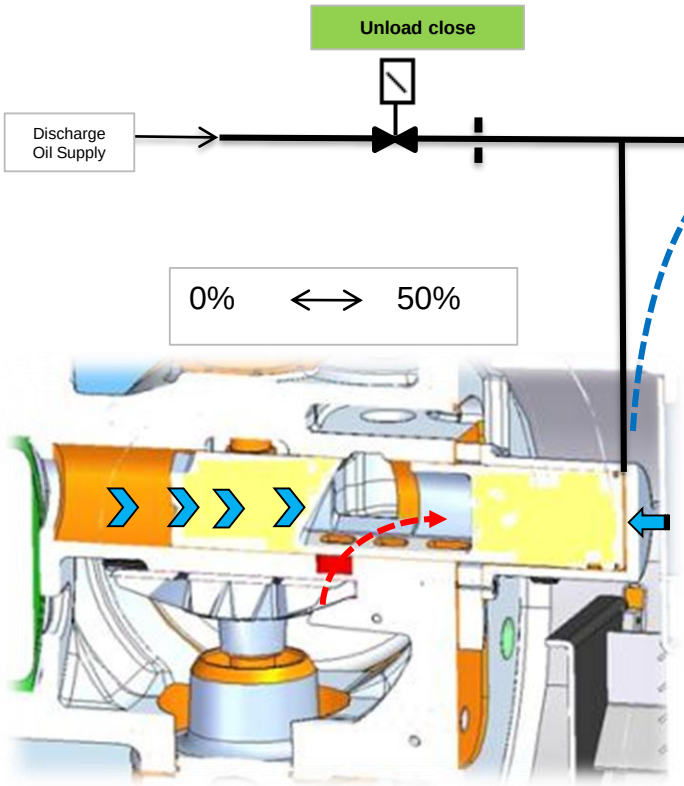




F4/F3 series – assymetric

Capacity regulation system – on/off slide

loading – normal conditions = oil venting!



Oil flow

Oil pressure

Discharge gas force on slide

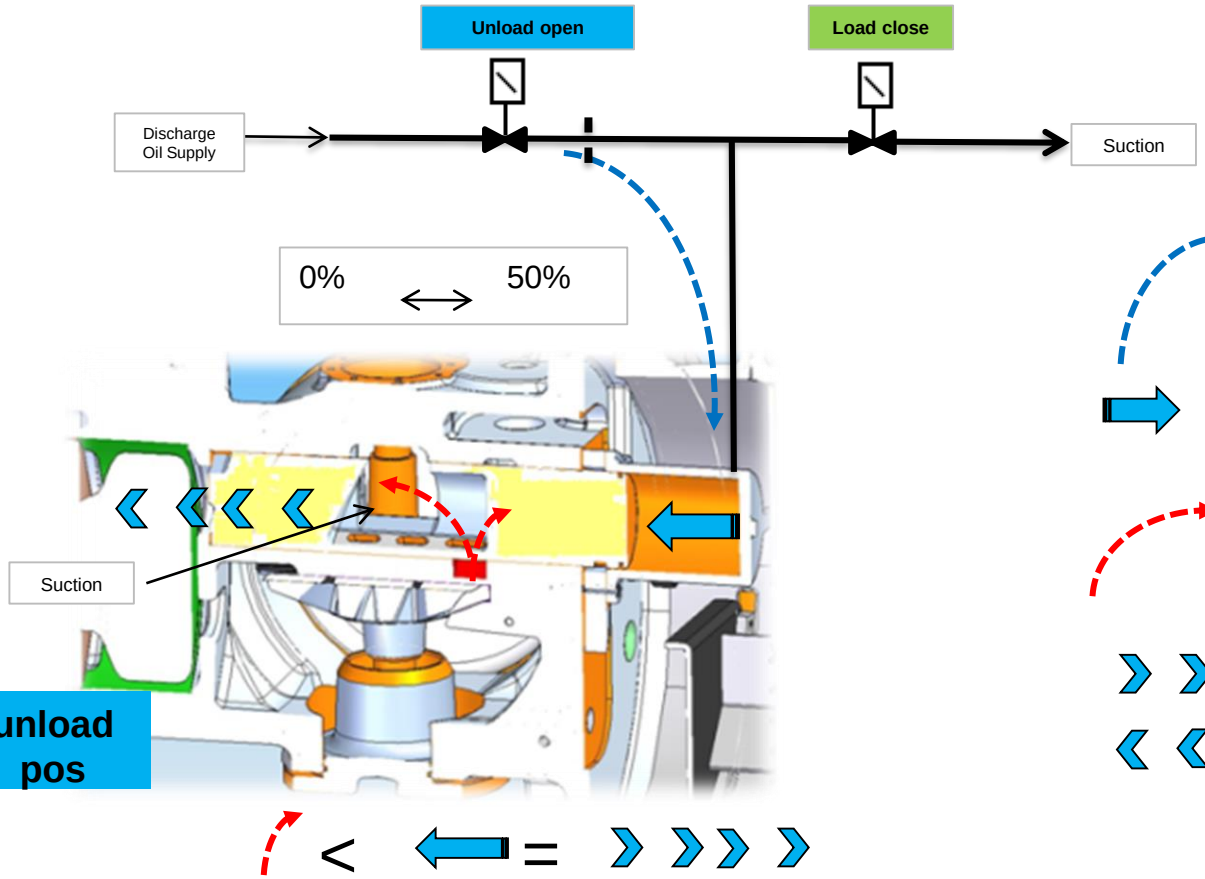
››› Slide movement to loadpos !

‹‹‹ Slide movement to unload pos

F4/F3 series – assymetric

Capacity regulation system – on/off slide

Unloading – normal conditions = oil charging!



Oil flow

Oil pressure

Discharge gas force on slide

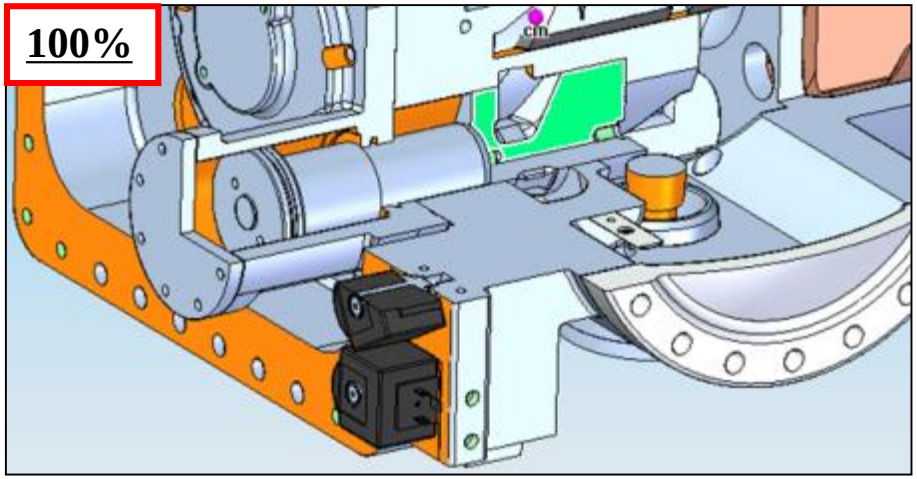
Slide movement to loadpos !

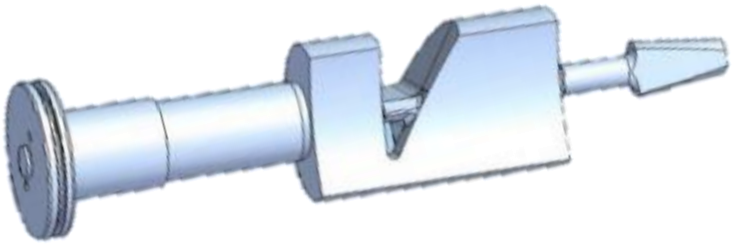
Slide movement to unload pos

F4/F3 series – assymetric

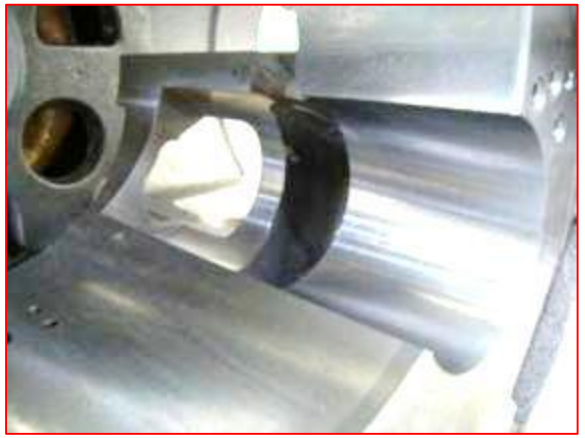
Capacity regulation system

b) modulating slide – detail





Note the pressence of the spring in real situ.

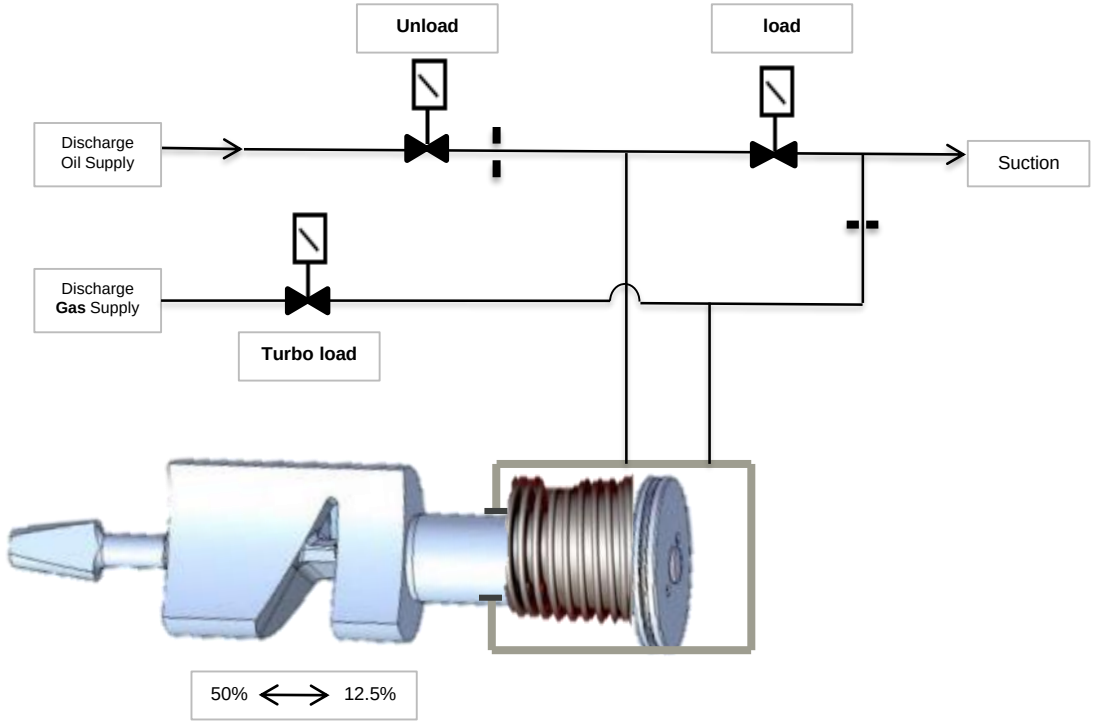


The modulating slide acts as a traditional slide controlled by pulses by the solenoid, and moves towards suction in order to increase compressor capacity.

F4/F3 series – assymetric

Capacity regulation system

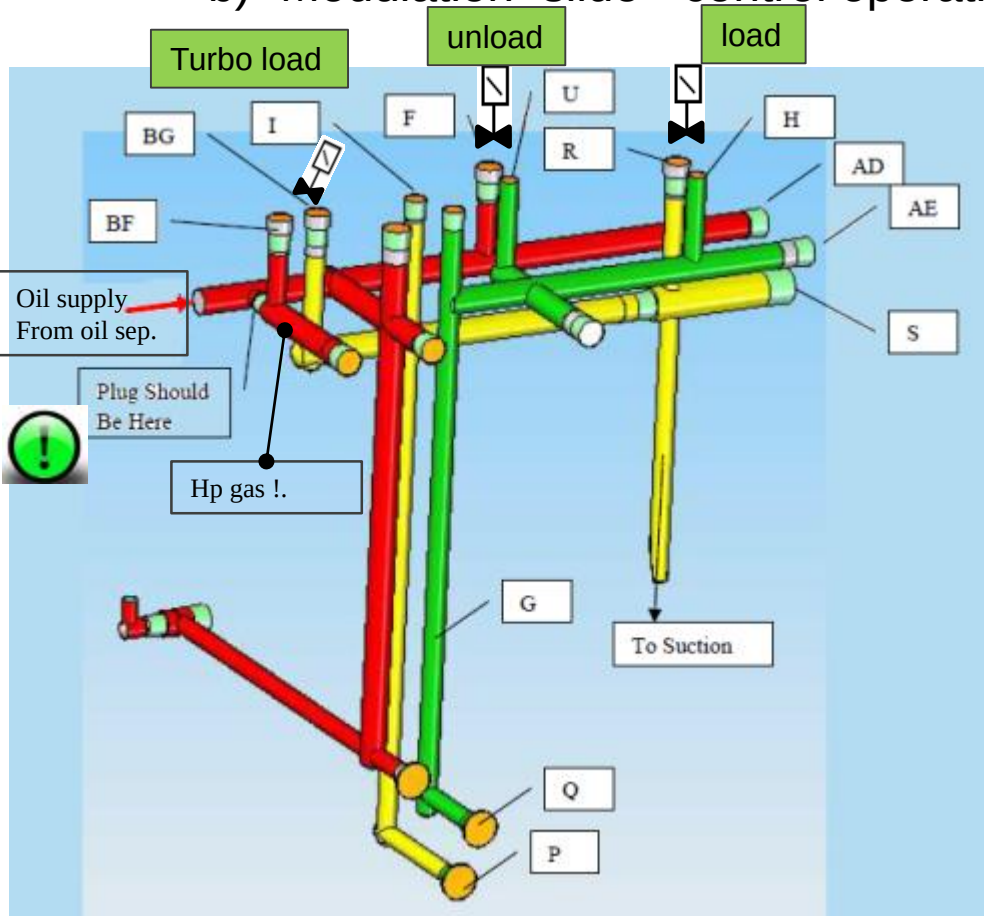
b) Modulation slide - control operation - oil drillings -

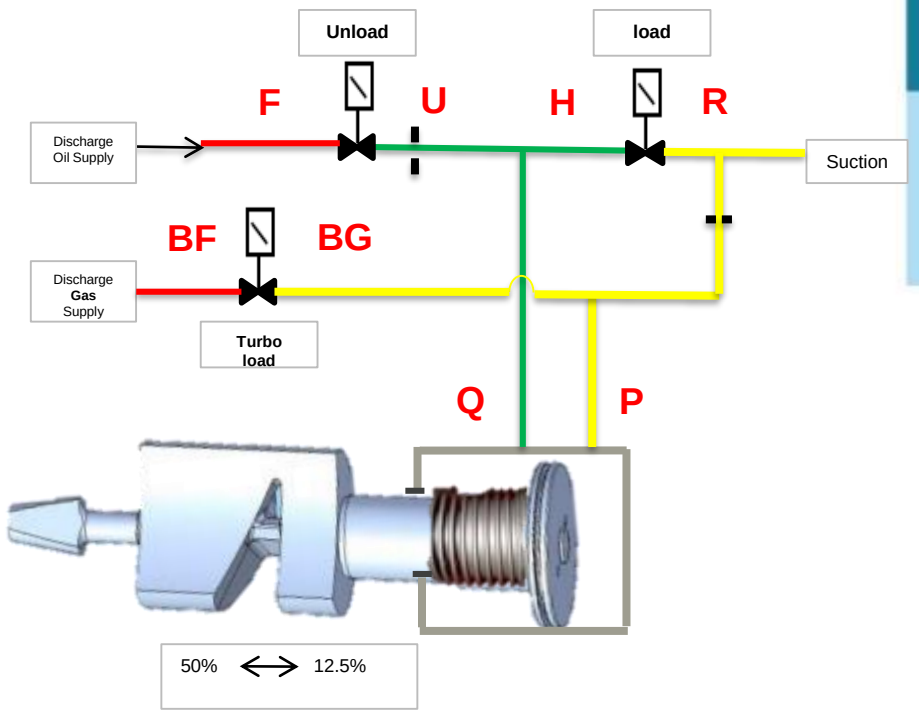


F4/F3 series – assymetric

Capacity regulation system

b) Modulation slide - control operation - oil drillings -

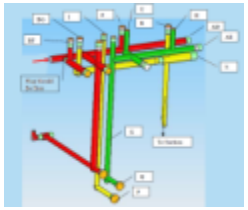




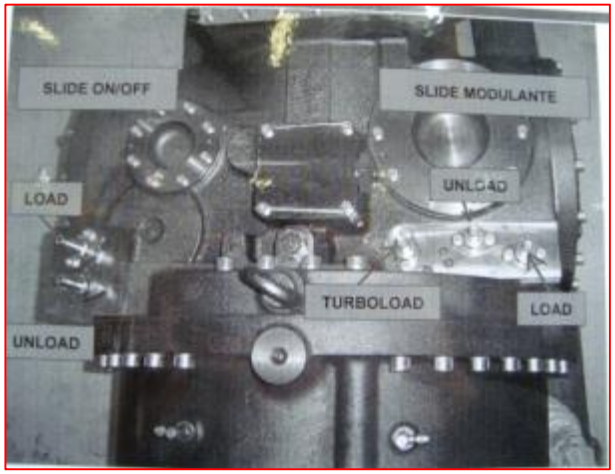
F4/F3 series – assymetric

Capacity regulation system

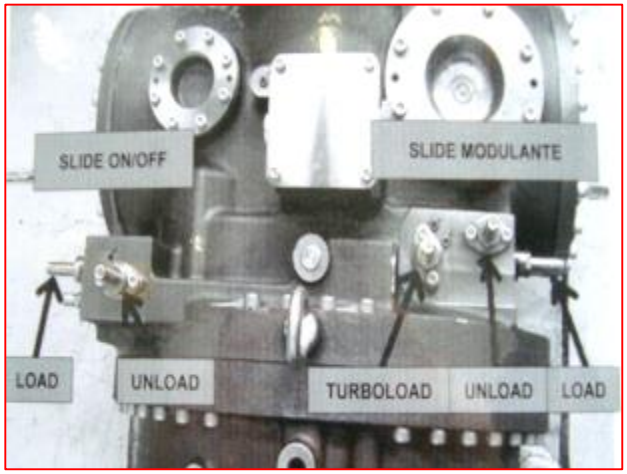
b) Modulation slide - control operation - oil drillings –



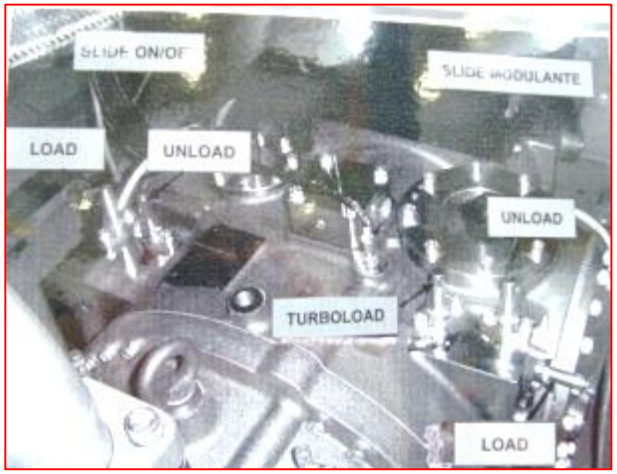
Note that depending the different size of compressor the solenoids may have different location on the compressor, BUT the principle of the oil drillings and controlling the slides stays the same



F4



F3B

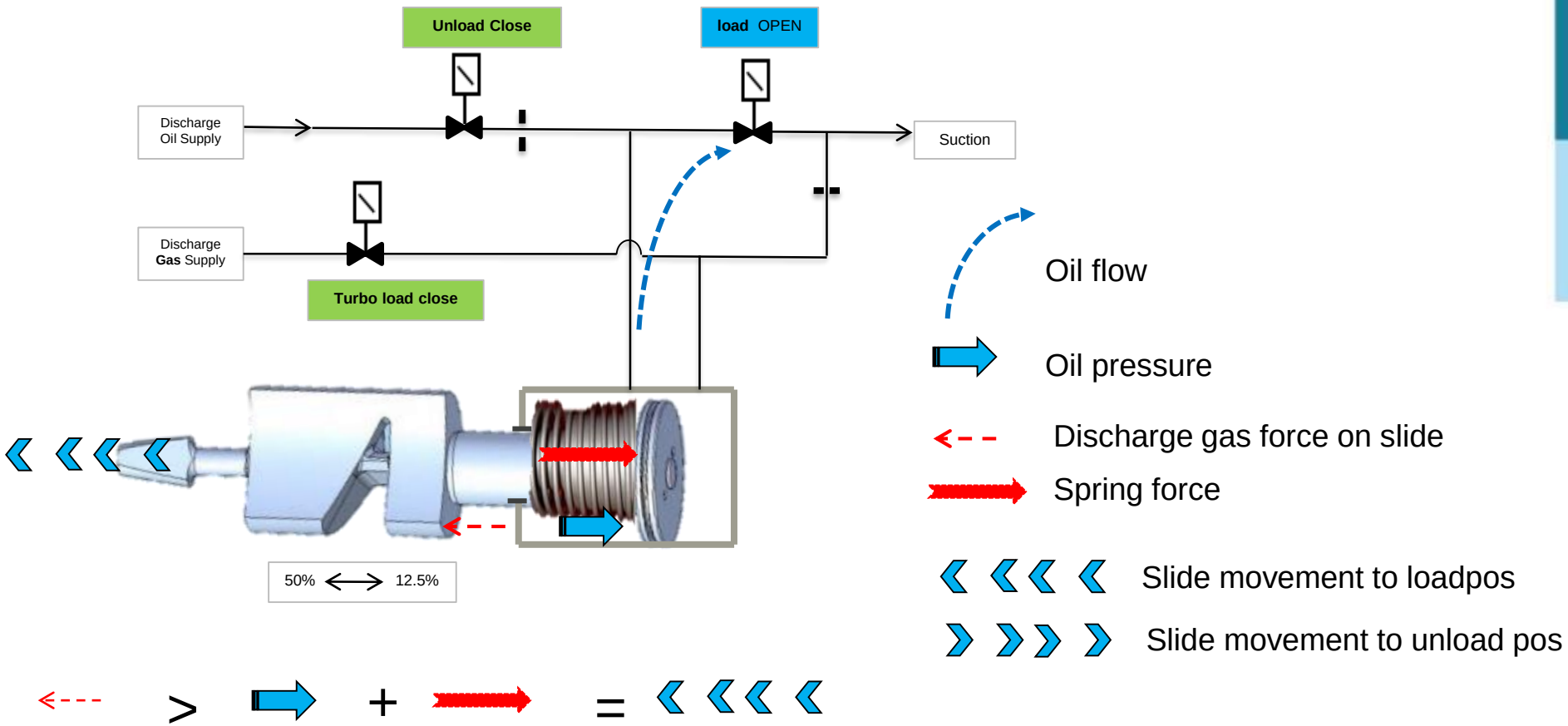


F3 A

F4/F3 series – assymetric

Capacity regulation system – modulating slide

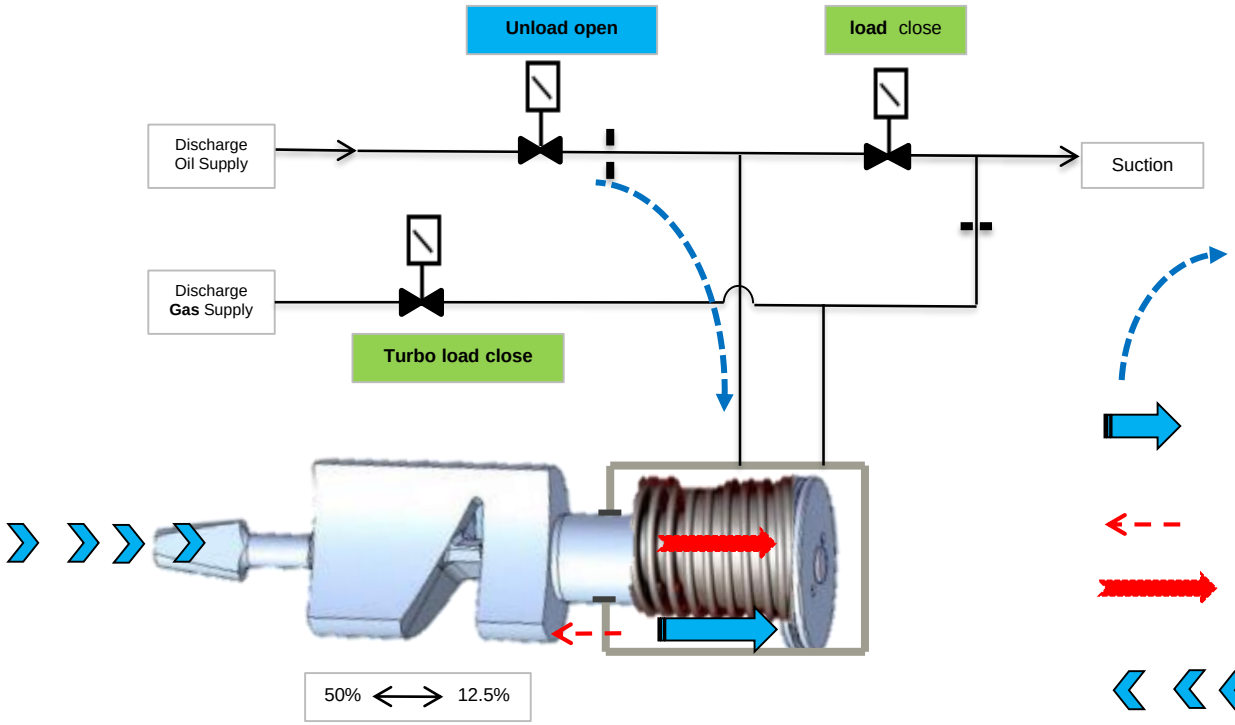
Loading – normal conditions = oil venting!



F4/F3 series – assymetric

Capacity regulation system – modulating slide

Unloading – normal conditions = oil charging!



Oil flow

Oil pressure

Discharge gas force on slide

Spring force

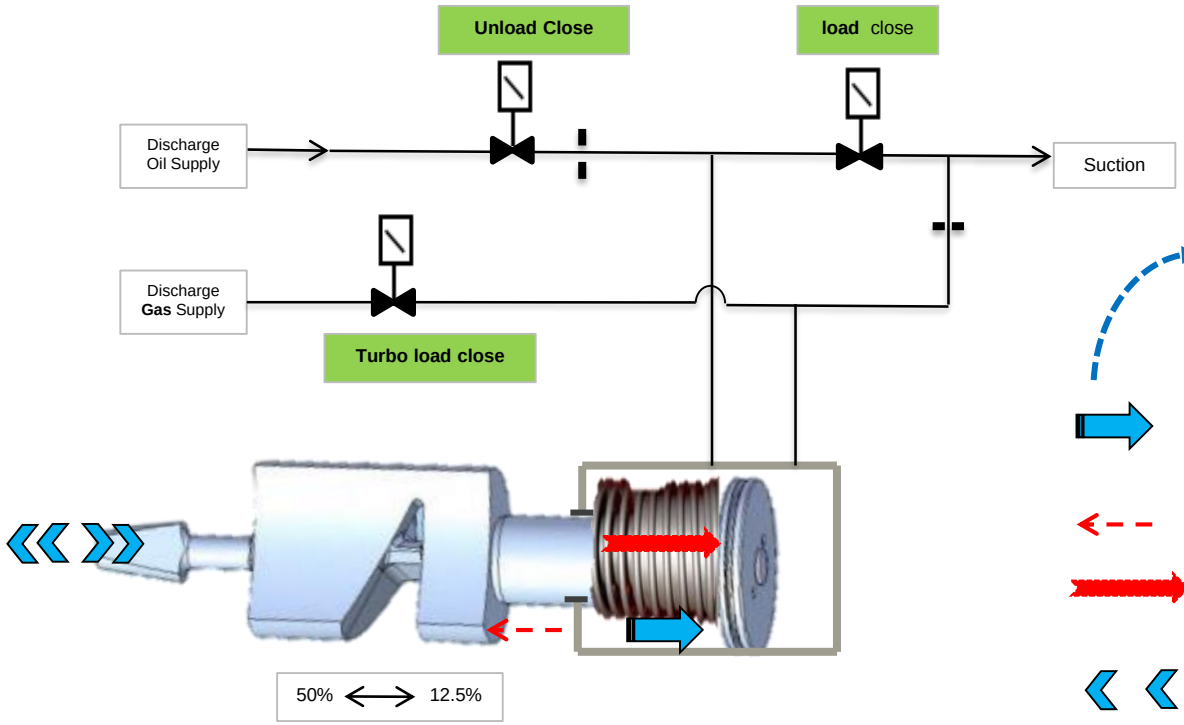
Slide movement to loadpos

Slide movement to unload pos

F4/F3 series – assymetric

Capacity regulation system – modulating slide

Holdig capacity = all solenoids closed!



Oil flow

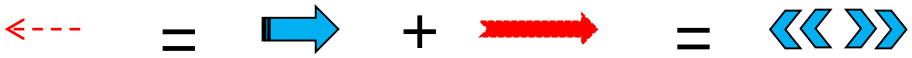
Oil pressure

Discharge gas force on slide

Spring force

Slide movement to loadpos

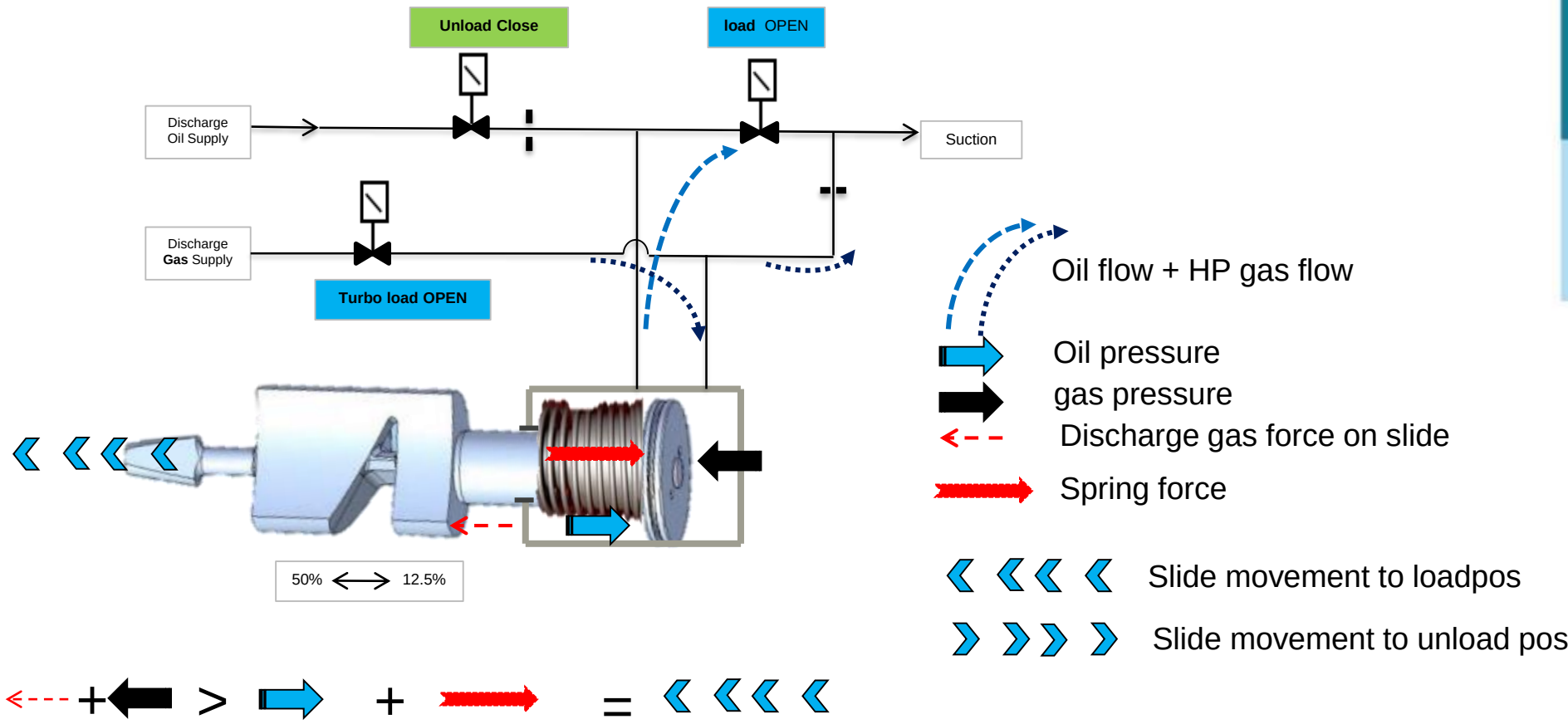
Slide movement to unload pos



F4/F3 series – assymetric

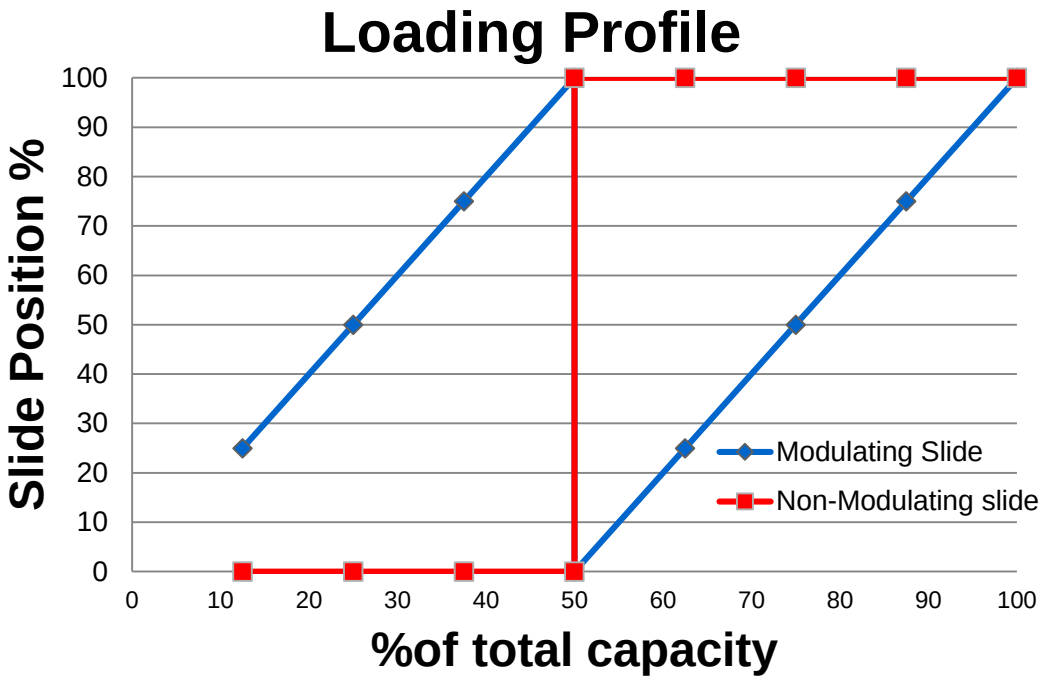
Capacity regulation system – modulating slide

Loading – low pressure ratio conditions = oil venting + Hp gas (TURBO)



F4/F3 series – assymetric

Loading profile of the different slides

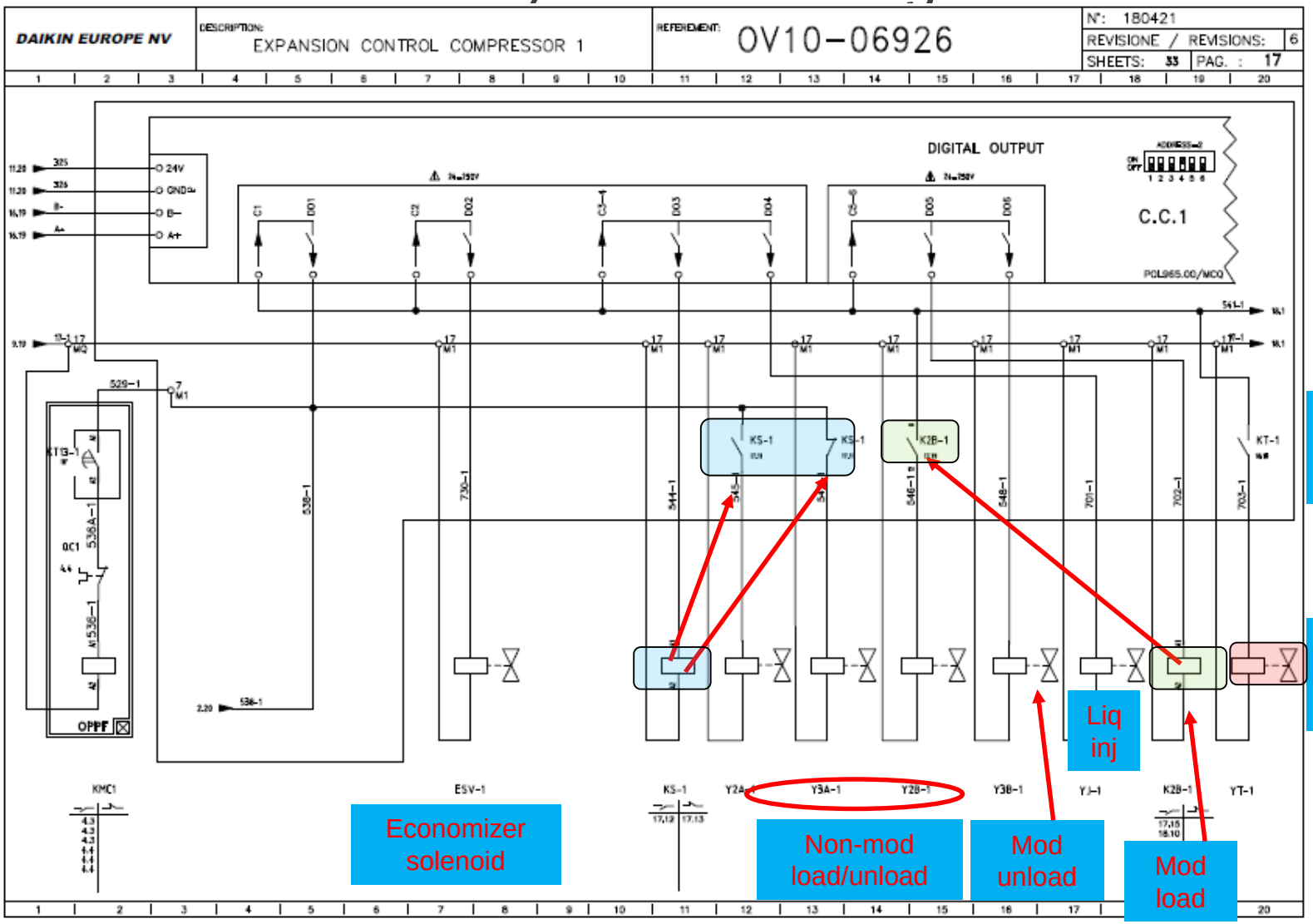


Modulating Slide Position %		Non-Modulating Slide Position %		Total Capacity
25	Minimum	0	Minimum	12.5
50	Half	0	Minimum	25
75	Three Quarter	0	Minimum	37.5
100	Maximum	0	Minimum	50
25	Minimum	100	Maximum	62.5
50	Half	100	Maximum	75
75	Three Quarter	100	Maximum	87.5
100	Maximum	100	Maximum	100

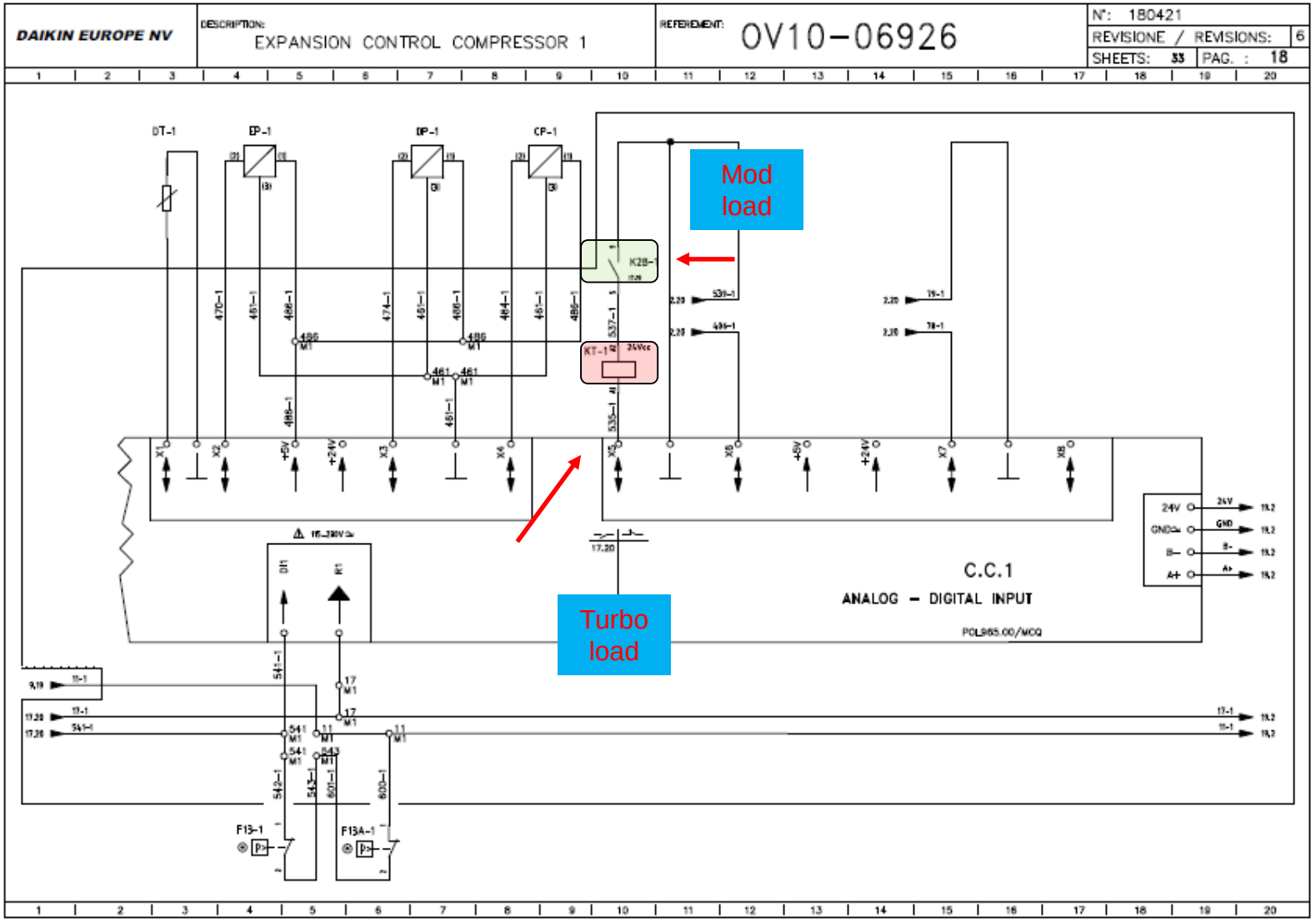
From minimum load (12.5% capacity), the modulating slide would be loaded incrementally to its maximum position. This would be 50% of the total compressor capacity. At this point the modulating slide would be fully unloaded and the non-modulating slide fully loaded.

From here the modulating slide would be loaded incrementally up to 100% of the compressors total capacity.

F4/F3 series – assymetric - wiring



F4/F3 series – assymetric



F4/F3 series - – assymetric

1. Capacity regulation test (fieldtest + workshop test)

   When performing?

   1. Compressor loads (on/off or modulating slide up unwanted to 50%
   2. Compressor cannot hold capacity (modulating slide)
   3. Compressor doesn't load (on/off or modulating)

2. Scope of tests:

   - Test 1 - To check correct internal sealing of solenoids (capacity holding)
   - Test 2 (a+b) - To check correct movement of capacity slides and test tightness of glyd rings (pressure test)
   - Test 3 (workshop) - detail check for any leaks on the capacity system (glyd ring, main bearing plate etc,

F4/F3 series – assymetric

WARNING !!! – prior to opening of compressor

- Stop circuit involved / pumpdown
- separate compressor from refrigerant circuit
- recover all existing refrigerant – check pressure !
- disconnect compressor from power supply
- avoid compressor can start unwanted (fuses)

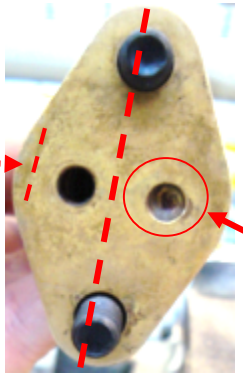
What do we need?

- Some special tools

Blank solenoid base

Pressure supply plug with Mano

Pressure/ vacu nozzle



hole oposite to mark is blanked by brazing,

- Nitrogen bottle

- Vacu pump, Manometers + hoses/ ampère meter, magnet

F4/F3 series – assymetric

What do we need? – can be self made

F4/F3 series – assymetric

Capacity regulation tests – note the different type solenoids

No longer use of separate orifice = less sensitive design
different approach for testing.

OLD type

3100-3200-4200

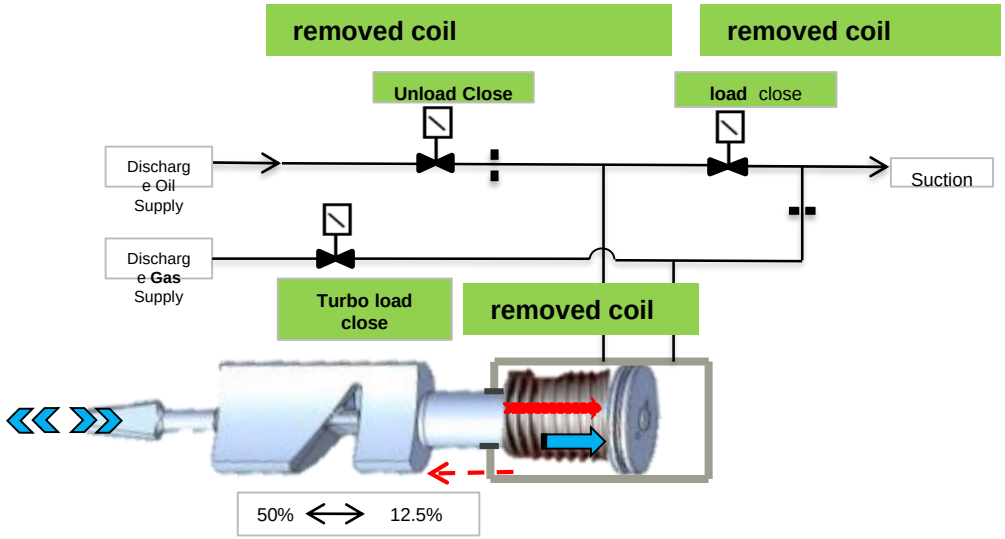
for assymetric
ASCO
SXE263B200T

F4/F3 series – assymetric

Field test – Test 1 – **Modulating slide only !**

Check of solenoids (test a) – compressor running !

- Perform compressor capacity holding test – remove both coils from solenoids ,
- ➔ compressor should keep capacity – check with ampère clamp,



Discharge pressure = Cylinder pressure + spring pressure = slide stays in same position

Possible Result:

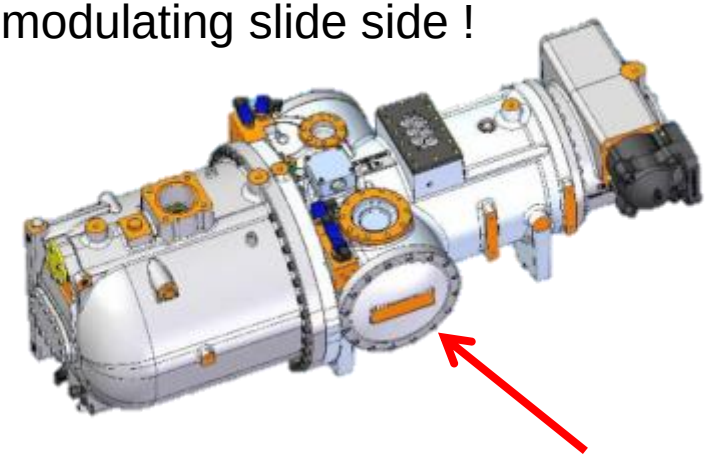
1) Current rise to max value ➔ load solenoid or Turbo solenoid is leaking
2) Current is decreasing to min value ➔ unload solenoid is leaking

First replace suspicious solenoid if still not ok Test 2 has to be performed.

F4/F3 series – assymetric

Field test – Test 2 – checking slide valve movement + pressure test

1. **Modulating slide Only !**
2. Remove satellite side cover of the modulating slide side !

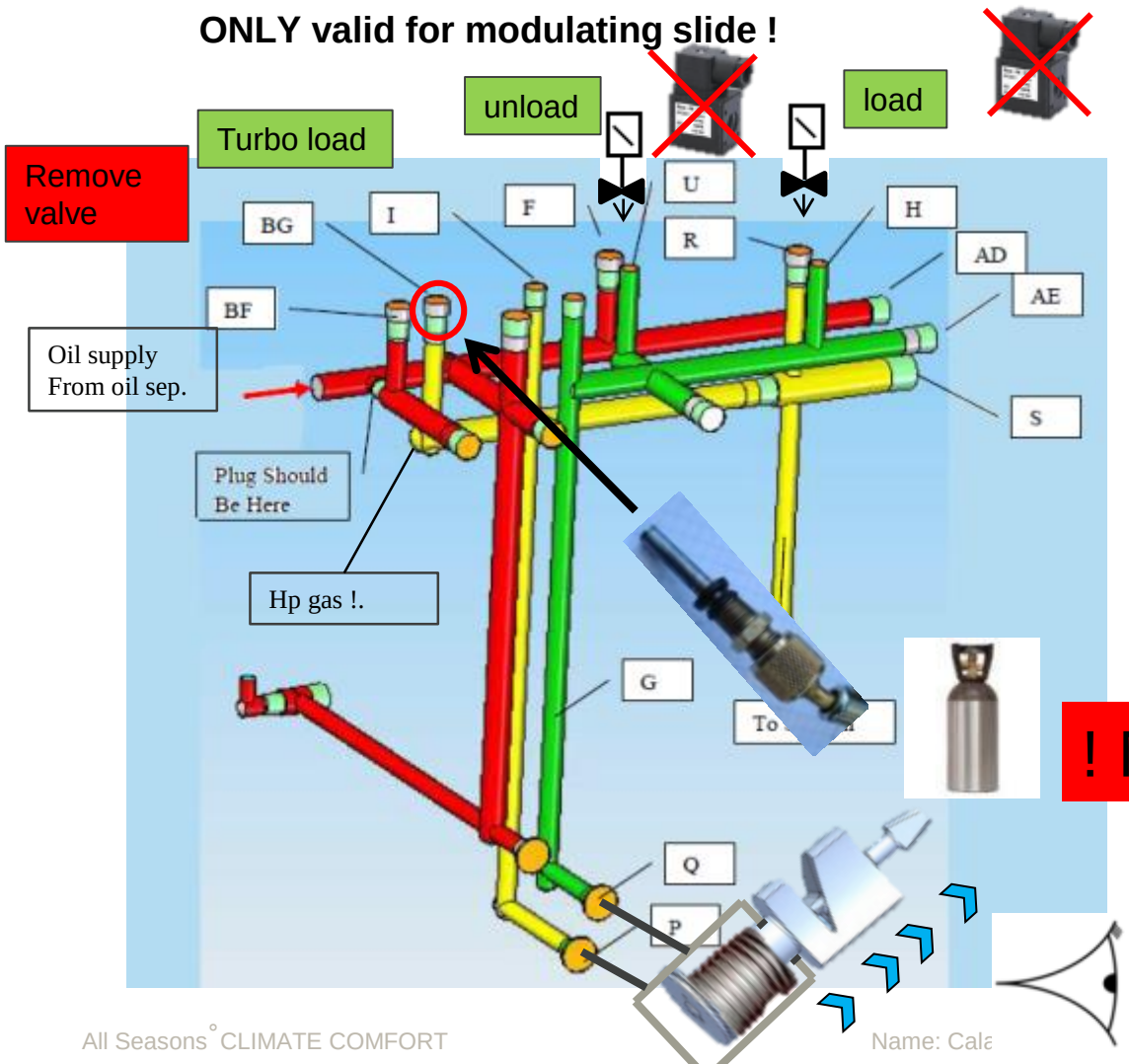


3. Remove solenoids **<u>coils only (load + unload).</u>**
4. Remove Turbo load valve complete.
5. Test the movement of the slide via Turbo load (to max pos) with nitrogen pressure.
6. Install blank plate on the load solenoid position
7. Install the pressure plug with manometer
8. Perform pressure test of the glyd ring .

F4/F3 series – assymetric

Field test – Test 2 (a) – checking slide valve movement

ONLY valid for modulating slide !



1

Movement test:

- Remove only Turbo valve complete
- Remove **coils** from load and unload

- Add nitrogen pressure with nozzle in hole BG, pressure will follow yellow pipe towards modulating slide,
- Slide must move to max position
- When releasing pressure slides moves back to min pos.

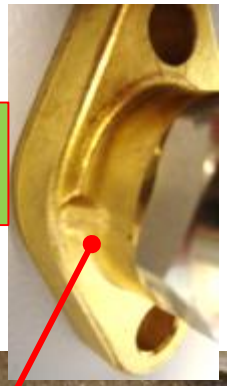
! Max 6 bar

Verify movement

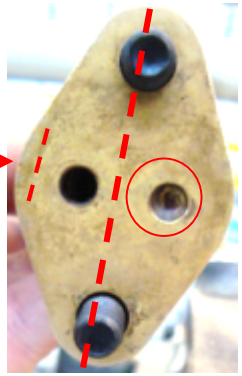
F4/F3 series – assymetric

Field test – Test 2 (b) – pressure tests – Important REMARK !

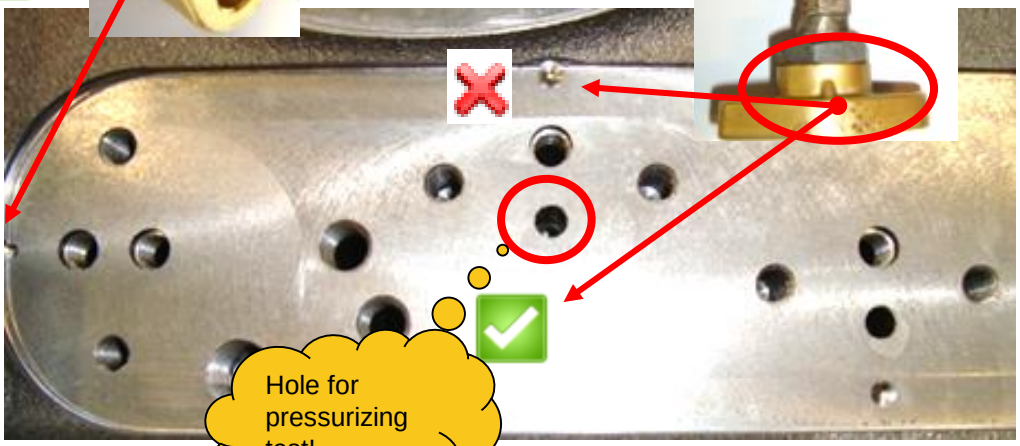
Normal valve



Modified for pressure test



hole oposite to mark is blanked by brazing,



For pressure testing, the solenoid plate of the manometer is positioned **opposite** to the **mark** on the compressor casing, this is due to the brazed hole!

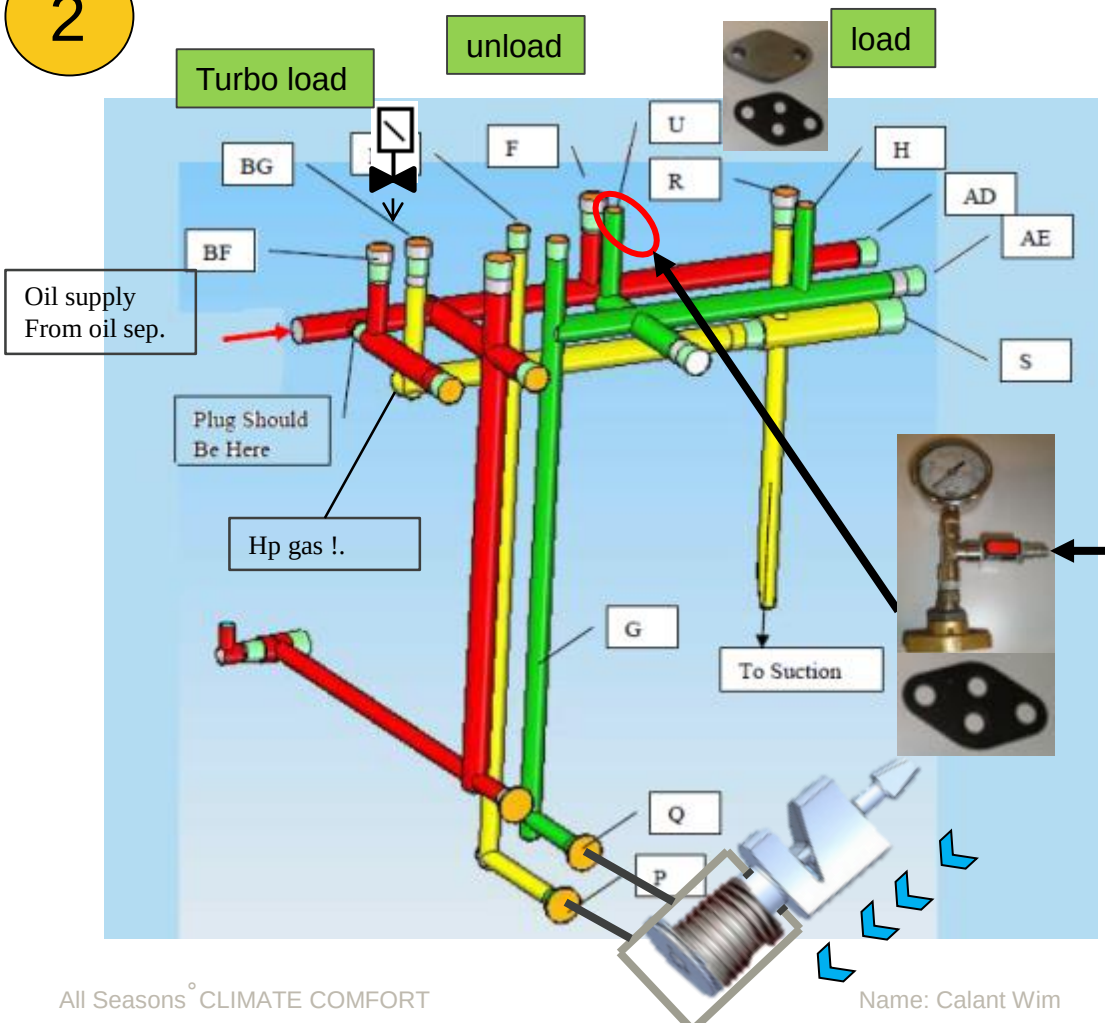
When remounting original solenoid , the **mark** of the solenoide is on the **mark** of the casing of course.

F4/F3 series – assymetric

Field test – Test 2 (b) pressure test

2

ONLY valid for modulating slide !



Pressure test:

- Remove load valve and mount blank
- Turbo load can be re mounted or stay open .
- Put blank plate on load position
- Remove unload valve
- Install manometer on unload position. **Mark on plate MUST be opposite to mark on compressor! (green pipe should become under pressure!)**
- Add nitrogen pressure via manometer in hole U (green pipe).

Pressurise to 6 bar for one minute, pressure loss not more than 1 bar

Glyd ring may be leaking, detailed pressure “test 3” needed !

F4/F3 series – assymetric

Field test – Test 1 – **for the ON/OFF slide only !**

WARNING - Check of solenoids (test 1) – compressor running !

Because the on/off slide vane immediately adds 50% capacity, and has no intermediate position , its adviced **NOT** to force the slide into the load position while compressor is running.

However a “zero” capacity holding test could be performed by forcing the unload solenoid with a magnet in order to check if the slide has not the tendancy to upload unwanted.

F4/F3 series – assymetric

See remark previous page

Field test – Test 1 – **ON/OFF slide only** !

Check of solenoids (test a) – compressor running !

a) Perform a on/off slide zero % capacity holding test
b) Remove coil from load solenoid
c) ➔ on/off slide should stay to zero capacity – check with ampère clamp,

IF slide has tendancy to move to load pos

Amps rising = NOK

Possible Result:

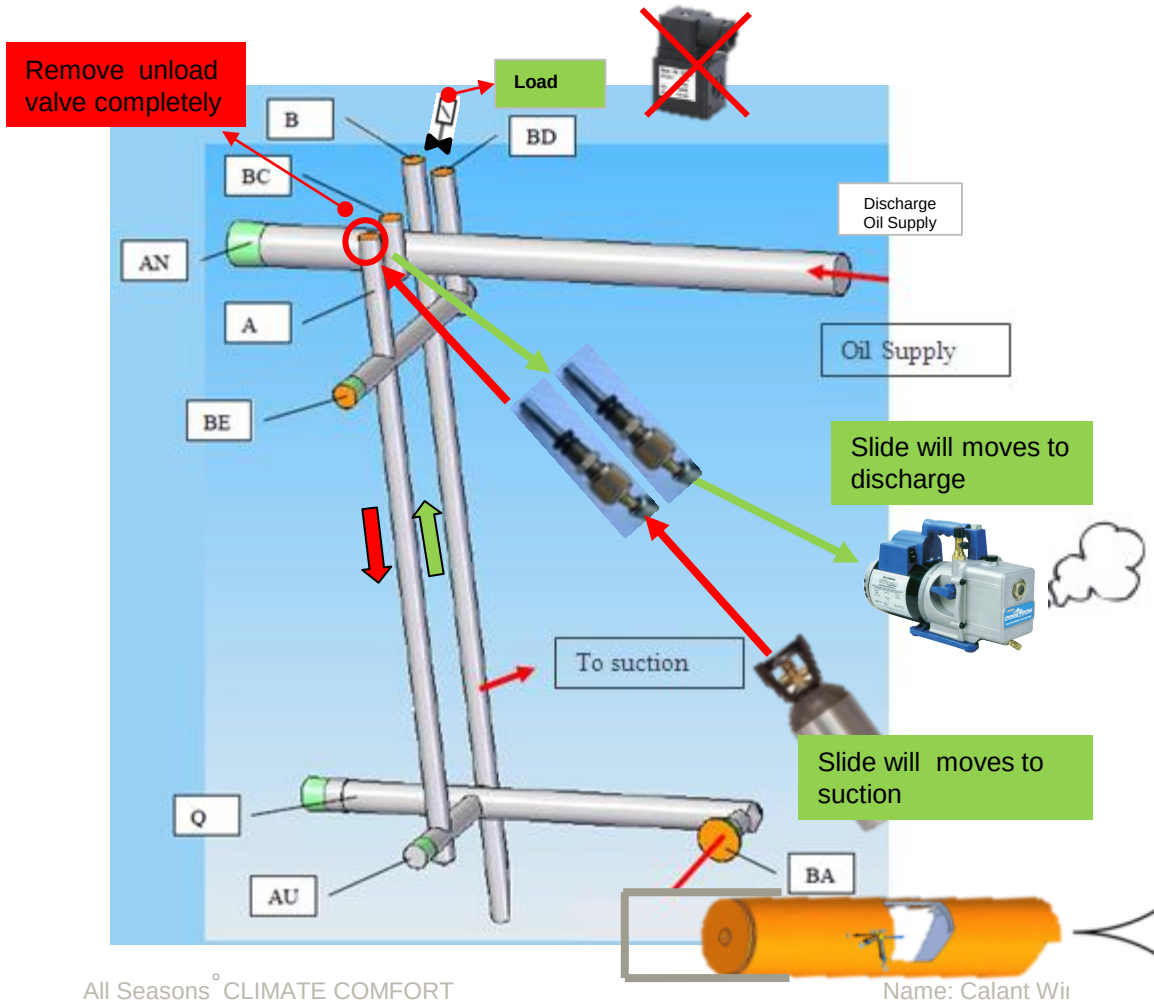
1) Current rises to high value , and is not dropping ➔ load solenoid is leaking
2) Current is decreasing to min value ➔ unload solenoid is leaking

First replace suspicious solenoid if still not ok Test 2 has to be performed.

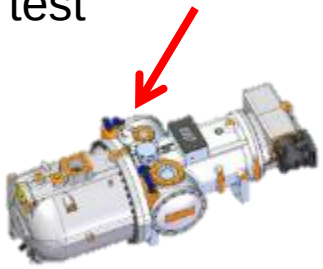
F4/F3 series – assymetric

Field test – Test 2 – checking slide valve movement + pressure test

ONLY valid for On/OFF slide !



1



Movement test

- Open side cover of the on/off slide
- Remove the coil from the load valve
- Remove unload valve completely
- Add nitrogen pressure with nozzle in hole A .
- Slide must move towards suction (zero %)postion)
- Apply vacuum on hole A via nozzle and vacu pump, slide must move towards discharge .

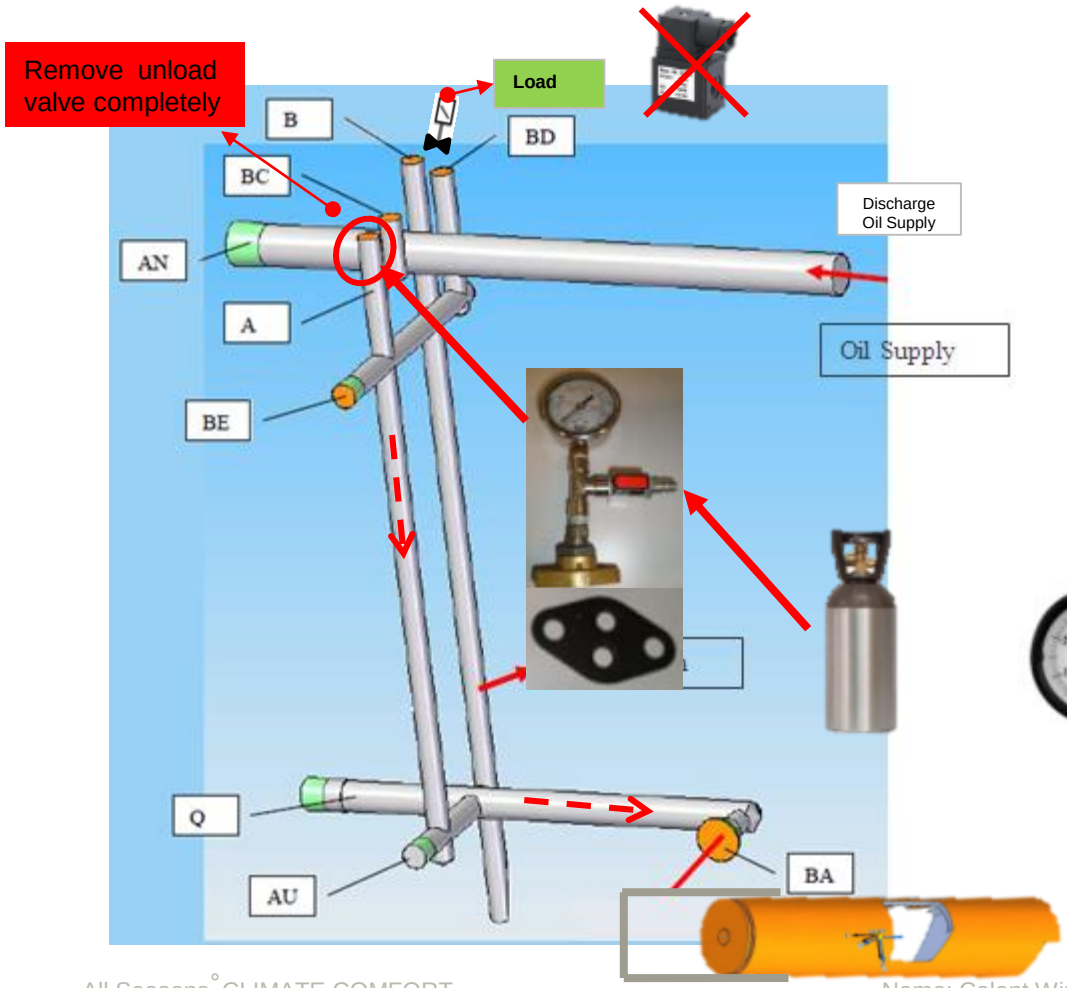
! Max 6 bar

Verify movement

F4/F3 series – assymetric

Field test – Test 2 – checking slide valve movement + pressure test

ONLY valid for On/OFF slide !



2

Pressure test

- Remove the coil from the load valve
- Remove unload valve completely
- Mount the special plate with manometer on the unload position
- **Mark on plate of solenoide MUST be opposite to the mark on compressor!**
- Add nitrogen pressure via manometer in hole A

Pressurise to 6 bar for one minute, pressure loss not more than 1 bar

Glyd ring may be leaking, detailed pressure “test 3” needed !

F4/F3 series – assymetric

Workshop test – Test 3

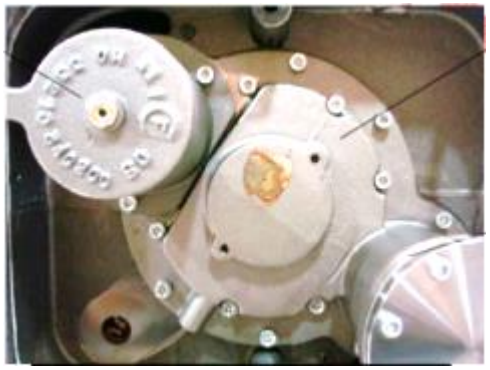
1. Remove oil from compressor
2. Oil separator to be removed from compressor
3. Depending on model a baffle plate may be present (remove it)
4. Perform similar pressure as test 2, pressure test as explained for modulating slide and on of slide.
5. Locate leaks on main bearing plate or capacity cylinders

1

2

3

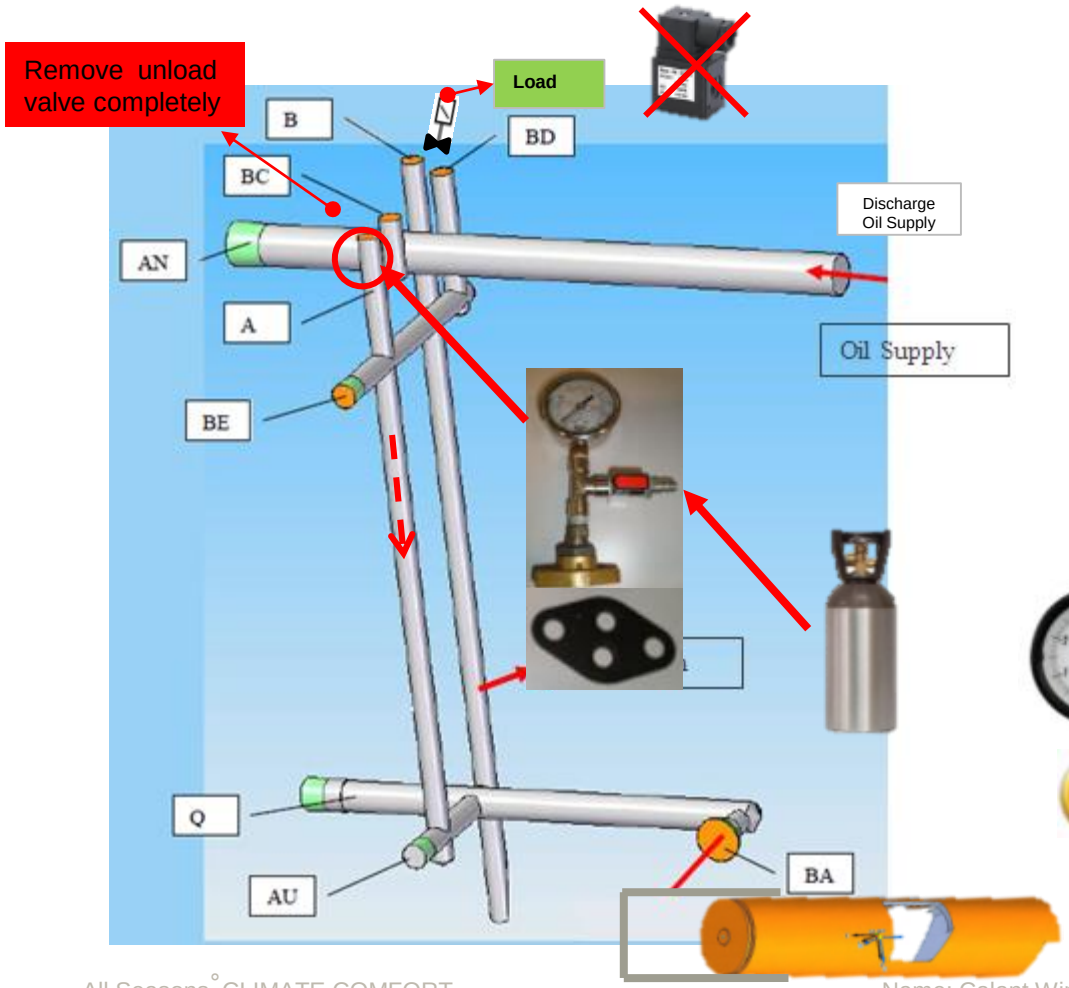
4/5



F4/F3 series – assymetric

Workshop test – Test 3 – pressure test – oil separator removed

ONLY valid for On/OFF slide !



Pressure test

- Remove the coil from the load valve
- Remove unload valve completely
- Mount the special plate with manometer on the unload position
- **Mark on plate of solenoide MUST be opposite to the mark on compressor!**
- Add nitrogen pressure via manometer in hole A

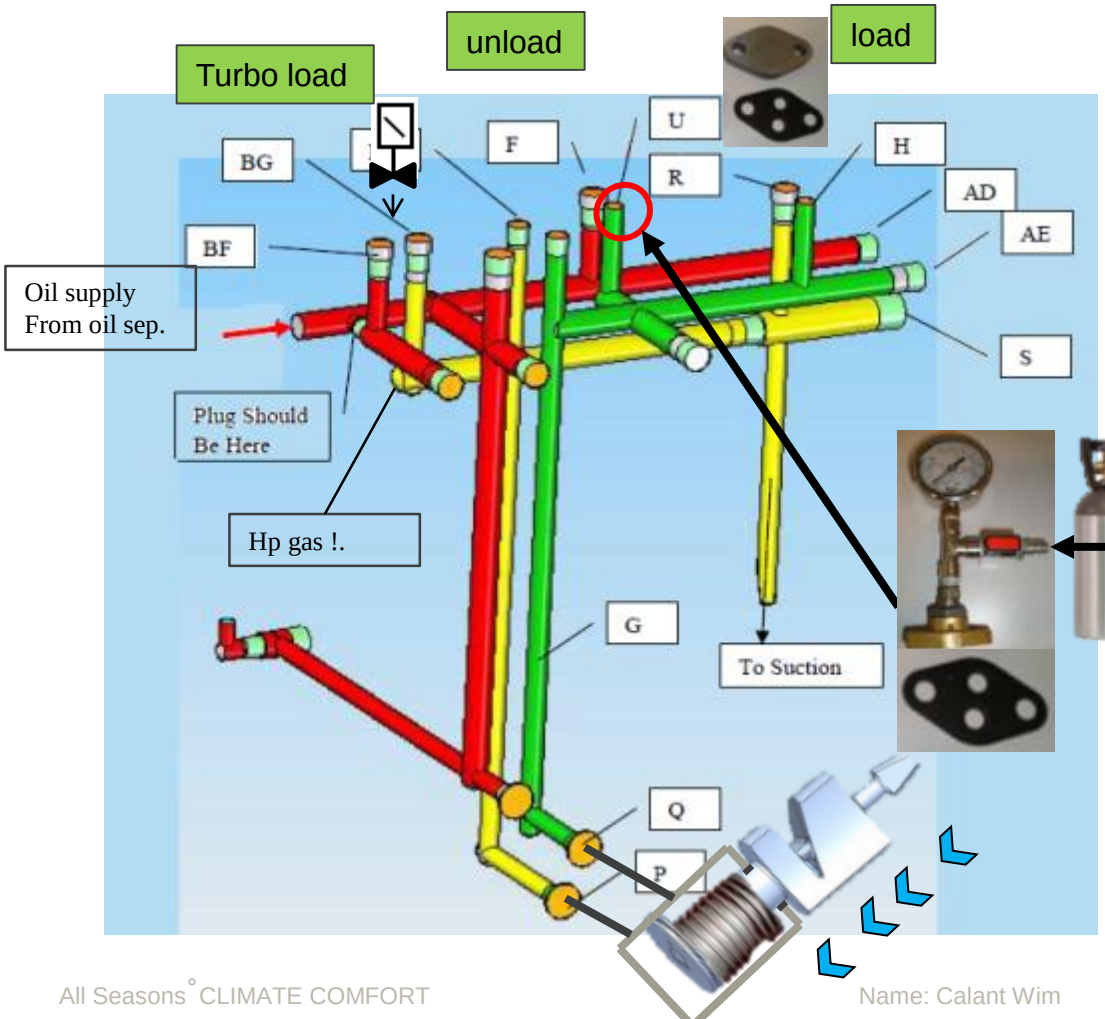
Pressurise to 6 bar for one minute, pressure loss not more than 1 bar

Inspect different sensible locations, cylinder covers, mean bearing plate, O-rings behind mean bearing plate, Glyd rings

F4/F3 series – assymetric

Workshop – Test 3 – pressure test – oil separator removed

ONLY valid for modulating slide !



Pressure test

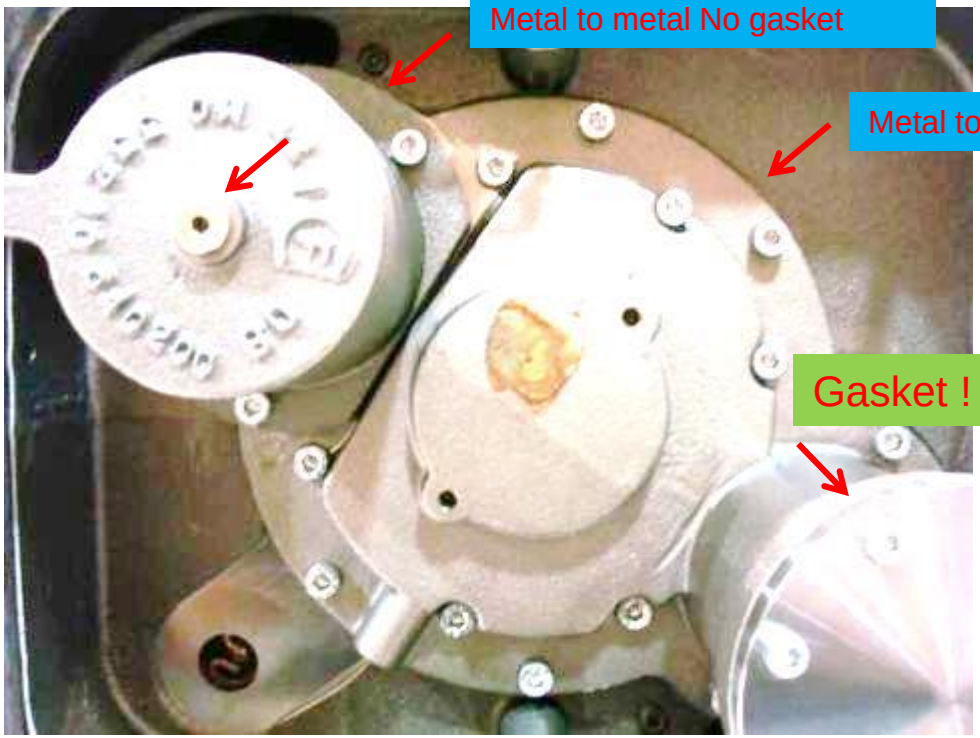
- Remove load valve, install blank
- Turbo load can be re mounted or stay open.
- Put blank plate on load position
- Remove unload valve
- Install manometer on unload position. **Mark on plate MUST be opposite to mark on compressor!**
- Add nitrogen pressure via manometer in hole U.

Pressurise to 6 bar for one minute, pressure loss not more than 1 bar

Inspect different sensible locations, cylinder covers, mean bearing plate, O-rings behind mean bearing plate, Glyd rings.

F4/F3 series – assymetric

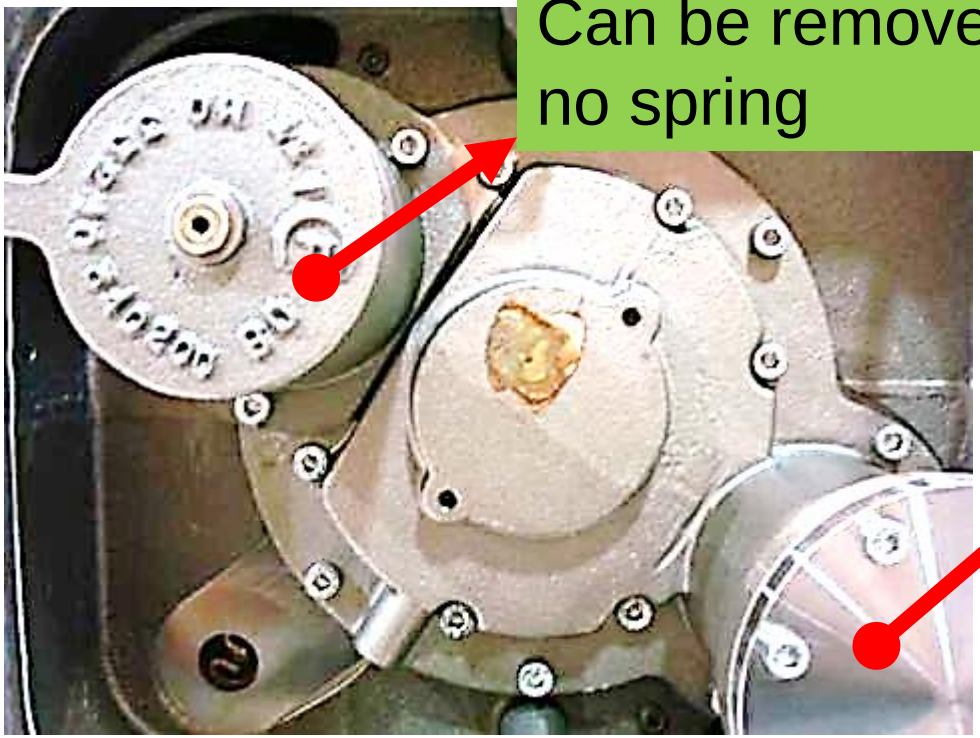
1. Workshop test – Test 3 – pressure test – oil separator removed
    1. Visualy check for leaks with leak tester spray, while being under pressure test



F4/F3 series – assymetric

Workshop test – Test 3 – pressure test – oil separator removed

Control of Glyd ring of ON/OFF slide only



Can be remove savely – no spring

Do not remove cylinder cover modulating spring – high spring force - energy present!

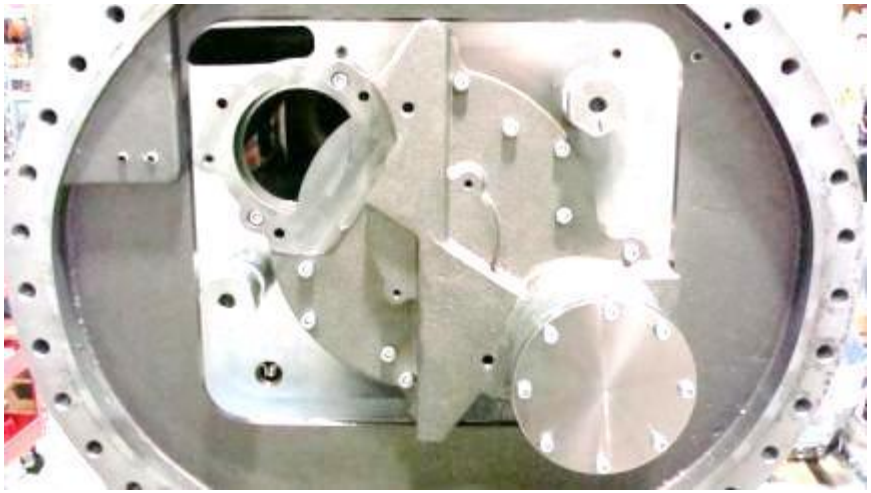
F4/F3 series – assymetric

Workshop test – Test 3 – pressure test – oil separator removed

Control of Glyd ring of ON/OFF slide only

Remove cylinder cover On/Off slide

Remove On/Off slide

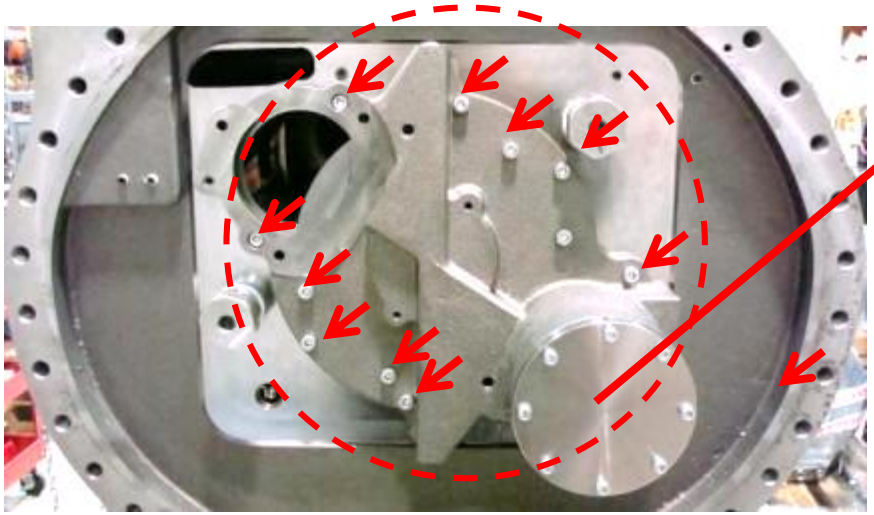


Inspect the Glyd ring/O ring or replace if damage found

F4/F3 series – assymetric

Workshop test – Test 3 – pressure test – oil separator removed

Control of Glyd ring modulating slide only



Very strong spring – Special procedure !!!

Remove first, the complete bearing plate

F4/F3 series – assymetric

Workshop test – Test 3 – pressure test – oil separator removed

Control of Glyd ring **modulating slide** – dismanteling modulating slide

Remove two bolts

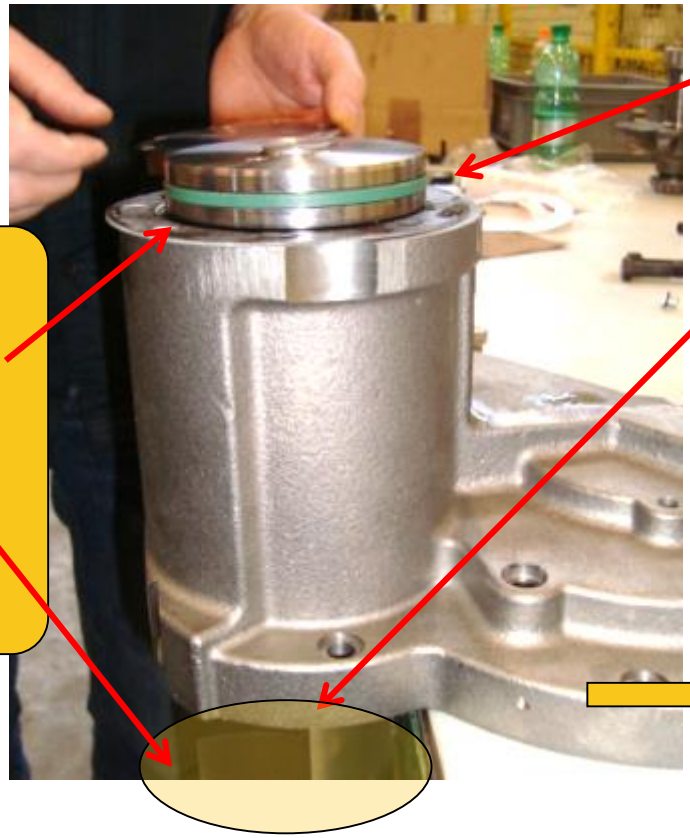
Replace the two bolts with two M6 thread studs.

Unscrew evenly until the cover can be removed

F4/F3 series – assymetric

Workshop test – Test 3 – pressure test – oil separator removed

Control of Glyd ring modulating slide – dismanteling modulating slide

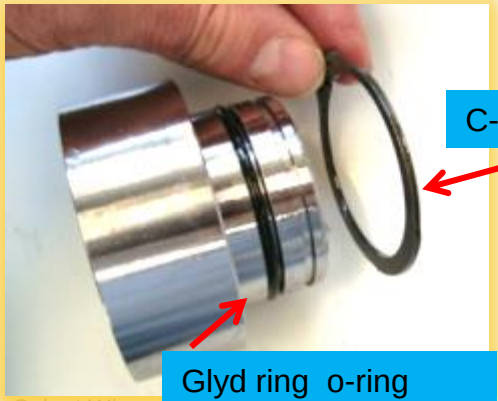


Two glyd rings

1 on top

1 on bottom

- At this point the glyd ring of the piston becomes visible and can be removed if needed,
- **If also the glyd ring at the bottom of the cylinder needs to be checked or replaced, we need to proceed with further dismanteling of the assembly,**



F4/F3 series – assymetric

Workshop test – Test 3 – pressure test – oil separator removed

Control of Glyd ring modulating slide – dismanteling modulating slide

Special tool needed “Hook and pin wrench, example from Facom

Using a set of spanners ,slightly loose the slide from the piston, DO NOT completely remove. Take care not to damage surface of the slide.

	Lengte mm	Capaciteit mm	g
117.B	245	20 - 100	530

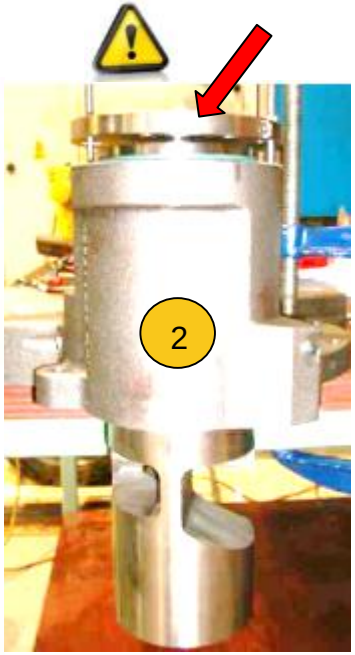
	Ø1 - Ø2 mm	g
117.E1	2,5 - 4	16
117.E2	6 - 8	24
117.E3	3 - 5	17
117.E4	7 - 9	27

F4/F3 series – assymetric

Workshop test – Test 3 – pressure test – oil separator removed

Control of Glyd ring **modulating slide** – dismanteling modulating slide

Using a set of spanners slightly loose the slide from the piston, DO NOT completely remove. Take care not to damage surface of the slide.



Re screw the cover to the cylinder, to avoid spring is released !

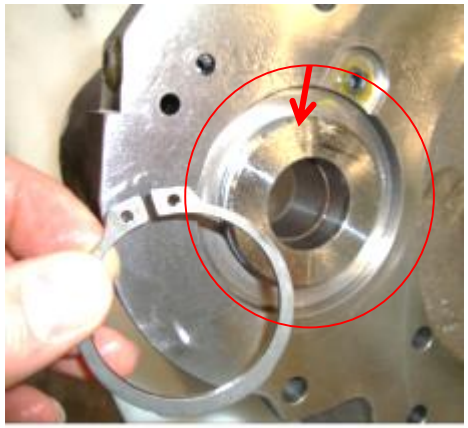
Now the slide can be removed competely by hand, by unscrew it from the piston

Un screw again the cover using long M6 thread studs until the spring will expand completely and can be removed safely,

F4/F3 series – assymetric

Workshop test – Test 3 – pressure test – oil separator removed

Control of Glyd ring **modulating slide** – dismanteling modulating slide



Remove the c-retainer

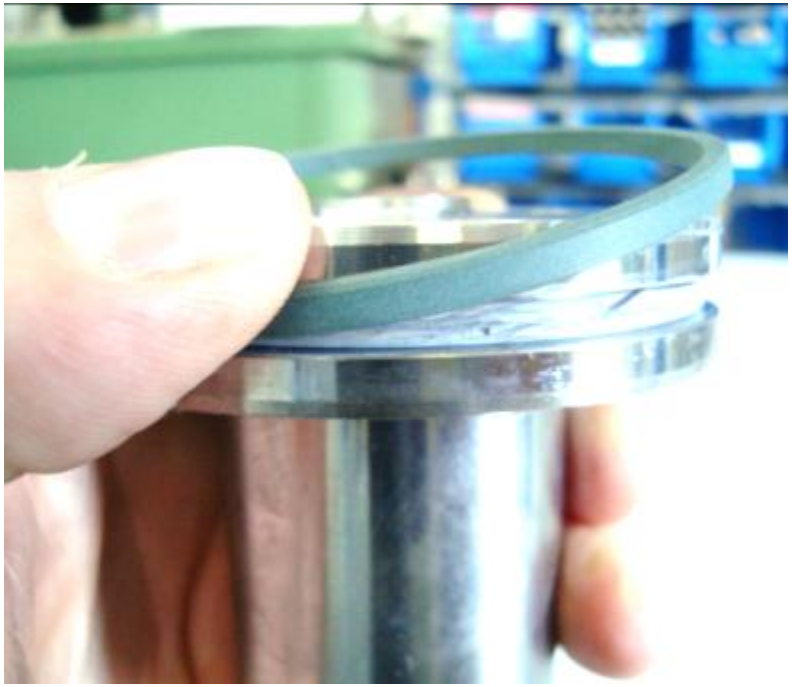
Steel bush can now be removed by hand or by using plastic hammer

Replace the glyd ring and corresponding O-ring,

F4/F3 series – assymetric

Workshop test – Test 3 – pressure test – oil separator removed

Control of Glyd ring **modulating slide** – dismanteling modulating slide



Check the Glyd ring and O-ring for damage.

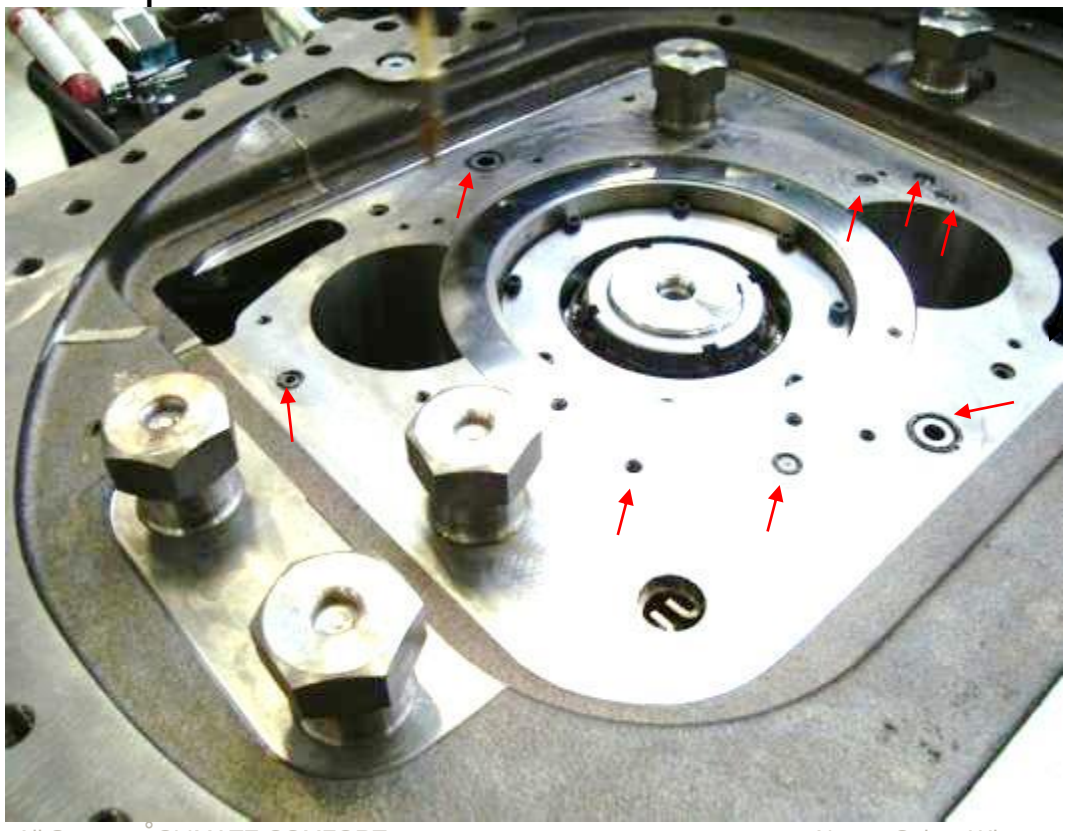
Apply Loctite 275 or equivalent on the threads of the cover plate

Re assemble the modulating slide components in opposite order

F4/F3 series – assymetric

Workshop test – Test 3 – pressure test – oil separator removed

Before re mounting the mean bearing plate – O-rings for oil supply should be checked on the compressor casing as they could be the origin of pressure loss.



Extra maintenance actions specific parts

All models

Information availabele – service manuals for 3100/3200,4200, F4/F4 under construction!

All models

Mc Quay recommended maintenance schedule

Frame 4 and Frame 3200 & Frame 3100 Screw Compressor Recommended Service Requirements

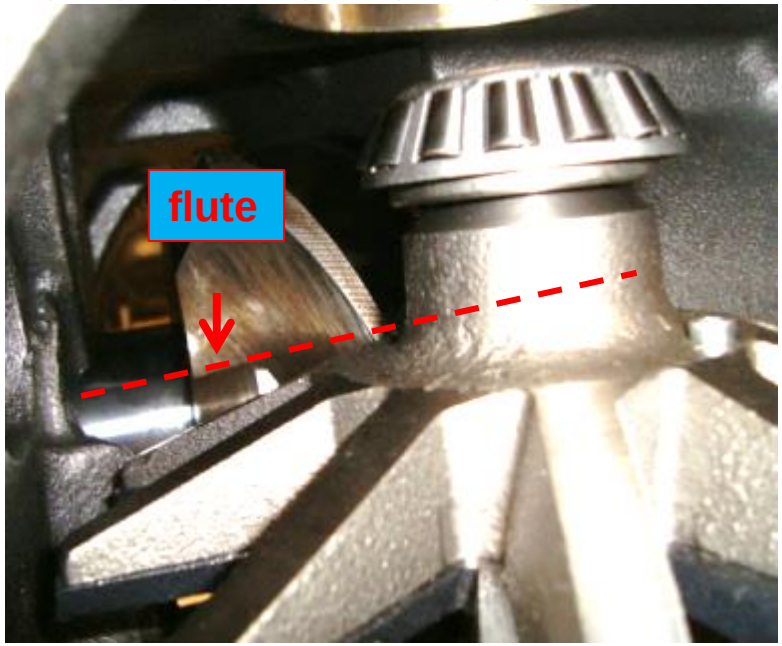
Component	Service Detail	Service Interval
Oil	Check level of oil in oil separator & for oil leakage from the system	Weekly
Refrigerant	Check for loss of refrigerant and check moisture indicators	Weekly
Capacity control	Check for correct operation of unloading gear.	Quarterly
Oil Filter	Check the presssure drop through the oil filter	Quarterly
System	Check & record system temperatures, pressures and flow rates.	Quarterly
Contactors	Check condition of motor starter contactors	Quarterly
Safety Cutout	Check operation of all safety cutouts	Annual
Oil Charge	Check the condition of the oil charge using suitable analysis	Annual
Refrigerant Charge	Check for loss of Refrigerant/Add charge as required	Annual
Liquid Filter Drier	Check pressure drop/ clean or replace if required	Annual
Compressor Oil Filter	Replace Oil Filter	Annual
Compressor Mounting	Check tightness of holding down bolts	Annual
Suction Strainer	Inspect and Clean	25,000 Hrs
Gaterotors	Examine for wear, replace if required.	25,000 Hrs
Gaterotor bearings	Examine for wear, replace if required.	25,000 Hrs
Gaterotors	Replace	100,000 Hrs
Gaterotor Bearings	Replace bearings	100,000 Hrs
Main Bearings	Replace bearings	100,000 Hrs
Compressor Seals	Replace seals	100,000 Hrs

Depending local fgas reglementation

Weekly activities may be undertaken by suitable trained site personnel.
All other activities must be undertaken by fully qualified refrigeration/air conditioning engineers.

Gate rotor assembly – gate rotor bearings

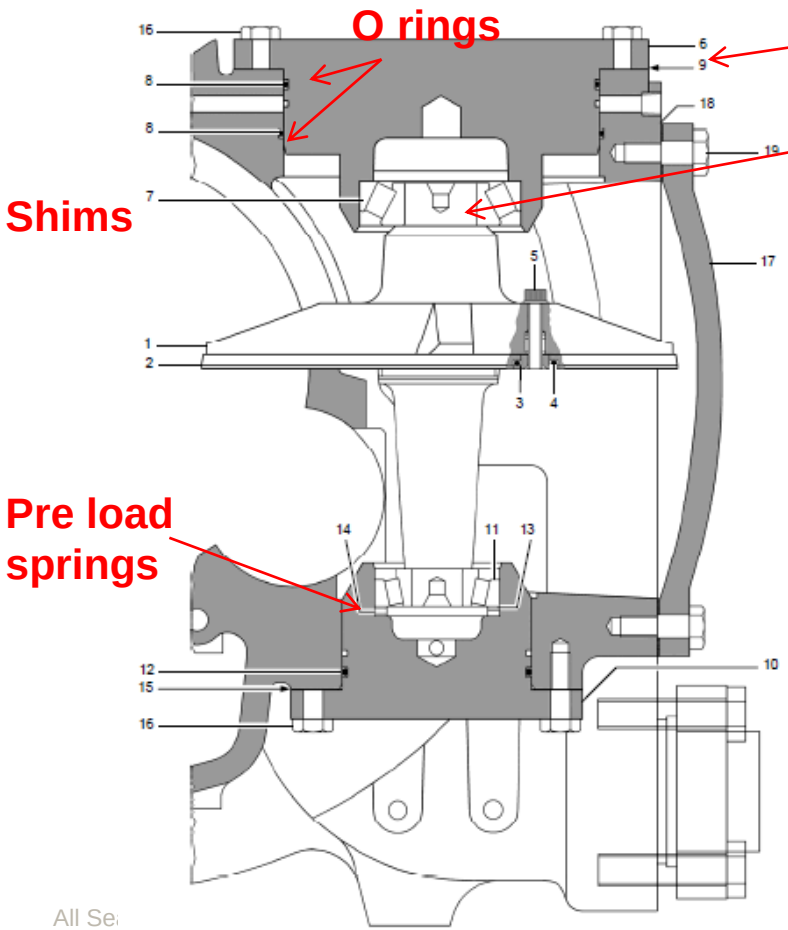
All models: in order to remove/mount the satelittes shaft, without damage, the satellite must be positioned in *one* particular way towards the main screw!



- The screw is positioned (by hand) so satelitte finger is starting to get engaged in the first flute of the screw!

Gate rotor assembly – gate rotor bearings

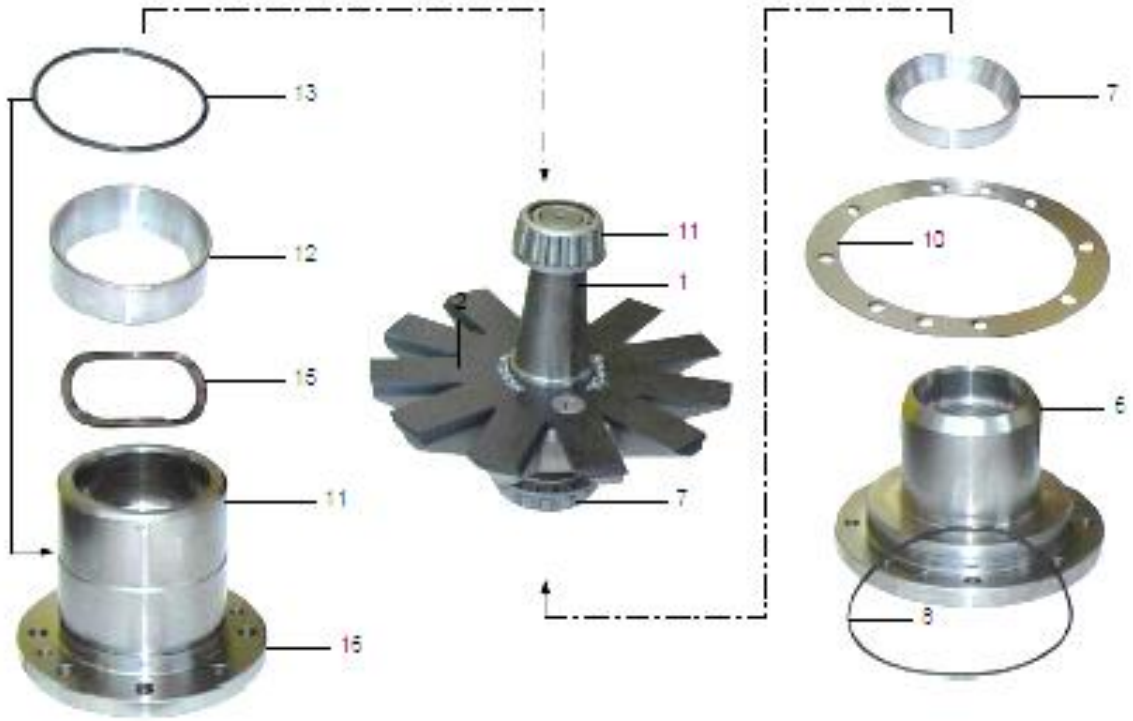
All models: McQuay uses more or less same principle of gate rotor design on all compressors.



- Taper roller bearings used
- Preload of the bearings is automactically performed with springs, on the side of the smaller bearing
- Shims are on the side of the biggest bearing (except 3200 both sides).
- O-rings are used to seal the bearing holder.

Gate rotor assembly – gate rotor bearings

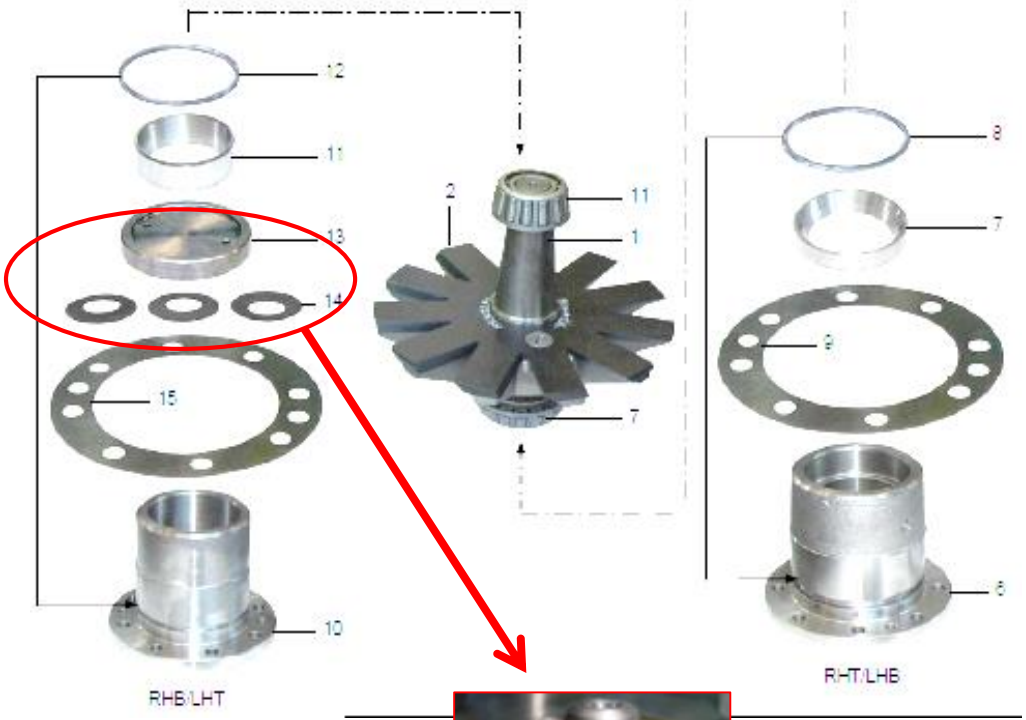
1. 3100



1	Star backing	
2	Star rotor	
3	Star locating pin	
4	'O' ring 15.54 OD x 2.62 section – star locating pin	
5	M5 x 35 socket head capscrew – star locating pin	
6	Star bearing housing	LBH
7	Taper roller bearing	LBH
8	'O' ring 142.47 OD x 3.53 section - housing to casing	LBH
9	M10 x 30 capscrew – star bearing housing	LBH
10	Shim(s)	LBH
11	Star bearing housing	SBH
12	Taper roller bearing	SBH
13	'O' ring 72.62 OD x 3.53 section – housing to casing	SBH
14	M8 x 25 capscrew – star bearing housing	SBH
15	Pre-load spring washer	SBH
16	Shim(s)	SBH
17	Top cover	
18	Gasket – top cover to casing	
19	M12 x 45 capscrew – top cover	

Gate rotor assembly – gate rotor bearings

1. 3200

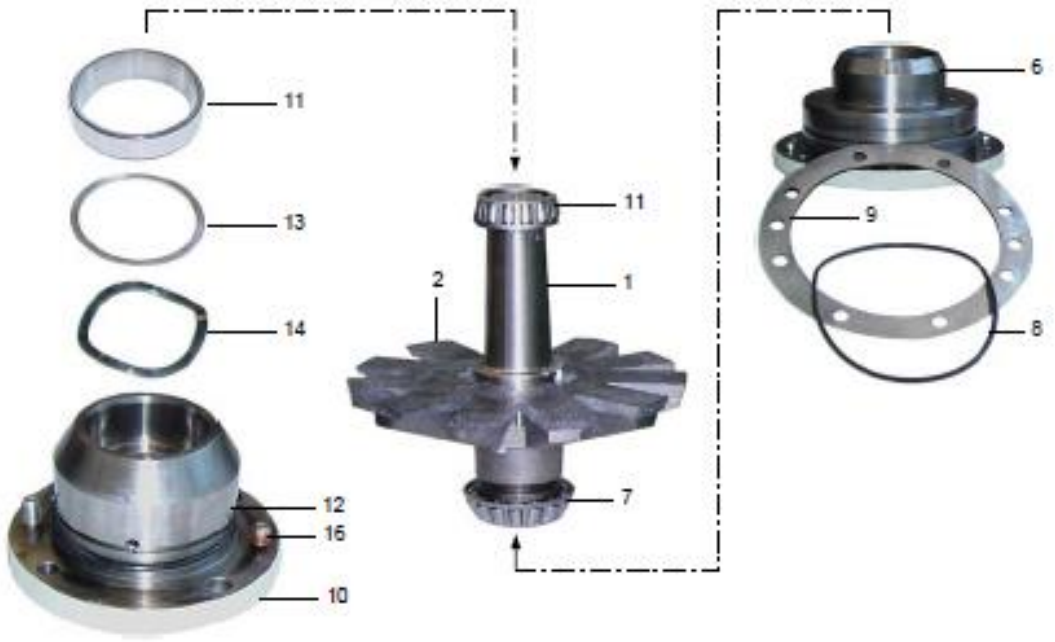


Pre load springs

1	Star backing	
2	Star rotor	
3	Star locating pin	
4	'O' ring 15.54 OD x 2.62 section – star locating pin	
5	M5 x 30 socket head capscrew – star locating pin	
6	Star bearing housing	RHT/LHB
7	Taper roller bearing	
8	'O' ring 84.3 OD x 5.7 section - housing to casing	
9	Shim(s)	
10	Star bearing housing	RHB/LHT
11	Taper roller bearing	
12	'O' ring 74.5 OD x 3.0 section – housing to casing	
13	Bearing pressure plate	
14	Pre-load spring washers (3 off)	
15	Shim(s)	
16	M8 x 25 capscrew – star bearing housing	

Gate rotor assembly – gate rotor bearings

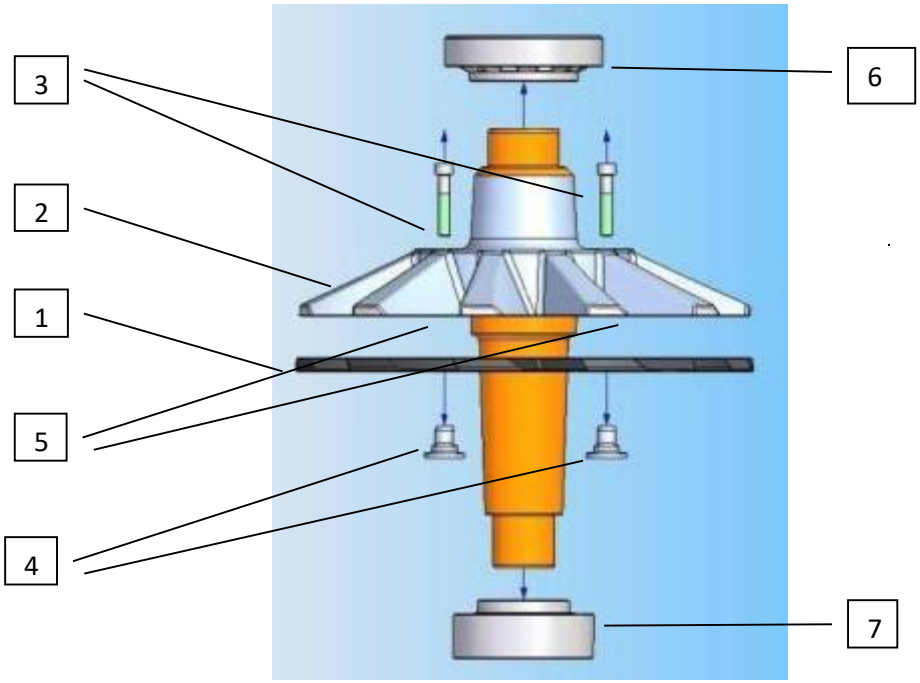
1. 4200

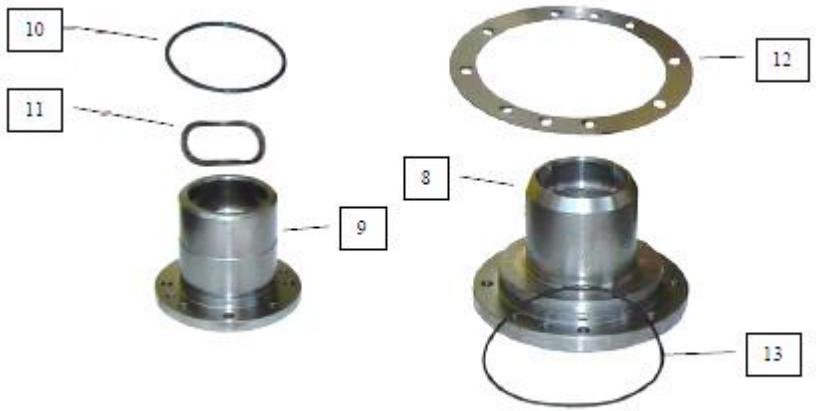


1	Star backing	
2	Star rotor	
3	Star locating pin	
4	'O' ring – star locating pin	
5	Capscrew – star locating pin	
6	Star bearing housing	RHT/LHB
7	Taper roller bearing	
8	'O' ring(s) – star bearing housing to casing; refer to Fig 6	
9	Shim(s)	
10	Star bearing housing	RHB/LHT
11	Taper roller bearing	
12	'O' ring(s) – star bearing housing to casing; refer to Fig 6	
13	Spacer	
14	Pre-load spring washer	
15	Shim(s)	
16	M10 x 30 hex head screw – star bearing housings	
17	Side cover	
18	Gasket – side cover to casing	
19	M12 x 35 hex head screw – side cover	

Gate rotor assembly – gate rotor bearings

1. F4/F3





	Part		Part
1	Gate Rotor	10	O-Ring – 88.5x3.5
2	Gate Backing	11	Pre-Load Spring Washer
3	M6 Bolts	12	Shims
4	Gate Locating Pin	13	O-Ring -164.7x3.5
5	O-Ring – 18.7x2.6	14	Side Cover Plate
6	Taper Roller Bearing	15	Side Cover Gasket
7	Taper Roller Bearing	16	M8 Bolts
8	Large Bearing Housing Cover	17	M10 Bolts
9	Small Bearing Housing Cover		

Gate rotor assembly – gate rotor bearings

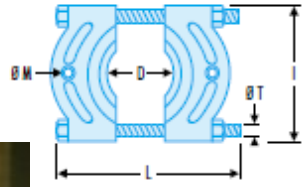
1. Bearings can easily be removed by use of proper bearing puller.

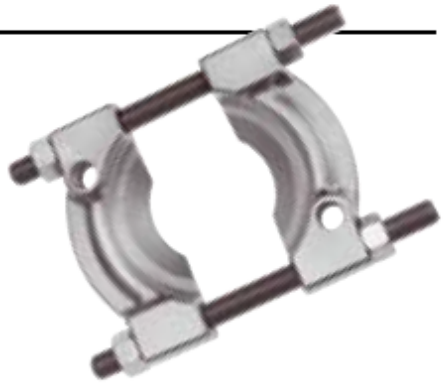
Gate rotor assembly – gate rotor bearings

1. Bearings can easily be removed by use of proper bearing puller. ➔ better version of extractor !

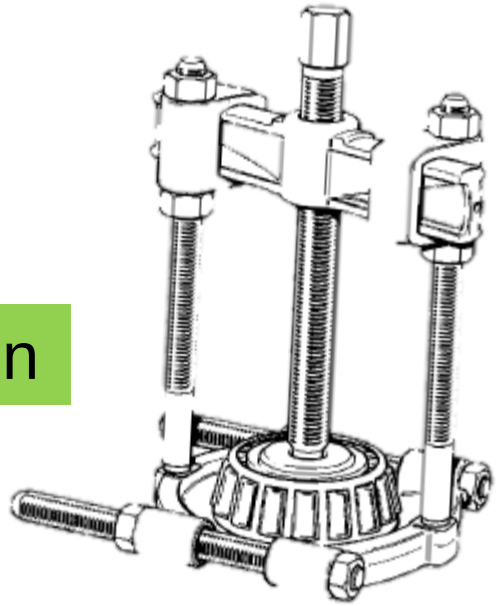
U.53T Décolleurs

	D mini - maxi mm	L mm	l mm	Ø T mm	Ø M mm	Pour		Δ kg
U.53T1	5-60	140	91	M12	M10	U.53K1	-	0,6
U.53T2	15-110	215	153	M16	M16	U.53K2	U.53S2A	2,3
U.53T3	15-150	290	204	M20	M20	U.53K3	-	5,1
U.53T4	20-180	360	289	M22	M22	U.53K4	U.53S4A	8,8
U.53T5	25-250	430	316	M22	M22	U.53K4	U.53S4A	11,3





Better option



Gate rotor assembly – gate rotor bearings

1. Inner race of the bearing can normally be removed by hand.

Normally you can remove by hand!

alternative

Extracteur pour prise intérieure

U.51B

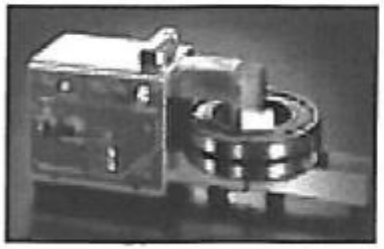
- Capacité : Ø 32 mm à 70 mm.
- Auxiliaires d'extraction adaptable = potence U.40 ou potence U.30.
- Livré avec 15 embouts.
- Livré en coffret plastique BP.109 avec plateau PL.710.

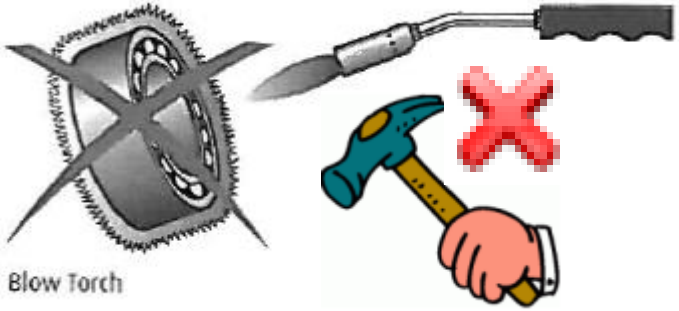
ΔΔ : 3,4 kg.

Gate rotor assembly – gate rotor bearings

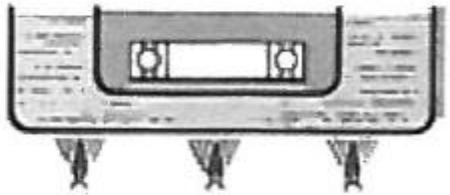
1. Remounting of bearings – shrink fit !
    1. Factory uses hydraulic press, in the field it's adviced to heat up the bearing.

Bearing Heater

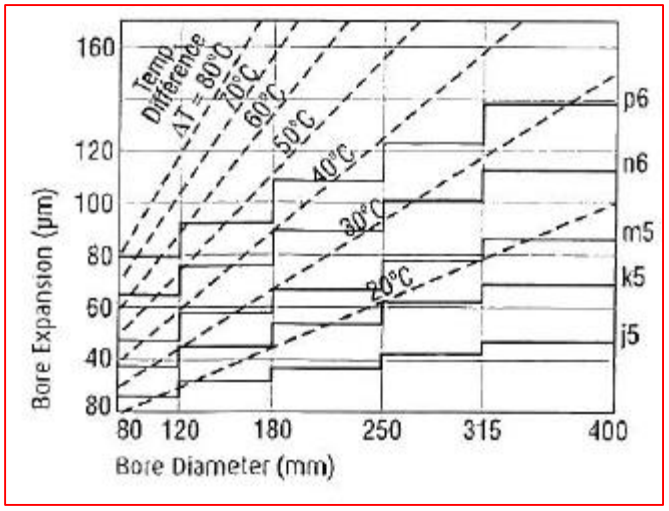




Heating Bearing in Oil



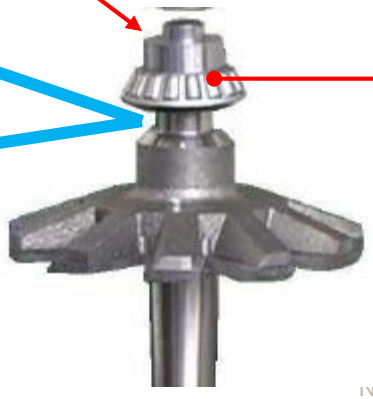
Alternative from SKF controlled temp = avoid bearing damage



Gate rotor assembly – gate rotor bearings

1. Remounting of bearings (shrink fit !!!)

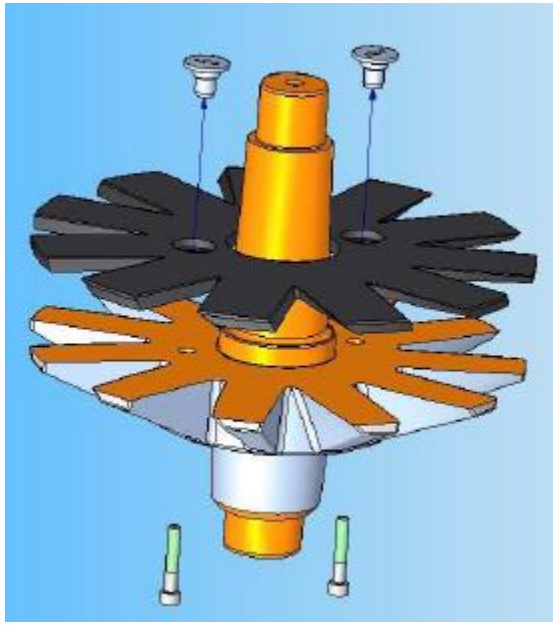
Old bearing inner ring can be used as proper “pressing tool” by cutting it with a grinder first = becomes elastic,



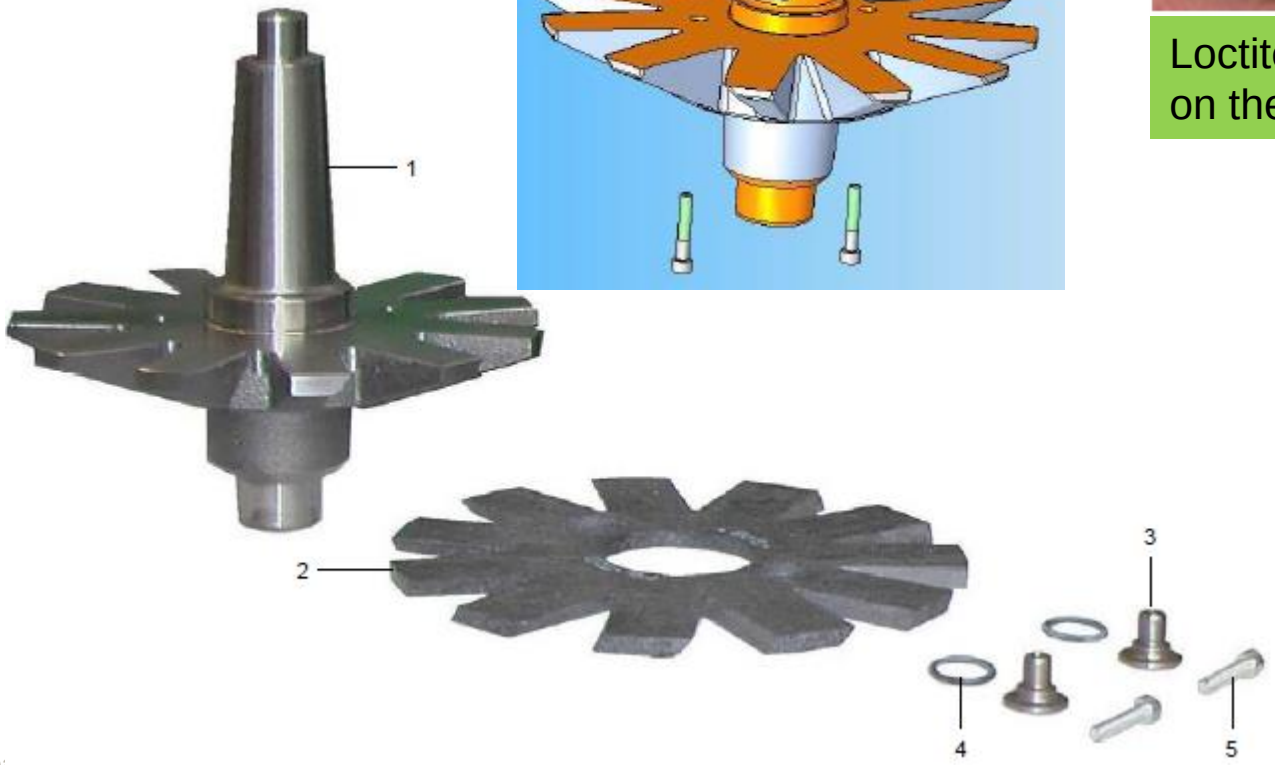
- New bearing, before mounting heat to 80° C
- Cooling down the satelitte shaft with eg ice spray helps for easy bearing mounting without force !

Gate rotor assembly – satelitte

1. All models



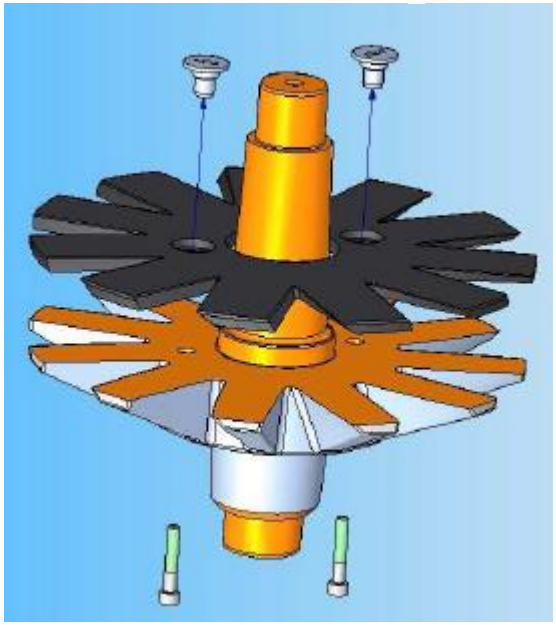
Loctite 275 should be used on the fixation screws

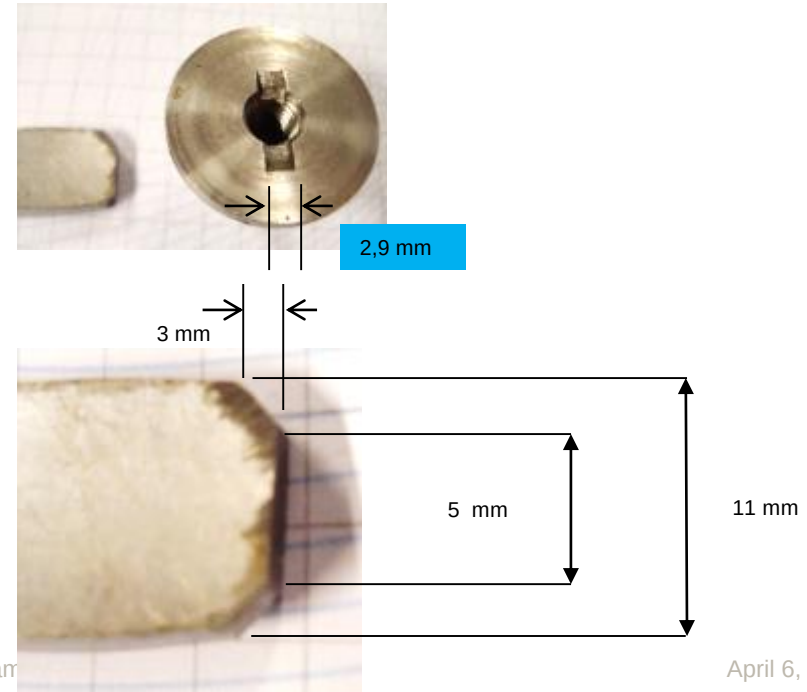


Gate rotor assembly – satelitte

1. All models

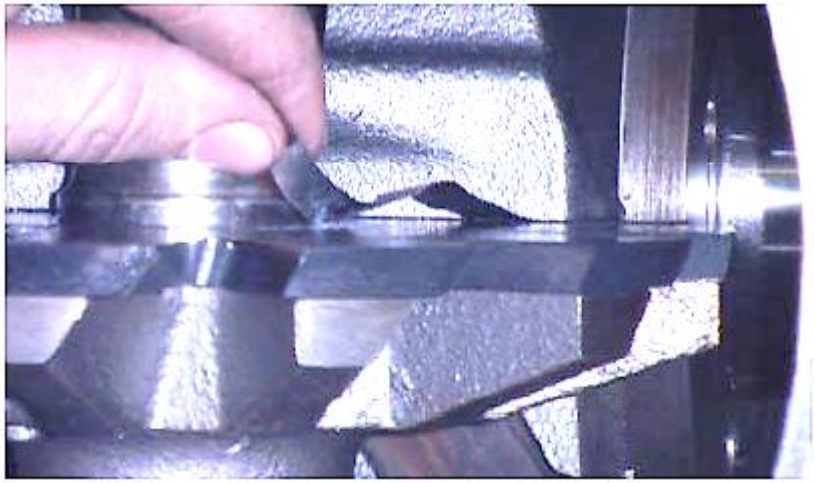
- As Loctite 275 has been used during production, the glue joint should first be broken by means of an accurate flame pointed on the M5 Bolt/ star locating pin
- For unscrewing the locating pin, a special shape “screw driver is needed





Gate rotor assembly – gate rotor clearance

1. Gate rotor Lip clearance. This is checked with feeler gauges, between lip and satellite material. When correct clearance is set by the shims, the feeler gauge can be pulled out by minimal force

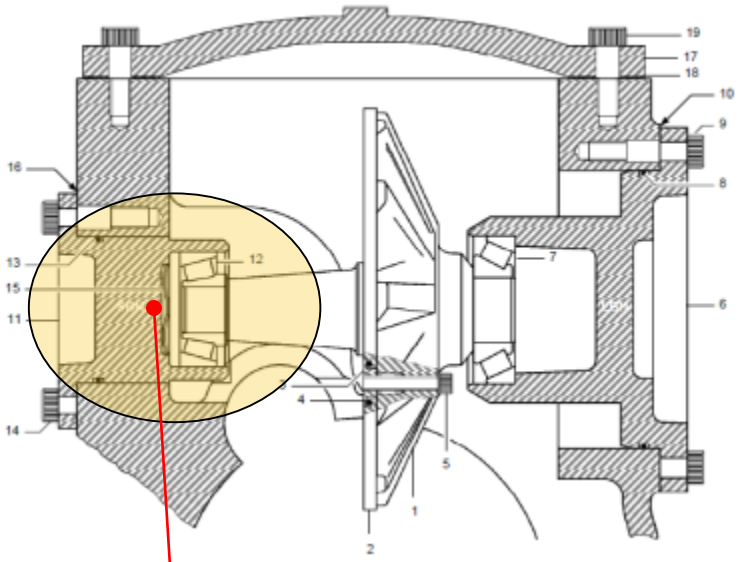


Lip clearance	Min (mm)	Max (mm)
3100	0.005	0.04
3200	0.005	0.04
4200	0.025	0.05
F4/F3	0.005	0.04

Gate rotor assembly – gate rotor clearance

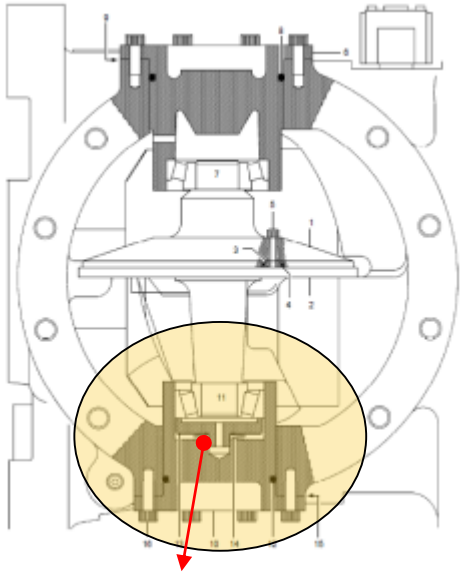
1. Gate rotor Lip clearances -**remark for 3200 compressor different pre load springs are used!**

3100/4200/F4/F3



Pre load spring

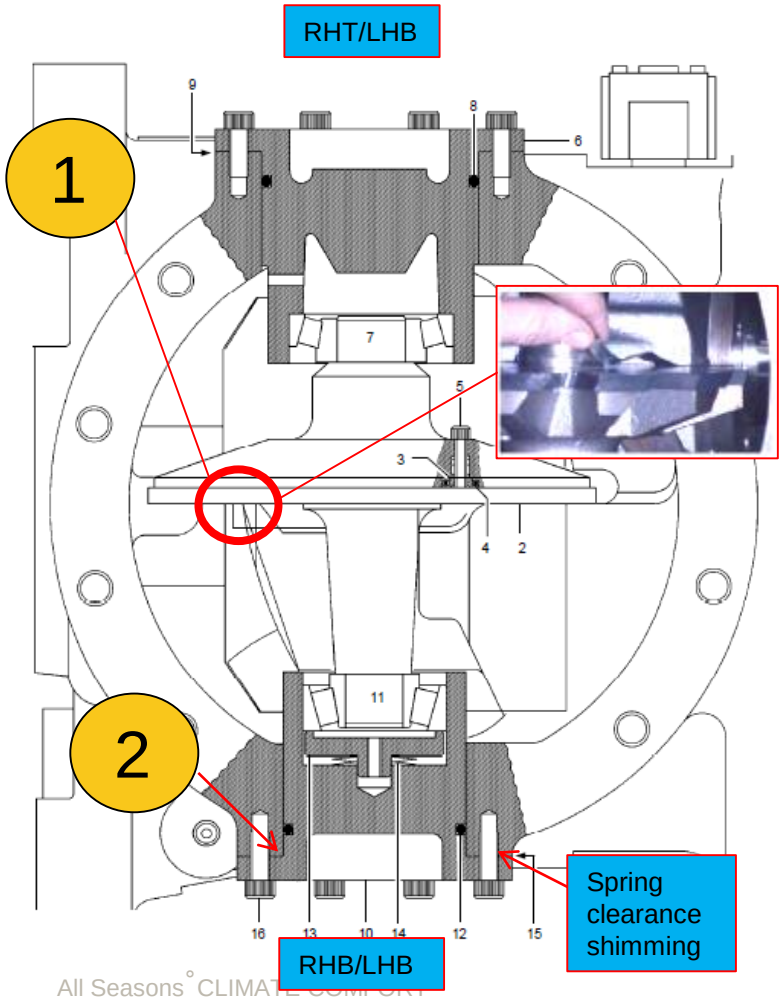
3200



Pre load spring washers

Gate rotor assembly – gate rotor clearance

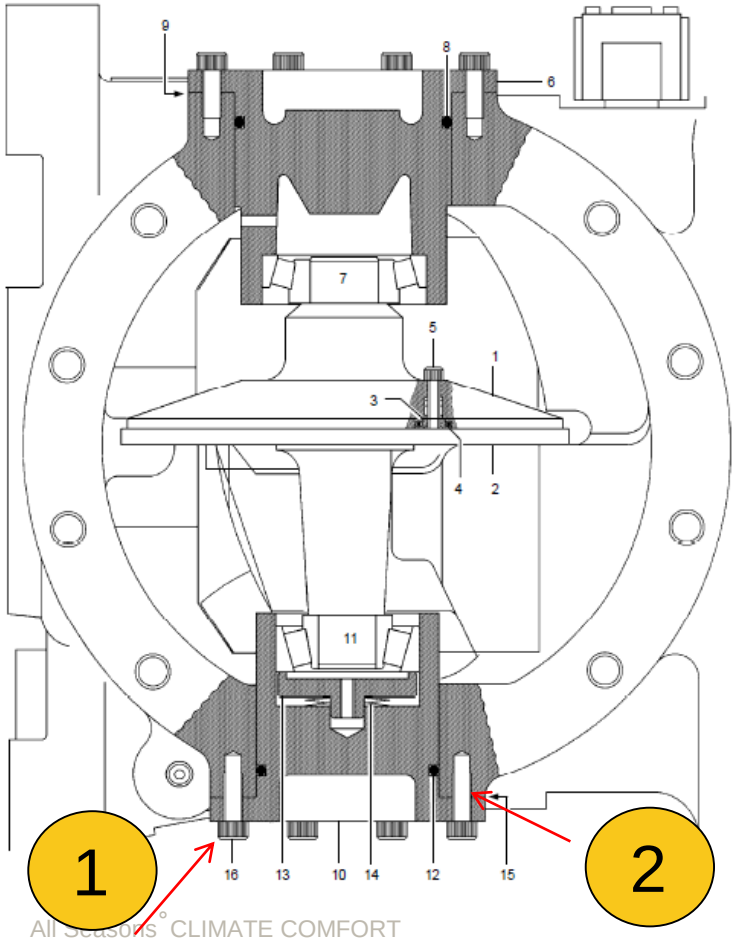
1. Gate rotor Lip clearance. Remark for 3200 compressor



1. As 3200 has different type of pre load washers, therefore there is also shimming needed at the RHB/LHB bearing holder. In order to achieve the correct lip clearance and spring force a slightly different apporach is needed. Don't install the O-rings yet at this time.
2. After establishing the correct gate rotor lip (> 0,04 > lip < ,005mm, the correct pre load of the bearing has to be checked,
3. checking the spring clearance : for this the bolts of the small bearingholder are loosened by hand, under spring pressure the holder will now be pushed out a little bit, fasten the screws again without pushing the bearing holder back, The clearance between the casing and bearing holder should now be minimum 0,75 mm, Add or remove shim's (under the small bearing cover) in order to achieve the 0,75mm, this will allow correct spring force

Gate rotor assembly – gate rotor clearance

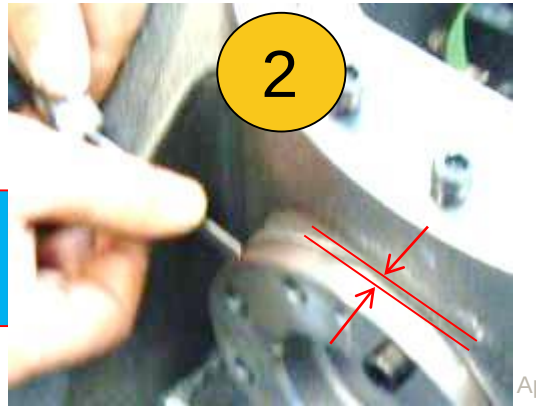
Gate rotor Lip clearance. Remark for 3200 compressor

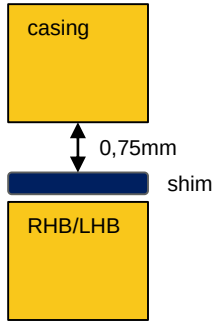


checking the spring clearance :

1) for this the bolts of the small bearingholder are loosened by hand, under spring pressure the holder will now be pushed out a little bit, fasten the screws again without pushing the bearing holder back,
2) The clearance between the casing and bearing holder should now be minimum 0,75 mm, Add or remove shim's (under the small bearing cover) in order to achieve the **0,75mm**, this will allow correct spring force

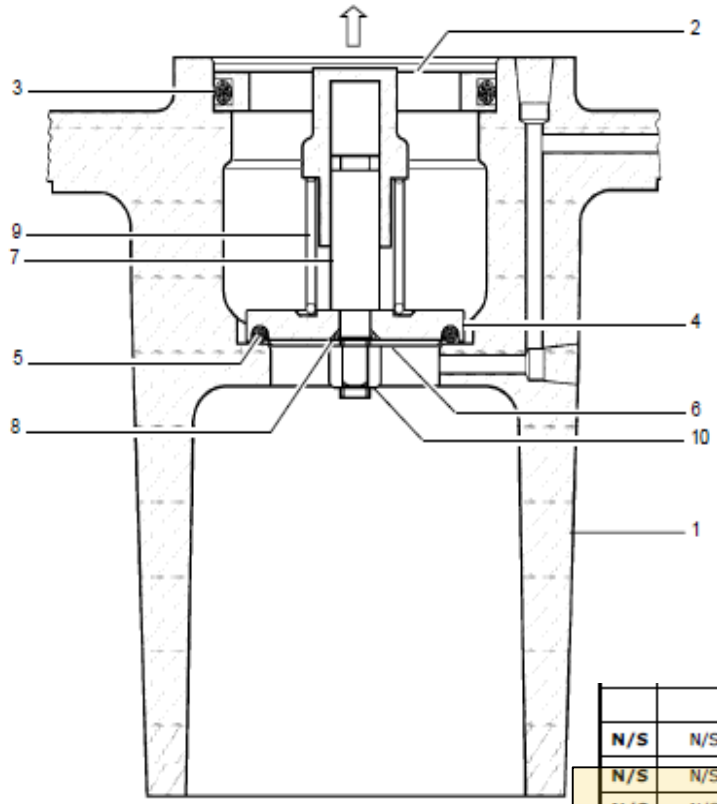
Min 0,75 mm needed for spring clearance





Replacement non return valves

1. 3100/3200 – valve parts



1	Oil separator cover	
2	Support	
3	'O' ring 78.97 x 3.53 section – support	
4	Valve plate	
5	'O' ring 53.34 x 5.33 section – valve plate	
6	Valve plate retainer	
7	Valve spindle	
8	'O' ring 9.25 x 1.78 section – valve spindle/plate retainer	
9	Spring	
10	M8 nut with nylon insert	

		Gasket, O-Ring and Shim Kits		
N/S	N/S	Motor Replacement Gasket & O-Ring Set	N33010065	95822-315
N/S	N/S	Oil Filter Replacement Gasket & O-Ring Set	N33010027	-
N/S	N/S	Discharge Check Valve Replacement Gasket & O-Ring Set	N33010066	95822-316
N/S	N/S	Economiser / Liquid Injection Gasket Set	N33010067	95822-317
N/S	N/S	Full Gasket & O-Ring Set	N33010068	-
N/S	N/S	Shim Set	N02260014	92847-301

Replacement/maintenance on non return valves

3100/3200 – valve parts

Valve in situ (oil separator

Remove the valve support

New O-ring has to be used

Remove spring

Remove spindle/plate

In order to separate spindle / plate, soft jaws can be used

Replacement/maintenance on non return valves

3100/3200 – valve parts

Unscrew M8 nut

Remove plate retainer

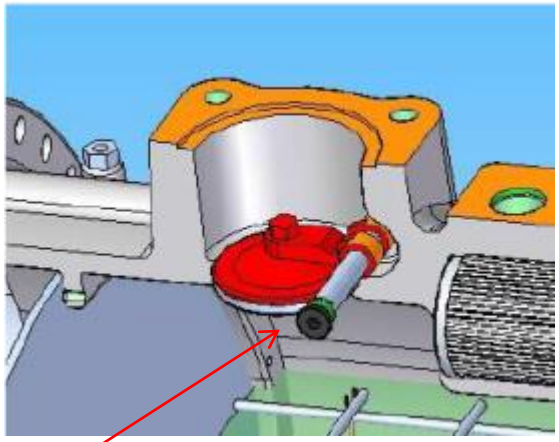
Renew the O-ring

Replace O-ring on spindle

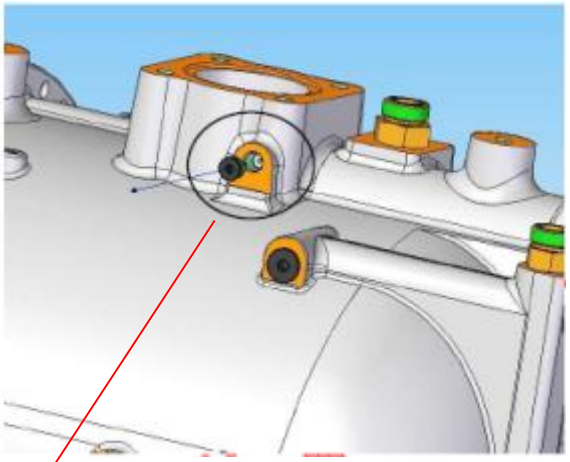
Re assemble in opposite order

Replacement/maintenance on non return valves

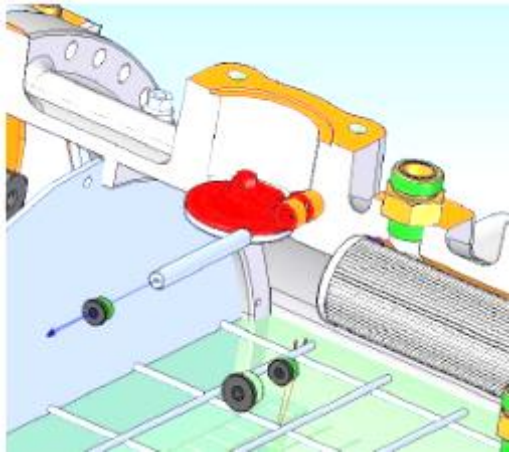
1. F4/F3

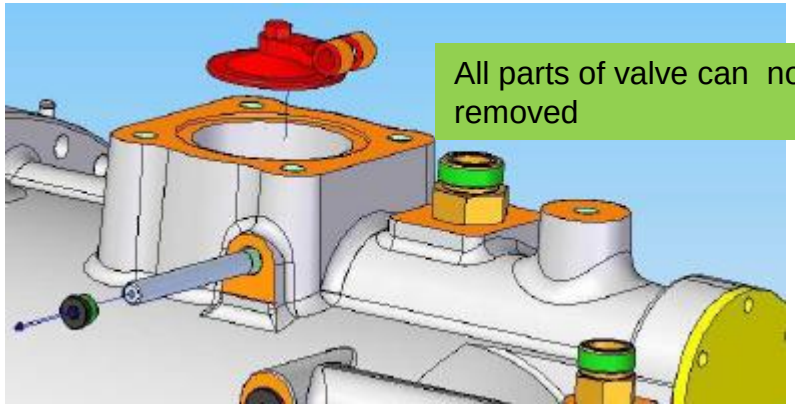


Remove plug



Use M6 bolt to extract the axle

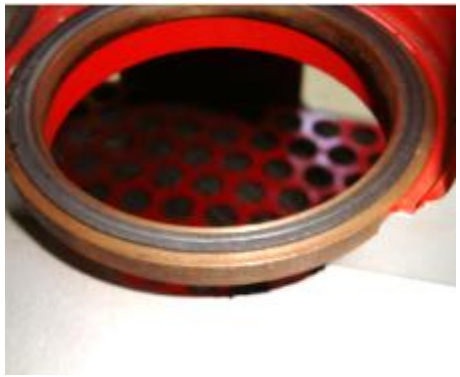


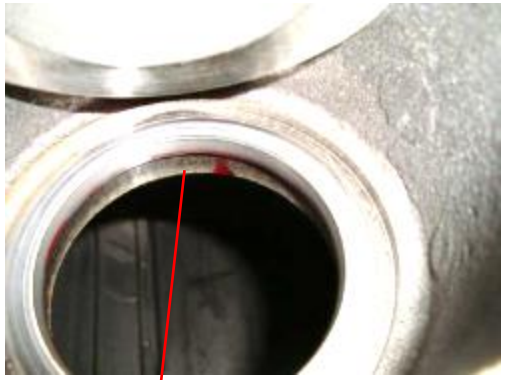


All parts of valve can now be removed

Replacement/maintenance on non return valves

F4/F3 - removal of sealing ring





Surface glued !

Use bearing puller to remove the ring – ring CANNOT be re-used

During production Loctite 554 is used to glue the ring towards oil separator surface – so local heating (250˚) may be needed to break the glue seal,
Always take into account the cure time of the glue!

European equivalent's

OR

Replacement non return valves

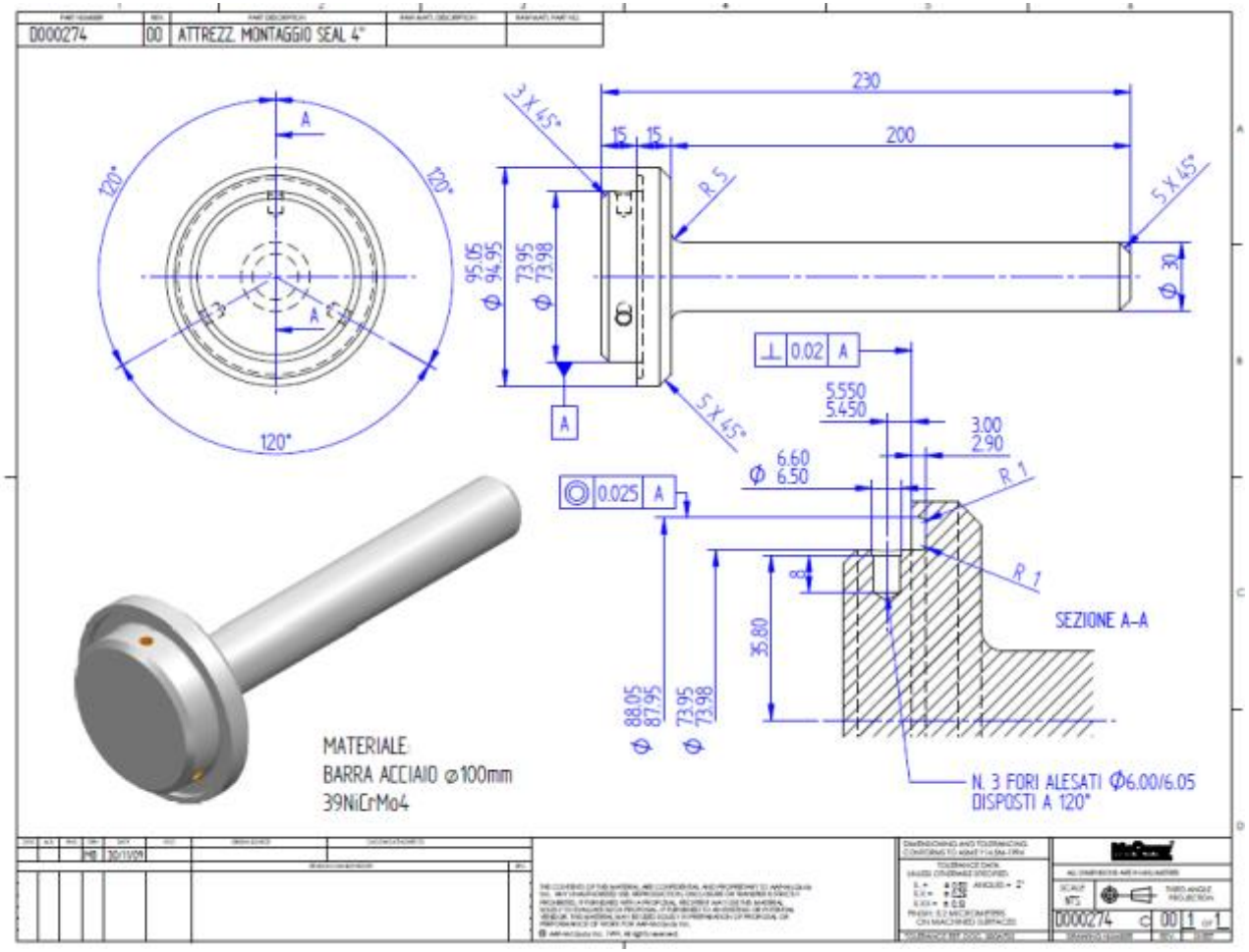
F4/F3 - install new sealing ring – special tooling needed

Use special mounting tool in order to avoid bending and thus damage of the seal ring

Any existing oil on the mounting surface must be removed prior to install new seal,

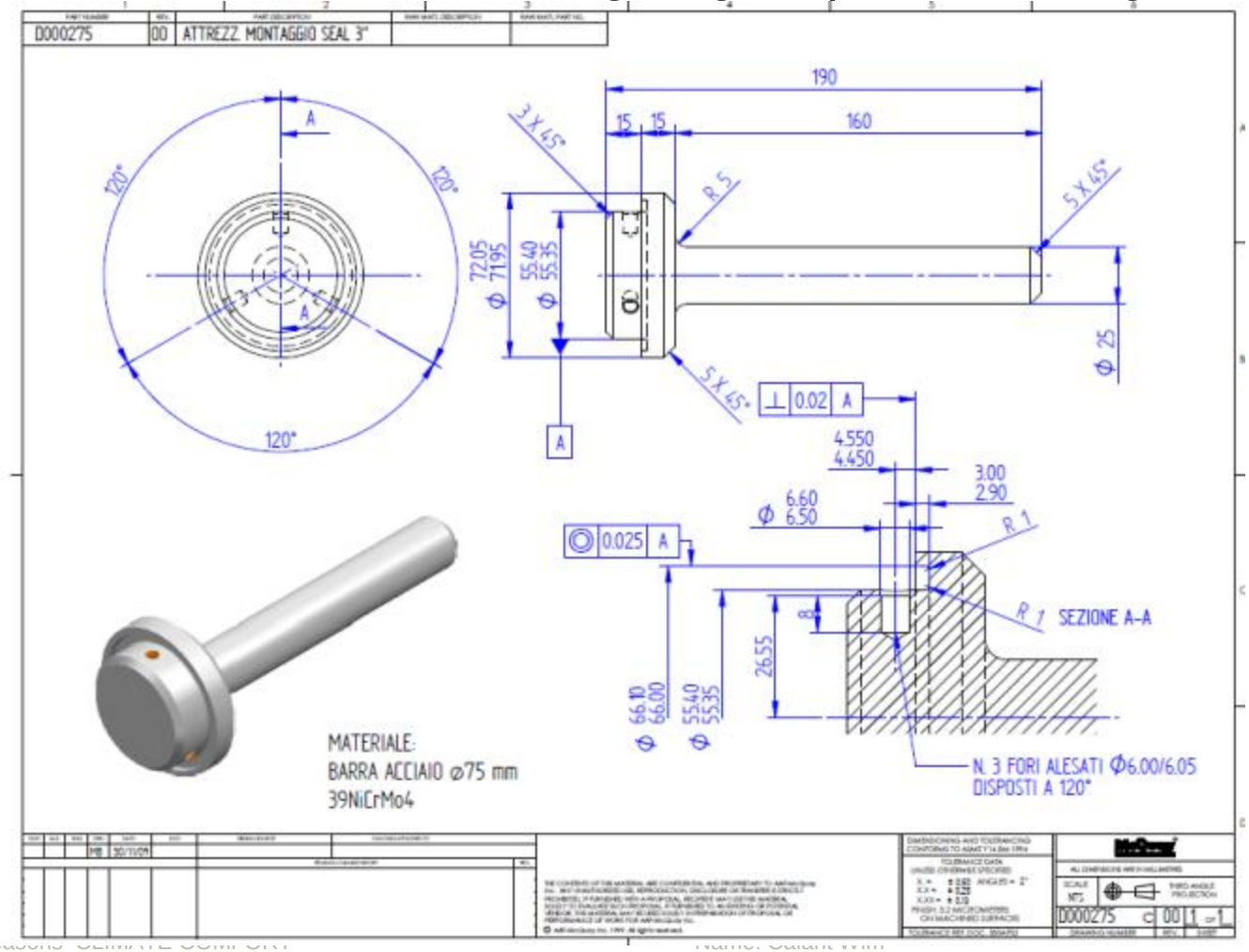
Replacement/maintenance on non return valves

F4/F3 - install new sealing ring – special tooling needed



Replacement/maintenance on non return valves

F4/F3 - install new sealing ring – special tooling needed



Torque values and oil quantities

F4/F3

bolt size	Nm
M5 (gate rotor F3A)	10
M6 (gate rotor F3B F4A)	15
M8 (power cables)	20
M8	35
M10	78
M12	148
M16	330

3100

Component					Fastening Size (mm)	Torque	
						Nm	Lbf ft
Common	Top cover				M12 x 45	104	77
	Suction end cover				M12 x 45		
	Main bearing housing cover				M8 x 25	30	22
	Main bearing retaining plate				M6 x 16	5	4
	Capacity control cylinder				M5 x 25	12	9
	Oil filter cover				M10 x 25	59	44
	Star bearing housing (larger)				M10 x 30	59	44
	Star bearing housing (smaller)				M8 x 25	30	22
	Star locating pin				M5 x 35	12	9
	Motor terminal plate				M8 x 30	30	22
	Motor terminals (stator/rotor side)				M8 x 25 (brass)	21	15
	Motor terminals (motor cable side)				M10 x 16	59	44
	Motor terminal box				M6 x 10	12	9
	Rotor retaining plate				M16 x 40	163	120
	Liquid injection/ economiser block				M8 x 55	30	22
HSS 3100	Oil separator				M12 x 45	104	77
	Oil separator cover				M12 x 40		
HS L/M 3100	Discharge end cover				M12 x 45		

Table 1 Recommended Tightening Torques for Fastenings – HS 3100 Series Compressors

Torque values and oil quantities

3200

HSO 3200	HS 3200	HS L/M 3200	HSS 3200	Component () () ()				Fastening () () () M x L (mm)	Torque () () () N M	Torque () () () Lbf ft
X	X	X	X	Side covers				M10 x 40	59	44
X	X	X	X	Main bearing housing				M10 x 30		
X	X	X	X	Star bearing housings				M8 x 25	30	22
X	X	X	X	Star locating pin				M5 x 30	12	9
X	X	X	X	Capacity control cylinder				M8 x 60	12	9
X	X	X	X	Capacity control cylinder cover				M6 x 20		
X	X	X	X	Oil drain tube cover				M6 x 16		
X	X			Front cover				M10 x 55	59	44
X	X			Gland housing				M10 x 30	59	44
X	X			Gland cover				M8 x 30	30	22
	X		X	Oil separator				M16 x 70	163	120
	X		X	Baffle plate				M8 x 16	30	22
	X		X	Oil filter cover				M10 x 25	59	44
X		X		Discharge end cover				M16 x 70	163	120
		X	X	Motor terminal plate				M8 x 30	30	22
		X	X	Motor terminals (stator/rotor side)				M8 x 25 (brass)	21	15
		X	X	Motor terminals (motor cable side)				M10 x 16	59	44
		X	X	Motor terminal box				M6 x 10	12	9
		X	X	Motor housing				M10 x 55	59	44
			X	Motor housing end cover				M10 x 40		
			X	Motor housing bearing retainer				M8 x 50	21	15

Table 1 Recommended Tightening Torques for Fastenings – HS 3200 Series Compressors

4200

Component					Fastening Size (mm)	Torque N M	Torque Lbf ft
Common () () ()	Side cover (blank)				M12 x 35	104	77
	Side cover (suction connection)				M12 x 45		
	Main bearing housing				M10 x 30	59	44
	Main bearing retaining plate				M6 x 40	12	9
	Suction end cover (outer)				M6 x 25		
	Suction end cover (inner)				M8 x 20	30	22
	Unloading cylinder cover				M8 x 30		
	Oil filter cover				M10 x 25	59	44
	Star bearing housings				M10 x 30		
	Star locating pin				M6 x 24	15	11
HSO 4200	Front cover				M10 x 45	59	44
	Gland housing				M10 x 30		
	Gland cover				M8 x 30	30	22
HSS 4200	Stator housing				M10 x 50	59	44
	Stator housing end cover				M10 x 40		
	Stator bearing housing				M8 x 50	30	22
	Motor terminal plate				M8 x 30	30	22
	Motor terminals (stator/rotor side)				M8 x 25 (brass)	21	15
	Motor terminals (motor cable side)				M10 x 16	59	44
	Motor terminal box				M6 x 10	12	9
	Motor terminal box cover						

Table 1 Recommended Tightening Torques for Fastenings – HS 4200 Series Compressors

Torque values and oil quantities

				oil charge
HSS4221	HSA205	HSW205		18 litres
HSS4222	HSA220	HSW220		18 litres
HSS4223	HSA235	HSW235		18 litres
HSS4224	HSA243	HSW243		18 litres
HSS3216	HSA167	HSW167		16 litres
HSS3218	HSA179	HSW179		16 litres
HSS3220	HSA197	HSW197		16 litres
HSS3221	HSA203	HSW203		16 litres
HSS3118	HSA3118			13 litres
HSS3120	HSA3120			13 litres
HSS3121	HSA3121			13 litres
HSS3122	HSA3122			13 litres
HSS3123	HSA3123			13 litres
Assymetric				
F4AL	HSA263			25 litres
F4AS	HSA241			25 litres
F3BL	HSA232			19 litres
F3BS	HSA215			19 litres
F3AL	HSA204			17 litres
F3AS	HSA192			17 litres