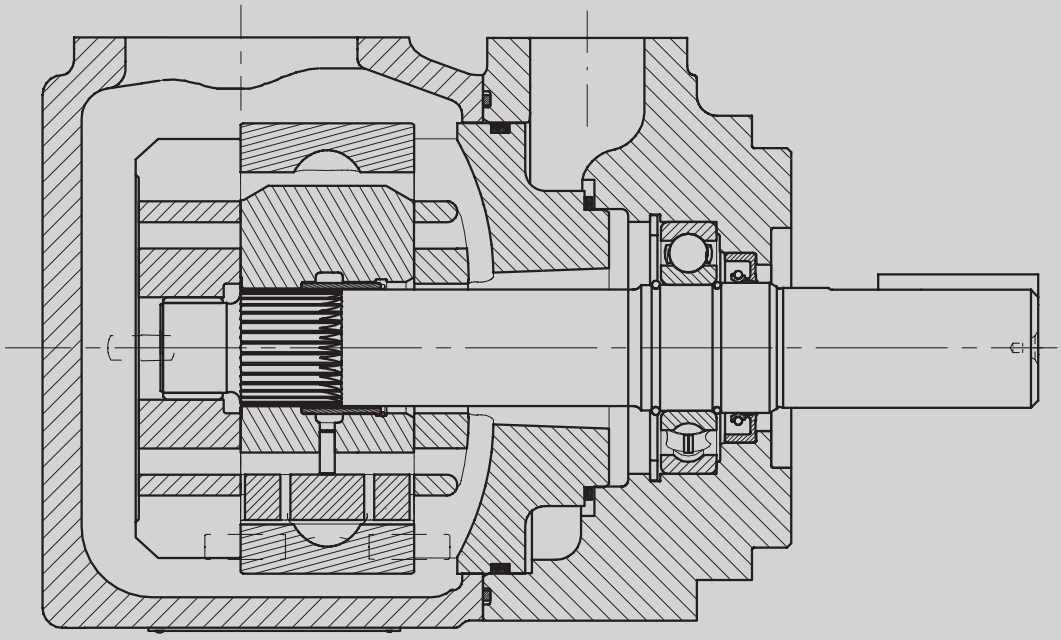
Single vane pumps
Overall instructions
T7 & T6 series
B - C - D - E sizes & drive train



Publ. S1 - EN0531 - A 06 / 2002 / FB Replaces : S1 - EN 081 - A L23 - 10531 - 1

DENISON Hydraulics

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Parker Hannifin
Denison Vane Pump Division
Vierzon - France

1 . 1 . GENERAL :

All DENISON Hydraulics vane pumps & motors are individually tested to provide the best quality & reliability. Modifications, conversions & repairs can only be done by authorized dealers or OEM to avoid invalidation of the guarantee.

The pumps & motors are to be used in the design limits indicated in all the sales bulletins. Please contact DENISON when tresspassing the catalog limits.

Do not modify or work on the pump (or motor) under pressure or when the electric motor (or any drive) is on.

Qualified personnel is required to assemble and set-up hydraulic devices.

Always conform yourself to the valid regulations (safety, electrical, environment...).

The following instructions are important to follow to obtain a good service life time from the unit.

ROTATION & PORTS INDICATION

The rotation and ports orientation are viewed from the shaft end.

CW stands for clockwise, right-hand rotation.

CCW stands for counter-clockwise, left-hand rotation.

START-UP CHECK-UP

Check that the assembly of the power unit is correct :

The distance between the suction pipe & the return lines in the tank should be at its maximum.

A bevel on both suction & return lines is recommended to increase the surface and so lower the velocity. We suggest a 45° minimum angle.

Velocities : inlet 0,5 < x < 1,9 m/s (1,64 < x < 6,23 ft per sec.)
: return x < 6 m/s (x < 19,7 ft per sec.)
: Always insure that all return and suction lines are under the oil level to avoid forming aeration or vortex effect. This should be done under the most critical situation (all cylinders extended for example). Straight and short pipes are the best.

$$V = \frac{Q\ (Lpm)}{6 \times \pi \times r^2\ (cm)} = m/s \qquad V = \frac{Q\ (GPM)}{3.12 \times \pi \times r^2\ (in)} = ft/s$$

The size of the air filter should be 3 times greater than the max. instant return flow (all cylinders in movement for example).

If the pump is in the tank, please choose the NOP option (no paint) and use a short inlet pipe.

DENISON does not recommend inlet strainers. If needed, a 100 mesh (149 microns) is the finest mesh recommended.

A coaxial drive is recommended. For any other type of drives, please contact DENISON.

Make sure that all protective plugs & covers have been removed.

Check the pump rotation versus the E-motor or engine rotation.

Start-up :

The tank has been filled up with a clean fluid in proper conditions.

Flushing the system with an external pump prior to the start-up is good.

To allow a good priming of the pump, the air should be bled off.

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The first valve on the circuit should be open to tank.

Air bleed off valves are available on the market place.

It is possible to bleed off the air by creating a leak in the P port of the pump.

Warning : this has to be done in low pressure mode as it could create a dangerous fluid leak. Make sure that the pressure cannot rise (open center valve to tank, pressure relief valve unloaded ...).

When oil free of air appears, tighten the connectors to the correct torque.

The pump should prime within a few seconds. If not, please read the troubleshooting guide (page 33).

If the pump is noisy, please troubleshoot the system.

Never operate the pump at top speed and pressure without checking the completion of pump priming.

1 . 2 . SHAFT & COUPLING DATA :

COUPLINGS AND FEMALE SPLINES

- The mating female spline should be free to float and find its own center. If both members are rigidly supported, they must be aligned within 0,15 TIR (0.006" TIR) or less to reduce fretting. The angular alignment of two splines axes must be less than ± 0,05 per 25,4 radius (± 0.002" per 1" radius).
- The coupling spline must be lubricated with a lithium molydisulfide grease, disulfide of molybdenum or a similar lubricant.
- The coupling must be hardened to a hardness between 29 and 45 HRC.
- The female spline must be made to conform to the Class 1 fit as described in SAE-J498b (1971). This is described as a Flat Root Side Fit.

KEYED SHAFTS

DENISON Hydraulics supplies the T6 series keyed shaft pumps with high strength heat-treated keys. Therefore, when installing or replacing these pumps, the heat-treated keys must be used in order to ensure maximum life in the application. If the key is replaced, it must be a heat-treated key between 27 and 34 R.C. hardness. The corners of the keys must be chamfered by 0,76 mm to 1,02 mm (0.03 to 0.04) at 45° to clear the radii in the key way.

The alignment of keyed shafts must be within tolerances given for splined shafts here above.

SHAFT LOADS

These products are primarily designed for coaxial drives which do not impose axial or side loading on the shaft. Contact DENISON for specific applications.

1 . 3 . SPECIFIC POINTS :

MINIMUM INLET PRESSURE

Please read the charts in the sales leaflets as the minimum requested inlet pressure varies versus the displacement and the speed.
Never go under 0,8 bar Absolute (-0,2 bar relative)
11.6 PSI Absolute (-2.9 PSI G).

MAXIMUM INLET PRESSURE

It is recommended to always have at least 1,5 bar (22 PSI) differential between inlet and outlet.
Standard shaft seals are limited to 0,7 bar (10 PSI G) but some allow 7 bar (100 PSI G). Please contact DENISON for more information.

MINIMUM OUTLET PRESSURE

It is recommended to always have at least 1,5 bar (22 PSI) differential between inlet and outlet.

VERTICAL MOUNT

When assembled vertically, always be careful to prevent any air from being trapped in the pump (behind the shaft seal for example).

1 . 4 . FLUIDS :

DENISON CLASSIFICATIONS

Types of fluids : For all types of fluids, DENISON's products have different pressures, speeds & temperature limits. Please refer to the sales leaflets.
HF-0 = Anti-wear petroleum base.
HF-1 = Non anti-wear petroleum base.
HF-2 = Anti-wear petroleum base.
HF-3 = Water-in-oil invert emulsions.
HF-4 = Water glycol solutions.
HF-5 = Synthetic fluids.

FILTRATION RECOMMENDATIONS

NAS 1638 class 8 or better.
ISO 18 / 14 or better.

Inlet strainers : DENISON does not recommend inlet strainers.
If requested, a 100 mesh (149 microns) is the finest mesh recommended.

RECOMMENDED FLUIDS

Petroleum based antiwear R & O fluids.
These fluids are the recommended fluids for pumps & motors. Maximum catalog ratings and performance data are based on operation with these fluids. These fluids are covered by DENISON Hydraulics HF-0 and HF-2 specifications.

ACCEPTABLE ALTERNATE FLUIDS

The use of fluids other than petroleum based antiwear R & O fluids requires that the maximum ratings of the pumps will be reduced. In some cases the minimum replenishment pressures must be increased. Consult specific sections for more details (page 4).

VISCOSITY

	Mobile	Indutrial
Max. (cold start, low speed & pressure)	2000 cSt - 9400 SUS	860 cSt - 3900 SUS
Max. (full speed & pressure)	108 cSt - 500 SUS	108 cSt - 500 SUS
Optimum (max. life)	30 cSt - 140 SUS	30 cSt - 140 SUS
Min. (full speed & pressure for HF-1, HF-3, HF-4 & HF-5 fluids)	18 cSt - 90 SUS	18 cSt - 90 SUS
Min. (full speed & pressure for HF-0 & HF-2 fluids)	10 cSt - 60 SUS	10 cSt - 60 SUS

VISCOSITY INDEX

90 min. Higher values extend the range of operating temperatures.

TEMPERATURES

The usual limitating factor of temperature (low or high) comes from the obtained viscosity. The seals are sometimes the limit : standard seals range from -30° C to 90° C (-9.4° F to 194° F).

Maximum fluid temperature (θ)	° C	° F
HF-0, HF-1, HF-2	+ 100	+ 212
HF-3, HF-4	+ 50	+ 122
HF-5	+ 70	+ 158
Biodegradable fluids (esters & rapeseed base)	+ 65	+ 149

Minimum fluid temperature (θ) (also depend on max. viscosity)	° C	° F
HF-0, HF-1, HF-2, HF-5	- 18	- 0.4
HF-3, HF-4	+ 10	+ 50
Biodegradable fluids (esters & rapeseed base)	- 18	- 0.4

Over or under these values, please contact DENISON.

WATER CONTAMINATION IN THE FLUID

Maximum acceptable content of water :
- 0,10 % for mineral base fluids.
- 0,05 % for synthetic fluids, crankcase oils, biodegradable fluids.

If the amount of water is higher, then it should be drained off the circuit.

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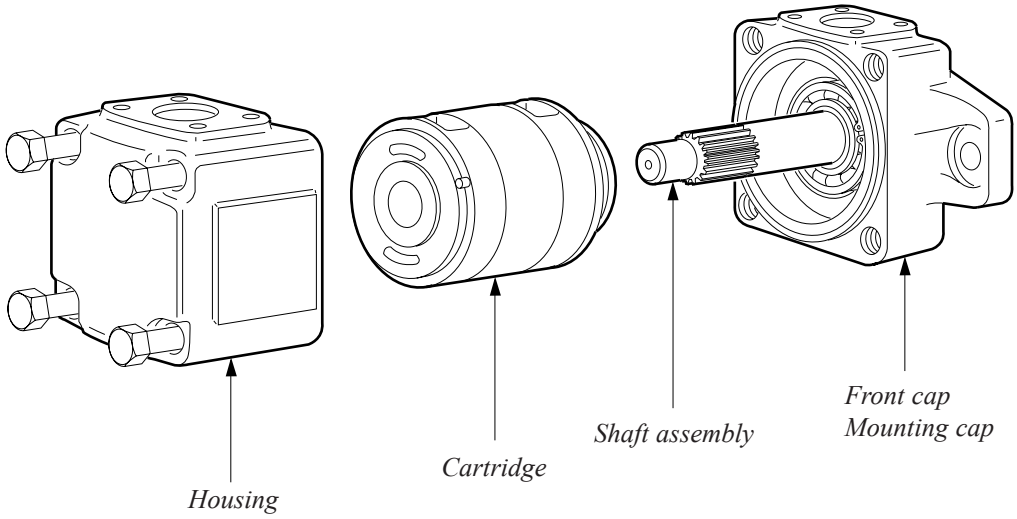

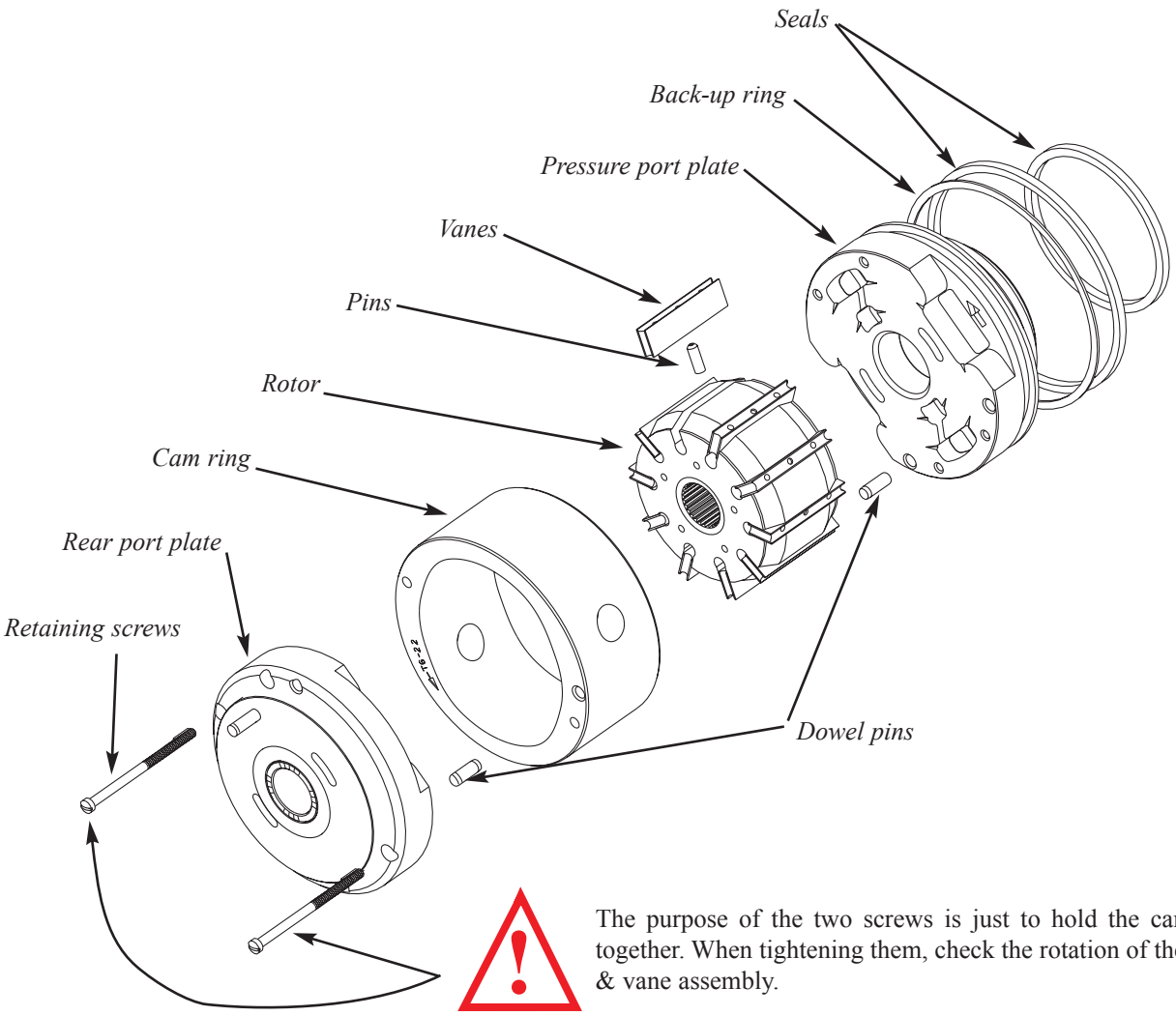

The purpose of the two screws is just to hold the cartridge together. When tightening them, check the rotation of the rotor & vane assembly.

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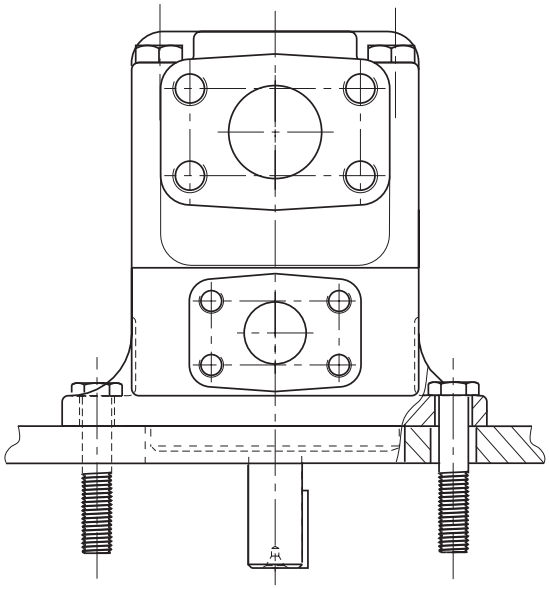
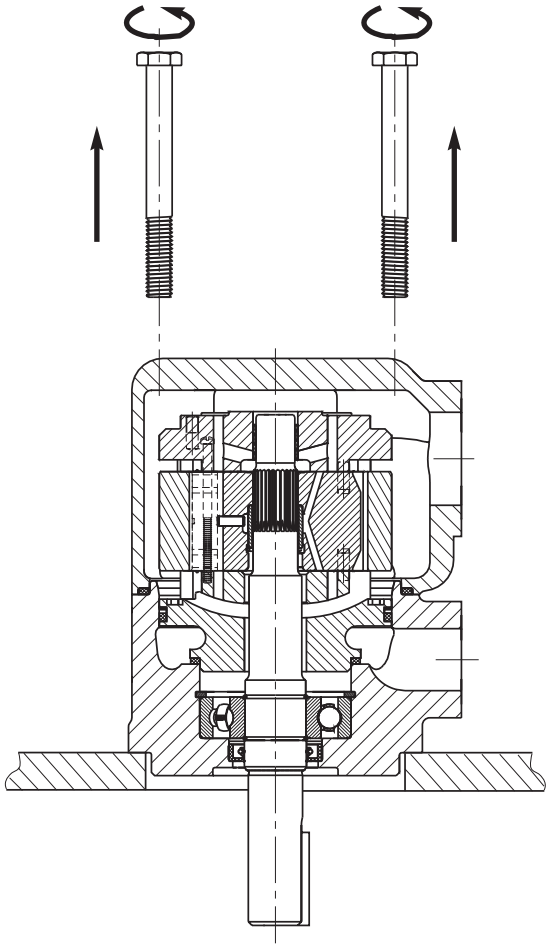
3 . 1 . CHANGING CARTRIDGE & SHAFT ASSEMBLY - STANDARD PUMP :

1 . Install the pump on the table.



Two bolts will help to unscrew the 4 pump bolts.

2 . Unscrew the 4 bolts.



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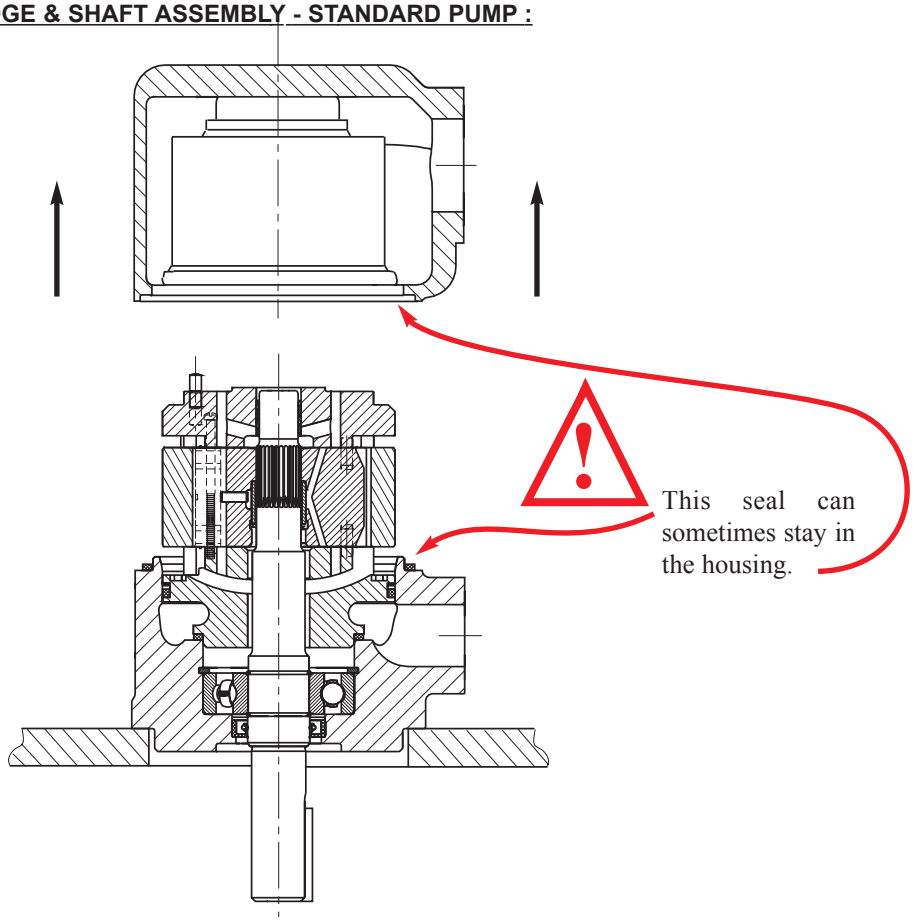
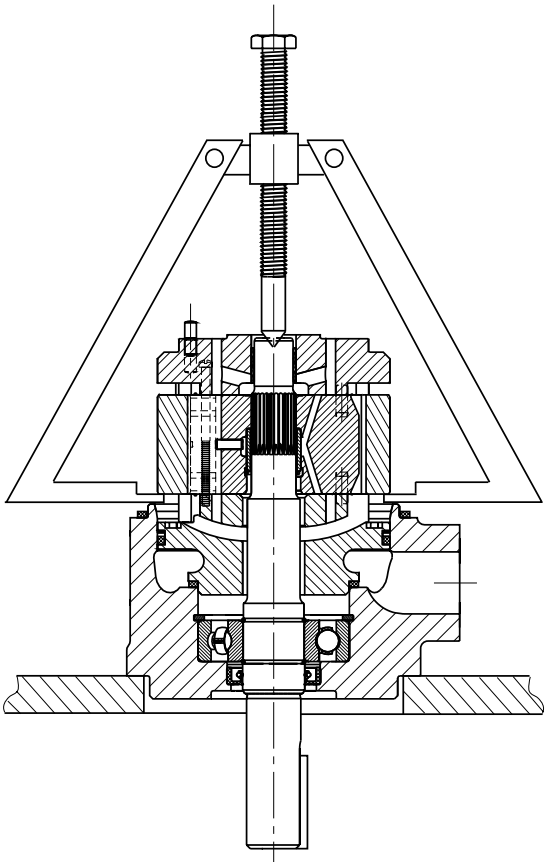
Parker Hannifin
Denison Vane Pump Division
Vierzon - France

3 . 1 . CHANGING CARTRIDGE & SHAFT ASSEMBLY - STANDARD PUMP :

3 . Remove the housing.



4 . Disassemble the cartridge / front cap with an extractor.



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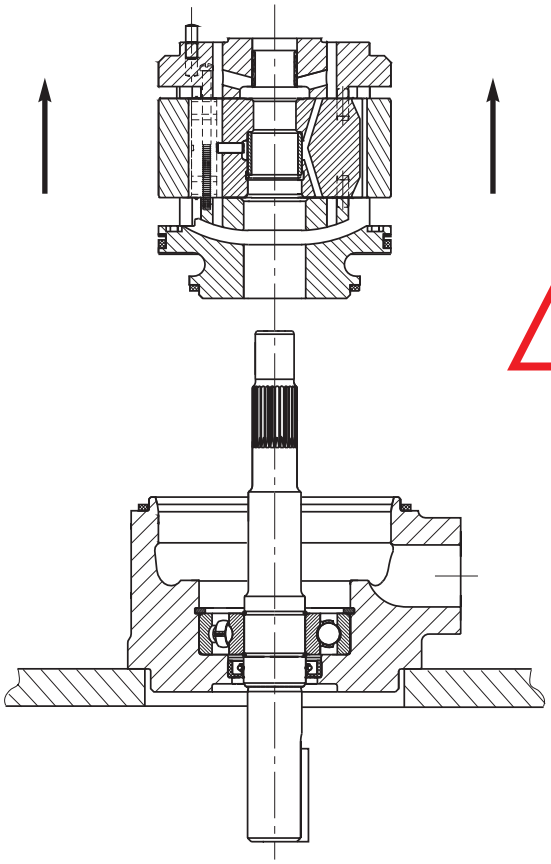
3 . 1 . CHANGING CARTRIDGE & SHAFT ASSEMBLY - STANDARD PUMP :



If you want to modify the cartridge, go to page 18.

If you want to reassemble a new cartridge, go to page 11.

If you wish to convert the cartridge, go to page 18.

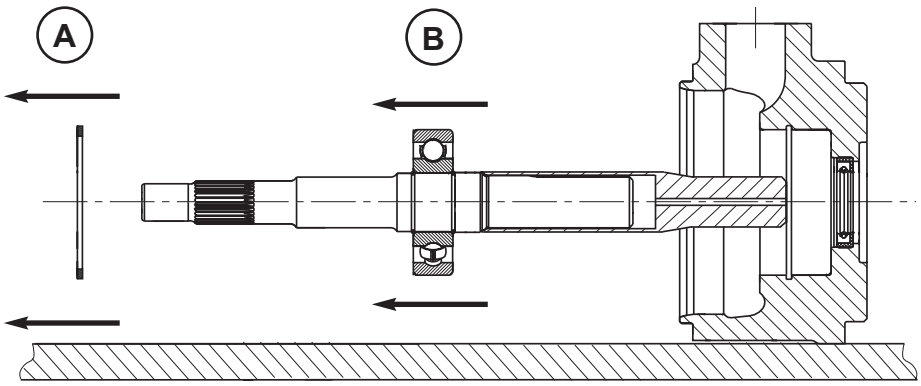
A : Remove the retaining ring.

B : Extract the shaft / bearing assembly.

Take a protection cone to prevent seal damage (dim. page 31).
If you don't, change the shaft seal.

If not new, the shaft seal should be replaced.

If the shaft Ø is bigger than the shaft seal Ø, please contact DENISON (TPI).



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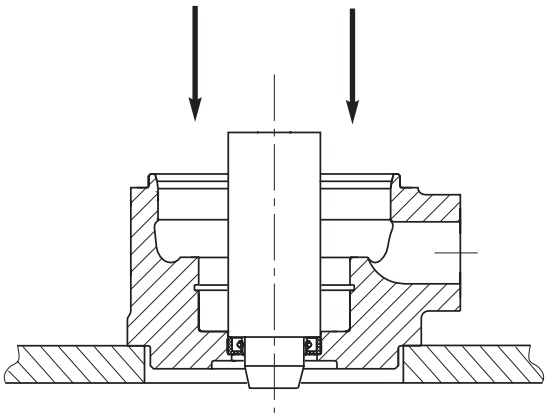
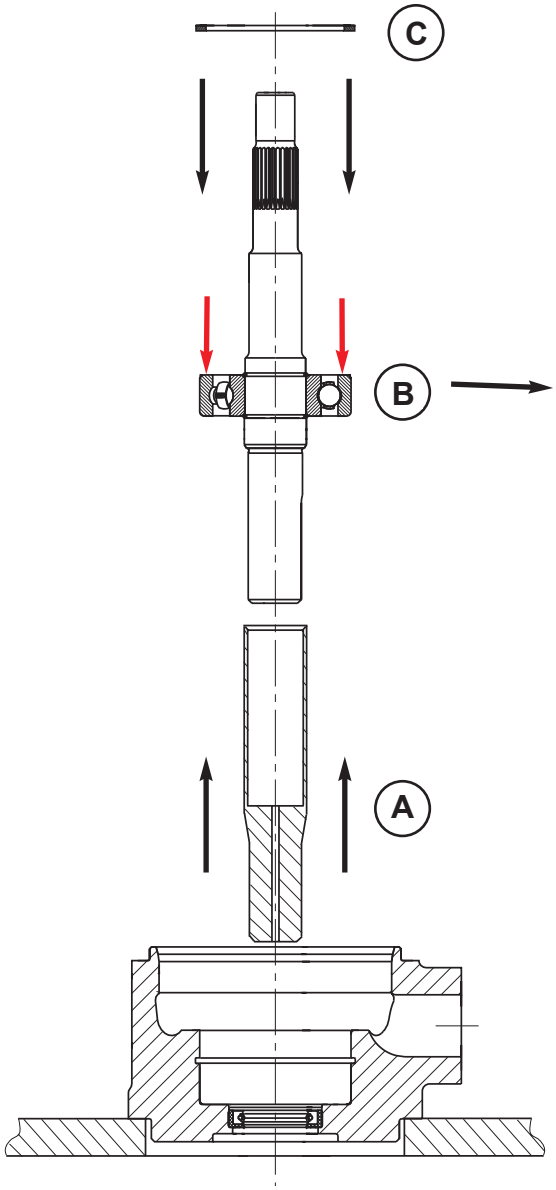
3 . 1 . CHANGING CARTRIDGE & SHAFT ASSEMBLY - STANDARD PUMP :

5 . Install the shaft seal (special tool dimensions, page 30).



Press carefully to avoid damaging the seal.

6 . Install the shaft assembly.



To avoid damaging the shaft seal, do not forget to put a protective cone on the shaft (dim. page 31).

Push on the external bearing “cage”.

If the shaft Ø is bigger than the shaft seal Ø, please contact DENISON (TPI)

A : Protective cone on the shaft assembly (dim. per shaft in page 31).

B : Shaft assembly + protective cone into the front cap. Slightly rotate the shaft to avoid the shaft seal lip(s) to be deteriorated.

C : Retaining ring into the front cap.

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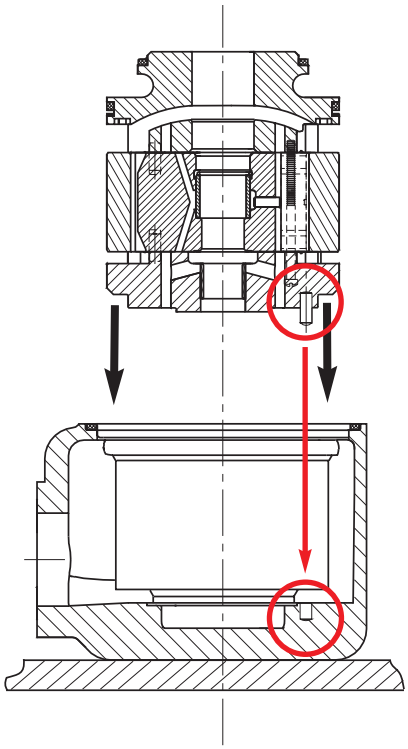
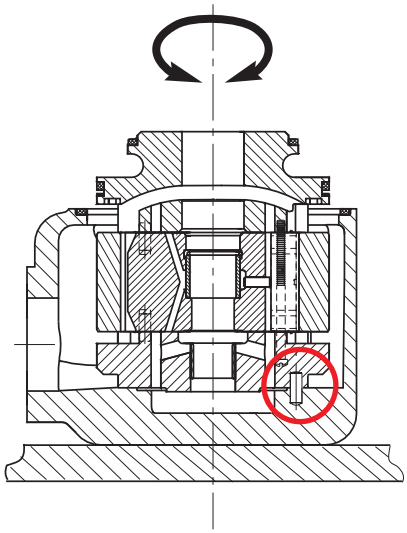
3 . 1 . CHANGING CARTRIDGE & SHAFT ASSEMBLY - STANDARD PUMP :

7 . Fit the cartridge into the housing.



8 . Check if the dowel pin is in its position in the housing by trying to rotate the cartridge.



Put some grease on the seals to prevent them from moving.

If the cartridge does rotate, the dowel pin is not in the hole. Take the cartridge out and try again.

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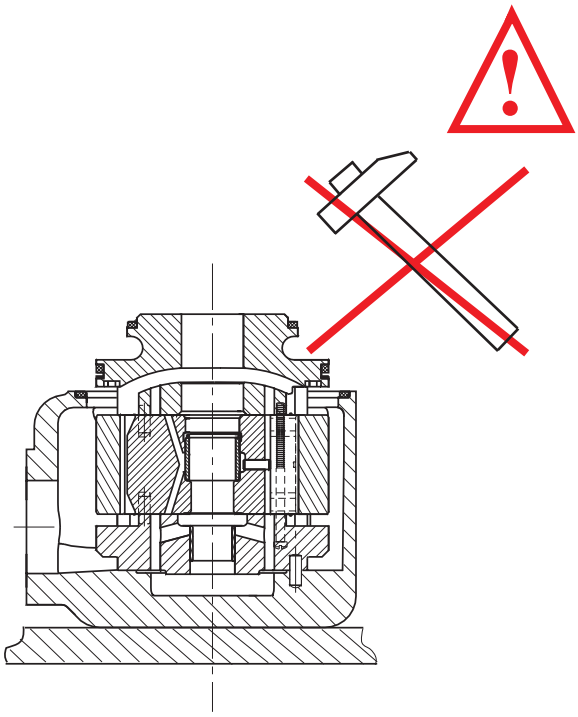
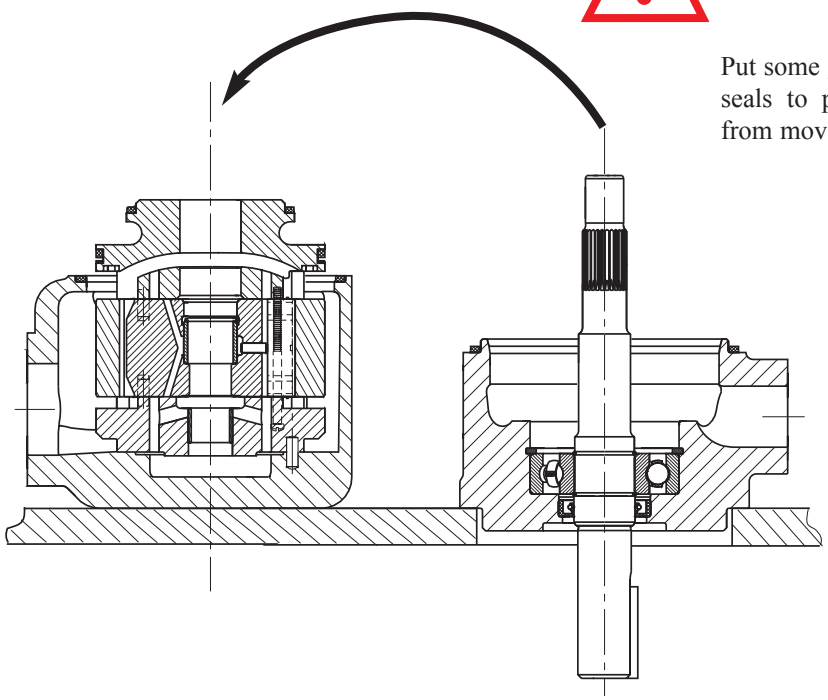
3 . 1 . CHANGING CARTRIDGE & SHAFT ASSEMBLY - STANDARD PUMP :

If the cartridge does not fit in the housing correctly, check the concentricity of the three elements = port plates (rear & pressure) & cam ring (see page 21).



Never use a hammer. The cartridge is to fit into the housing without any tools.

9 . Assemble the front cap assy on the housing & cartridge assy.

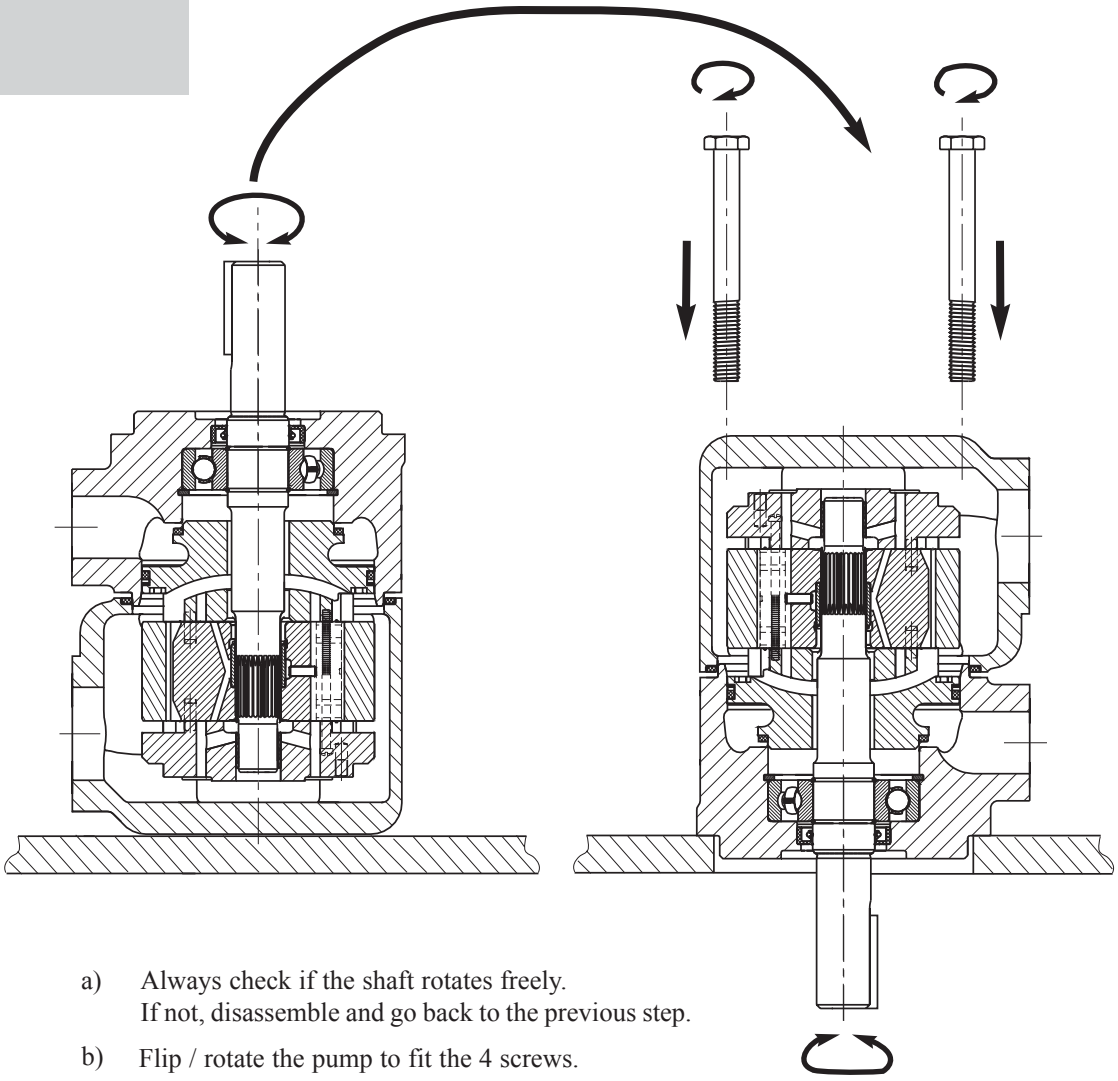


Position the shaft / front cap assy only if the cartridge is well positioned, dowel pin in the housing dowel pin hole.

Put some grease on the seals to prevent them from moving.

3 . 1 . CHANGING CARTRIDGE & SHAFT ASSEMBLY - STANDARD PUMP :

10 . Final assy.



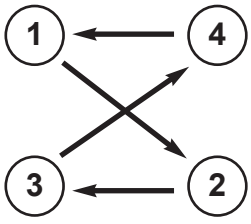
a) Always check if the shaft rotates freely.
If not, disassemble and go back to the previous step.

b) Flip / rotate the pump to fit the 4 screws.

c) Fix the pump to the table (as page 7) before tightening the pump's bolts.

d) Check the porting configuration (see table page 29).

e) Tighten the 4 bolts



Step by step to avoid damaging the seals.

f) Always check if the shaft rotates freely.
If not, disassemble and go back to the previous step.

TORQUE REQUIREMENTS.

T6C-T6CM-T6CP	159 Nm	117 ft.Lbs
T6D-T7D	187 Nm	138 ft.Lbs
T6E-T7E	187 Nm	138 ft.Lbs
T7B-T7BS	187 Nm	138 ft.Lbs

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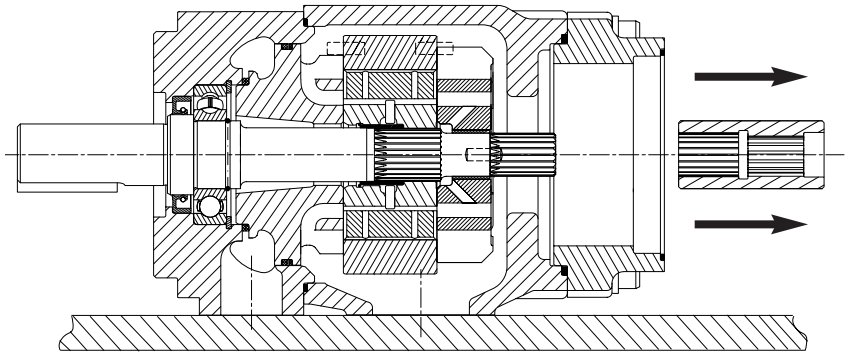
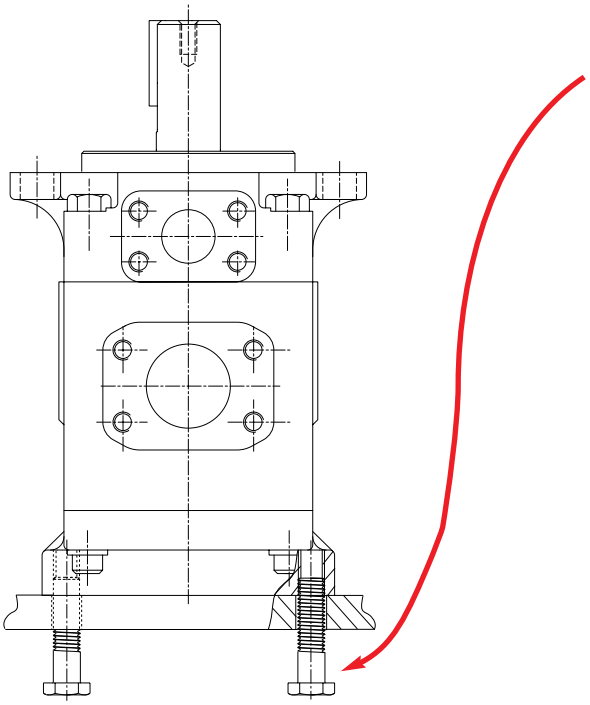
3 . 2 . CHANGING CARTRIDGE - DRIVE TRAIN PUMP :

1 . Remove the coupling.



2 . Install the pump on the table.



Two bolts will help to unscrew the 4 pump bolts.

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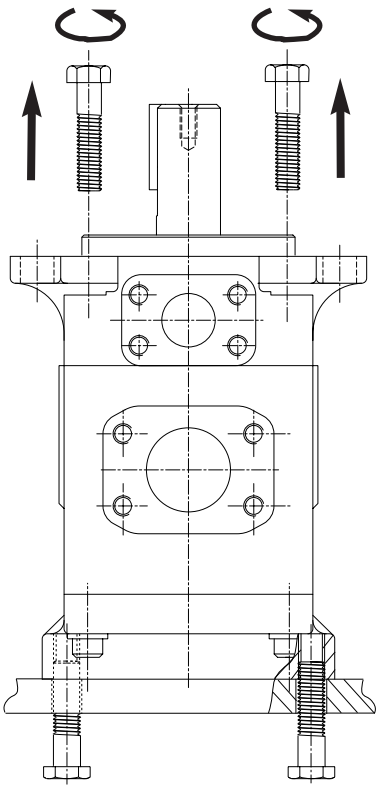
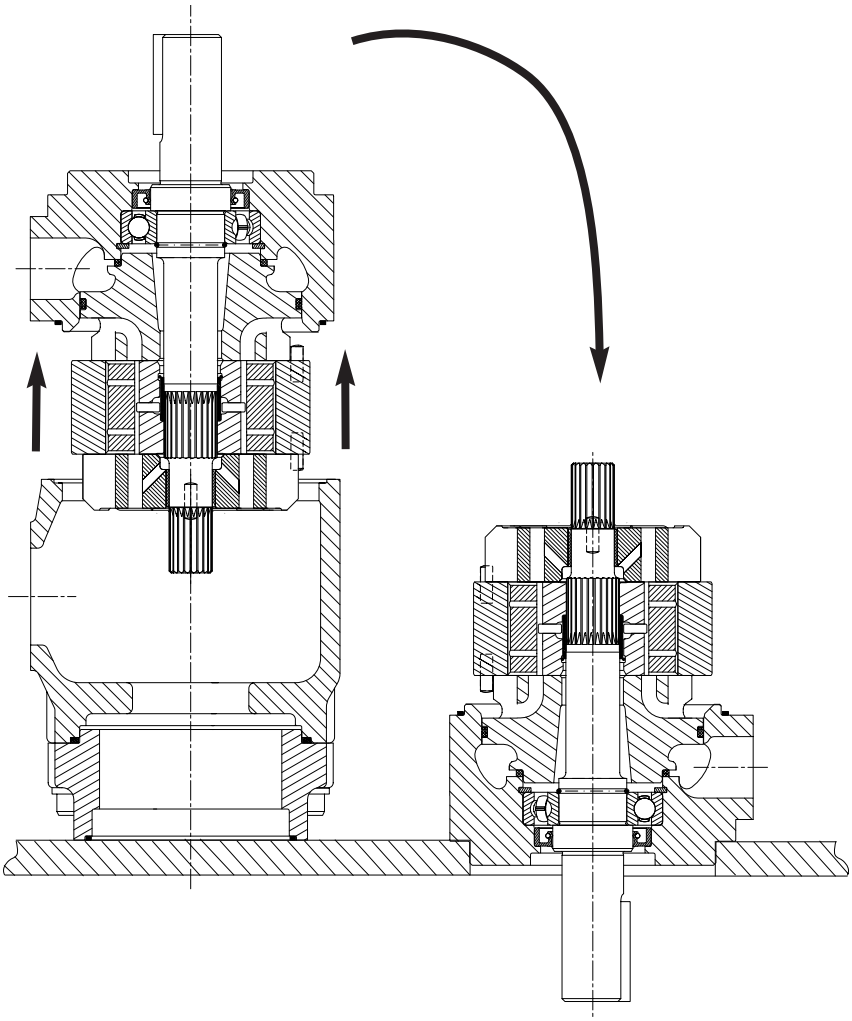
3 . 2 . CHANGING CARTRIDGE - DRIVE TRAIN PUMP :

3 . Unscrew the 4 bolts.



4 . Remove the front cap/ cartridge assembly.



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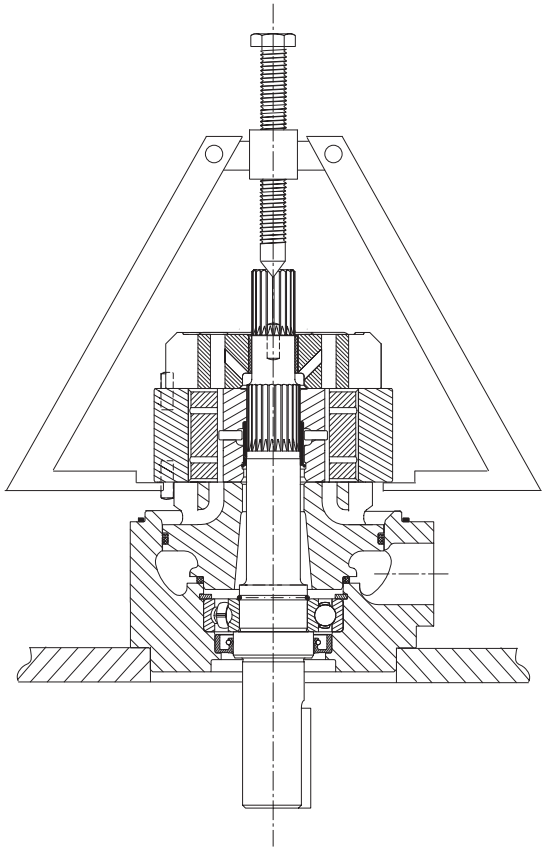
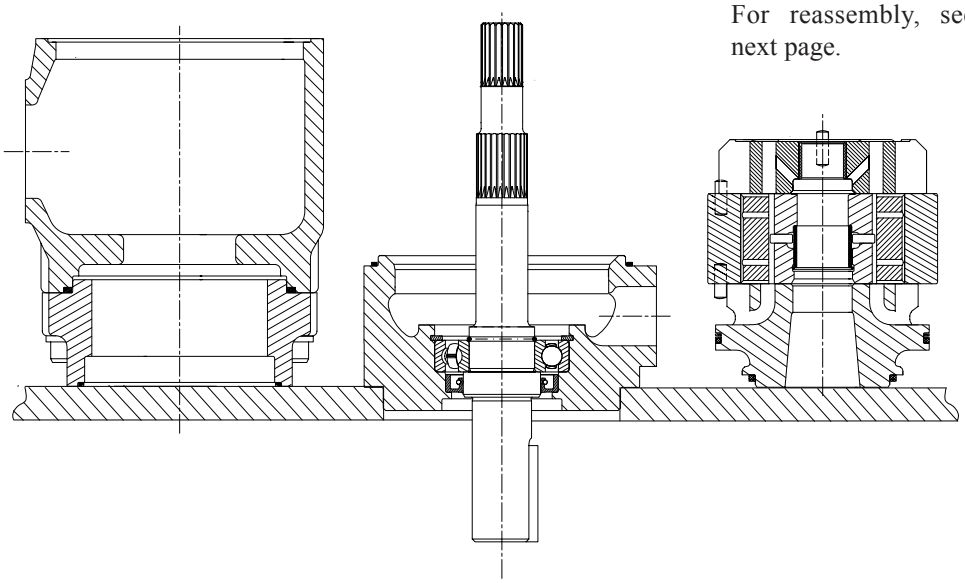
3 . 2 . CHANGING CARTRIDGE - DRIVE TRAIN PUMP :

5 . Disassemble the cartridge from the front cap with an extractor.



6 . All needed sub-assemblies are obtained.



For shaft modification, see page 9.
For cartridge modification, see page 18.
For reassembly, see next page.

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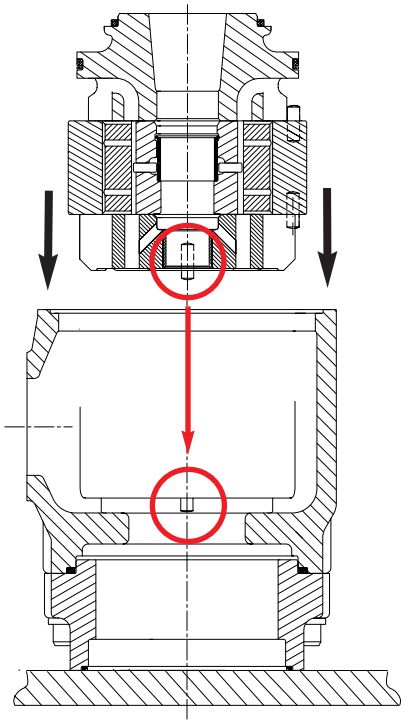
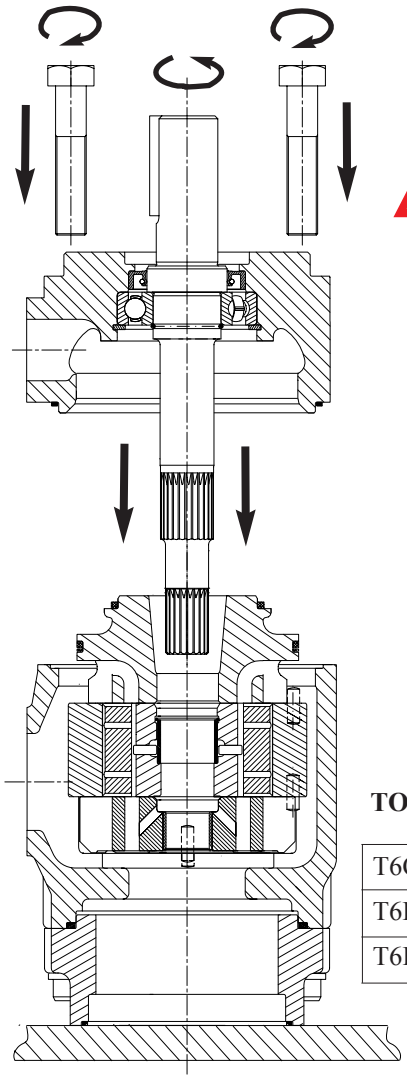
3 . 2 . CHANGING CARTRIDGE - DRIVE TRAIN PUMP :

7 . Assemble the new cartridge in the housing.



Check if the dowel pin is in its position in the housing by trying to rotate the cartridge.

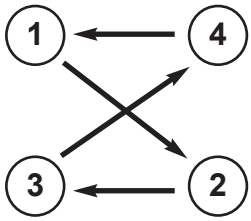
8 . Install the front cap & shaft assembly.
Orient the P1 to obtain the correct porting (see page 29).



a) Always check if the shaft rotates freely.
If not, disassemble and go back to the previous step.

b) Check the porting configuration (see table page 29).

c) Tighten the 4 bolts.



Step by step to avoid damaging the seals.

d) Always check if the shaft rotates freely.
If not, disassemble and go back to the previous step.

TORQUE REQUIREMENTS.

T6CR	159 Nm	117 ft.Lbs
T6DR - T7DRS	187 Nm	138 ft.Lbs
T6ER - T7ERS	187 Nm	138 ft.Lbs

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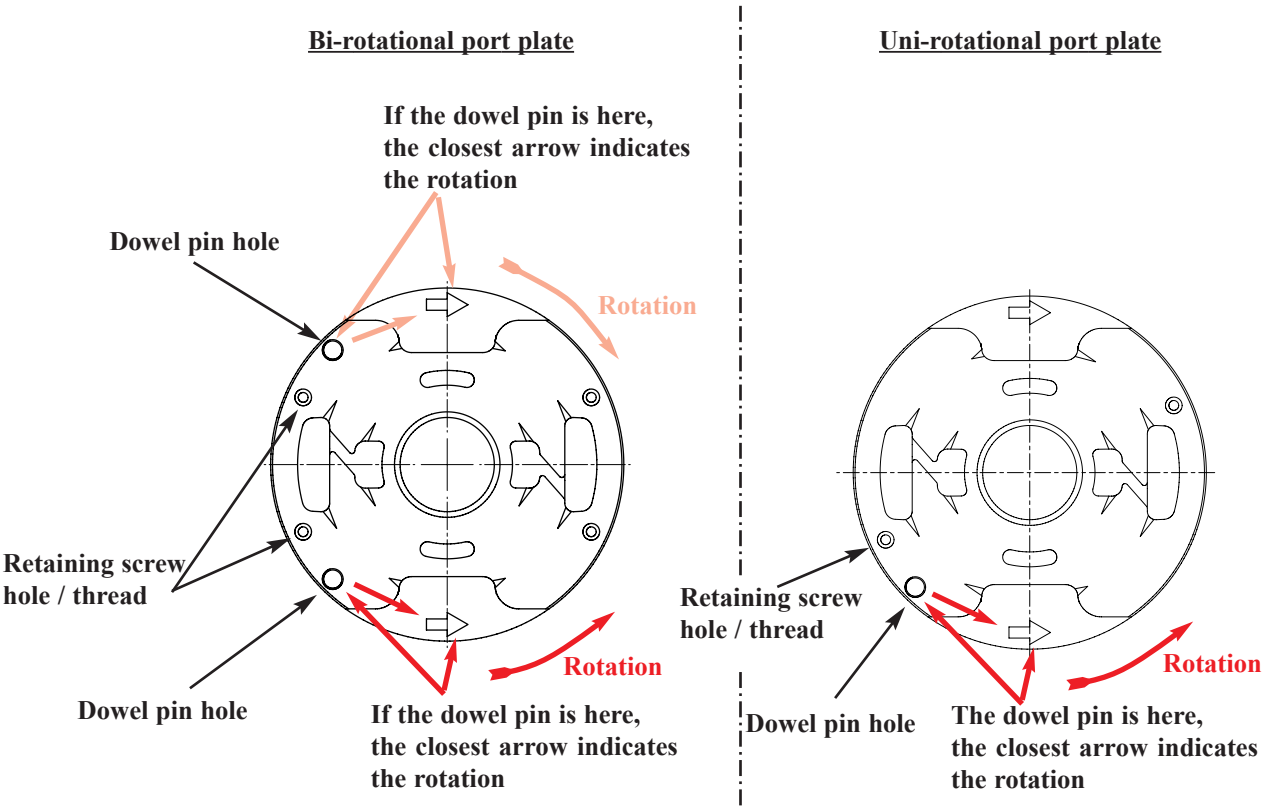
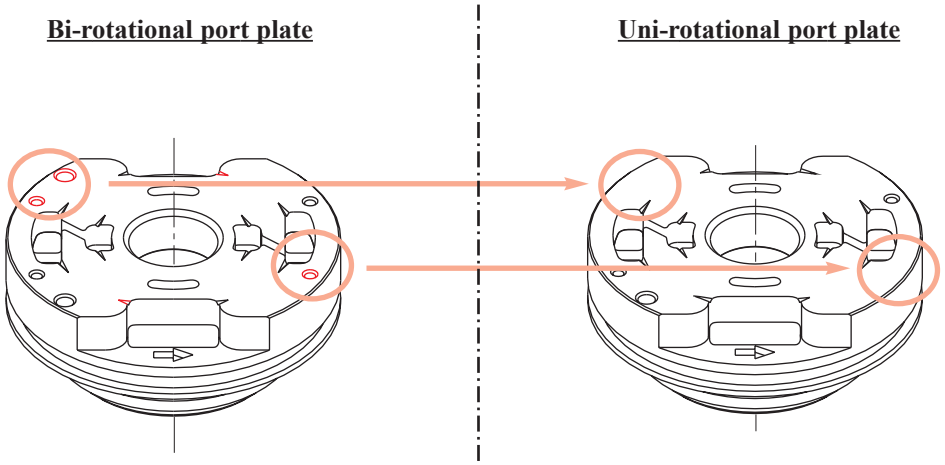
3 . 3 . CHANGING ROTATION :

1 . Explanations :

Bi & uni-rotational port plates.





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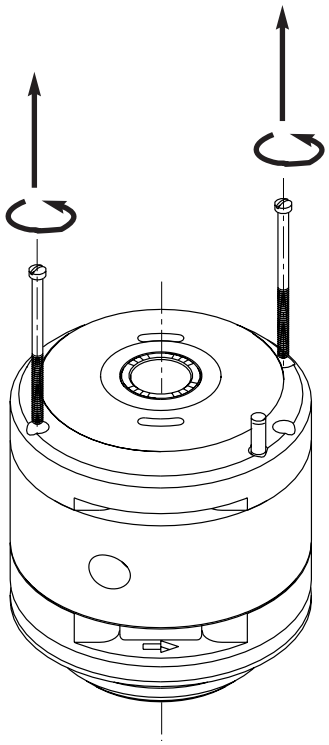
3 . 3 . CHANGING ROTATION :

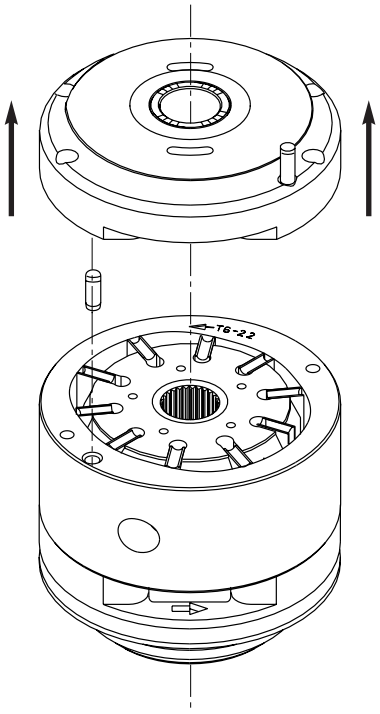
It is possible to change the rotation if the port plates are bi-rotational.

If uni-rotational, change the port plates to change the rotation.

2 . Remove the two retaining screws.



3 . Remove the rear port plate.



Rear port plate with or without bushing, it depends :
P2 position = no bushing.
P3 position = with bushing.

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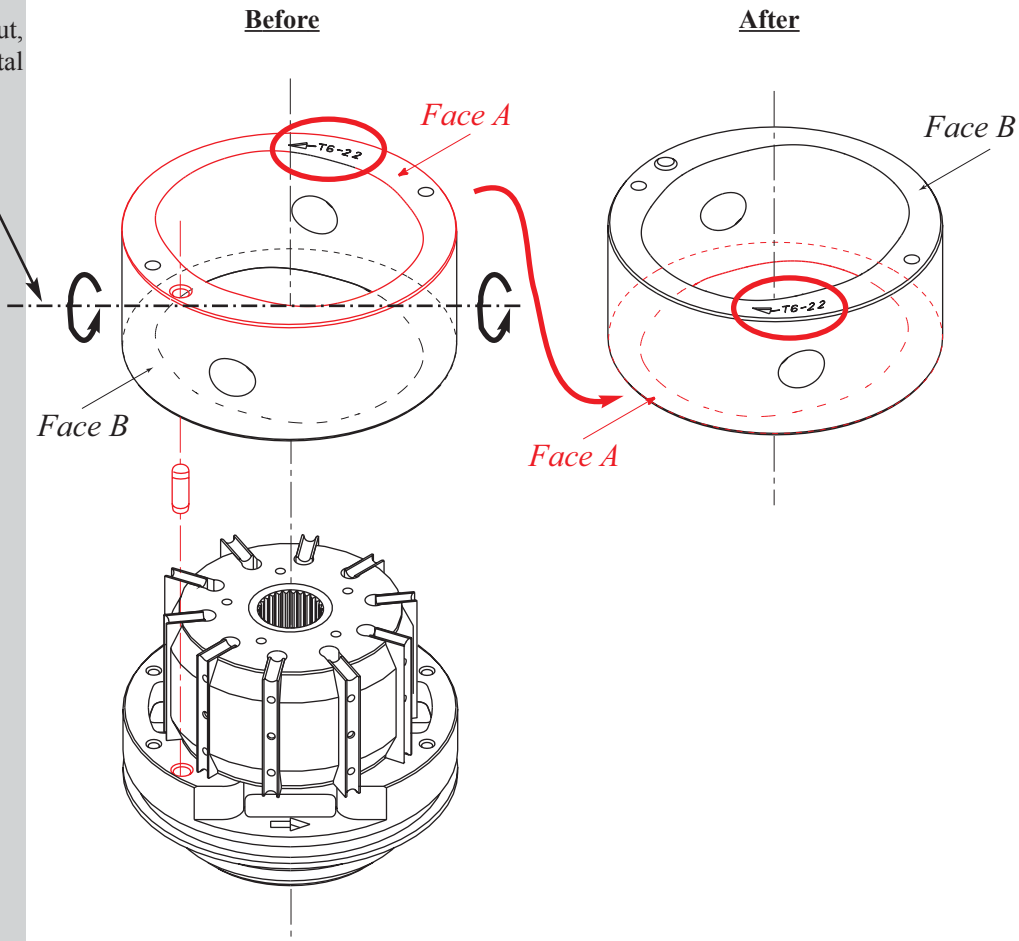
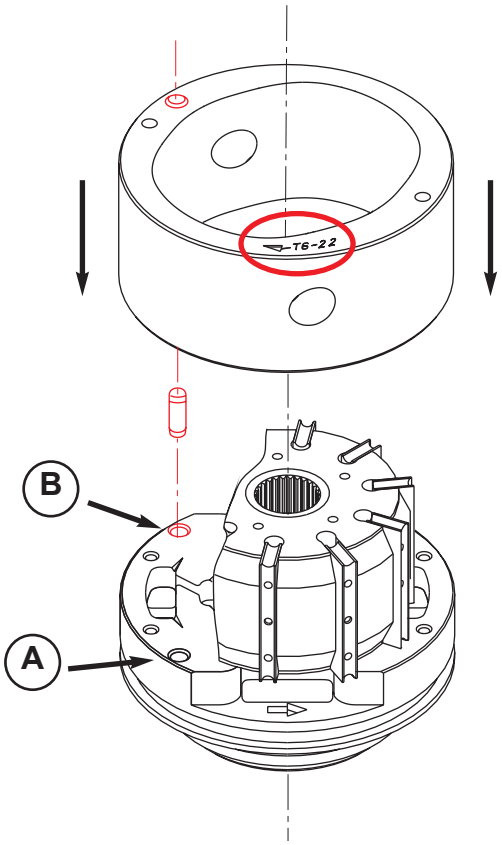
3 . 3 . CHANGING ROTATION :

4 . Take the cam ring out, flip it around the horizontal axis.



5 . Change the dowel pin from A to B.
Position the cam ring.



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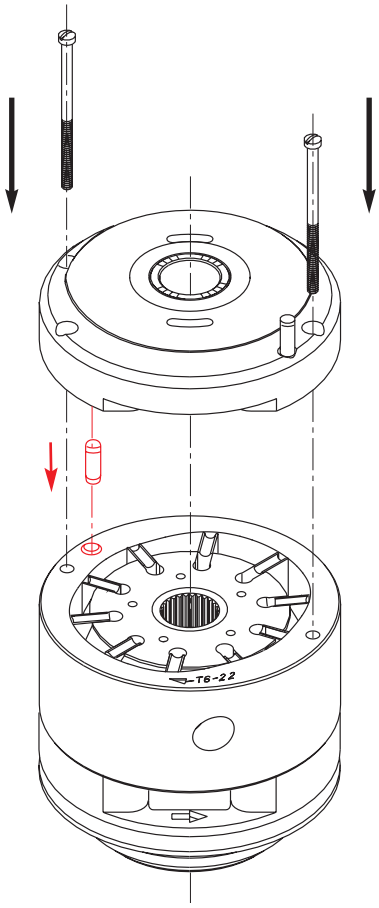
3 . 3 . CHANGING ROTATION :

6 . Position the dowel pin.

7 . Position the port plate & screws.



Before tightening the screws, rotate the rotor/vane.

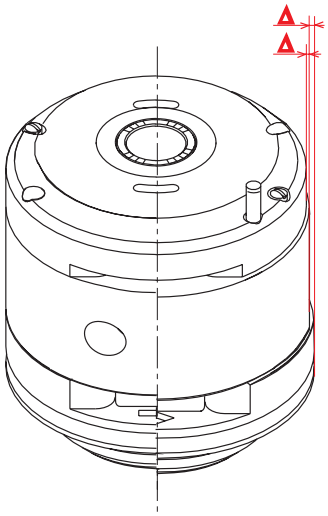
Retaining screws = assembly purpose & concentricity of the elements.

Rotate rotor after cartridge assembly.

The screws should only be loosely tightened.

GOOD CONCENTRICITY

BAD CONCENTRICITY



If the elements are not properly assembled together (bad concentricity), the cartridge will not fit correctly into the housing.

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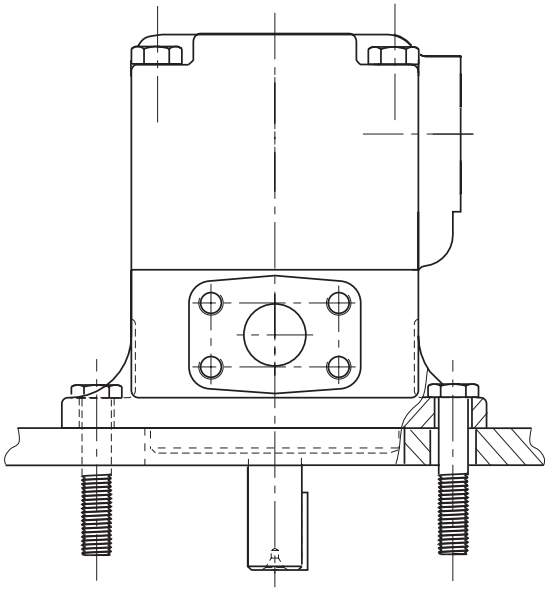
3 . 4 . CHANGING PORTING - STANDARD PUMP :

1 . Install the pump on the table.



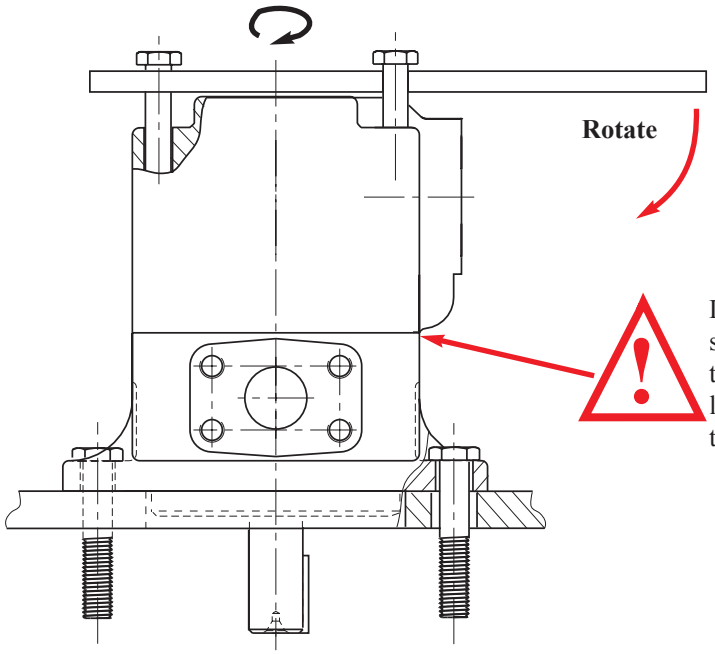
Two bolts will help to unscrew the 4 pump bolts.

2 . Unscrew the 4 bolts.

3 . Keep two bolts.

4 . Rotate the housing with a bar blocked between the two screws.

Note : the cartridge will rotate with the housing.



Do not lift the housing, this to prevent the dowel pin from leaving its position in the housing.

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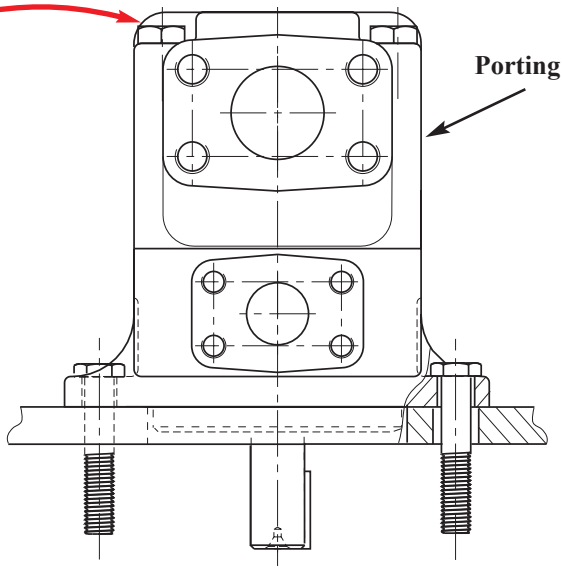
3 . 4 . CHANGING PORTING - STANDARD PUMP :

5 . Put the screws back.

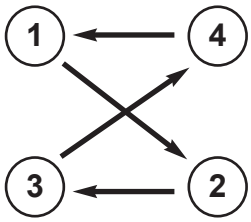
6 . Tighten to the correct torque (see table hereunder).



a) Always check if the shaft rotates freely.
If not, disassemble and go back to the previous step.

b) Check the porting configuration (see table page 29).

c) Tighten the 4 bolts



Step by step to avoid damaging the seals

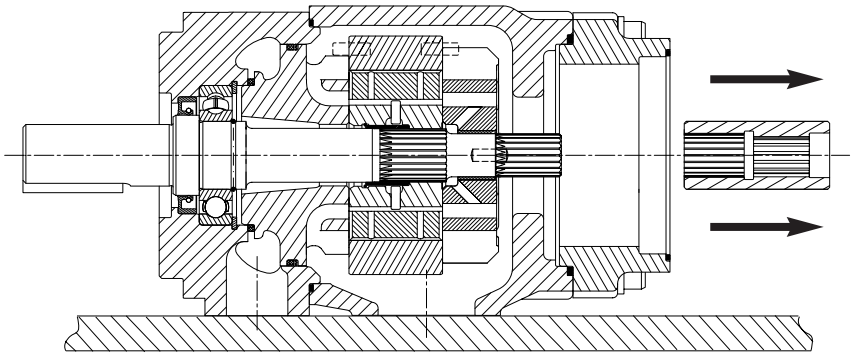
d) Always check if the shaft rotates freely.
If not, disassemble and go back to the previous step.

TORQUE REQUIREMENTS.

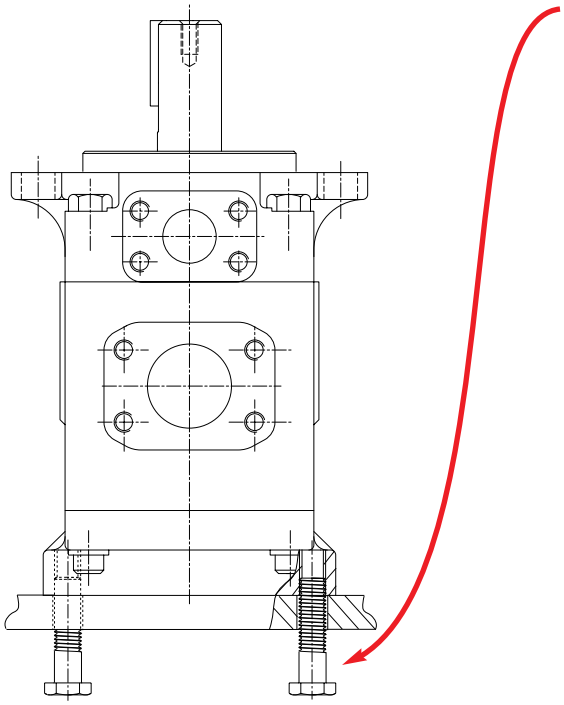
T6C-T6CM-T6CP	159 Nm	117 ft.Lbs
T6D-T7D	187 Nm	138 ft.Lbs
T6E-T7E	187 Nm	138 ft.Lbs
T7B-T7BS	187 Nm	138 ft.Lbs

3 . 5 . CHANGING PORTING - DRIVE TRAIN PUMP :

1 . Remove the coupling.



2 . Install the pump on the table.



Two bolts will help to unscrew the 4 pump bolts.

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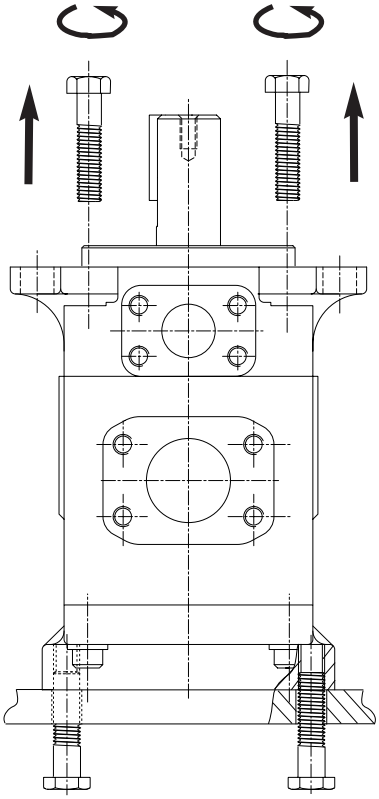
3 . 5 . CHANGING PORTING - DRIVE TRAIN PUMP :

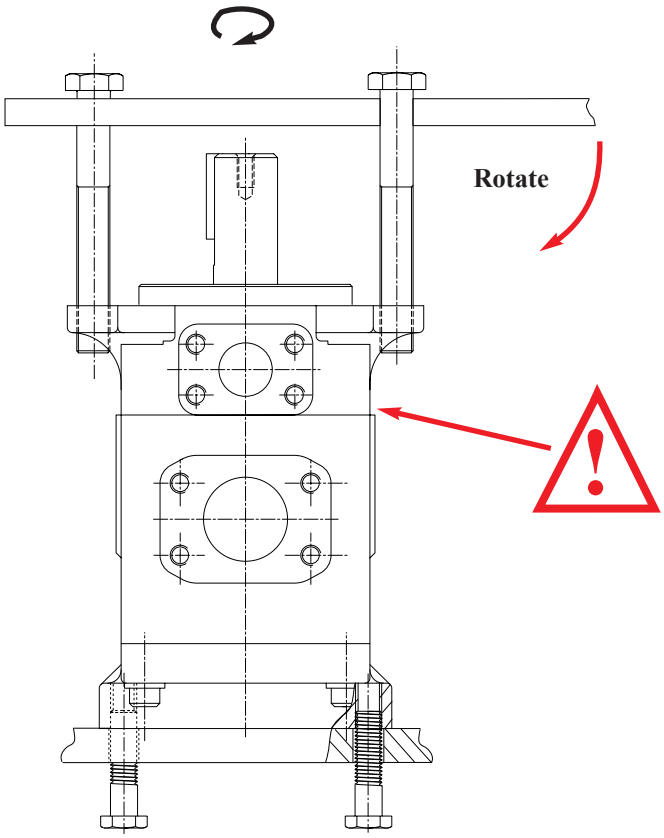
3 . Unscrew the 4 bolts.



4 . Keep two bolts.

5 . Rotate the front cap with a bar blocked between the two screws.

2 bolts in front flange to rotate “P1”.



Do not lift the cap end, this to prevent the dowel pin from leaving its position in the housing.

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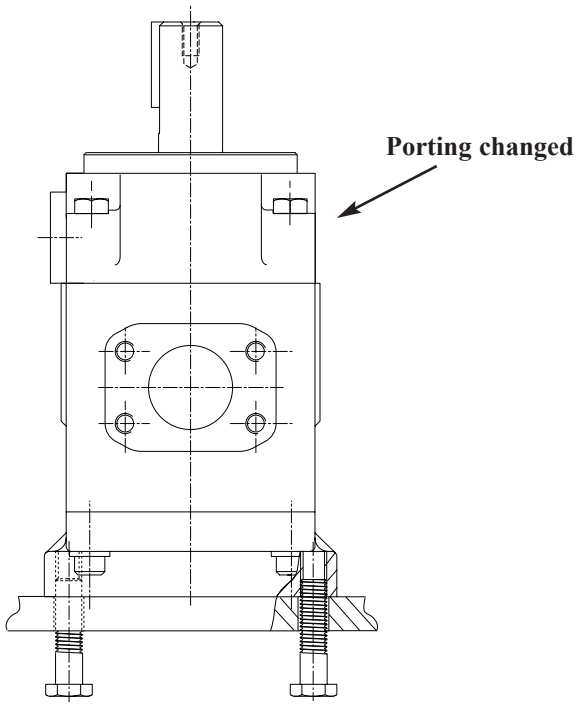
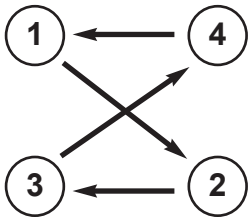
3 . 5 . CHANGING PORTING - DRIVE TRAIN PUMP :



a) Always check if the shaft rotates freely.
If not, disassemble and go back to the previous step.

b) Check the porting configuration (see table page 29).

c) Tighten the 4 bolts



Step by step to avoid damaging the seals

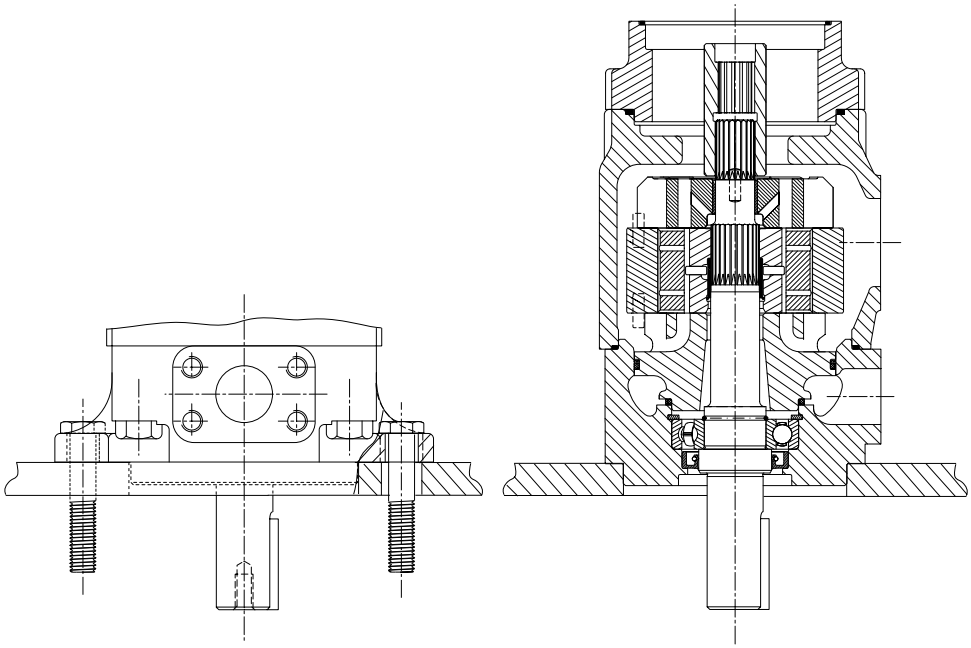
d) Always check if the shaft rotates freely.
If not, disassemble and go back to the previous step.

TORQUE REQUIREMENTS.

T6CR	159 Nm	117 ft.Lbs
T6DR - T7DRS	187 Nm	138 ft.Lbs
T6ER - T7ERS	187 Nm	138 ft.Lbs

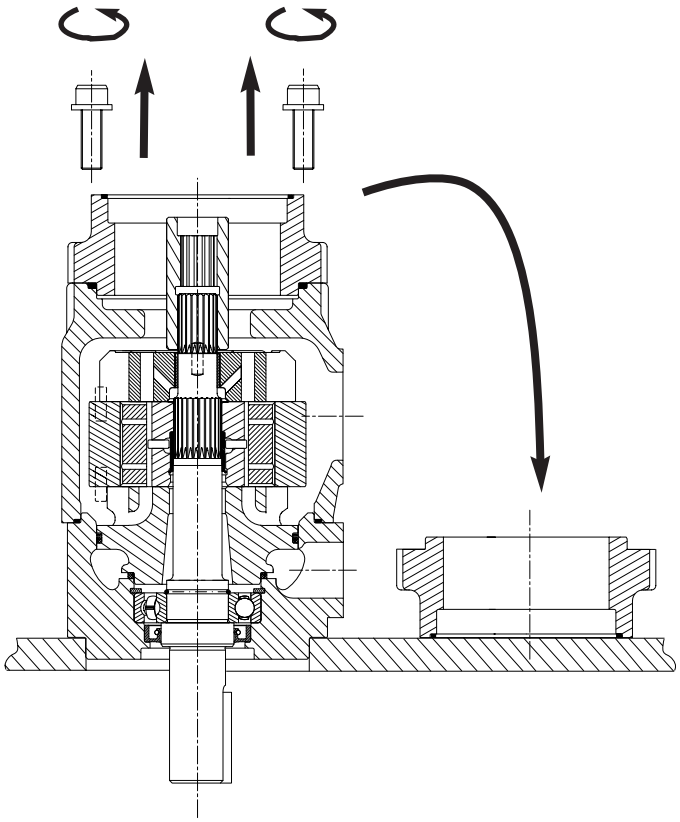
3 . 6 . CHANGING ADAPTER - DRIVE TRAIN PUMP :

1 . Install the pump on the table.



2 . Unscrew the 4 bolts.

3 . Remove the adapter.



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3 . 6 . CHANGING ADAPTER - DRIVE TRAIN PUMP :

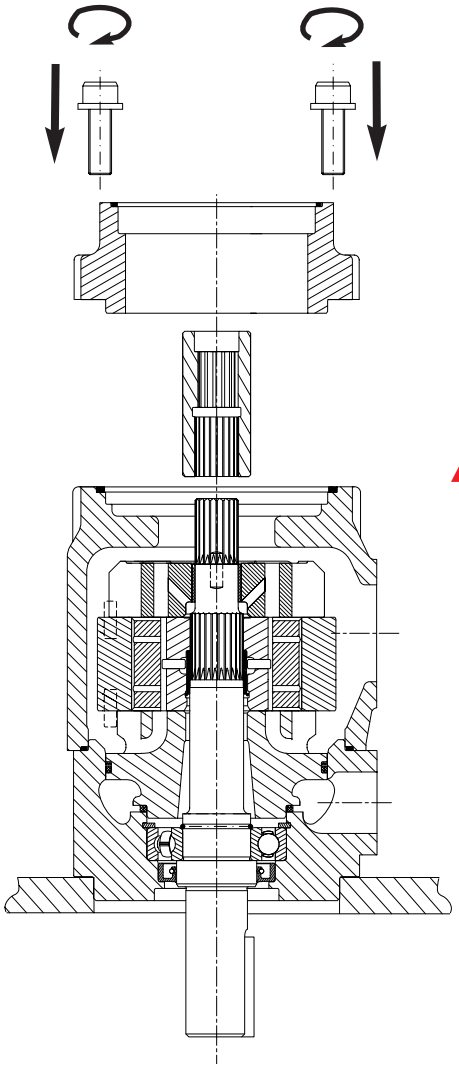
COUPLINGS :

	SAE A – 9 teeth	SAE B		SAE BB	SAE C	SAE 11 teeth
		For adapter SAE B	For adapter SAE A			
T6CR	034 - 66537	034 - 66540	034 - 66649	034 - 66543	034 - 66546	034 - 66652
T6DR - T7DRS	034 - 66538	034 - 66541	034 - 66650	034 - 66544	034 - 66547	034 - 66653
T6ER - T7ERS	034 - 66539	034 - 66542	034 - 66651	034 - 66545	034 - 66548	034 - 66654

ADAPTERS :

	SAE A	SAE B	SAE C
T6CR T6DR - T7DRS T6ER - T7ERS	034 - 67437	034 - 67438	034 - 66934

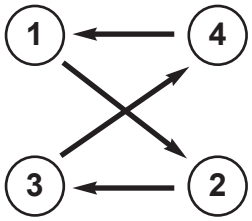
4 . Assemble the new adapter & new couplings.



a) Always check if the shaft rotates freely.
If not, disassemble and go back to the previous step.

b) Check the porting configuration (see table page 29).

c) Tighten the 4 bolts.



Step by step to avoid damaging the seals.

d) Always check if the shaft rotates freely.
If not, disassemble and go back to the previous step.

TORQUE REQUIREMENTS.

T6CR T6DR - T7DRS T6ER - T7ERS	72 Nm	53 ft.Lbs

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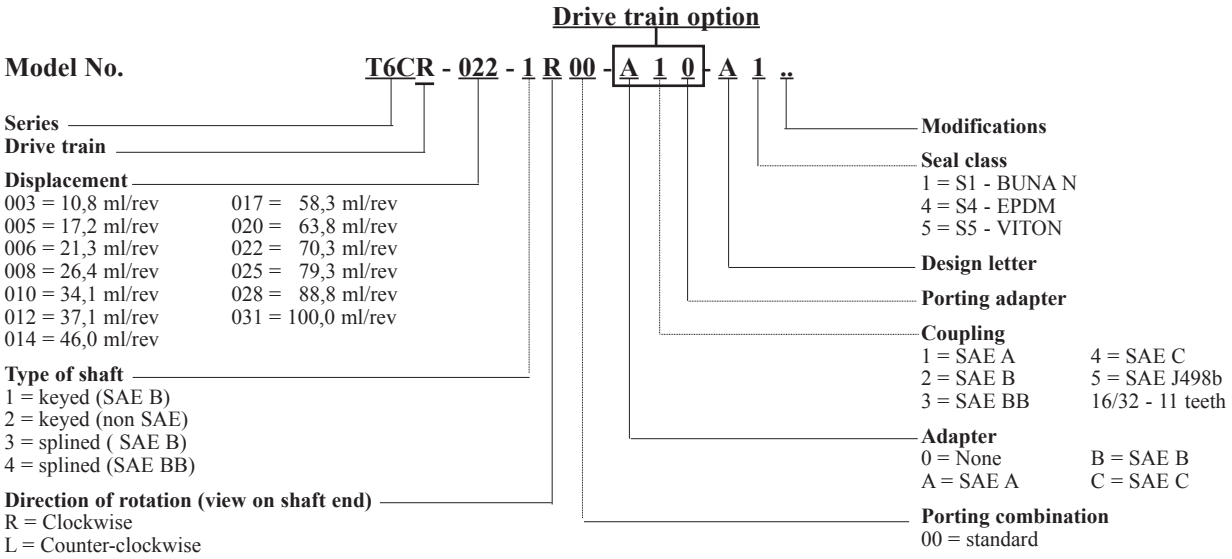
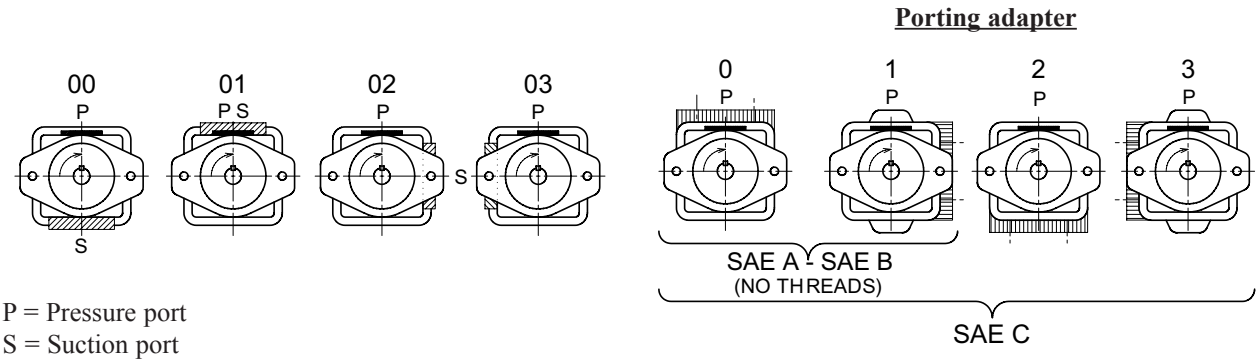
4 . 1 . KEY SHEET :



4 . 2 . PORTING TABLES :



P = Pressure port
S = Suction port

4 . 3 . TORQUE REQUIREMENTS :

	T7B	T6C T6CR	T6D / T7D T6DR / T7DRS	T6E / T7E T6ER / T7ERS
Torque on the 4 main bolts (front cap / housing)	187 Nm 138 ft.Lbs	159 Nm 117 ft.Lbs	187 Nm 138 ft.Lbs	187 Nm 138 ft.Lbs
	Drive train only			
Torque on the adapter (adapter / housing) 4 bolts		72 Nm 53 ft.Lbs	72 Nm 53 ft.Lbs	72 Nm 53 ft.Lbs
Torque between the adapter and the adapted pump (2 screws)		SAE A = 49 Nm 36 ft.Lbs SAE B = 88 Nm 65 ft.Lbs SAE C = 190 Nm 140 ft.Lbs		

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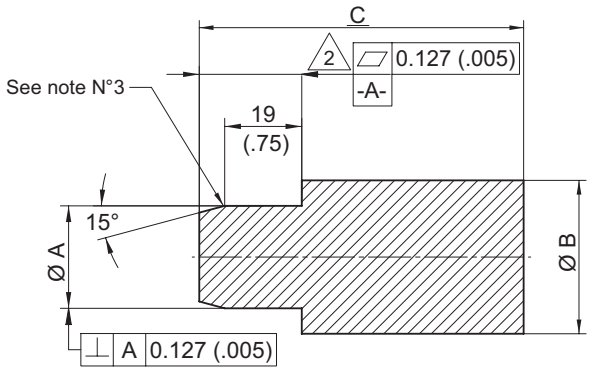
Parker Hannifin
Denison Vane Pump Division
Vierzon - France

5 . 1 . SEAL DRIVER - DIMENSIONS:

Series	Tool N°	Ø A		Ø B		C	
		mm	inch	mm	inch	mm	inch
T6C-T6CM-T6CP	DM3-418S0-1	25,27 25,40	0.995 1.000	37,82 37,98	1.489 1.495	145	5.708
T6D-T7D	DM3-418S0-2	34,74 34,90	1.368 1.374	56,92 57,11	2.241 2.248	145	5.708
T6E-T7E	DM3-418S0-4	41,11 41,27	1.618 1.625	59,97 60,16	2.361 2.368	145	5.708
T7B-T7BS	DM3-418S1-0	31,60 31,75	1.244 1.250	44,16 44,32	1.738 1.745	145	5.708
T6CR	DM3-418S1-0	31,60 31,75	1.244 1.250	44,16 44,32	1.738 1.745	145	5.708
T6DR-T7DRS	DM3-418S0-4	41,11 41,27	1.618 1.625	59,97 60,16	2.361 2.368	145	5.708
T6ER-T7ERS	DM3-418S0-4	41,11 41,27	1.618 1.625	59,97 60,16	2.361 2.368	145	5.708



NOTES :

1. Remove all burrs and break sharp edges: 0.25/0.13 R (.010/.005 R).

2. Length 2 to be heat treated to RC 47/50.

3. Length 2 to have a 10-20 full length, with a smooth intersection between chamfer and dia. "A".

4. Grease O.D. of length 2 before installing the shaft seal on the tool to prevent damaging the seal.
Material 4140 or equivalent.

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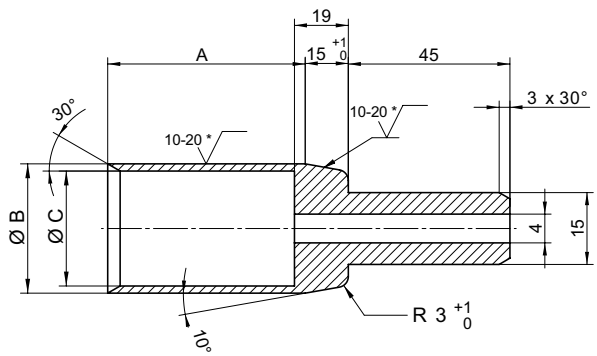
5 . 2 . PROTECTIVE CONE - DIMENSIONS:

Series	Code N°	Tool N°	A		Ø B		Ø C	
			mm	inch	mm	inch	mm	inch
T6C*	Code 1 & 2	DM3-392CP-01	70,0	2.756	25,30 25,40	0.996 1.000	22,28 22,35	0.877 0.880
	Code 3	DM3-392CP-33	38,0	1.496			21,86 21,81	0.859 0.861
T6CP	Code 3	DM3-392CP-14	60,0	2.362	34,95 35,00	1.376 1.378	31,25 31,33	1.230 1.233
	Code 2	DM3-392CP-02	83,0	3.268			31,80 31,88	1.252 1.255
T6D T7D	Code 1 & 2	DM3-392CP-02	83,0	3.268	34,95 35,00	1.376 1.378	31,80 31,88	1.252 1.255
	Code 3 Code 4	DM3-392CP-14	60,0	2.362			31,25 31,33	1.230 1.233
T6E T7E	Code 1	DM3-392CP-04	89,0	3.504	41,25 41,33	1.624 1.627	38,15 38,23	1.502 1.505
	Code 2	DM3-392CP-11	80,0	3.150			31,80 31,88	1.252 1.255
	Code 3	DM3-392CP-24	93,0	3.661			34,92 35,00	1.375 1.378
	Code 3	DM3-392CP-10	55,0	2.165			31,25 31,33	1.230 1.233
T7B/BS	Code 2 Code 4	DM3-392CP-19	42,0	1.653	31,77 31,72	1.251 1.249	25,05 25,13	0.986 0.989
	Code 3	DM3-392CP-17	36,0	1.417			21,85 21,93	0.860 0.863
	Code 1	DM3-392CP-05	70,0	2.756			22,28 22,35	0.877 0.880
T6CR	Code 1	DM3-392CP-15	70 ,0	2.756	31,77 31,72	1.251 1.249	25,43 25,51	1.001 1.004
	Code 2	DM3-392CP-05	70,0	2.756			22,28 22,35	0.877 0.880
	Code 3	DM3-392CP-17	36,0	1.417			21,85 21,93	0.860 0.863
	Code 4	DM3-392CP-19	42,0	1.653			25,05 25,13	0.986 0.989
T6DR T7DRS	Code 1	DM3-392CP-11	80,0	3.150	41,25 41,33	1.624 1.627	31,80 31,88	1.252 1.255
	Code 2	DM3-392CP-04	89,0	3.504			38,15 38,23	1.502 1.505
	Code 3	DM3-392CP-10	55,0	2.165			31,25 31,33	1.230 1.233
	Code 5	DM3-392CP-16	80,0	3.150			34,95 35,03	1.376 1.379
T6ER T7ERS	Code 1	DM3-392CP-04	89,0	3.504	41,25 41,33	1.624 1.627	38,15 38,23	1.502 1.505
	Code 3	DM3-392CP-10	55,0	2.165			31,25 31,33	1.230 1.233
	Code 4	DM3-392CP-18	56,0	2.205			37,62 37,70	1.481 1.484

If shaft Ø > than shaft seal Ø, there are not specific tools. Please contact DENISON for the specific TPI.



* full length of O.D. no tool marks or scratches permissible with a smooth intersection between 10° chamfer & dia. "B".

NOTES :

1. Remove all burrs and break sharp edges: 0.25/0.13 R (.010/.005 R).

2. Teflon preferred, alternate 4140 treated after machining to RC 50-55.

3. Install protective cone over shaft extension and grease O.D. to prevent damaging the shaft seal.

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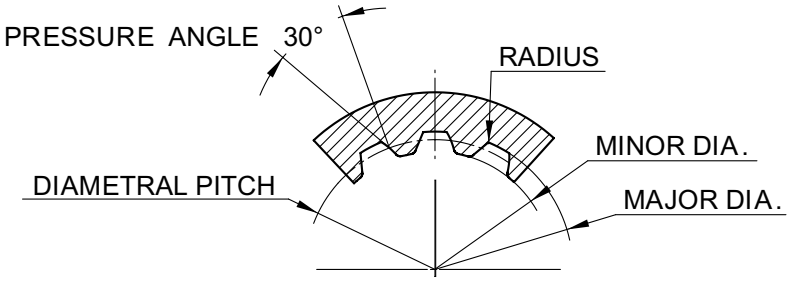
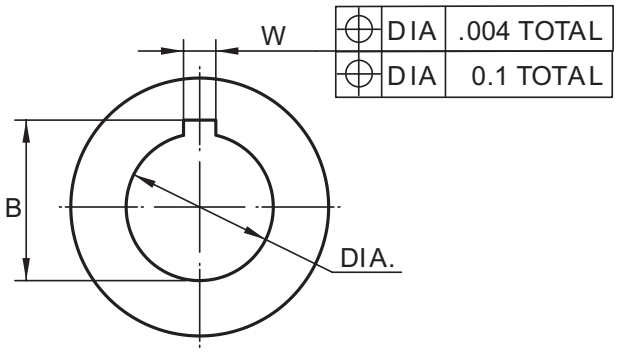
6 . 1 . FEMALE COUPLING DIMENSIONS :

SPLINED SHAFTS :



Shafts	T6C* code 3 T7BS code 3		T6C* code 4 T7BS code 4		T6CP code 3 T6D* - T7DS code 3 & 4 T6E* - T7ES code 3		T6E* - T7ES code 4	
Type	SAE B		SAE BB		SAE C		SAE CC	
Number of teeth	13		15		14		17	
Pitch	16/32		16/32		12/24		12/24	
	mm	inch	mm	inch	mm	inch	mm	inch
Major dia.	22,221 22,500	0.8748 0.8858	25,400 25,679	1.0000 1.0110	31,750 32,080	1.2500 1.2630	38,100 38,430	1.5000 1.5130
Minor dia.	19,134 19,261	0.7533 0.7583	22,268 22,395	0.8767 0.8817	27,589 27,716	1.0862 1.0912	33,876 34,003	1.3337 1.3387
Pitch dia.	20,638	0.8125	23,812	0.9375	29,634	1.1667	35,984	1.4167
Form dia.	21,908	0.8625	25,082	0.9875	31,326	1.2333	37,676	1.4833
Pin dia.	2,743	0.1080	2,743	0.1080	3,658	0.1440	3,658	0.1440
Max. measurement between two pins	16,505 16,589	0.6498 0.6531	19,722 19,807	0.7765 0.7798	24,305 24,407	0.9569 0.9609	30,562 30,648	1.2032 1.2066
Circular space width : Min. effective Max. actual	2,494 2,560	0.0982 0.1008	2,494 2,560	0.0982 0.1008	3,325 3,398	0.1309 0.1338	3,325 3,401	0.1309 0.1339
Radius max.	0,150	0.0059	0,150	0.0059	0,300	0.0118	0,300	0.0118

KEYED SHAFTS :



Shafts	T6C code 1 & 2 T7BS code 1		T6CP code 2 T6D* - T7DS code 1 & 2 T6E* - T7ES code 2		T6E* - T7ES code 1		T7B/BS code 2		T7D/DS code 5		T7E/ES code 5	
	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
Diameter	22,232 22,253	0.8753 0.8761	31,759 31,784	1.2504 1.2513	38,109 38,134	1.5004 1.5013	25,028 25,007	.985 .984	32,050 32,025	1.262 1.261	38,050 38,025	1.498 1.497
W	6,363 6,414	0.2505 0.2525	7,953 8,004	0.3131 0.3151	9,533 9,584	0.3753 0.3773	8,018 7,982	.316 .314	9,982 10,018	.393 .394	9,982 10,018	.393 .394
B	24,970 25,098	0.9831 0.9881	35,212 35,339	1.3863 1.3913	42,250 42,377	1.6634 1.6684	28,30 28,40	1.114 1.118	35,30 35,40	1.390 1.394	41,30 41,40	1.626 1.630

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7 . VANE TROUBLESHOOTING GUIDE :

1 . No flow, no pressure	a) Is the pump rotating ?	a-1) Check if the coupling is rotating. If not, check the rotation of the electric motor. a-2) Check the keys of the pump and E motor shaft. a-3) Check if the shaft is not broken.
	b) Is the rotation in the correct direction?	b-1) Check if the rotation of the pump corresponds to the arrow on the name plate. b-2) Check if the wiring of the electric motor is correct.
	c) Is the air bleed-off done?	c-1) Check that no air is still located in the pressure line. Loosen a connector.
	d) How are the inlet conditions?	d-1) Check if the inlet gate valve is not closed. d-2) Check the oil level. d-3) Check if the inlet hose in the tank is under the oil tank level. d-4) Check if an air intake is not disturbing the inlet (missing inlet flange seal, air trapped in suction line as examples). d-5) Check if the pump is not located too high above the oil level. d-6) Check if the tank is not completely sealed. Then the lack of atmospheric pressure will not allow the pump to prime. d-7) Check if all connections and seals are air-tight.
	e) Is the Viscosity not too high?	e-1) Check if the oil characteristics are not incompatible with the temperature and the pumps requirements. Too high Viscosity will "stick" the vein fluid and enable the pump to suck the oil correctly.
	f) Is the pump flow not going somewhere else?	f-1) Check the hydraulic circuit and the main sequences. Doing so, you will check if all the valves are set or work properly. f-2) Check if the main relief valve is not set at an extremely low pressure and therefore bringing all the flow back to the tank. f-3) Check if in the directional valves the spools are not sticking in a position that brings the flow back to the tank. f-4) check if the check valve is not mounted "upside down".
	g) Is the receptor working correctly?	g-1) Check if the motor does not let all the flow leak internally. g-2) Check if the cylinder inner seals are not ruined.
	h) Is the speed high enough?	h-1) Check if the minimum speed is reached. Mobile pumps require 400 rpm and industrial pumps require 600 rpm.
2 . Not enough flow (or not the flow required)	a) Are the components OK?	a-1) Check the displacement of the pump. a-2) Check if the speed of the pump is not too low or too high (E motor or thermic engine sized too small so dropping the speed too low...). a-3) Check if the main relief valve is not set at an extremely low pressure and therefore venting some flow back to the tank.

7 . VANE TROUBLESHOOTING GUIDE :

2 . Not enough flow (or not the flow required) (continuation)	a) Are the components OK? (continuation)	a-4) Check if in the directional valves the spools are not sticking in a position that brings part of the flow back to the tank. a-5) Check if the hydraulic motor is not leaking internally due to a bad efficiency, low viscosity... a-6) Check if the cylinder inner seals are not ruined and therefore allow internal leakage.
	b) Is the connection from the tank to the pump correct?	b-1) Check if there is no air intake between the pump and the inlet pipe (bad seals for example). b-2) Check if the inlet hose is convenient for the required velocity ($0,5 < V < 1,9$ m/s). b-3) Check if the pump is not too high compared to the oil level or if the pump is not too far from the tank (check the inlet absolute pressure with the catalog values). b-4) Check if the gate valve is not semi-open. b-5) Check if the inlet strainer is sized correctly (250 m mesh mini.) or not clogged.
	c) Is the tank design correct?	c-1) Check if the oil level is correct. c-2) Check if the suction pipe is under the oil level during the complete cycle of the machine. c-3) Check if the inlet hose fitted in the tank is cut with an angle wider than 45°. c-4) Check if this inlet hose is not too close to the tank wall or to the bottom of the tank and therefore limits the "vein flow". c-5) Check if the suction hose is not located near the return line and therefore sucking a lot of air coming from these turbulences. c-6) Check if baffles are required to allow correct deareation of the fluid. c-7) Check if the air filter is not clogged or undersized (not well dimensioned). c-8) Check if the tank is not fully tight, not allowing the atmospheric pressure to apply.
	d) Is the oil convenient?	d-1) Check if the oil characteristics are not incompatible with the pumps requirements. d-2) Check if the viscosity is not too high, therefore "sticking" some vanes in the rotor or blocking the vein fluid. d-3) Check if the high temperature does not destroy the viscosity of the fluid. Doing so, the internal leakage will "consume" the flow.
3 . No pressure	a) Is the hydraulic circuit correctly designed?	a-1) Check the hydraulic circuit schematic.
	b) Is the circuit correctly piped?	b-1) Compare the schematic to the piped circuit.

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3 . No pressure (continuation)	c) Are the components working properly?	c-1) Check the main sequences. Doing so, you will check if all the valves are set or work properly. c-2) Check if the main relief valve is not set at an extremely low pressure and therefore bringing all the flow back to the tank. c-3) Check if in the directional valves the spools are not sticking in a position that brings the flow back to the tank.
4 . Not enough pressure	a) Check as when "no pressure" 3.	
	b) Is the system well dimensioned?	b-1) Check if the flow required is not over the available flow and therefore cannot build-up pressure.
	c) Is there an internal leakage somewhere that maintains a certain pressure?	c-1) Check all the possible faulty components, from the pump to all the receptors and intermediates (high pressure seals, mechanical wear...).
5 . Uncommon noise level	a) Is the noise coming from the pump?	a-1) Check the mechanical link of the pump shaft : alignment, balancing of the coupling or Universal joint, key properly fastened... a-2) Check if the air bleed has been done correctly. a-3) Check if there is no air intake from the tank to the pump (nor through the shaft seal). a-4) Check if the hose strain force does not create this noise. a-5) Check if the oil level is correct. a-6) Check if the oil in the tank is not aerated. a-7) Check if the strainer is not clogged or under-dimensioned. a-8) Check if the inlet pipe is under the oil level. a-9) Check if the air filter is not clogged or too small. a-10) Check if the speed is not incompatible with the catalog values. a-11) Check if the oil is compatible with the catalog recommendations. a-12) Check if the inlet pressure is not higher than the outlet pressure.
	b) Is the noise coming from the surroundings?	b-1) Check the hoses and see if the noise in not coming back to the pump this way. b-2) Check the pressure piping and see if its length dumps or amplifies the noise. b-3) Check if the structure of the tank is stiff enough to avoid amplification/resonance. b-4) Check the E motor fan. b-5) Check the balancing of the E motor. b-6) Check the water cooler and its theoretical limits. b-7) Check the filtration unit, its capacity and if the noise does not come from the opened by-pass valve.

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6 . Unusual heat level	a) Does the heat appear when the pump is running without pressure?	a-1) Check the oil level and the suction pipe. Is the oil coming to the pump (check the length of the pipe, its internal diameter, all that could influence the inlet pressure)? a-2) Check if the air bleed has been done correctly. a-3) Check if the flow versus the volume of oil in the tank is correct to obtain a good cooling effect. a-4) Check if a cooler is required or, if there is one, if it is well dimensioned. a-5) If there is a cooler, check if it is working (example for water cooler: is the water flow open or sufficient). a-6) Check if the hydraulic circuit is not bringing back the flow directly to the inlet port. Doing so, it would create a very small closed circuit not able to cool down the fluid. a-7) Check the quality of the fluid. a-8) Check the velocity of the fluid. a-9) Check the filtration unit, its capacity and if the heat does not come from the open by-pass valve or if it is under-dimensioned (bigger delta P).
	b) Does the heat appear when the pump is running with pressure?	b-1) Check the viscosity. b-2) Check the pressure rating. b-3) Check if the cooler is working correctly or well dimensioned. b-4) Check if the relief valve is not creating this heat because always open. b-5) Check if any other component in the system is not creating this heat due to an internal defect. b-6) Check if there is a big temperature differential between the inlet and the outlet.
7 . Shaft seal leakage	a) Is the seal destroyed?	a-1) Check the alignment and the correct power transmission (non homokinetic movement, high radial force as examples). a-2) Check the inlet pressure and compare it to the catalog values. a-3) Check if the bad suction conditions do not create a vacuum that could even reverse the seal lip. a-4) Check if the external environment is not too dirty and therefore ruining the seal.
	b) Is the seal only leaking?	b-1) Check the alignment of the front shaft and check if there is not any radial load. b-2) Check if seal lip has not been cut during a maintenance operation. b-3) Check if the inlet pressure is not over or under the catalog values. This has to be done for the whole cycle because the inlet pressure can vary from time to time. b-4) Check if the seal material has not been modified because of a too warm environment. The seal can vulcanize and stop sealing correctly. b-5) Check the acidity of the oil that can "burn" the seals material. It will therefore destroy the elasticity of the sealing. b-6) Check if the chosen seal (high pressure seal for example) is not too stiff for the use. If the environment requires some elasticity due to a gentle misalignment, a high pressure seal will not be able to follow the movement and therefore leak.

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