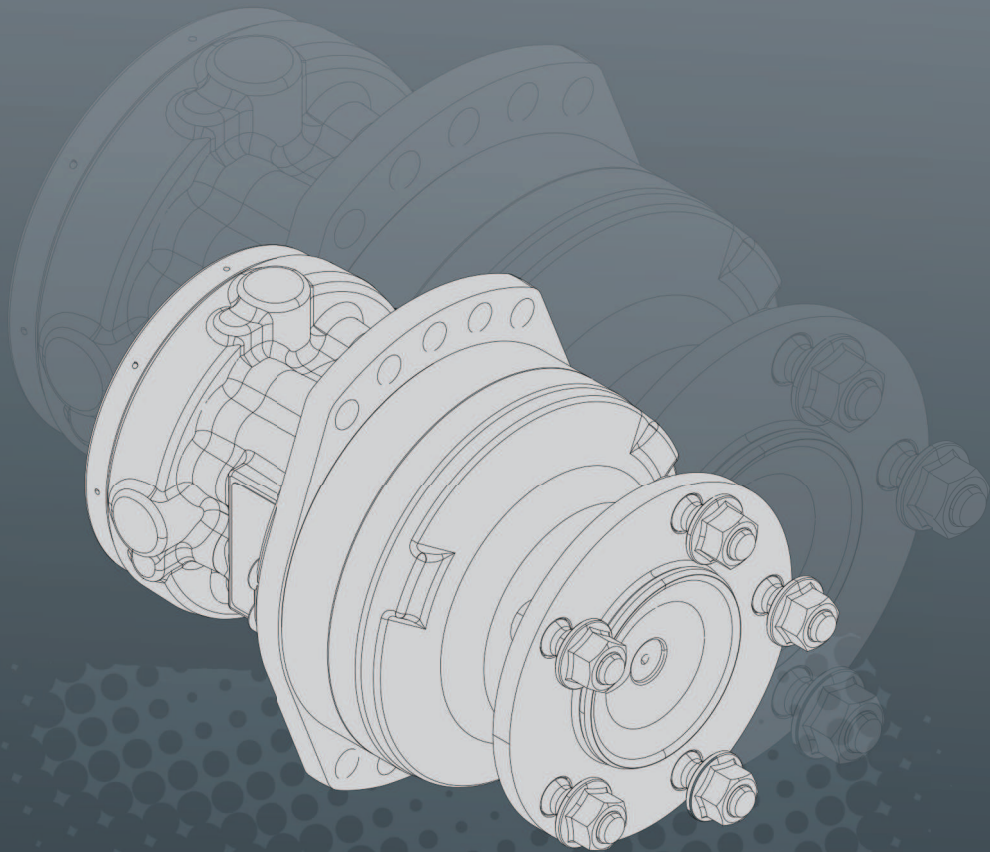


**WHEEL MOTOR**  
**MS/MSE**  
**HYDROSTATIC**

Repair manual



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General	Repairs		Tools	Parts	SB
Minors	Brake	Valving	Torque module	Bearing support	Options

## Staff, workshop equipments and safety

MS

### Before servicing



**Performing the repair work on operational mobile machine or industrial system is hazardous to life or physical conditions of operators.**

Before servicing, it is mandatory to:



Take all necessary safety precautions (people and machines) and comply with safety regulations in effect.



Confirm that mobile equipment is immobilised and positioned on a flat horizontal surface.



Confirm that the hydraulics systems' energy generator (motor) is stopped and electric power is disconnected.



Lay out a safety perimeter.



Do not perform any work on a hydraulic system that is hot or under pressure (discharge accumulators).



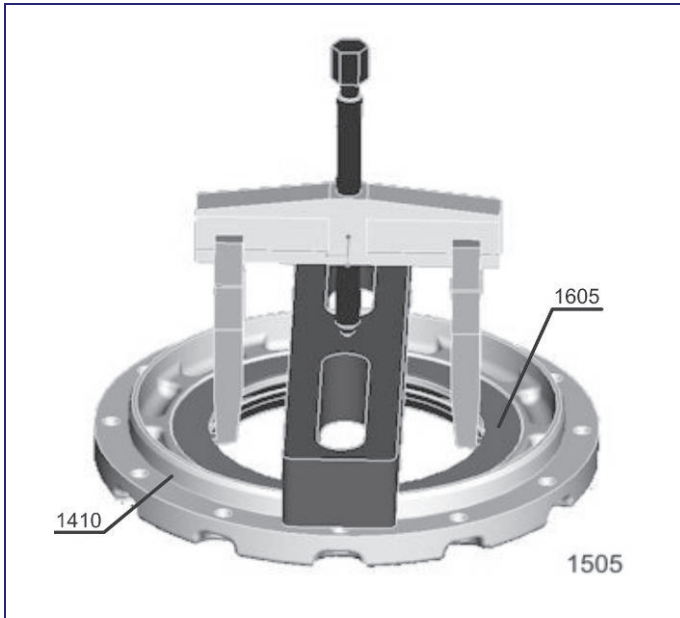
Clean the external parts of components to eliminate any mud and grease traces.




**Hot hydraulic fluid can cause severe burn injuries. Hydraulic fluid under pressure can penetrate the skin causing severe poisoning and injuries. It is mandatory to protect hand, eyes and body with suitable protective clothes, glasses and gloves. If an accident occurs, consult a doctor immediately.**


## Operations done without complete motor disassembly


MS

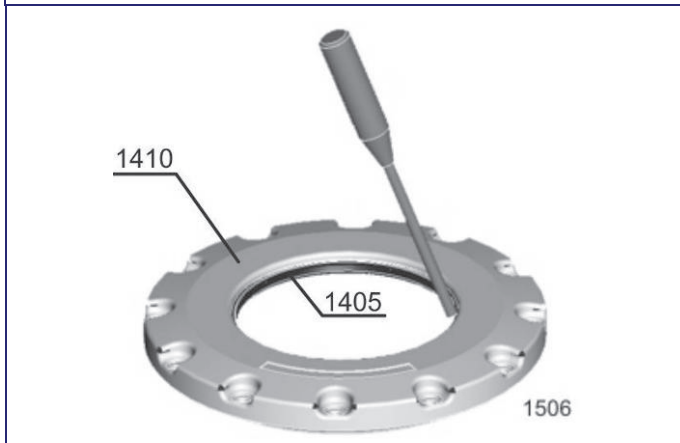


 **In case of motor with no adapter skip to next step.**

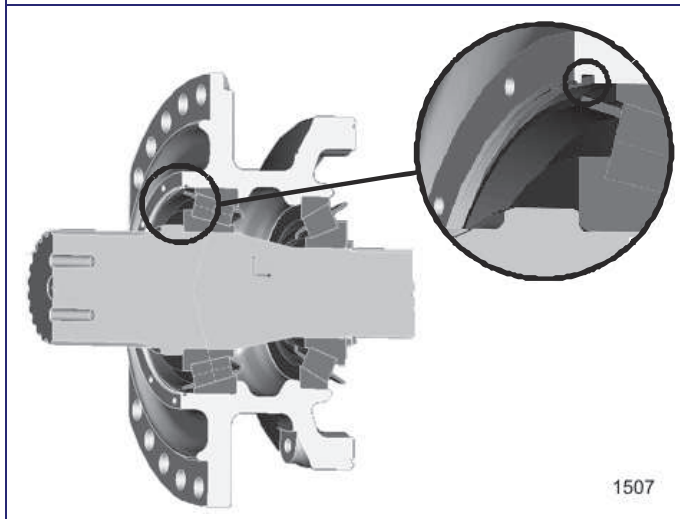
- Using an extractor remove the composite seal support (1605) together with back-up ring (1615) and O-ring (1610) from the sealing cap (1410).

 **Discard the O-ring together with back-up ring.**

 **Keep the composite seal support to be used during the installation.**



- Using a drift punch and hammer extract the sealing ring (1405) from the sealing cap (1410) and discard it.



- Remove the O-ring (1425) from bearing support (1005) and discard.

General	Repairs		Tools	Parts	SB
Minors	Brake	Valving	Torque module	Bearing support	Options

## Operations done without complete motor disassembly

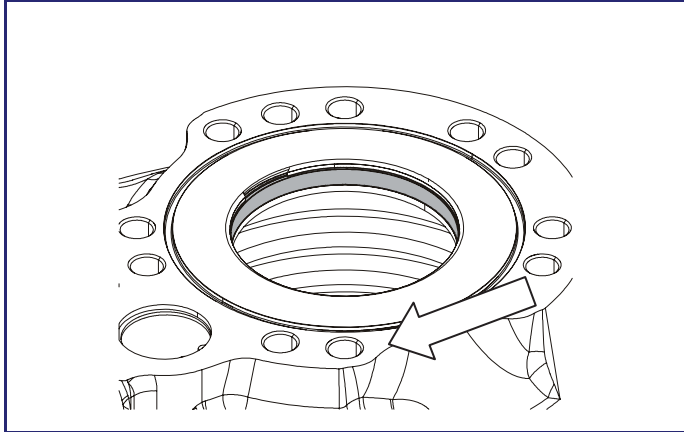
MS


<p>3505 valley top 1005 3510 1862</p>	<ul style="list-style-type: none"> <li>Install the cam (3505) either on the cam (3510 if present) or directly on the bearing support (1005).</li> </ul> <div style="background-color: #e0e0e0; padding: 5px; margin-top: 10px;">  Ref.: MS-RE-TM-IN-EN, Cam ring disassembly and installation.         </div> <div style="background-color: #e0e0e0; padding: 5px; margin-top: 10px;"> <b>In case of two cams (3505 and 3510) make sure that all cam tops and valleys are lined up according to the illustration.</b> </div>
<p>3005 1863</p>	<ul style="list-style-type: none"> <li>Lubricate the cylinder-block's (3005) mating face with hydraulic oil.</li> </ul>
<p>2000 4000 3005 3505 1005 4070 1864 1865</p>	<ul style="list-style-type: none"> <li>Insert the valving assembly (4000) together with the brake assembly (2000 if present) with its face on the cam (3505).</li> <li>Secure the valving assembly with fixing screws (4070).</li> <li>Remove the brazen bar.</li> </ul> <div style="background-color: #e0e0e0; padding: 5px; margin-top: 10px;">  Ref.: MS-RE-VA-IN-EN, Valving cover assembly procedure.         </div> <ul style="list-style-type: none"> <li>Install a new plug (2520) or the screw (2530) together with the seal washer (2535) or the conic plug (2605).</li> </ul> <div style="background-color: #e0e0e0; padding: 5px; margin-top: 10px;">  Ref.: MS-RE-BR-KH-EN, Brake covers removal and installation.         </div>

General	Repairs		Tools	Parts	SB
Minors	Brake	Valving	Torque module	Bearing support	Options
<b>Multidisc static brake</b>					


**MS**

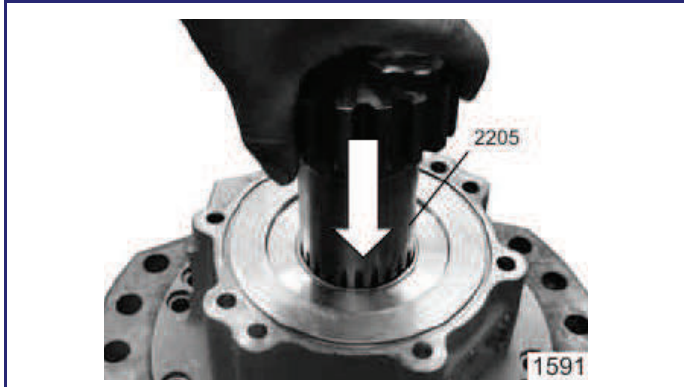
**Assembly**




 **Before installation clean all mating surfaces of the brake parts.**

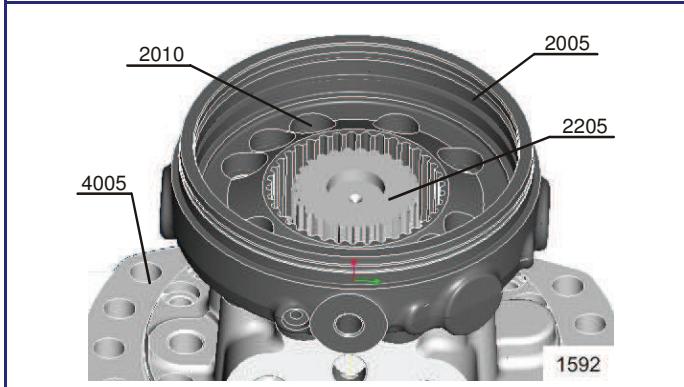
- Install the O-ring (2215), back-up ring (2235) and bushing (2255).

 Ref.: MS-RE-BR-KH-EN, Sharing balls and grip washer installation.




- Lubricate splines of the brake shaft (2205) with oil.
- Slide the brake shaft in the valving cover assembly (4000) by fitting its splines in those of the cylinder-block (3005).

 **Make sure the brake shaft is installed all the way to the stop on the cylinder-block.**



- Place the brake housing (2005) onto the valving cover (4005) and secure with mounting screws (2010).

 Ref.: MS-RE-BR-KH-EN, Brake housing installation.



General	Repairs		Tools	Parts	SB
Minors	Brake	Valving	Torque module	Bearing support	Options
<b>Drum brake</b>					

**MS**

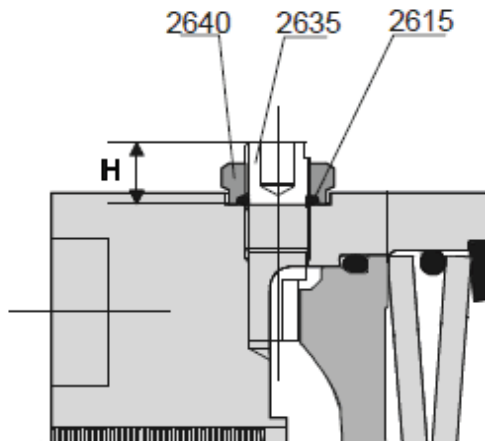
Assembly	
<p>9265</p> <p>9245</p> <p>9267</p> <p>9267</p> <p>1798</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p><b>All parts of the drum brake must be clean before reassembly.</b></p> </div> <ul style="list-style-type: none"> <li>Mount the wheel cylinder assembly (9265) on the back plate (9245) using screws (9267) and washers (9268).</li> </ul>
<p>9245</p> <p>2720</p> <p>1005</p> <p>1787</p>	<ul style="list-style-type: none"> <li>If the front bearing must be changed go to the section Bearing support repair.</li> </ul> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>Ref.: MS-RE-BS-IN-EN, Bearing support assembly procedure.</p> </div> <ul style="list-style-type: none"> <li>Turn the bearing support up side down.</li> <li>Mount the back plate (9245) on the bearing support (1005) using back plate bolts (2720).</li> </ul>

## Combined brake (C12)

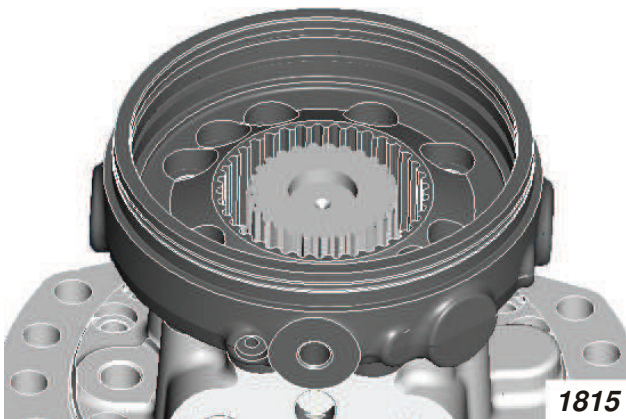
MS



**It is necessary to remove the eccentric screw to perform brake shimming.**



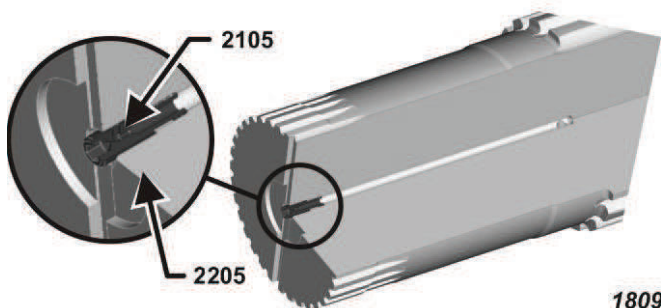
- Loosen the counter nut (2640).
- Loosen and remove the eccentric screw (2635) together with the counter nut.
- Remove the counter nut from the eccentric screw.
- Extract and discard the O-ring (2615).



- Remove brake discs (2405), and (2410), brake shaft (2205) and brake housing (2005).



Ref.: MS-RE-BR-IN-EN,  
Multidisc brake disassembly  
procedure.

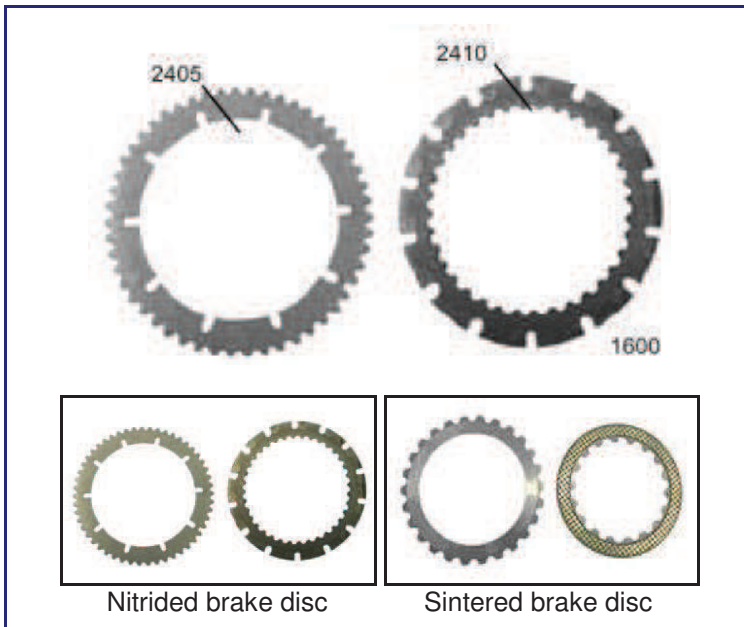


**Once the brake shaft (1105) is disassembled remove the jet screw (2105) and keep it to assemble in the new brake shaft.**

General	Repairs		Tools	Parts	SB
Minors	Brake	Valving	Torque module	Bearing support	Options

## High pressure brake (H09)

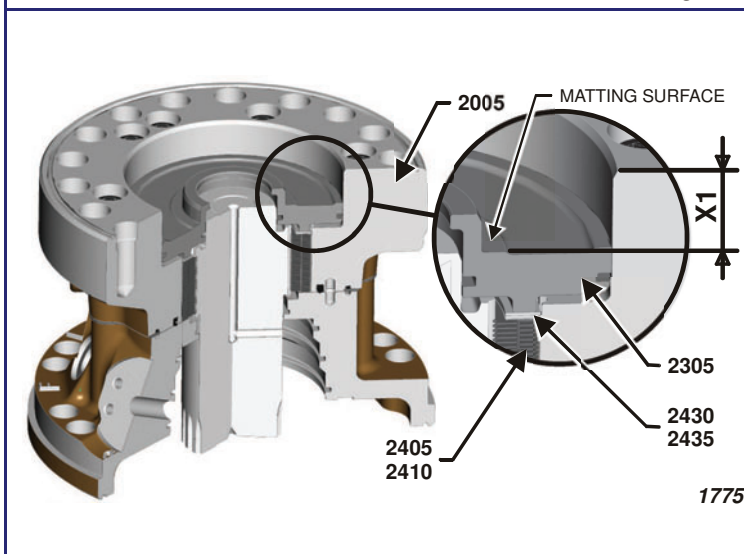
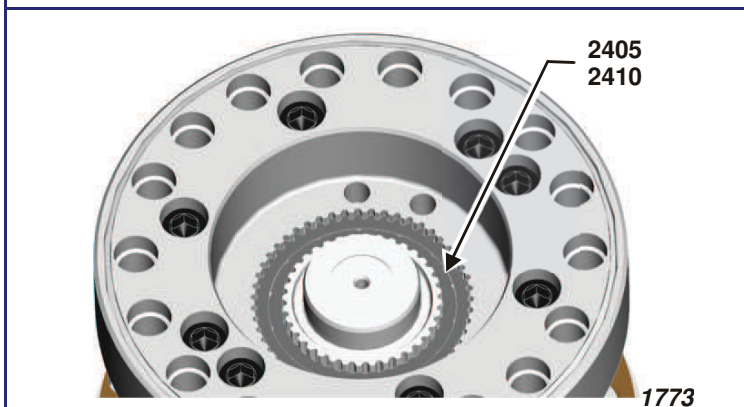
MS



- Oil the brake discs (2405) and (2410) with hydraulic fluid.
- Start by installing brake disc with external splines (2405), then one brake disc with internal spline (2410), then alternately (2405) and (2410).



See number of external and internal discs by motor, Ref.: MS-RE-BR-VU-EN, Table of values for brake repair.


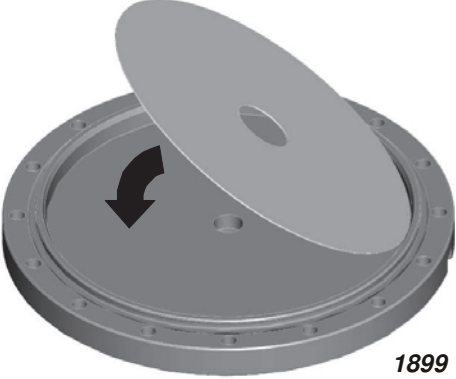

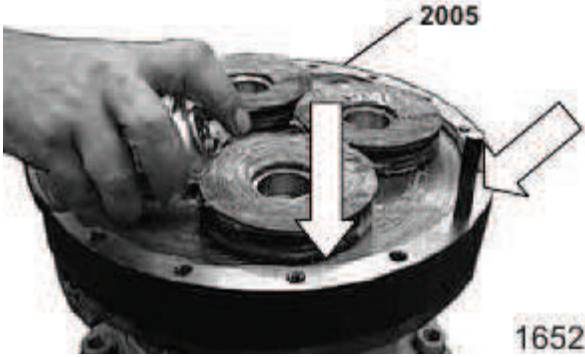


- Insert a brake piston (2305) together with a proper amount of shims (2430 and 2435) in the brake housing (2005) to get the X1 dimension measured from the upper face of the brake housing to the spring washer's matting face of the brake piston (2305).



See the value X1, Ref.: MS-RE-BR-VU-EN, Table of values for brake repair.


<b>Brake covers removal and installation</b>						<b>MS</b>
--	--	--	--	--	---	-----------

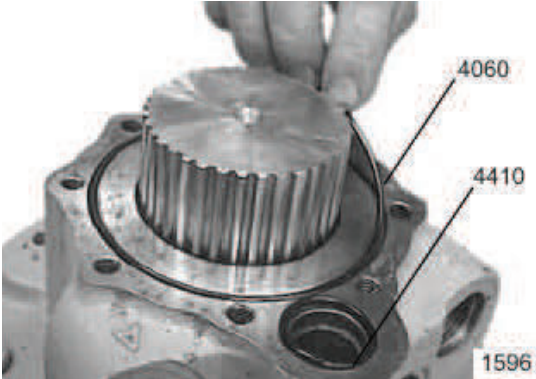
		Brake cover option D
 <p>2550</p> <p>1651</p>		<ul style="list-style-type: none"> <li>Lubricate the brake cover (2550) with anti-oxidizing grease.</li> </ul>
 <p>1899</p>		<ul style="list-style-type: none"> <li>If necessary, install the force increase shims (2055).</li> </ul>
 <p>2510</p> <p>1650</p>		<ul style="list-style-type: none"> <li>Install the brake cover O-ring (2510) lubricated with anti-oxidizing grease.</li> </ul>
 <p>2005</p> <p>1652</p>		<ul style="list-style-type: none"> <li>Install the guide pins that fix the brake cover.</li> <li>Apply a Loctite 7471 activator on the brake housing (2005).</li> </ul>

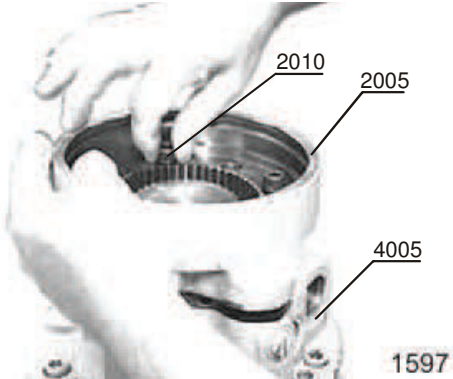
## Brake housing installation




MS

### Installation without glue

	 <div style="background-color: #cccccc; padding: 5px; display: inline-block;"> <p><b>Before installation clean all mating surfaces of all brake parts.</b></p> </div>
--	--

	<ul style="list-style-type: none"> <li>• Install the new O-ring (4060).</li> <li>• For dual displacement motors install also the O-ring (4410).</li> </ul>
--	--

	<ul style="list-style-type: none"> <li>• Install a brake housing (2005) onto the valving cover (4005).</li> <li>• Install new mounting screws (2010).</li> </ul>
---	--

	<ul style="list-style-type: none"> <li>• Tight mounting screws (2010) to the required torque.</li> </ul> <div style="background-color: #cccccc; padding: 5px; margin-top: 10px;">  <p>See the tightening torque, Ref.: MS-RE-VU-EN, General values for tightening torques.</p> </div>
---	--

General	Repairs		Tools	Parts	SB
Minors	Brake	Valving	Torque module	Bearing support	Options

## Snap ring removal and installation



MS

### Disassembly



#### Compress the spring washer (2040) with a mandrel and a bolt M12 class 12.9.:

- Make a mark of the snap ring orientation for later need during assembly procedure.
- Install mandrel onto the spring washer (2040).
- Lubricate the bolt thread and the nut faces.
- Tight the screw in the brake piston (2305) down to the thread root.

Compress the spring washer (2040) by tightening the nut and locking the screw until the gap between spring washer and snap ring (2080) can be seen.



Ref.: TO-2000-001-001 to 005  
See Tooling catalogue.



- Remove the snap ring (2080) with an internal snap ring pliers.

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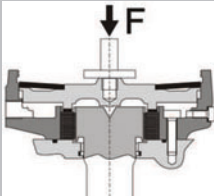

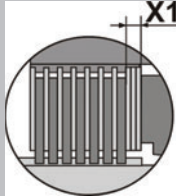
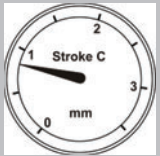
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General	Repairs		Tools	Parts	SB
Minors	Brake	Valving	Torque module	Bearing support	Options

## Table of values for brake repair



MS

Brakes	Number of discs											
	Outer teeth	Inner teeth	kN	[lbf]	Bar	[PSI]	mm	[in]	mm		[in]	
F01	15	14	50	[11240]	7	[102]	9,03	[0.356]	0,71	+0,32 -0,14	[0.028]	[+0.012] [-0.005]
F03	21	20	50	[11240]	12	[174]	9,97	[0.415]	0,95	+0,1 -0,1	[0.039]	[+0.004] [-0.004]
	21	19	50	[11240]	12	[174]	10,17	[0.423]	0,95	+0,32 -0,14	[0.039]	[+0.012] [-0.005]
T03	21	20	50	[11240]	12	[174]	5,97	[0.248]	0,95	+0,1 -0,1	[0.039]	[+0.004] [-0.004]
FH3	21	20	50	[11240]	20	[290]	10,26	[0.427]	0,55	+0,25	[0.023]	[+0.01]
F04	19	18	70	[15736]	12	[174]	10,47	[0.412]	0,67	+0,45 -0,25	[0.026]	[+0.018] [-0.01]
F05	15	14	70	[15740]	12	[174]	1	[0.039]	0,7	+0,40 -0,30	[0.028]	[+0.016] [-0.012]
F07	15	15	70	[15740]	12	[174]	10,4	[0.409]	0,9	±0,2	[0.035]	±[0.007]
F08	15	14	90	[20230]	12	[174]	13,1	[0.051]	0,65	+0,40 -0,30	[0.026]	[+0.016] [-0.012]
T09/F09	19	18	100	[20230]	12	[174]	12,38	[0.487]	0,85	+0,40 -0,30	[0.034]	[+0.016] [-0.012]
F10	28	18	100	[20230]	12	[174]	12,38	[0.487]	0,85	+0,40 -0,30	[0.033]	[+0.016] [-0.012]
T11/F11	11	10	100	[22480]	12	[174]	1,2	[0.047]	0,65	+0,40 -0,30	[0.026]	[+0.016] [-0.012]
T12/F12	20	19	100	[22480]	12	[174]	14,5	[0.571]	0,9	+0,42 -0,30	[0.035]	[+0.017] [-0.012]
P18	18	18	55	[12367]	12	[174]	15,85	[0.624]	1,05	+0,35 -0,1	[0.041]	[+0.014] [-0.004]
T19/F19	33	32	100	[22480]	12	[174]	14,58	[0.574]	1,4	+0,35 -0,25	[0.056]	[+0.014] [-0.010]
	31(SYM)	30(SYM)	100	[22480]	12	[174]						
T26/F26	33	27	100	[22480]	10	[145]	5 EXTERNAL SHIMMING DISCS		1,27	±0,2	[0.050]	±[0.008]
F30/T30	29	28	120	[26976]	10	[145]	1,27	[0.05]	1,27	±0,2	[0.050]	±[0.008]
F60/T60	33	32	120	[26976]	12	[174]	1,2	[0.047]	1,2	±0,2	[0.047]	±[0.008]
C12	33	32	100	[22480]	12	[174]	25,2	[1.05]	1,9	+0,35 -0,2	[0.075]	[+0.014] [-0.008]
H09	28	27	100	[22480]	35	[500]	26,18	[1.09]	1,58	±0,2	[0.06]	±[0.008]

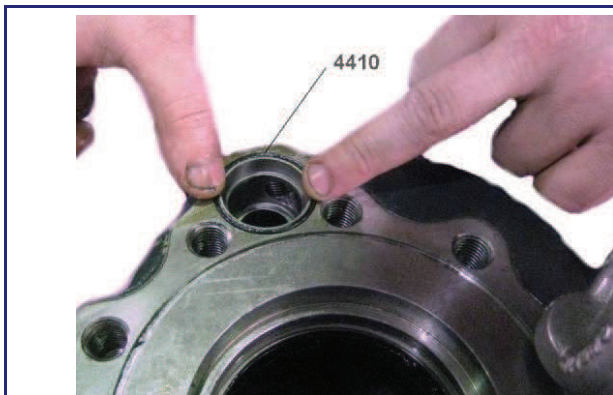
Both discs gray colored



General	Repairs		Tools	Parts	SB
Minors	Brake	Valving	Torque module	Bearing support	Options

## Valving cover repair

MS



- Extract and discard the O-ring (4410).
- In case of valving with integrated exchange spool with relief valve see section:

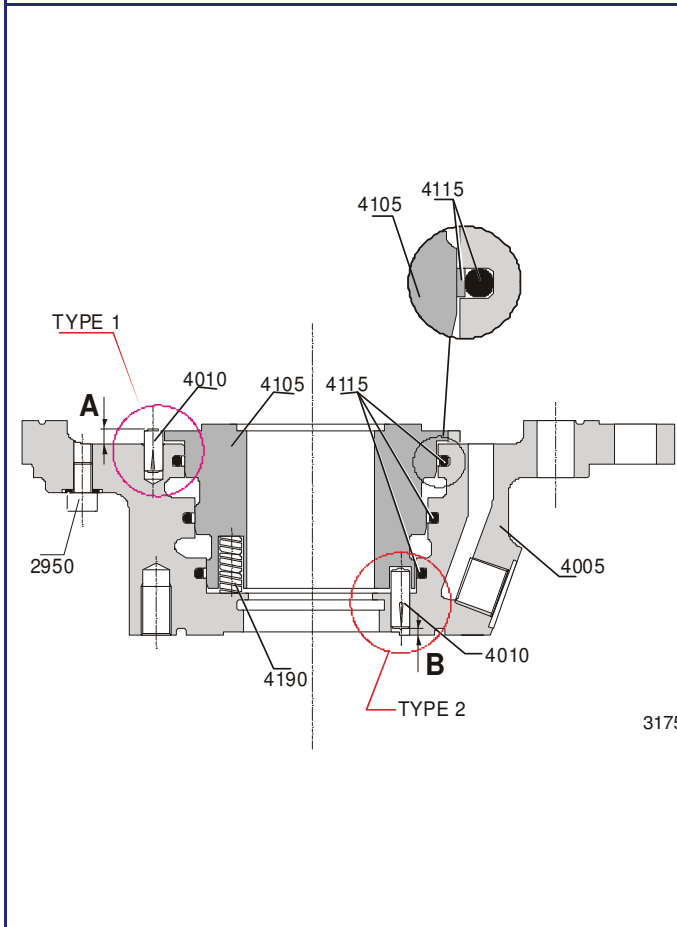


Ref.: MS-RE-VA-KH-EN,  
Integrated exchange spool removal  
and installation.

### Assembly



**Before installation clean all mating surfaces of the cover and valving.**



- In case of new valving cover (4005), install valving timing pin (4010) in its hole.

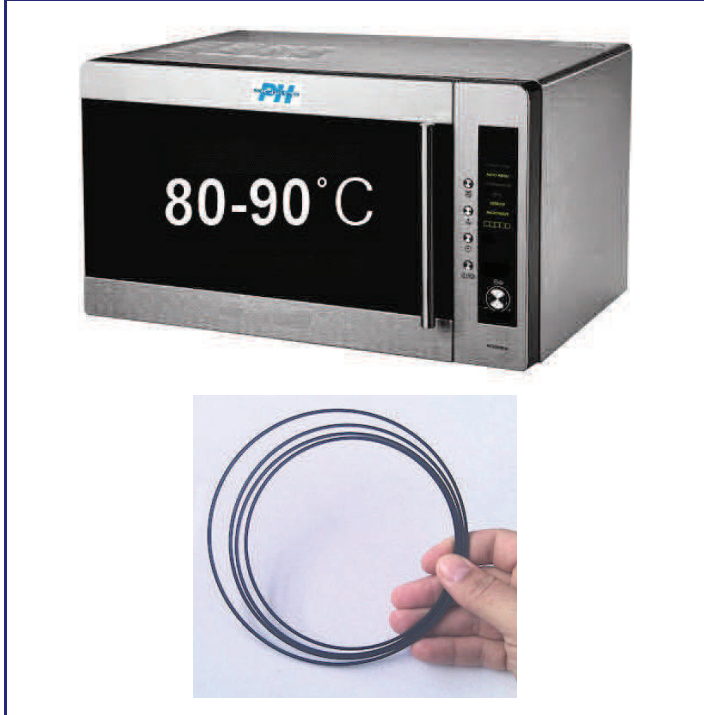


**Respect dimension A or B depending on type of valving block, 1 or 2.**


Motor	Type 1 – dimension A	
	mm	[in]
MS02	5,35 ±0,15	[0.21 ±0,006]
MS05	6 <sup>+0,8</sup> <sub>+0,2</sub>	[0.25] <sup>[+0.003]</sup> <sub>[+0.008]</sub>
MS83 MS125	21,7 ±0,1	[0.85 ±0.004]

Motor	Type 2 – dimension B	
	mm	[in]
MSE02 MS04	1,5 ±0,10	[0.05 ±0.003]
MS, MSE11 MS, MSE18	0 <sup>+0,5</sup> <sub>0</sub>	[0] <sup>[+0.02]</sup> <sub>[ 0]</sub>
MS, MSE11 MS, MSE18	8,5 ±0,5	0,31 ±0,02

### Procedure 1



- Insert new back-up rings (4160, 4165, 4170 and 4175 if present) in a heating oven for 5 minutes at the temperature between 80 and 90°C.



**Install all back-up rings immediately until they are heated up.**


### Procedure 2



- Place new back-up rings (4160, 4165, 4170 and 4175 if present) in a waterproof bag to avoid their contact with water.



- Immerse the bag into the hot water with temperature between 80 and 90°C for 5 minutes maximum.

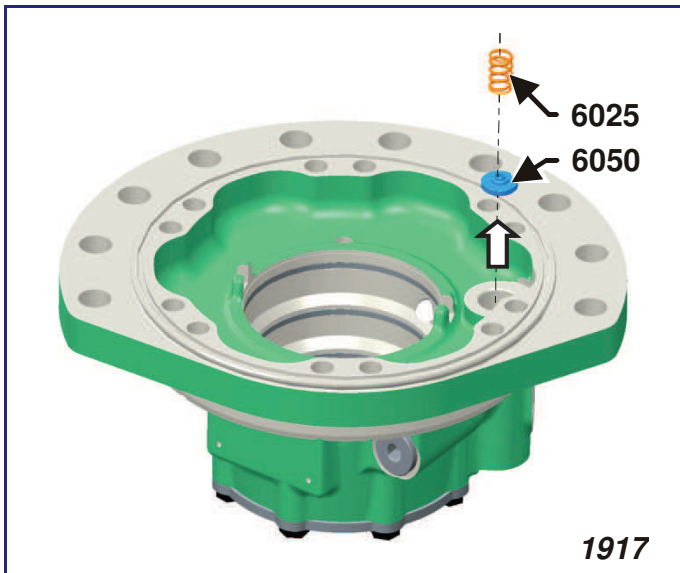


**Install all back-up rings immediately until they are heated up.**

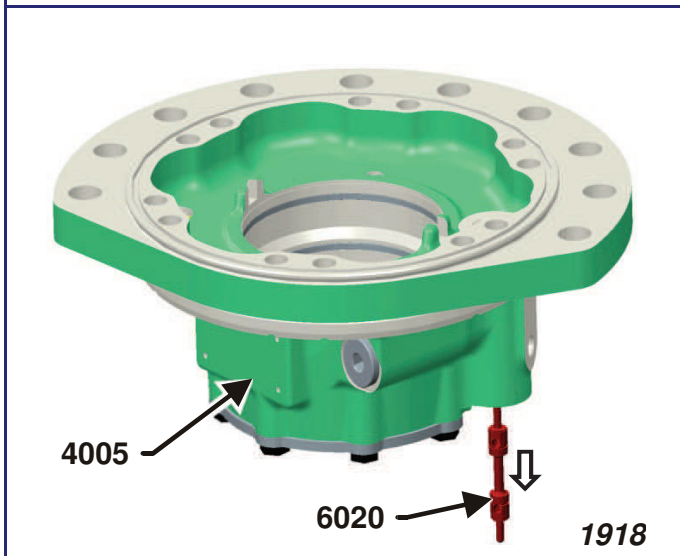
**Integrated exchange spool with pressure relief valve removal and installation**



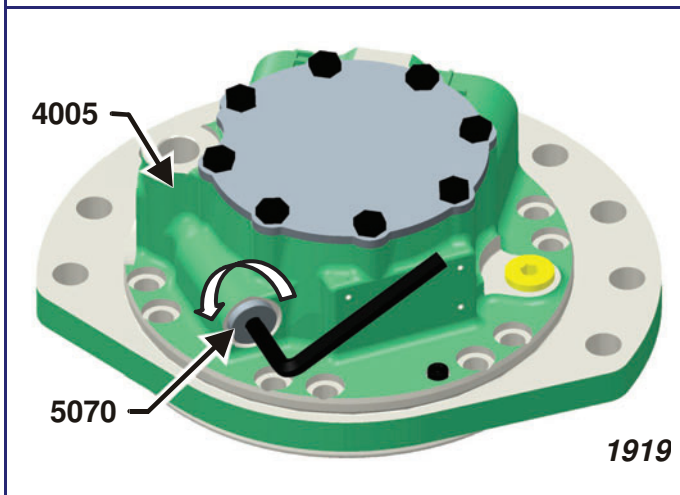
**MS**



- Remove the spring (6025) together with the spool guide (6050).



- Remove the spool (6020).

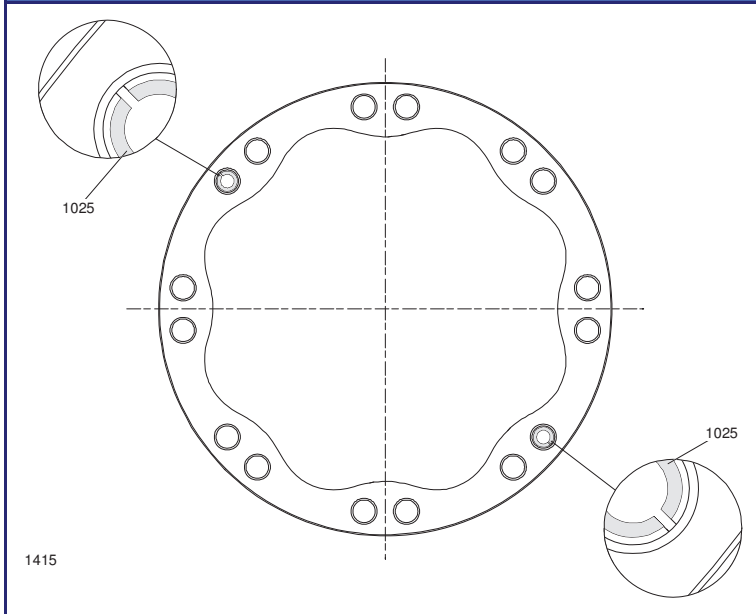


- Release and unscrew the plug (5070) together with the rec seal (5071).
  - Discard the rec seal (5071).
- Be careful that the plug doesn't jump out during the disassembly.**

## Pins overview

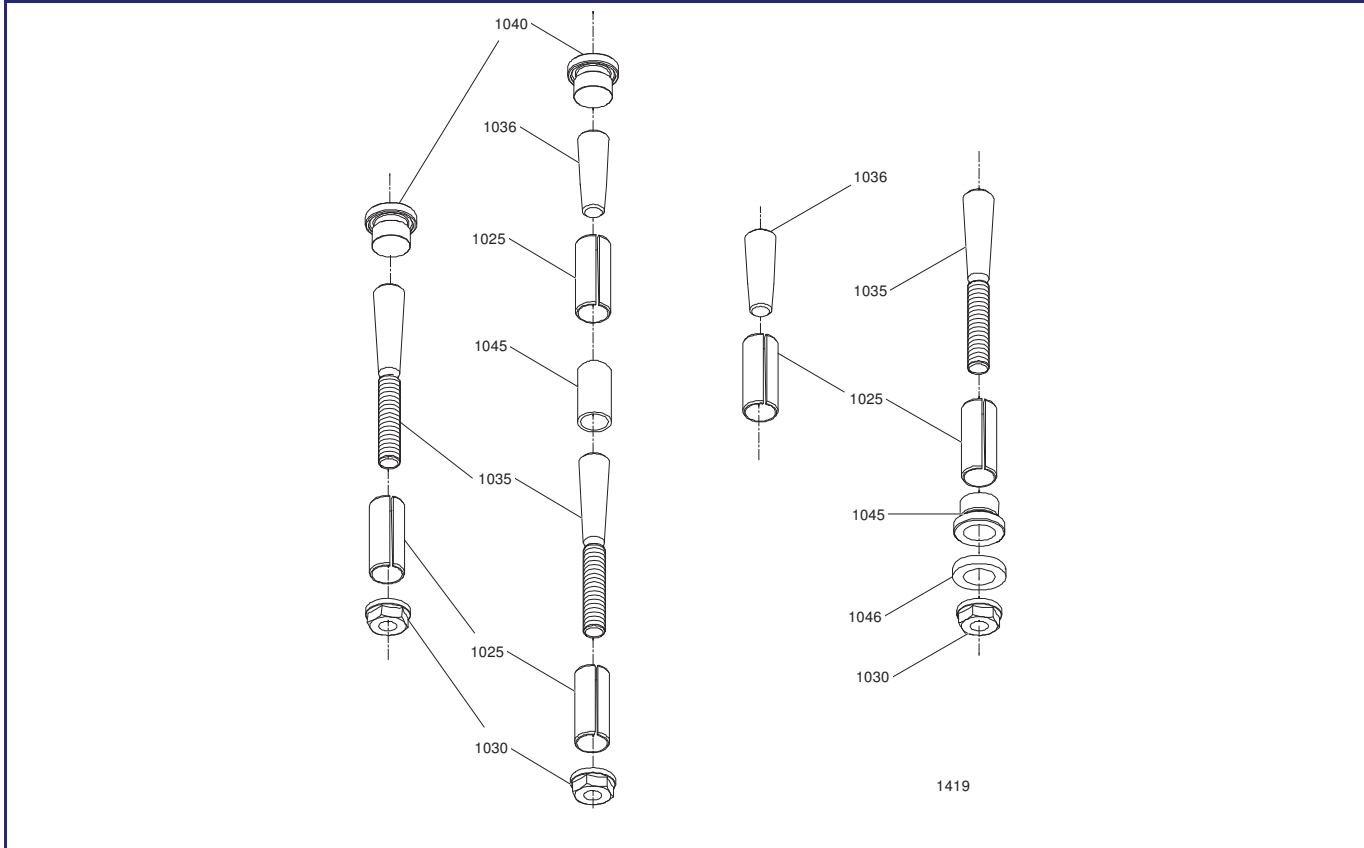
MS

### Type 1 – Slit pins



- During installation of pins (1025) in the valving cover (4005), the split in the pins must be oriented towards the outside diameter of the cam ring.

### Type 2 – Tapered pins



# Cylinder-block removal and installation



MS

## Removal - small motors



- Using just hands.

## Removal - big motors

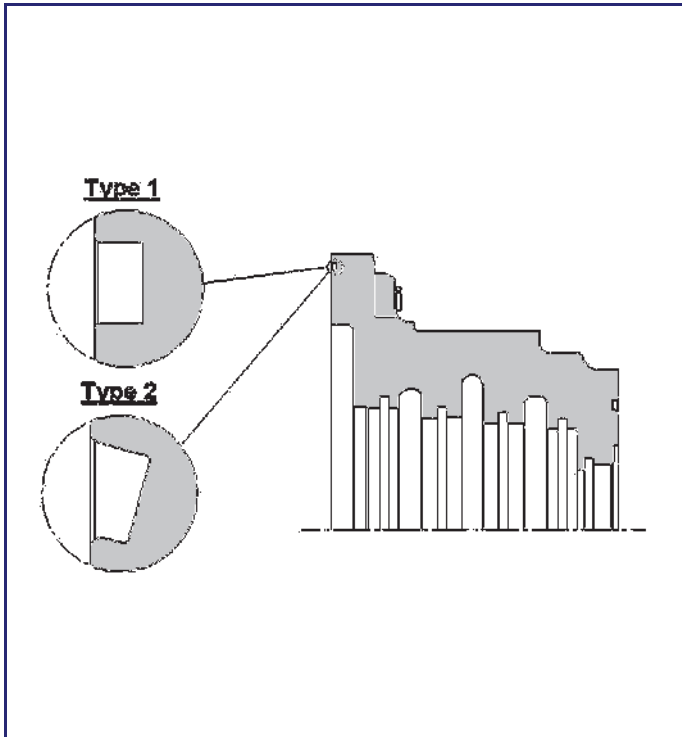


- Using two screwdrivers.




- Using two lugs and a jib to remove the largest cylinder blocks.


<b>O-ring installation</b>						<b>MS</b>
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**Type 1: straight groove**

 Before installation O-ring (4085) must be lubricated with petroleum jelly.

**Type 2: Autolock™ groove**

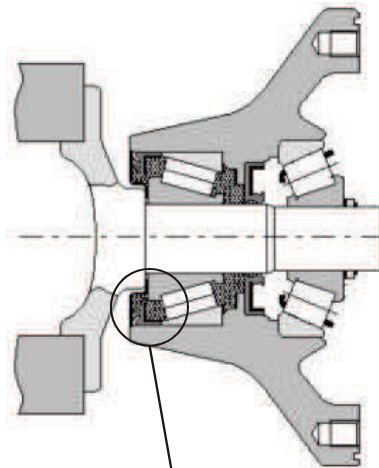
 Never lubricate O-ring (4085) before installation.

 In case of cam with higher rugosity on its faces never lubricate O-ring (4085) before installation.

# Components identification

MS

## Environmental sealing options



1716

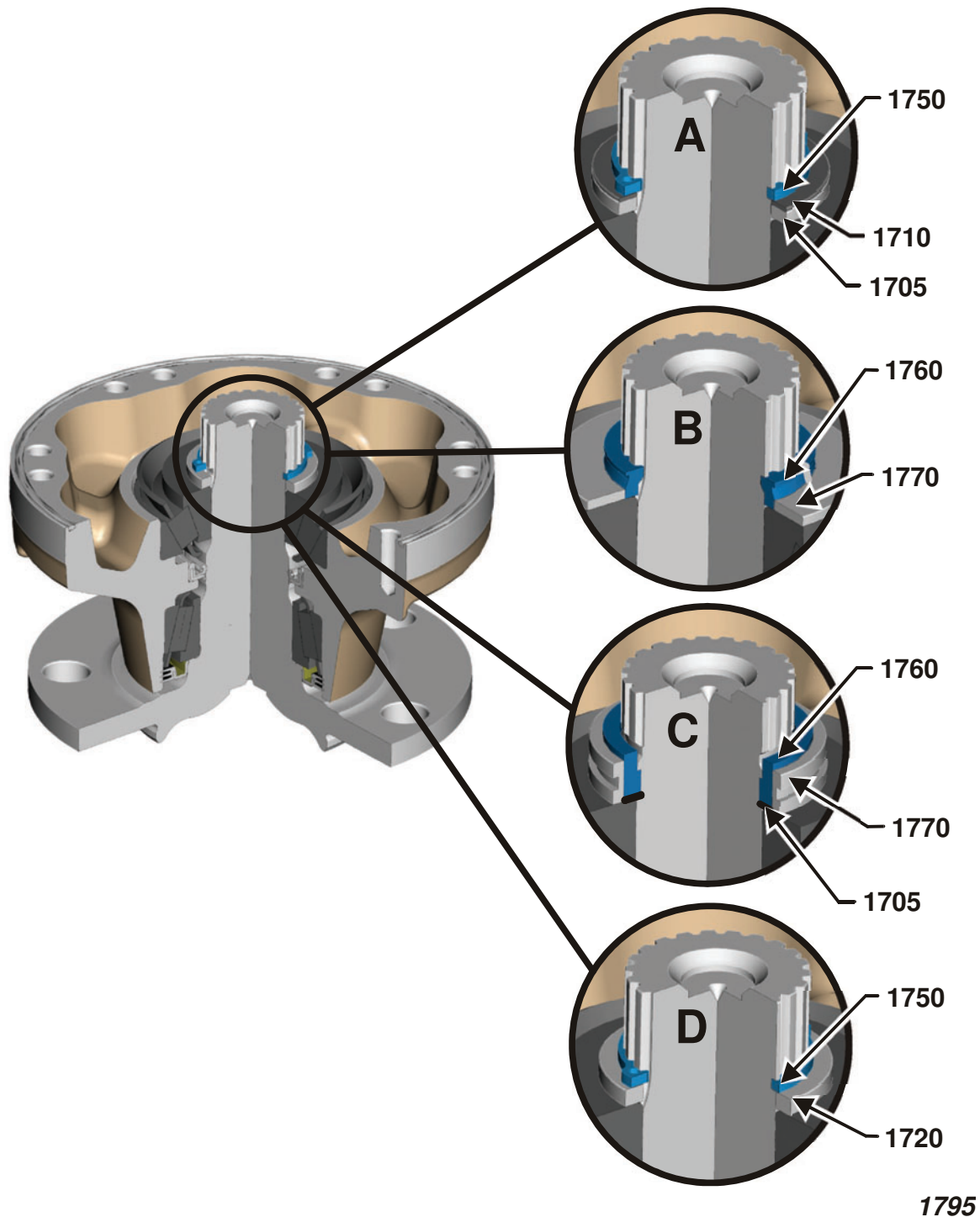
<p><b>A</b></p>	<p><b>B</b></p>	<p><b>C</b></p>	<p><b>D</b></p>
<p><b>E</b></p>	<p><b>F</b></p>	<p><b>G</b></p>	<p><b>H</b></p>
<p><b>I</b></p>	<p><b>J</b></p>	<p><b>K</b></p>	<p><b>L</b></p>
<p><b>M</b></p>	<p><b>N</b></p>	<p><b>O</b></p>	<p><b>P</b></p>
<p><b>Q</b></p>	<p><b>R</b></p>	<p><b>S</b></p>	<p><b>T</b></p>
<p><b>U</b></p>			

# Bearing shimming kit removal and installation



**MS**

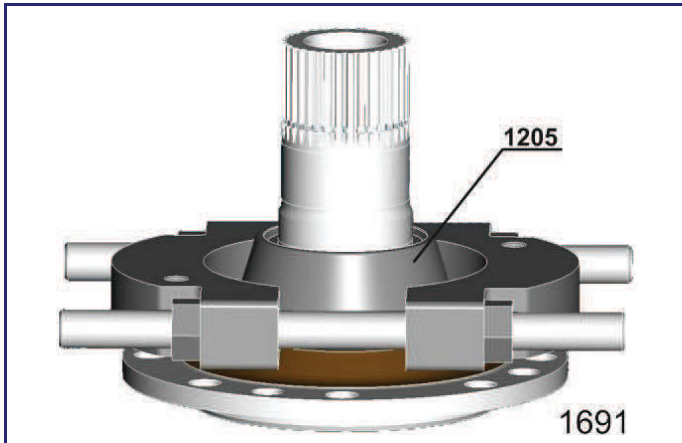
## Shimming kits overview



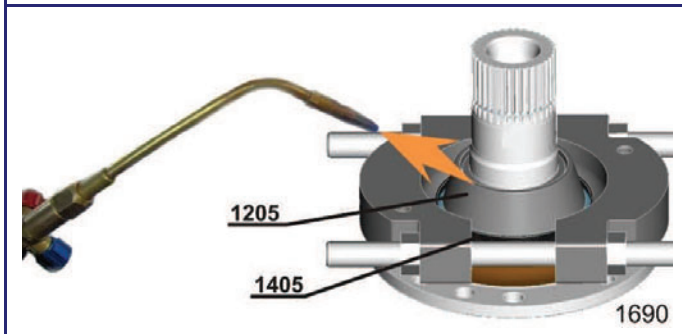
**Locked up inner race of bearing removal**



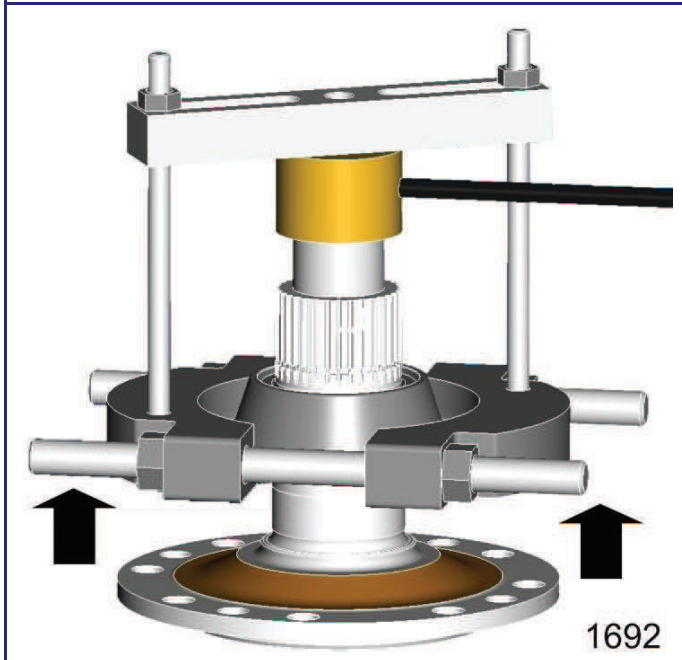
**MS**



- Install a bearing extractor under the sealing ring (1405).



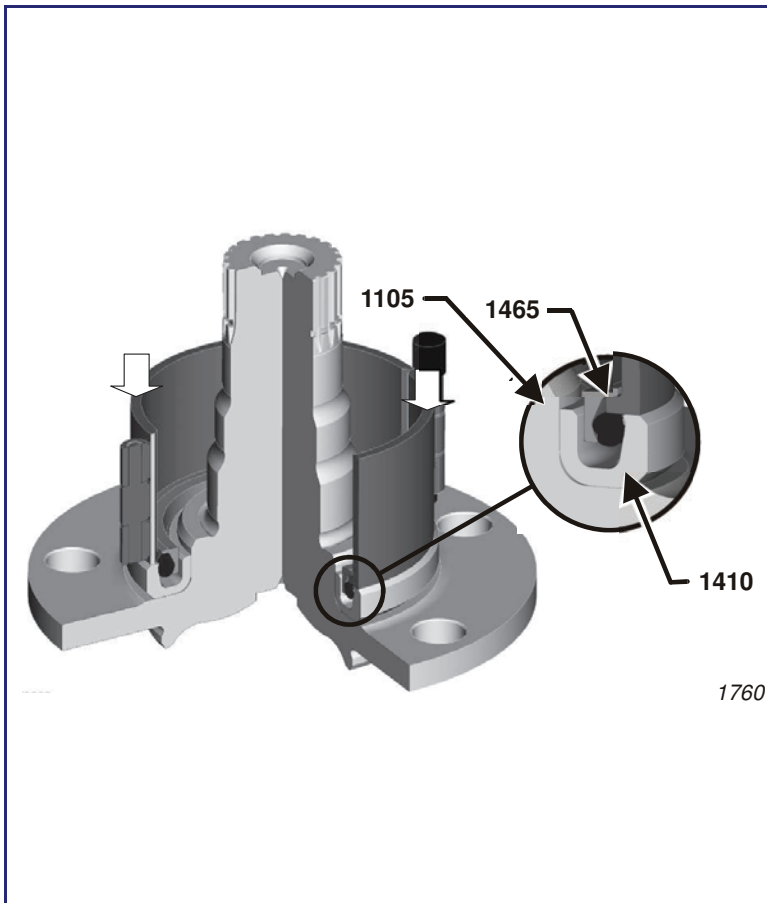
- Heat up the inner race of front bearing (1205) using torch to release it.



- Extract the front bearing (1205) together with sealing ring (1405) and deflector (1450) if present.

# Mechanical seal removal and installation


MS



- Take the metallic seal (1405) together with its O-ring and insert it in a special tool so that the tool's protrusion is between the O-ring and the inner face of a metallic seal (1405).

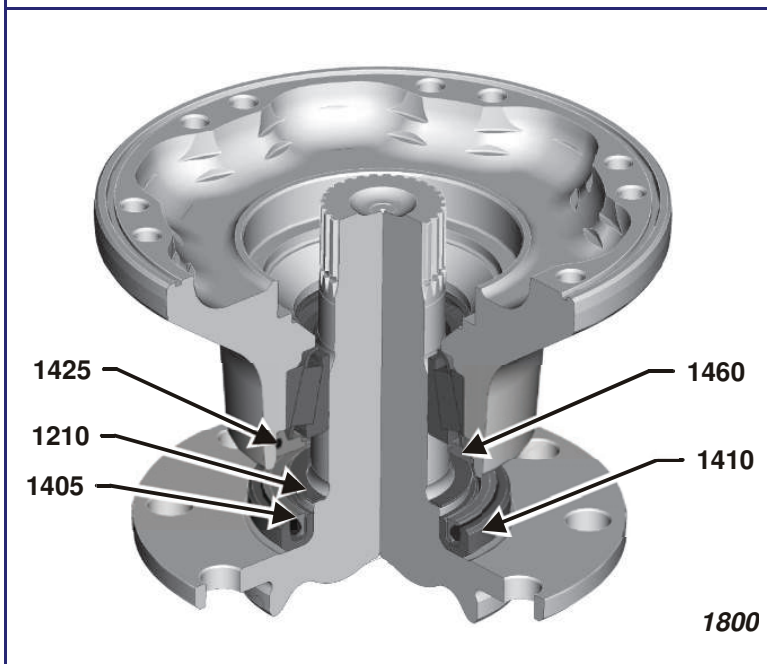


Ref.: TO-1000-003-001 to 007  
See Tooling catalogue.



**All surfaces of the sealing (1405) including the O-ring and seal support (1410) must be degreased before installation. Use Loctite 7063.**

- Secure the tool using a pin.
- Push on the tool by hands so that the tool's face mates the upper face of the seal support (1410).

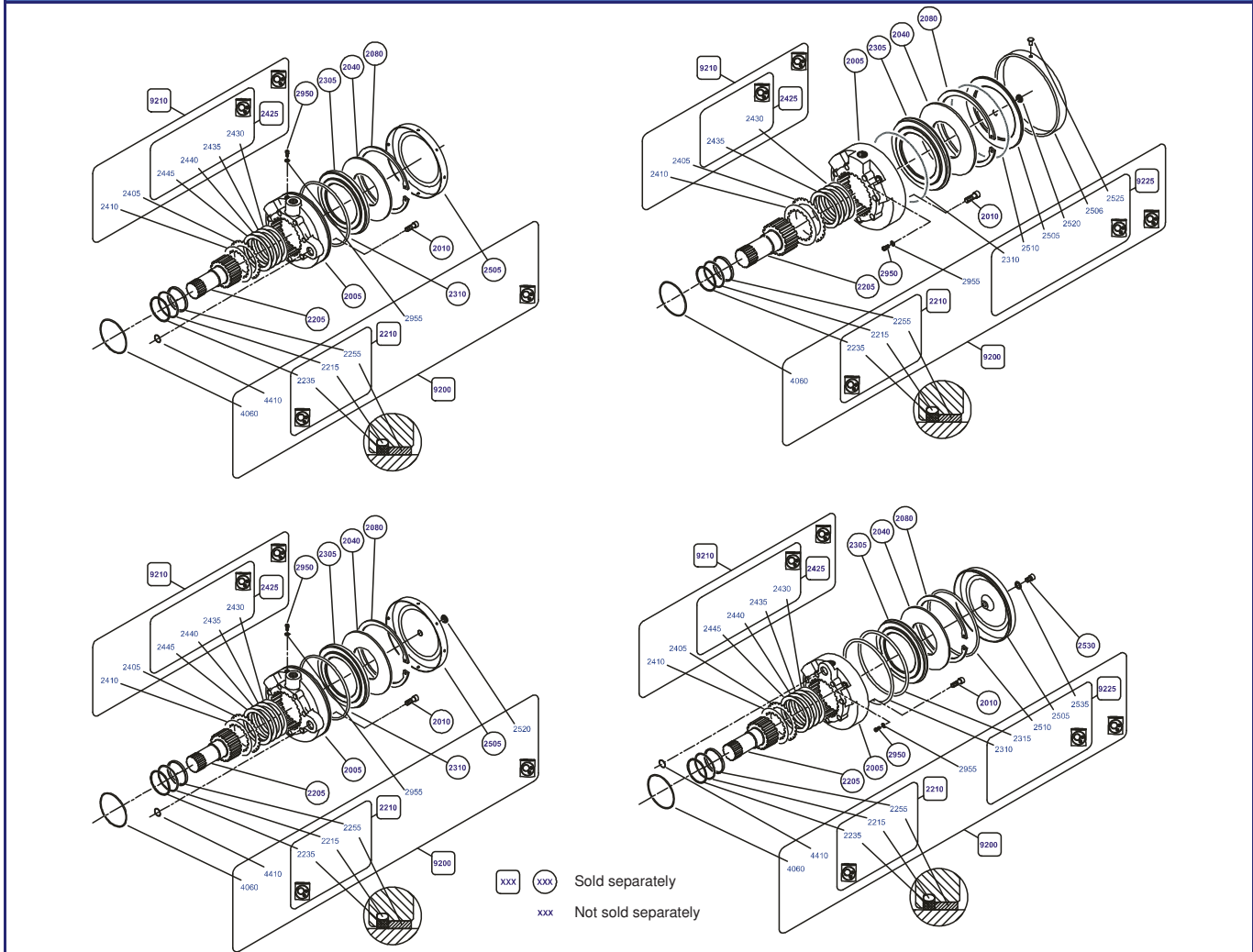


- After the front bearing installation (described in section MS-RE-BS-IN-EN) insert the bearing support (1005) together with the counter ring (1460) and O-ring (1425) through the shaft (1105) and apply the force 70kN [44.25lbf] so that the counter ring's (1460) face mates the upper face of the seal support (1410).

General	Repairs		Tools	<b>Parts</b>	SB
Minors	Brake	Valving	Torque module	Bearing support	Options
<b>Generic spare parts list</b>					

**MS**

**Brake (2000)**



Item	Description	Old item	Position	Description	Old item
2000	Brake assembly	100	I L 9225	Brake opening kit	-
I - 2005	Brake housing	101	I - 2310	O-ring	106
I - 2010	Mounting screw	102	I - 2315	O-ring	-
I - 2040	Spring washer	108	I - 2505	Brake environmental cover	141
I - 2080	Snap ring	109	I - 2510	Brake environmental cover O-ring	143
I - 2205	Brake shaft	110	I - 2520	Brake environmental cover plug	142
I - 2305	Brake piston	107	I - 2535	Seal washer	-
I - 2530	Mounting screw	-	I - 2525	Rivet	145
I - 2950	Bleed screw	112	I 9210	Brake discs and shims kit	135
I - 9200	Break repair kit	-	I - 2405	Disc with external splines	103
I - 2210	Brake shaft seal kit	111	I - 2410	Disc with internal splines	104
I   I - 2215	O-ring	111-1	L 2425	Brake shims kit	105
I   I - 2235	Back-up ring	111-2	I - 2430	Brake shim	-
I   I L 2255	Bushing	111-3	I - 3435	Brake shim	-
I - 2955	Seal washer	113	I - 2440	Brake shim	-
I - 4060	O-ring	045	L 2445	Brake shim	-
I - 4410	O-ring	057			

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