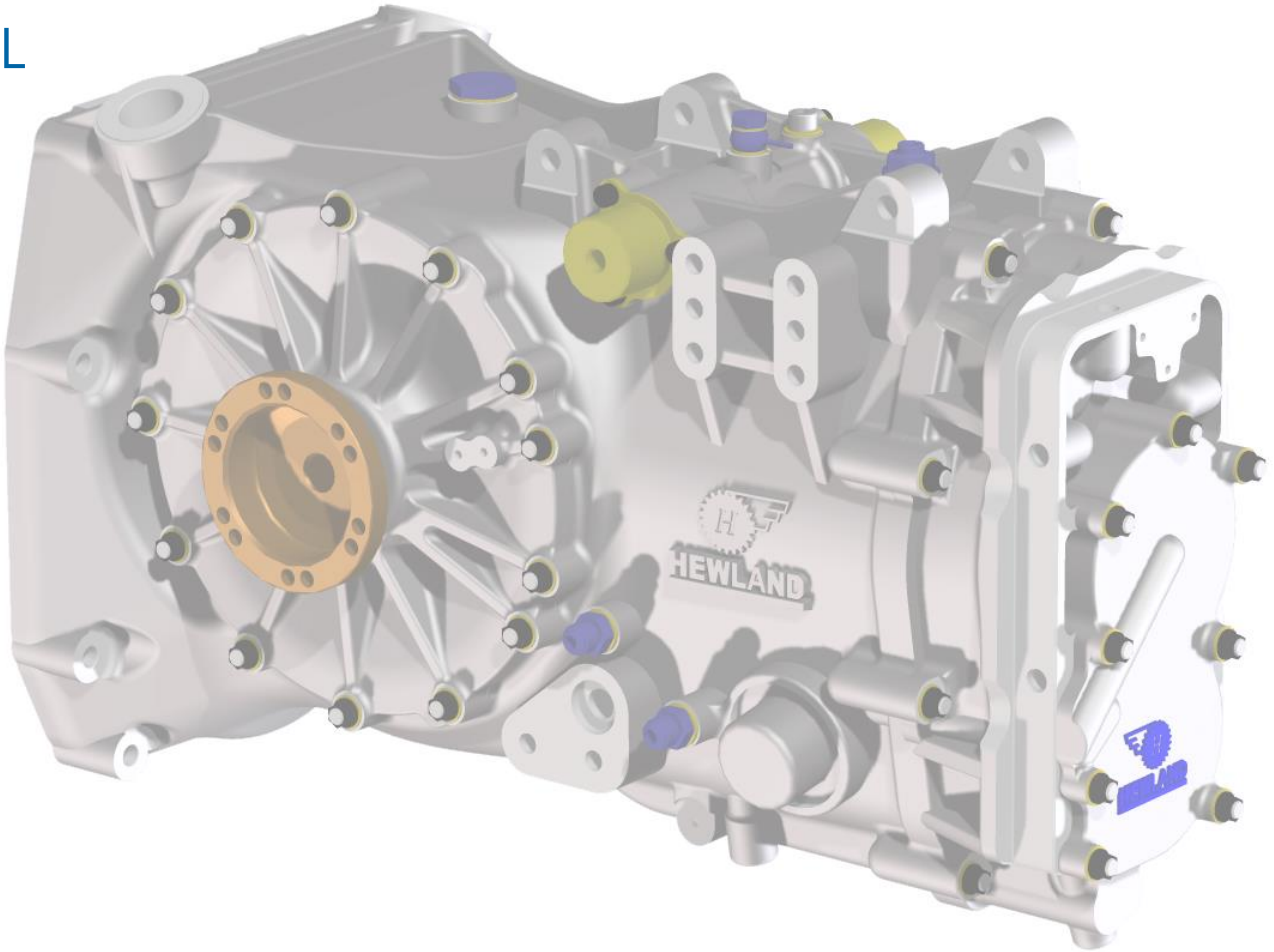
HEWLAND

GEARBOX MANUAL



TMT-200

Hewland Engineering Ltd
Waltham Road, White Waltham
Maidenhead, Berkshire, SL6 3LR, UK

+44 (0) 1628 827600
info@hewland.com
www.hewland.com

Issue: 20
Date: 16/10/2020

LIMITATION OF LIABILITY AND WARNING

The Hewland products and transmissions which are detailed herein are intended to be used in motorsport activities and are therefore subject to the following warning:

A) Hewland products are intended for use in or as high speed and high performance racing vehicles. The racing of high speed and high performance vehicles can be a very hazardous activity and therefore involves a high risk of personal injury or even death. Hewland products will not withstand all foreseeable impacts during their normal intended use in or as a racing vehicle without the likelihood of serious personal injury or death to the driver and/or passenger(s) or of damage to the Hewland products themselves which may impact the products performance and safe use.

B) Hewland products should only be driven or used:

1. By a driver with the requisite training, skill and experience necessary both for the conditions under which the products are to be used and for the racing of high speed and high performance vehicles
2. On specially designed racing tracks and under the supervision of official and approved racing organisations or otherwise under proper and reasonable operating conditions supported by appropriate safety, medical and rescue services
3. With proper maintenance and repairs effected to parts and gearboxes as all parts and gearboxes, being mechanical devices, are inherently subject to wear and tear, fatigue or disintegration and/or damage due to collision or improper use.

WARNING

The information and/or graphics presented in this Hewland Gearbox Service Manual may include inaccuracies or typographical errors. Changes and/or improvements may also be made to the information presented herein without notice at any time. Hewland Engineering Limited makes no representations about the suitability, reliability, availability, timeliness or accuracy of the information and/or graphics presented herein. All such information and/or graphics are provided on an “AS IS” basis without warranty, representation or guarantee of any kind, express or implied. Hewland Engineering Limited hereby disclaims, to the fullest extent permitted under law, all warranties and conditions with regard to this information and/or graphics, including all implied warranties and conditions of merchantability, fitness for a particular purpose, and workmanlike effort.

The user of the information and/or graphics contained in this Hewland Gearbox Service Manual is solely responsible for its use. If the user is dissatisfied with any such information and or graphics, or with the terms of use, the user’s sole and exclusive remedy is to discontinue using the information and/or graphics. In no event shall Hewland Engineering Limited be liable for any direct, indirect, incidental, special or consequential damages whatsoever, including without limitation, damages for accident, injury, property damage, loss of use, loss of data or loss of profits (whether such damages are based on contract, tort, negligence, strict liability or otherwise, even if Hewland Engineering Limited has been advised of the possibility of damages arising), arising out of or in any way connected with:

1. The use or performance of the information and/or graphics presented in this Hewland Gearbox Manual
2. Any inability to use such information and/or graphics,
3. any other use of such information and/or graphics.

CONTENTS

`

FIGURES

TECHNICAL SPECIFICATION

The TMT gearbox is a transaxle unit, designed for mid-engined, rear wheel drive cars. The unit is produced with six forward gears, reverse, and a powerflow differential.

The gear selection mechanism is sequential, and is available as either a pneumatically actuated semi-automatic or a mechanically operated direct link, both have reverse engagement locked out.

The gear selection order is Rev - Neutral - 1st 2nd 3rd 4th 5th & 6th

The drive is taken from the engine via the clutch shaft, to the layshaft, through gears to the pinion shaft, and then on to the crownwheel and differential assembly.

Gear changing is effected through non-synchronising face dogs. An extensive range of gear ratios provides a wide range of gearing requirements. The gear ratios and differential assembly can easily be changed without removing the gearbox from the vehicle.

Heat treated nickel chrome steel is used to manufacture all gears and shafts. The selector forks are also steel. Lubrication is by internal pump with distribution circuit, and the oil is retained by lipped oil seals.

In general configuration, the TMT-200 is a high tech racing transaxle unit which achieves the maximum effective use of power, in conjunction with extremely stiff integral rear suspension mountings.

1st to 6th gear ratios from 3.083:1 to 0.9230:1

Note: Overdrive ratios need proof maching found in TMT-202 version 12 and above.

Final drive ratios 8/35, 9/35, 10:31 & 11/31

Clutchshafts made to customer's requirements

WEIGHT	Aluminium 49.5kg / Magnesium 44.5kg
OIL GRADE	SAE 80 or SAE 90
OIL QUANTITY	1.75ltr (not including oil cooler circuit)
MAXIMUM TORQUE	320lbs.ft (430Nm) – reduced to 275lbs.ft (373Nm) for 8:35 final drive

RECOMMENDED TIGHTENING TORQUES

Unless otherwise specified within this manual.

			Direct in material						Nut on EN16 Stud		Steel Insert (Helicoil, Timesert, Keensert)			
			Torque in Steel		Torque in Aluminium		Torque in Magnesium		Nut Torque		Torque in Aluminium		Torque in Magnesium	
			Nm	lb/ft	Nm	lb/ft	Nm	lb/ft	Nm	lb/ft	Nm	lb/ft	Nm	lb/ft
Metric	Fine	**M3x0.35**	1.4	1.1	0.8	0.6	0.5	0.4	1.7	1.2	1.2	0.9	0.7	0.6
	Course	**M3x0.5**	1.4	1.0	0.8	0.6	0.5	0.4	1.6	1.2	1.3	0.9	0.8	0.6
	Fine	**M4x0.5**	3.5	2.5	2.0	1.4	1.2	0.9	4	3	3	2	1.8	1.3
	Course	**M4x0.7**	3.0	2.5	1.8	1.4	1.2	0.9	4	3	3	2.5	2	1.4
	Fine	**M5x0.5**	7	5	4	3	2.5	2	8	6	5	4	3.5	2.5
	Course	**M5x0.8**	6	5	4	3	2.5	2	7	5	6	4	3.5	3.0
	Fine	**M6.0.75**	11	8	7	5	4	3	13	10	10	7.0	6	4.5
	Course	**M6x1.0**	11	8	6	5	4	3	13	9	10	8	7	5
	Fine	**M8x1.0**	27	20	16	12	10	7	32	23	23	17	14	11
	Course	**M8x1.25**	26	19	15	11	10	7	31	23	24	18	15	11
	Fine	**M10x1.25**	53	39	31	22	19	14	62	46	44	33	28	21
	Course	**M10x1.5**	51	38	30	22	19	14	60	44	46	34	29	22
	Fine	**M12.x1.5**	91	67	53	39	34	25	107	79	76	56	48	36
	Course	**M12x1.75**	89	66	52	38	33	24	104	77	79	58	50	37
Imperial	UNF	**1/4x28**	14	10	8.0	6.0	5.0	4.0	16	12	12	9	8	6
	UNC	**1/4x20**	13	10	8.0	6.0	5.0	3.5	16	12	14	10	9	6
	UNF	**5/16x24**	27	20	16	12	10	7	32	24	23	17	15	11
	UNC	**5/16x18**	26	19	15	11	10	7	31	23	25	19	16	12
	UNF	**3/8x24**	48	35	28	20	18	13	56	41	38	28	24	18
	UNC	**3/8x16**	46	34	27	20	17	12	54	40	43	32	27	20
	UNF	**7/16x20**	76	56	44	32	28	21	89	66	61	45	39	29
	UNC	**7/16x14**	73	54	42	31	27	20	86	63	68	50	43	32

Figure 1-This table is taken from Hewland Standard: DOS-006-V4

Final Drive Bolts	100	Nm
Pinion Shaft Nut	163	Nm
Differential Centre Bolt	80	Nm
Selector Barrel Bolt	48	Nm
All Studs	12	Nm

RECOMMENDED LOCTITE USE

Unless otherwise specified within this manual.

		Loctite 222	Loctite 243	Loctite 270	Loctite 542	Loctite 648
Permanent fixings	Studs being fitted to holes tapped directly into base material			✓		
	Fixing timesert or keensert into tapped hole in base material			✓		
General fixings	Screws / bolts being fitted to holes tapped directly into base material			✓		
	Screw / bolt into timesert	✓				
	Screws / bolts fitted to heli-coil fixings **(LAST RESORT IF LOCKWIRE CANNOT BE USED)**	✓				
Specific fixings	Oil line blanking plugs				✓	
	Differential cap bolts / studs					✓
	Pinion / Mainshaft / Layshaft nut **(ONLY IF LOCKING DEVICE IS NOT INCORPORATED INTO DESIGN)**			✓		
	Crownwheel bolts / studs					✓
	Selector barrel Nut		✓			
	Pinion bearing retaining bolts			✓		

Figure 2-This table is taken from Standard: DOS-006-V4

GENERAL NOTES

- Read these instructions carefully and with reference to the illustrations.
- Before dismantling the gearbox, see that a clean tray is available, in which to place the parts.
- Thoroughly clean and inspect all parts before reassembly. Discard any worn or damaged components and replace with new ones.
- Use only genuine Hewland parts as replacements. These are manufactured in our workshops to the fine tolerances necessary and are rigorously inspected.
- Always ensure that locknuts, and oil seals are in good condition when reassembling.
- All studs and screws must be Loctited or wirelocked in position, unless stated otherwise.
- Bearing Replacement :-
  - Bearings can only be removed or renewed if the casings have been warmed in an oven, or with a blowlamp. In the latter case, keep the blowlamp moving while heating the casing.
  - NB. Do not overheat. Test with a spot of water which will bounce off at the correct temperature. Once a casing is heated, all bearings should be pressed into their respective seating's without delay, thus eliminating the need to reheat. At the correct temperature, fitting the bearings should present no difficulty.
  - During cooling, or when the casings have cooled, it is advisable to once more lightly press the bearings to ensure that they are correctly seated.
- Oil:-
  - Fill the gearbox through the oil filler hole on top of the maincase. The oil will find its own level within the gearbox.
  - NB. Too much oil will not directly cause any harm, but is undesirable as it will induce power loss and overheating of the internals.

DIFFERENTIAL BEARING PRELOAD

Using the original shims (40) as a guide, fit the outer races of bearings (37) to the maincase and side cover. Fit the inner races of the bearings to the differential case. Offer up the differential assembly to the maincase and fit the sideplate.

Adjust shims (40) as necessary to achieve 0.012”/0.015” of preload, giving 4/6 lb ft (5.4/8.1 Nm) torque to turn.

(With bearings oiled.)

Refer to page 19 for part references.

The table below is to inform you of which sideplate spacers should be used with which crownwheel when mounted on a TPT differential. The reason that there are two sets of spacers, is that the crownwheels have different mounting distances. The table also shows which crownwheel Bolts should be used with each crownwheel, as shorter bolts are required for the 11/31 CW.

PART NUMBER	RATIO	MOUNTING DISTANCE	ITEM (41)	ITEM (68)	CW BOLTS ITEM (126)
TMT-221-EW	8/35	2.100”	FGC-206-2D	NLT-206-2	VG-221-1
TMT-221-CW	9/35	2.200”	FGC-205-2A	NMT-205-2A	VG-221-1
NMT-221-BW	10/31	2.316”	FGC-206-2A	NMT-205-2	VG-221-1
NMT-221-AW	11/31	2.316”	FGC-206-2A	NMT-205-2	VG-221-1C

Refer to page 19 for part references.

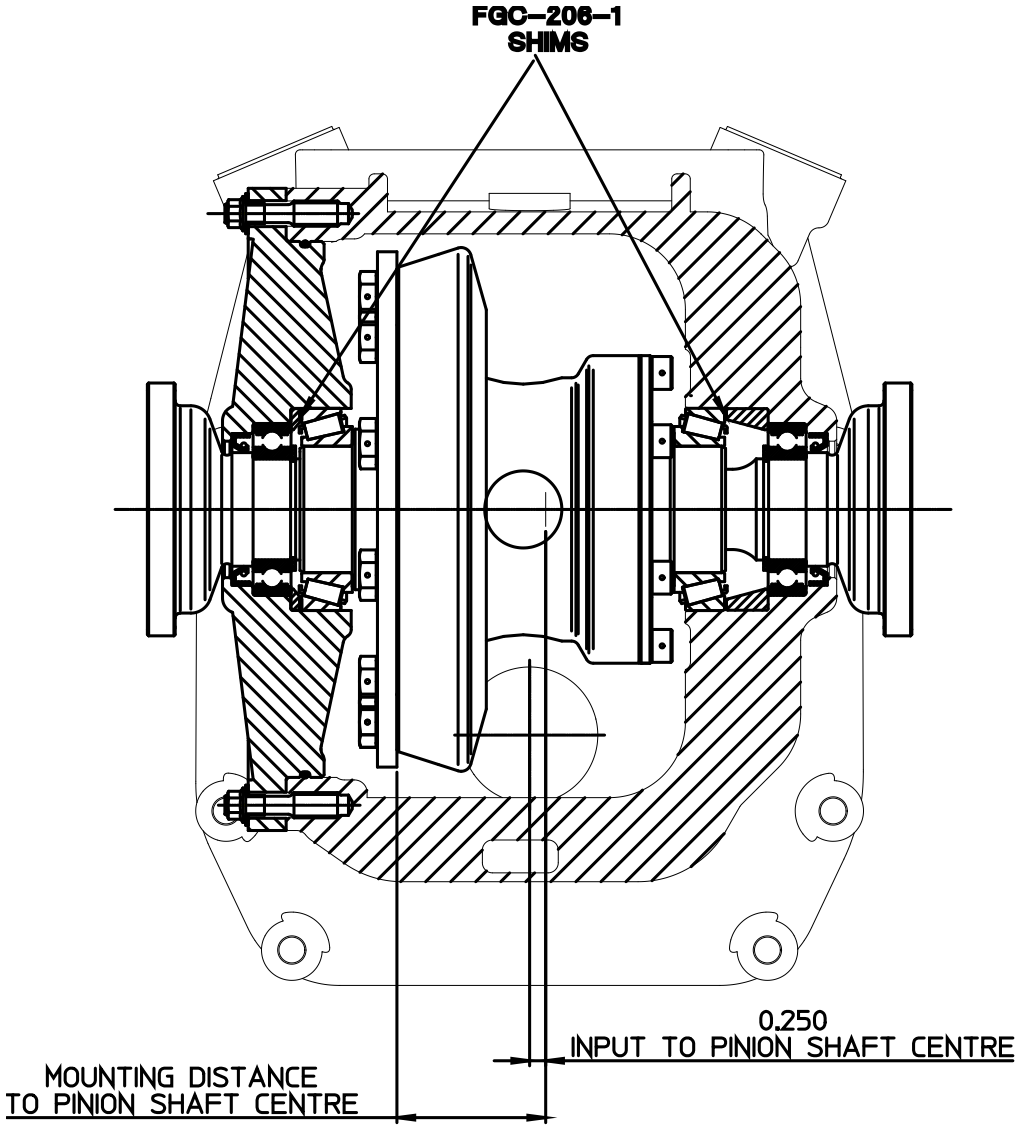


Figure 3- Differential Bearing Preload

PINION HEIGHT SETTINGS

Special tools required: **SK-1470-A**

Press the inner race of the pinion head bearing

(67) Onto the pinion shaft (69). Fit the bearing outer race and nominal shim pack (66) into the maincase (102). Assemble the pinion shaft into the maincase, then fit the tail bearing outer race (14) to the bearing carrier (105), and secure it to the maincase. Tighten the pinion shaft nut (110) onto the pinion shaft until the shaft requires 20-25 lbs.in (2.2-2.8Nm) to turn it in its bearings.

Fit tool SK-1470-A into the maincase diff bearing bore, and use feeler gauges to measure the gap between the tool and the pinion shaft front face. This clearance should comply with the dimension indicated on the

crownwheel & pinion label (also etched on the head of the pinion shaft), and can be adjusted by reducing the peelable shimpack (66) behind the pinion head bearing outer race.

Refer to page 19 for part references.

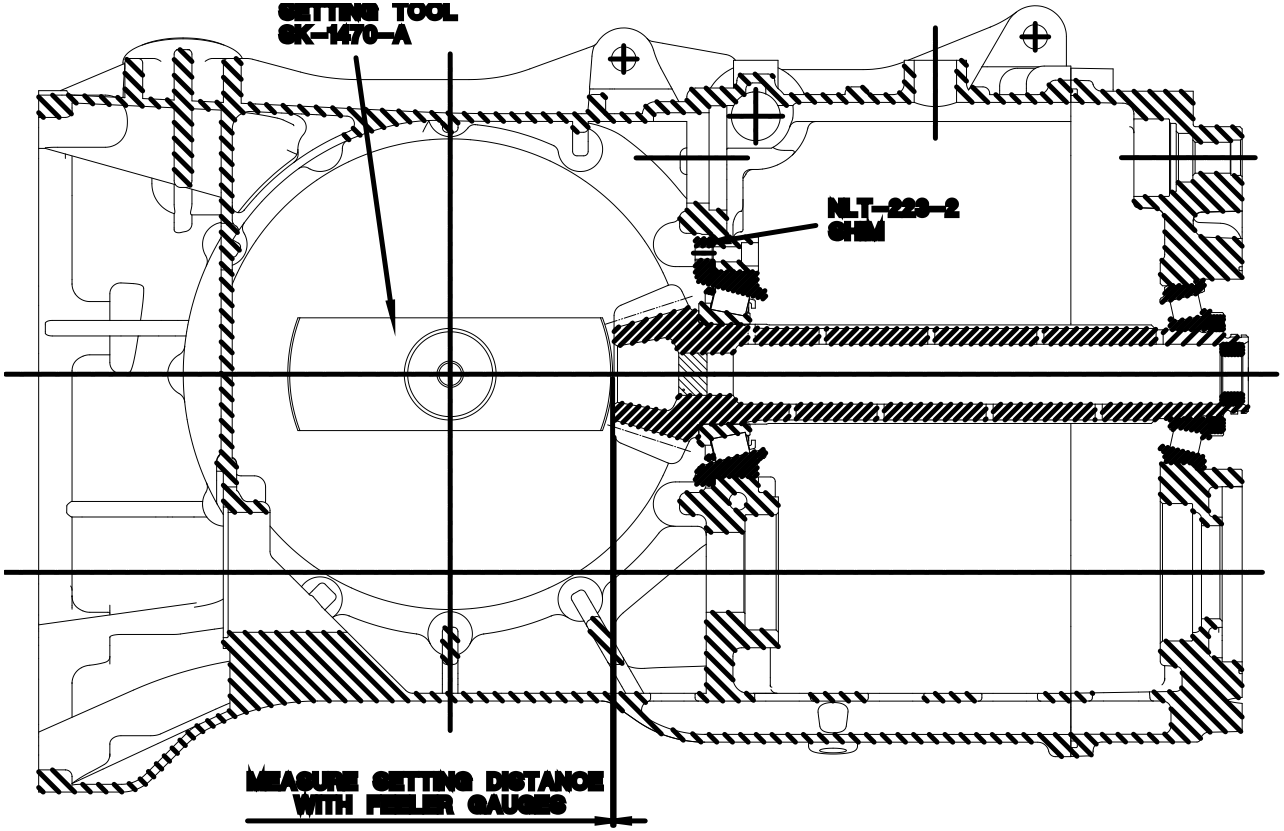


Figure 4-Pinion Height Setting

Alternatively, the pinion mounting distance can be measured with a height gauge, and set to the dimension indicated on the pinion shaft label.

(Also etched on the head of the pinion shaft).

NB. It is not correct practice to replace a pinion shaft without checking the setting distance, even if the old and new shafts have the same recorded setting distance.

-

It is also good practice to renew the pinion head bearing if the pinion shaft is being replaced.

PINION BEARING PRELOAD

Having obtained the correct pinion setting, remove

The bearing carrier (105). Add the reverse gear spacer (71), reverse gear inner track (109), reverse clutch ring (31), 3 off hubs (2) and spacer (108) to the pinion shaft. Replace the bearing carrier (105), bearing inner race (24) and pinion nut (110). Tighten the pinion shaft nut until the shaft requires 20-25 lbs.in (2.2-2.8Nm) to turn it in its bearings.

If necessary adjust the preload across the bearings by grinding the pinion shaft spacer (71) on its pinion bearing face to reproduce the pinion shaft setting figure (see previous page) It is essential that if any component on the mainshaft is renewed, then the bearing preload must be checked and adjusted as required.

Refer to page 19 for part references.

NB. It is essential that the pinion bearing

preload is checked and adjusted if any of the pinion shaft components are replaced, with

the exception of the locknut and locking ring. Fitting a longer reverse gear spacer (71) will

decrease the pinion bearing preload, whereas shortening the reverse gear spacer (71) will

increase the pinion bearing preload.

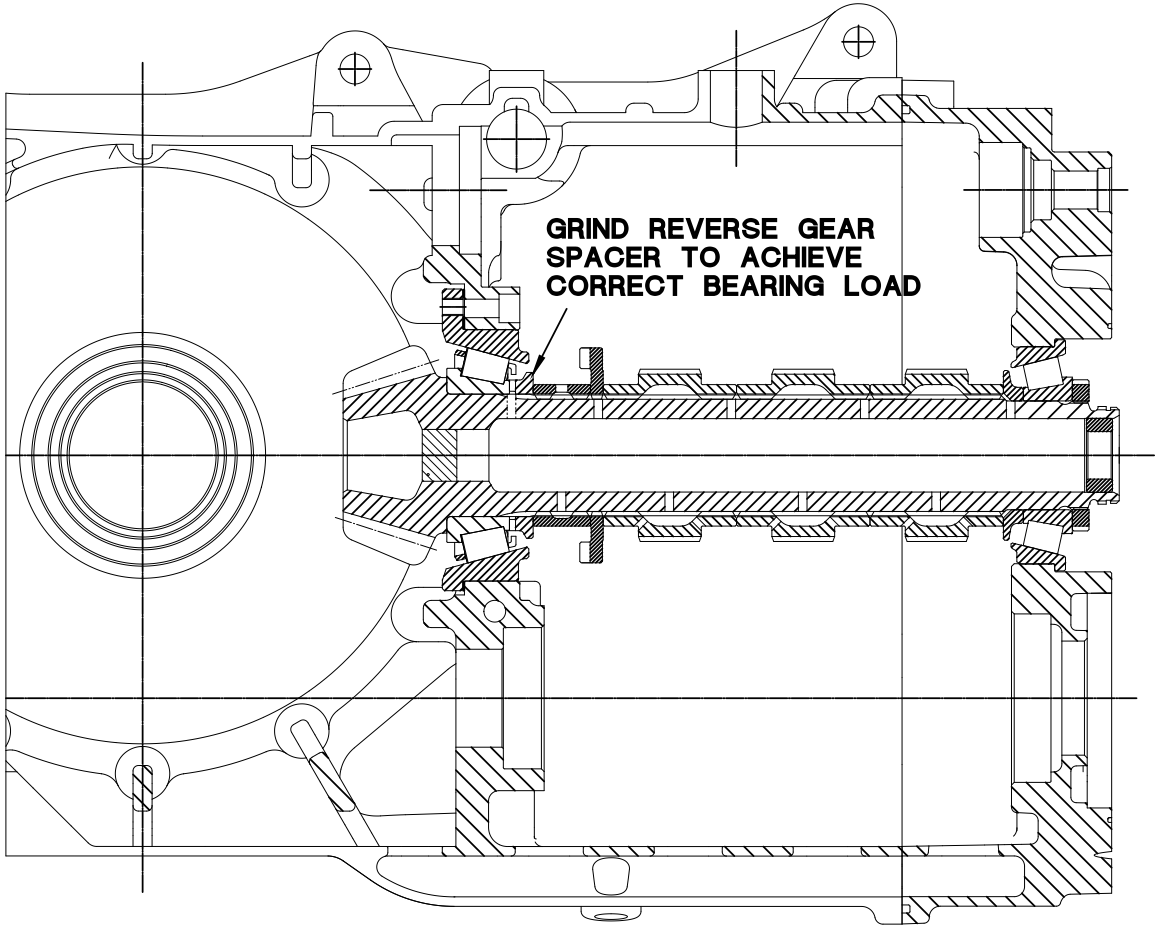


Figure 5- Pinion Bearing Preload

CROWNWHEEL & PINION BACKLASH SETTING

- Special tools required: **SK-1913**

With the pinion shaft, differential assembly, and sideplate fitted, and the correct diff bearing shims ascertained, the actual backlash can be measured by means of a dial test indicator against the relevant crownwheel & pinion ratio mark etched in the face of tool SK-1913. Be sure to take at least 6 backlash readings, turning the crownwheel 30-45 degrees between each reading (this is to ensure that any variation due to manufacturing tolerances are taken into account). The backlash variation from manufacture will be logged on the gear data card supplied with each crownwheel & pinion set.

-

The correct minimum backlash figure should be 0.005” (0.13mm) taken at the tightest point of gear mesh. If the measured backlash is incorrect, rectify it by removing some shims (40) from behind one diff bearing, and inserting the equivalent amount of shim behind the other, thus moving the diff across in the maincase.

NB. Generally 0.001” of crownwheel axial adjustment equates to 0.0008” modification in gear set backlash.

Do not add or discard any shims, as to do so will affect the differential bearing preload.

NB. Dummy bearings can be used to ease the shim change during the setting procedures. However, before fitting the actual differential bearings, it is important to compare their width with that of the dummy bearings and compensate the shim thicknesses for any difference.

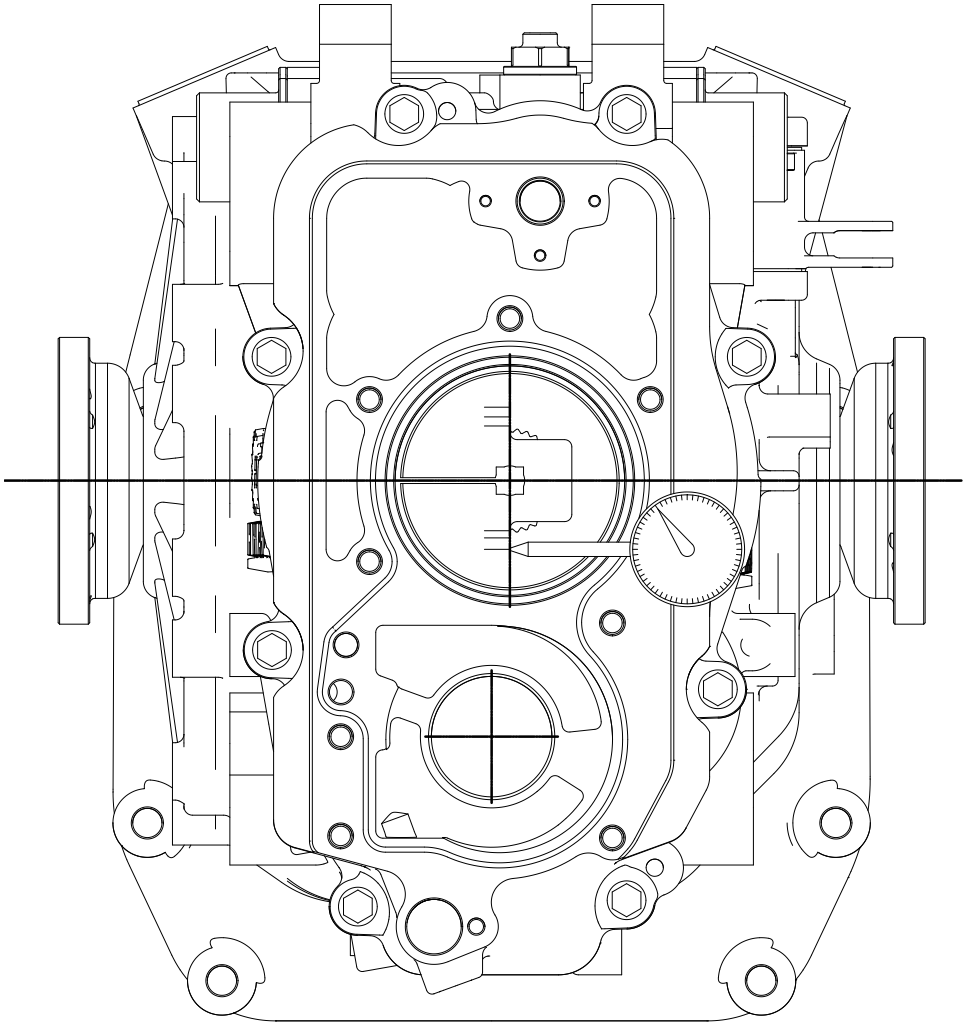


Figure 6- Crownwheel & Pinion Backlash Setting

SEQUENTIAL BARREL SETTING

- Special tools required: **SK-2311**

Build up the assembly into the maincase, and fit the fork setting fixture as shown, making sure that the barrel is in the neutral position before securing the face plate of the fixture.

Measure and record the dog face clearance for 5th and 6th gears. Their position in the maincase, (furthest away from the datum face), means any dog clearance errors due to tolerance build up, will be at their worst. Therefore it is acceptable to adjust the barrel position according to these readings. Any difference in the dog face clearance between these gears must be averaged out by changing the barrel setting spacer (32). Spacers of various thicknesses are available, as shown in Fig.6.

In order to change this spacer, the face plate of the fixture, the mainshaft locknut (110), selector rail (114), selector forks (22) and the barrel bolt (118) must be removed. (Please note for clarity the selector rail (114) and selector forks (22) have not been shown in Fig.6).

Removal and replacement of the barrel bolt (118) is made easier if a suitable tool is located into the radial hole in the barrel (117) and the reverse blocker hole in the maincase above it.

NB. It is not possible (or necessary) to individually adjust each fork.

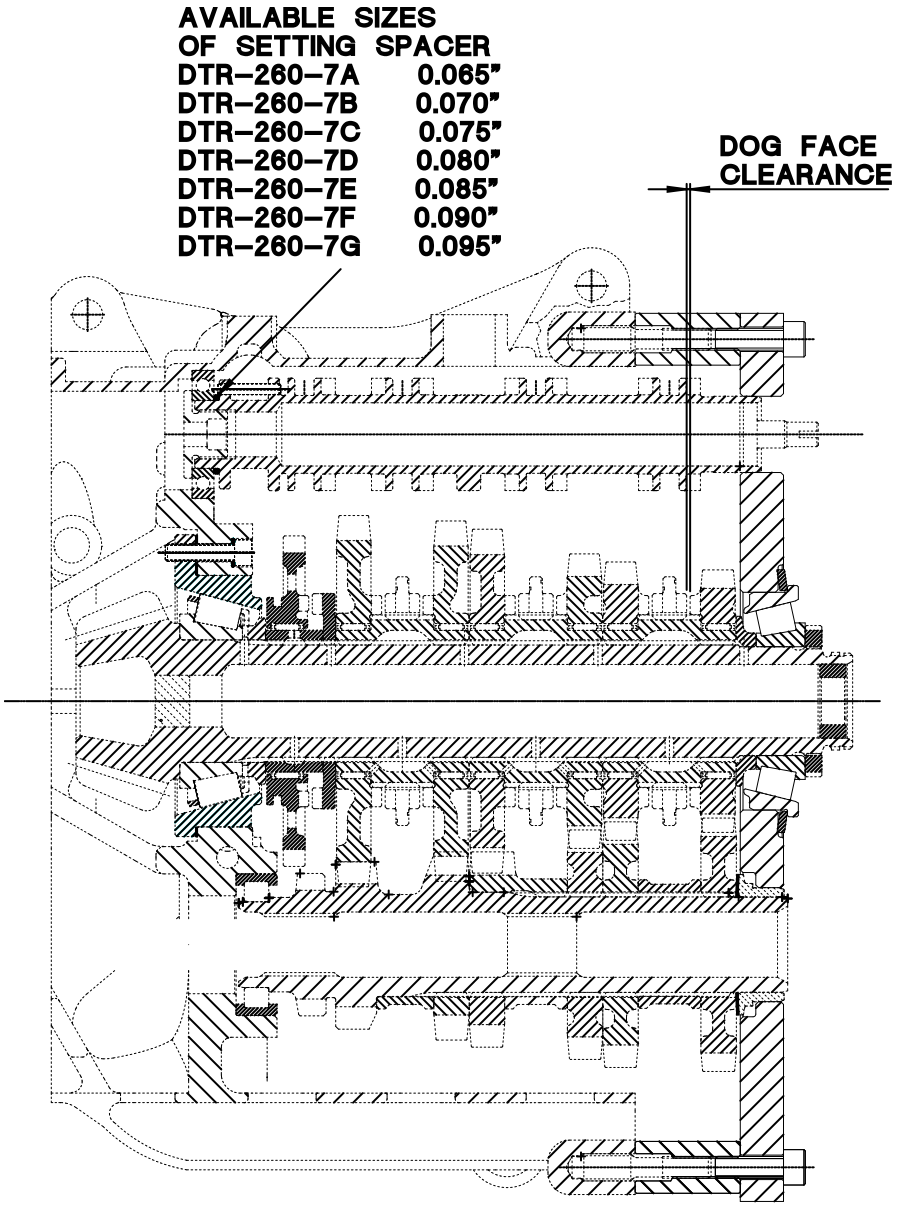


Figure 7- Sequential Barrel Setting

DIFFERENTIALS

Powerflow Differential

This powerflow differential unit is designed with versatility as its major asset. Many factors will contribute to the settings required. A car with good traction and low power, may require a completely different arrangement to that of a car with poor traction and high power. There are 10 friction plates within the unit (4 splined to the diff casing, and 6 splined to the side bevel gears). Slip limiting is dependent on the friction resistance between these plates, and is affected by clamping the plates together. Four factors contribute to the total friction torque between the plates:-

1) The side bevel gears thrust apart to clamp the plates as they transmit the driving power. This is a feature of the gear geometry, and is not adjustable.

2) The side ring gear ramp angles have an effect on how much of the transmitted torque is converted into sideways (clamping) force onto the plates. For example, on the drive side of the ring gear, 45 degrees transmits less sideways force than 30 degrees. Likewise on the coast side of the ring gear, an 80 degree angle will transmit little or no clamping force onto the plates, whereas a 45 degree angle will transmit a much greater force. The side rings gear are available with many different drive/coast ramp angle combinations.

3) The second adjustable factor is how tightly the plate stack is compressed on assembly (known as static preload). The preload torque is measured between the side bevel gears, by holding one side bevel gear stationary, and measuring the torque required to turn the other.

NB. Figure 8 shows a belleville spring fitted to the plate stack, that can be used to maintain static preload during the “running in” period.

4) The final adjustment is simply to re-order the plate stack so as to change the number of relatively rotating faces. The diagram shows the stack setup with the maximum 12 working faces. Standard stack may be shuffled to give as few as 2 working faces.

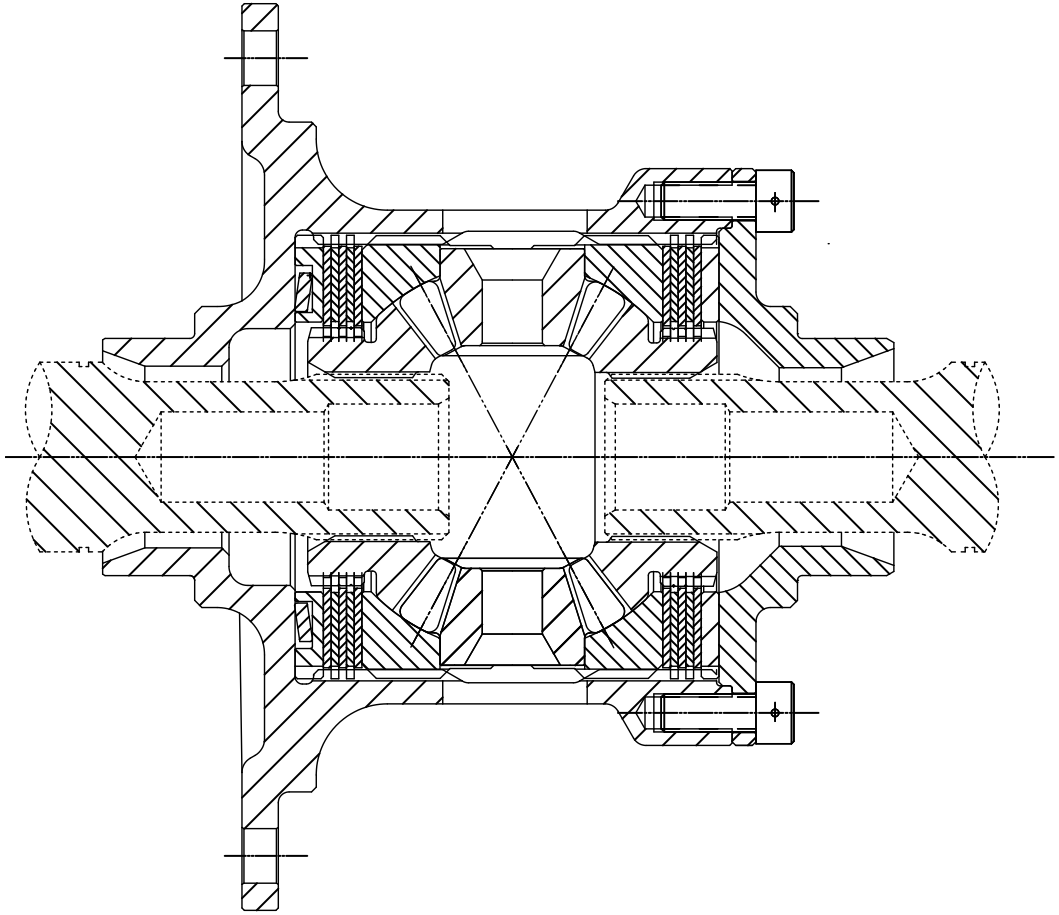


Figure 8- Powerflow Differential

Differential Settings

This table is intended as a quick reference guide to percentage lock various setting permutations.

30 degree ramps with 12 working plate surfaces has been set as the 100% benchmark.

Percentage Rating	Ramp Angle	No. of Friction Surfaces
4	85	2
4	80	2
7	85	4
7	60	2
8	80	4
11	85	6
11	45	2
13	80	6
14	85	8
15	60	4
17	80	8
17	30	2
18	85	10
21	85	12
21	80	10
22	60	6
22	45	4
25	80	12
30	60	8
33	45	6
33	30	4
37	60	10
43	45	8
45	60	12
50	30	6
54	45	10
65	45	12
67	30	8
83	30	10
100	30	12

Figure 9- Differential Settings

TPT Differential Assembly

Bill of Material		TPT-212	TPT DIFF ASSEMBLY
Position	Qty	PartNo	PartName
301	4	TPT-213-10	OUTER DRIVE CLUTCH PLATE
302	6	TPT-213-12	CAP SCREW - MODIFIED
303	1	TPT-213-3	SPACER-PRELOAD SETTING
304	3	TPT-213-5AH	PLANET DIFF. GEAR
305	2	HP-N-2041-H	SIDE BEVEL GEAR
306	2	TPT-213-7	SIDE RING GEARS
307	6	TPT-213-6	CORE PLATE
308	1	TPTS-213	DIFF CASE
309	1	TPTS-214	DIFF END PLATE
310	1	CS-1401	SPRING CARRIER
311	1	SPR-026	BELLEVILLE SPRING

PART 302 MUST BE FITTED USING LOCTITE RETAINER AND WIRELOCKED

SPRING AND CARRIER	PRELOAD RANGE
SPR-026 WITH CS-1401	85-145 Lbs.Ft
SPR-032 WITH CS-1401	0-140 Lbs.Ft
SPR-065 WITH CS-1401	0-110 Lbs.Ft
SPR-150 WITH TPT-213-3SP	40-80 Lbs.Ft

Various Bellville springs (311) and Carriers (310) are available.

The first preload value given is the initial value that will be given without any additional shims.

Shims can be added to the carrier to give higher preloads if required.

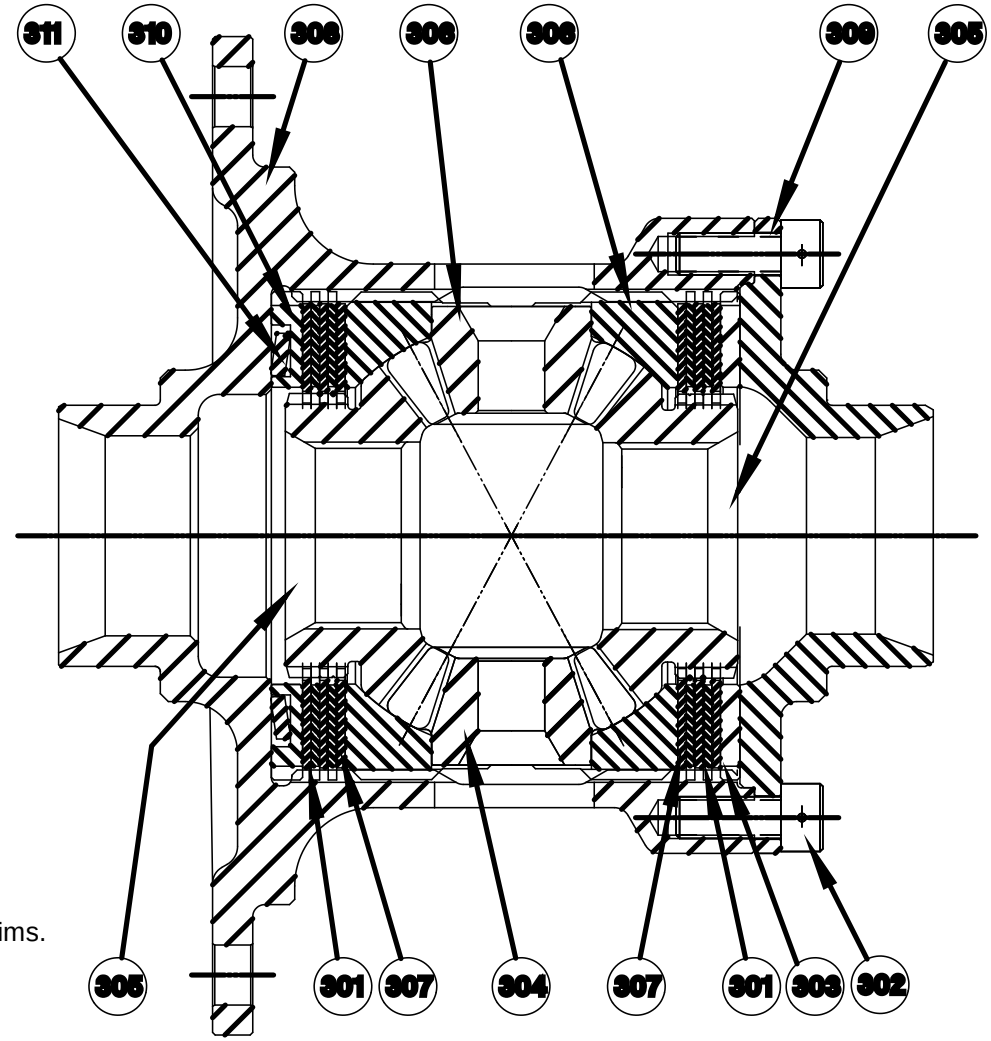


Figure 10- TPT Differential Assembly

GEARBOX ASSEMBLY – (MANUAL GEAR SHIFT)

- It is assumed that all bearings, oil seals, studs, oil jets, and dowels are already fitted into their casings.

- Slide the reverse idler top hat bush (48) into place in the maincase (102), then push it in as far as it will go. Slide the second reverse idler top hat bush (34) into place, then pull it towards the rear of the maincase. Press the bearing (52) into the reverse idler gear (33), slide the sleeve (49) into the bearing, and position the gear between the bushes. Push the reverse idler top hat bush (34) towards the front of the maincase, fit the screw (87), and lockwire.

- Press the dowel (35) into the maincase, and secure the detent arm (82), trunion (51), and spring (83) into the maincase using screw (59) and washer (53).

- Position the pawl (91) in the slot in the selector rack (153), and press pin (30) into place ensuring that it does not protrude outside the rack outer diameter, and moves freely. Slide the washers (50), spring (155), and sleeve (156) onto the rack and secure them with circlip (16). This spring has a limited effective life, therefore periodic replacement is recommended. It is also advisable never to re-use the circlip (16).

- Fit the quad ring seal (154) carefully into the seal carrier (152), then assemble it onto the maincase using screws (90) ensuring o-ring (78) is fitted. Fit the spring carrier (151), into the maincase, oil the rack liberally and slide it in, ensure that it travels back and forth without any stiction. Fit the anti-rotation pin (93) and washer (128) into the maincase.

- Put the fork setting spacer (32) onto the barrel (117) and whilst holding the detent arm against its spring using a pair pliers feed the barrel into the maincase and secure with the barrel bolt (118). It may be necessary to lift the pawl up so as to let the barrel pass underneath it.

- Slide the plunger (92), spring (1) and washer (36) into the rack and secure with circlip (15), then fit rack cover (150) and o-ring (78), using screws (90). NB. If the gearbox has not yet been fork set, then delay this step, as it easier to push the pawl up if it has not yet been fitted with its return spring.

- Assemble the bell crank (162), bearings (160), spacer (161), washers (158) and shim washer (159) to the maincase and secure with screw (157) and nut (163). Ensure by adjusting the shim washer thickness that the selector operates smoothly in both directions, and self-returns to its normal position. Fit the bearing (28) onto the clutchshaft (18) and secure using circlip (26). Fit oilseal (44) into slave adaptor (116), and slide the slave adaptor over the clutchshaft to enable fitting of bearing circlip (27). Offer up clutchshaft assembly to the maincase with o-ring (29) in place and secure with screws (90).

- Fit the bearing (28) onto the clutchshaft (18) and secure using circlip (26). Fit oilseal (44) into slave adaptor (116), and slide the slave adaptor over the clutchshaft to enable fitting of bearing circlip (27). Offer up clutchshaft assembly to the maincase with o-ring (29) in place and secure with screws (90).

- The gear cluster can now be loaded into the maincase, (this is assuming that the pinion, and pinion bearing preload have been set as previously described). With the pinion shaft (69) complete with the pinion head bearing (67) inner race held in position in the maincase the pinion gears, spacers, hubs, bearings and clutchrings can be slide onto it. It is necessary to fit the relevant selector forks in conjunction with their clutchring, locating the selector fork pin into the barrel track, once all four forks are correctly located with their clutchring, and the barrel, then the selector rail (114) can be slid through all of the forks and into the maincase. The layshaft, input gears, and spacers can now also be assembled into the maincase. (See figure 14 for details of both layshaft designs). NB The pinion gears may need rotating in order to allow the input gears to pass and mesh properly.

- The bearing carrier (105) can now be fitted with the barrel oil seal (64), barrel bearing (8), pinion shaft bearing outer (14), layshaft bearing outer race (11), and secured onto the maincase, ensuring that the o-ring cord (125) has been correctly fitted into its groove.

- The pinion shaft bearing inner race (24), and locknut (110) can now be fitted and tightened to the recommended torque, the locknut locking ring (72) and retaining circlip (43) can now be applied.

- The oil pump gears (112), (120), and rear cover (123) can now be fitted ensuring that the o-ring (76) has been correctly located in its groove.

- Fit the output shaft oilseal (39), bearing (38), and output flange (107) in the maincase, securing it with circlip (23). Fit similar parts into the sideplate (106). Assuming that the differential bearing preload and the crownwheel and pinion backlash have been set as previously described, then the differential can be fitted into the maincase, and the sideplate (106) secured into position ensuring that the o-ring (81) is fitted.

- Fit all ancillary parts, oil filters, pinion oil spray, breather and oil fittings.

- s) Assemble the neutral/reverse blocker and fit it into the maincase above the barrel. NB When installing the gearbox into the car, the blocker release cable length should be adjusted so that the blocker plunger is held just clear of the barrel when a forward gear is selected.
-
- Refer to page 19 for part references.

GEARBOX ASSEMBLY – (PNEUMATIC GEAR SHIFT)

- All assembly details are as for the manual gear shift with the exception of the rack.

- a) Position the pawl (91) in the slot in the selector rack (20), and press pin (30) into place ensuring that it does not protrude outside the rack outer diameter. Slide the washer (50), spring (95), and sleeve (21) onto the rack and secure them with circlip (16). This spring has a finite life and will weaken with use. A new spring has a free height of 2.000”. It is also advisable never to re-use the circlip (16). Slide the plunger (92), spring (1) and washer (36) into the rack and secure with circlip (15). Slide rack assembly into the rack bore of the maincase.

- a) Carefully mount the glide rings (13) and hydraulic seals (80) onto both of the pistons (19), fit a spring (96) into both piston housings (119), and slide the pistons in after them, it is essential that the pistons are fitted into the housings correctly with the hydraulic seals positioned furthest away from the selector barrel.

- The piston housings (119) can now be secured using screws (90) to the maincase ensuring that oring (78) is fitted to both

- Refer to page 19 for part references.

- NB. If it is necessary to remove the barrel from the maincase without removing the rack, then this can be achieved by removing the piston housing, and piston from the right hand end of the rack, so exposing the rack end. The 5mm set screw located in the rack can now be removed, and a suitable tool can then be pushed up the Ø5mm hole that runs up the centre of the rack. This tool can then lift the pawl against its return spring, so allowing the barrel to pass underneath it and out of the maincase, once the barrel bolt has been removed. The 5mm set screw must be re-fitted using a suitable thread sealant to ensure the gearbox oil does not leak up through the rack.

CHANGING GEAR RATIOS

- With a drip tray placed beneath the gearbox, remove the magnetic drain plug (54) and drain the oil.
- Remove the nuts (73) and washers (36) securing the rear cover (123), oil pump gears (112), (120) and the pinion shaft bearing locking ring retaining circlip (43).
- Remove the retaining ring (72), the locknut (110) and the pinion bearing inner race (24).
- Remove the nuts (73) and washers (36) securing the bearing housing, and slide it off of the maincase. It may be necessary to lightly tap the bearing carrier using a soft mallet, never use a screwdriver to lever between the joint faces, as this may damage the faces and impair the seal efficiency when reassembled.
- Remove the selector rail from the maincase sliding it out of the selector forks, and systematically remove the ratios, spacers, hubs, bearings, clutchrings and selector forks, from both the pinion shaft and layshaft, as necessary. The layshaft itself can now be removed from the maincase if so desired.
- Replace the gears with the required ratios. Gears are supplied in matched pairs, one for the mainshaft and one for the layshaft. Each gear is marked with two sets of numbers. The first of these indicates the number of teeth on the layshaft gear, while the second signifies the number of teeth on the mainshaft gear which mates with it. (e.g. 16/32) Both gears of each pair are marked in an identical manner. It is essential that gears are correctly paired to these numbers. On all first gears, and some second gears, the gear teeth are machined integral with the layshaft. In such cases, therefore, if a first, or second, gear ratio change is required, the layshaft itself must be changed. If the integral first/second layshaft is fitted, then the third gear ratio on the layshaft is a hubbed gear, if the first only gear is integral on the layshaft, then second and third gear ratios are standard gears and spacers (5) and (180) are required. Refer to figure 14 for details.
- Whilst changing ratios it is advisable, as a matter of course, to wash and inspect all components which are to be used again before refitting. Check for wear and cracks, particularly to the clutch rings. Also examine the selector forks for heavy or uneven wear.
- Reassembly is the reverse of disassembly. Take care, when refitting the gear cluster into the maincase, to ensure location of the layshaft into its bearing
- Refer to page 19 for part references.

ILLUSTRATED PARTS LIST

OUTPUT ASSEMBLY

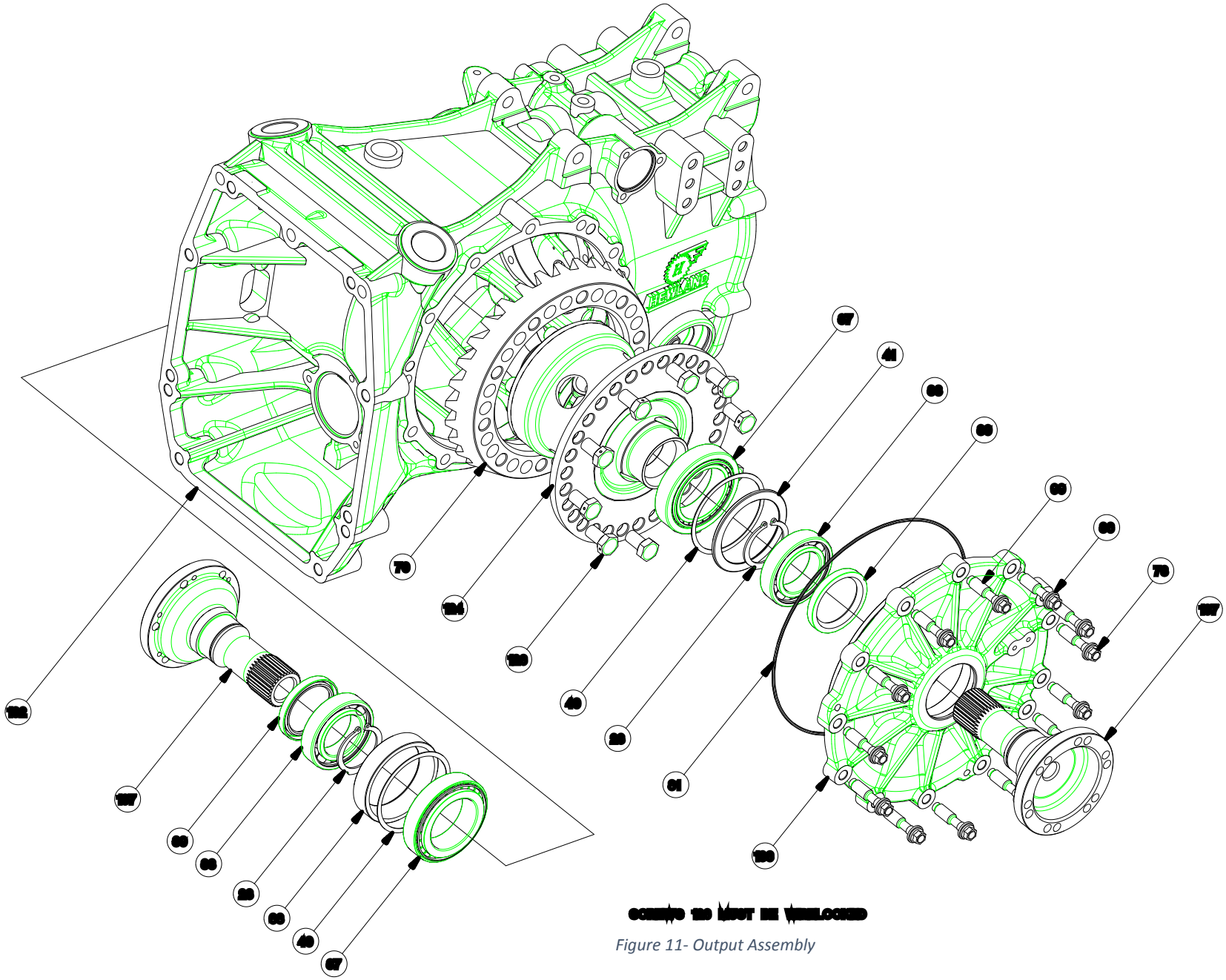


Figure 11- Output Assembly

CASING PARTS (WITHOUT INTEGRAL GEAR SHIFT COMPRESSOR)

Gearboxes marked up to and including 029, part number 48 is SK-2363

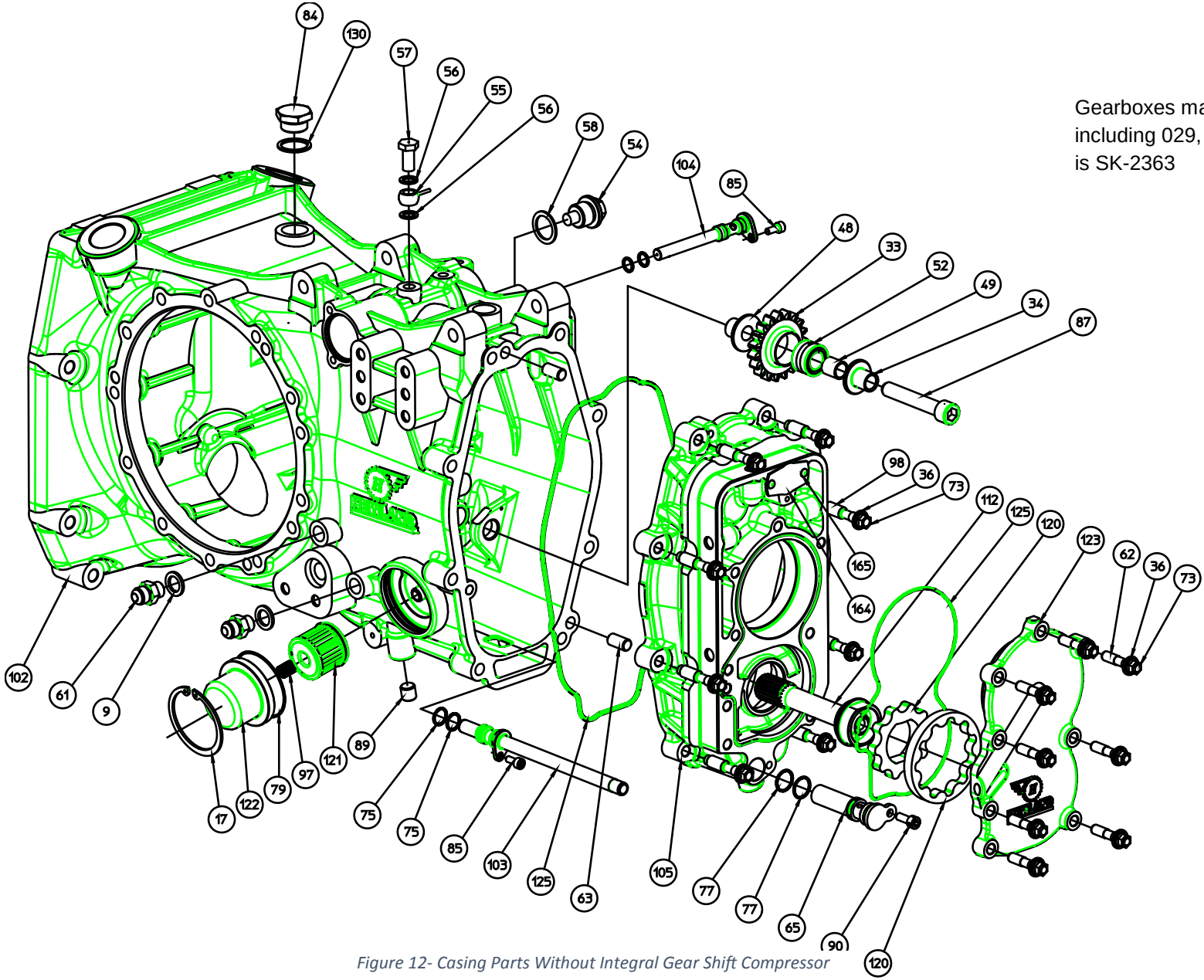
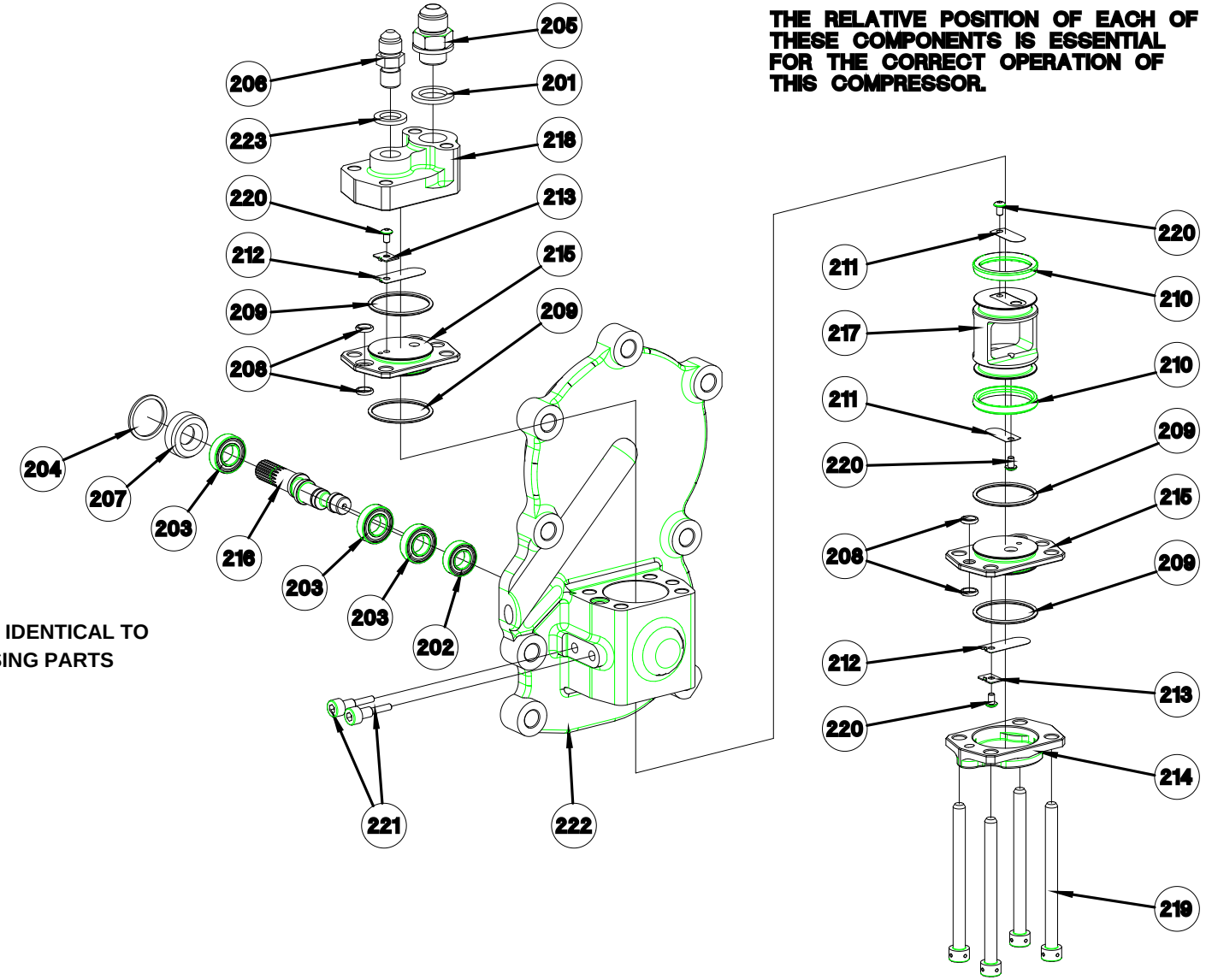


Figure 12- Casing Parts Without Integral Gear Shift Compressor

CASING PARTS (WITH INTEGRAL GEAR SHIFT COMPRESSOR)

THE RELATIVE POSITION OF EACH OF THESE COMPONENTS IS ESSENTIAL FOR THE CORRECT OPERATION OF THIS COMPRESSOR.



ALL OTHER PARTS ARE IDENTICAL TO THOSE USED IN THE CASING PARTS SHOWN IN FIGURE 12.

Figure 13- Casing Parts With Integral Gear Shift Compressor

LAYSHAFT ASSEMBLY

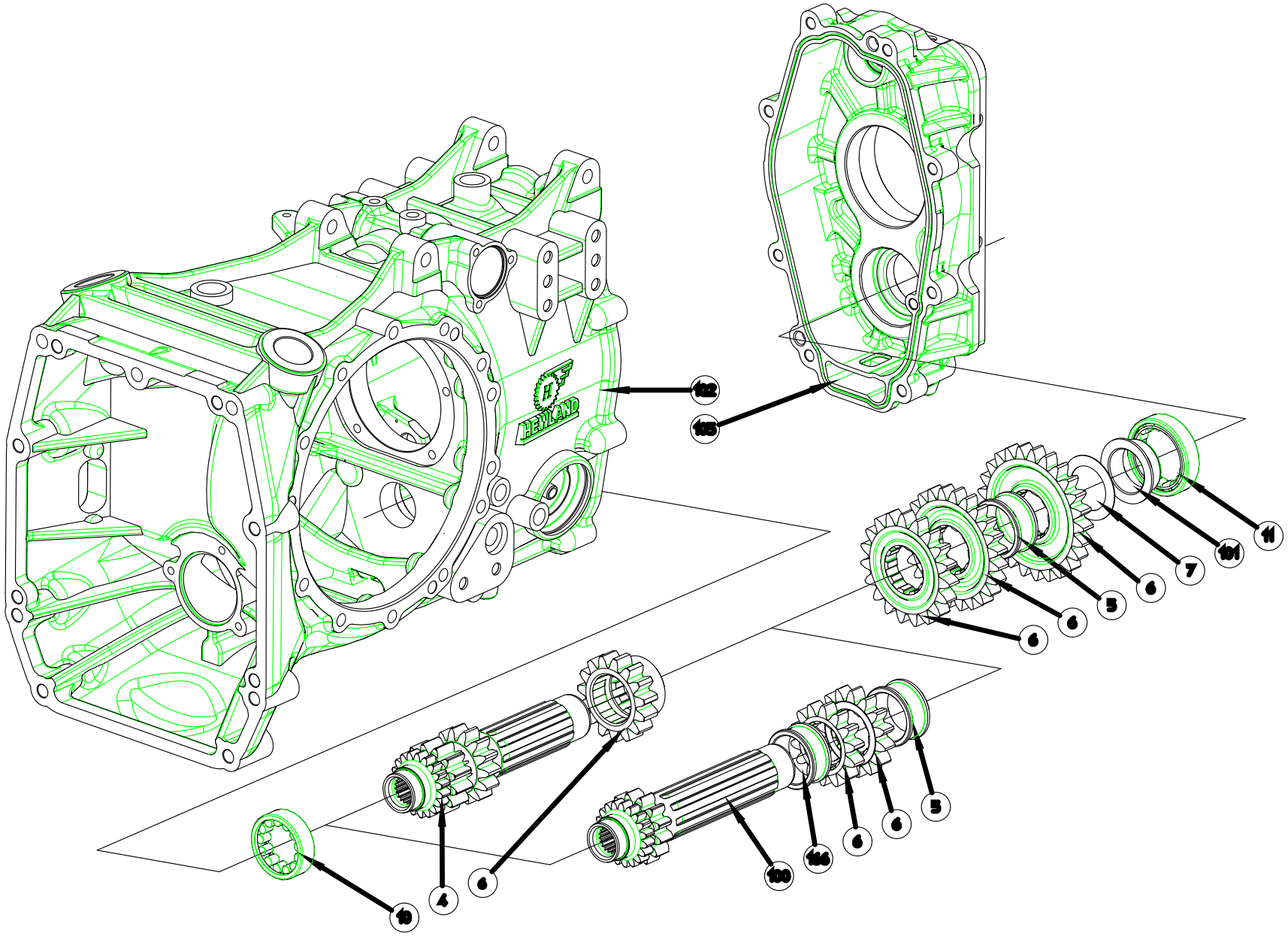


Figure 14- Layshaft Assembly

PINION SHAFT ASSEMBLY

IT IS ESSENTIAL TO ALWAYS RE-FORK SET THE GEARBOX IF THE PINION SHAFT HAS BEEN REPLACED

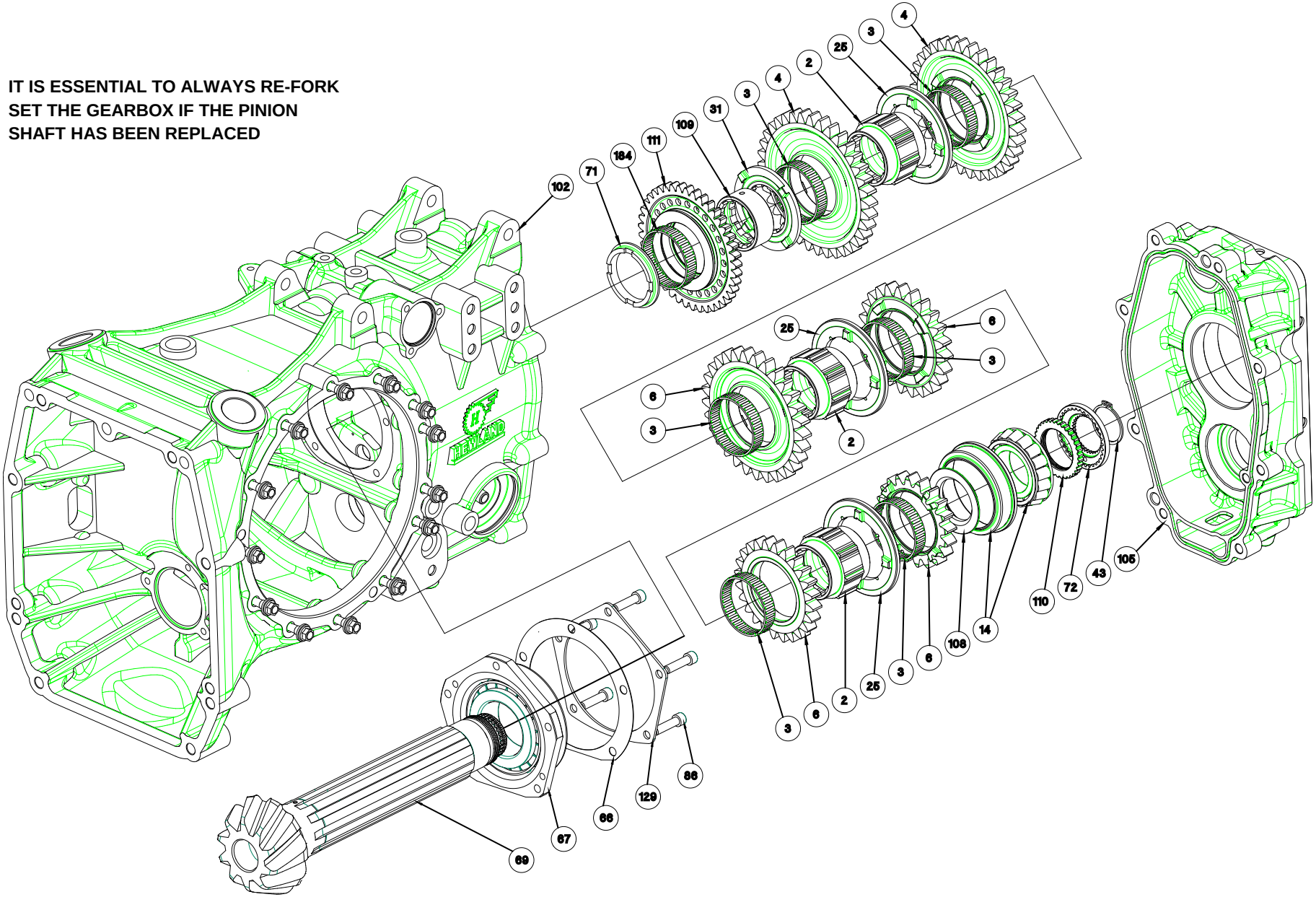


Figure 15- Pinion Shaft Assembly

GEAR SHIFT ASSEMBLY (MANUAL GEAR SHIFT ONLY)

IMPORTANT NOTE:-

ITEM 118 BARREL BOLT MUST BE LOCTITED AND TIGHTENED TO THE TORQUE SPECIFIED ON PAGE 5

Neutral blocking plunger parts as standard manual shift

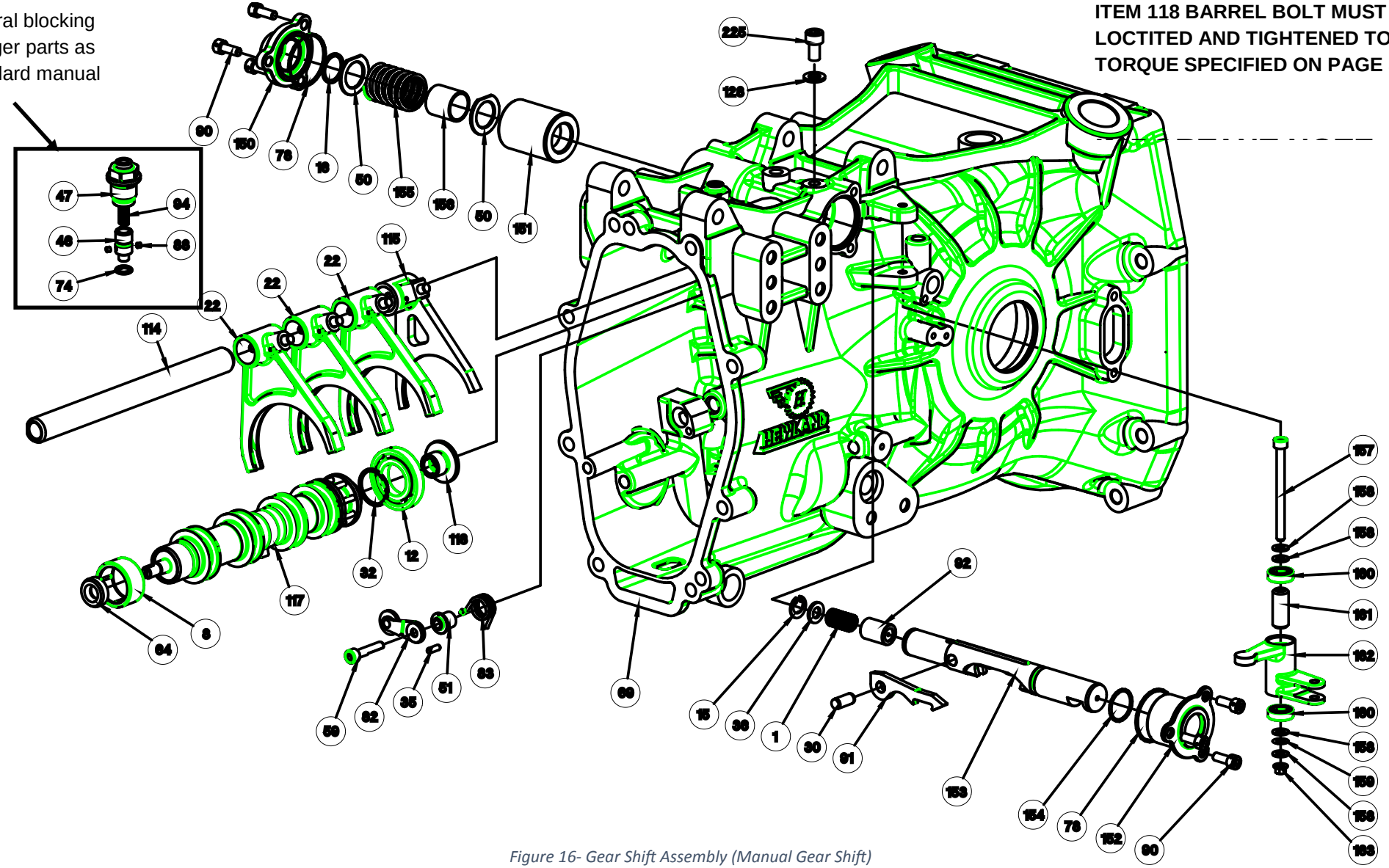


Figure 16- Gear Shift Assembly (Manual Gear Shift)

GEAR SHIFT ASSEMBLY (PNEUMATIC GEAR SHIFT ONLY)

Blanking plug (224) replaces neutral blocker parts (Page 25; 46, 47, 74, 88 & 94) found on the manual shift.

(As standard pneumatic has no blocking plunger)

ALL OTHER GEAR SHIFT PARTS ARE IDENTICAL TO THOSE USED IN THE MANUAL GEAR SHIFT ASSEMBLY.(SEE FIGURE 16)

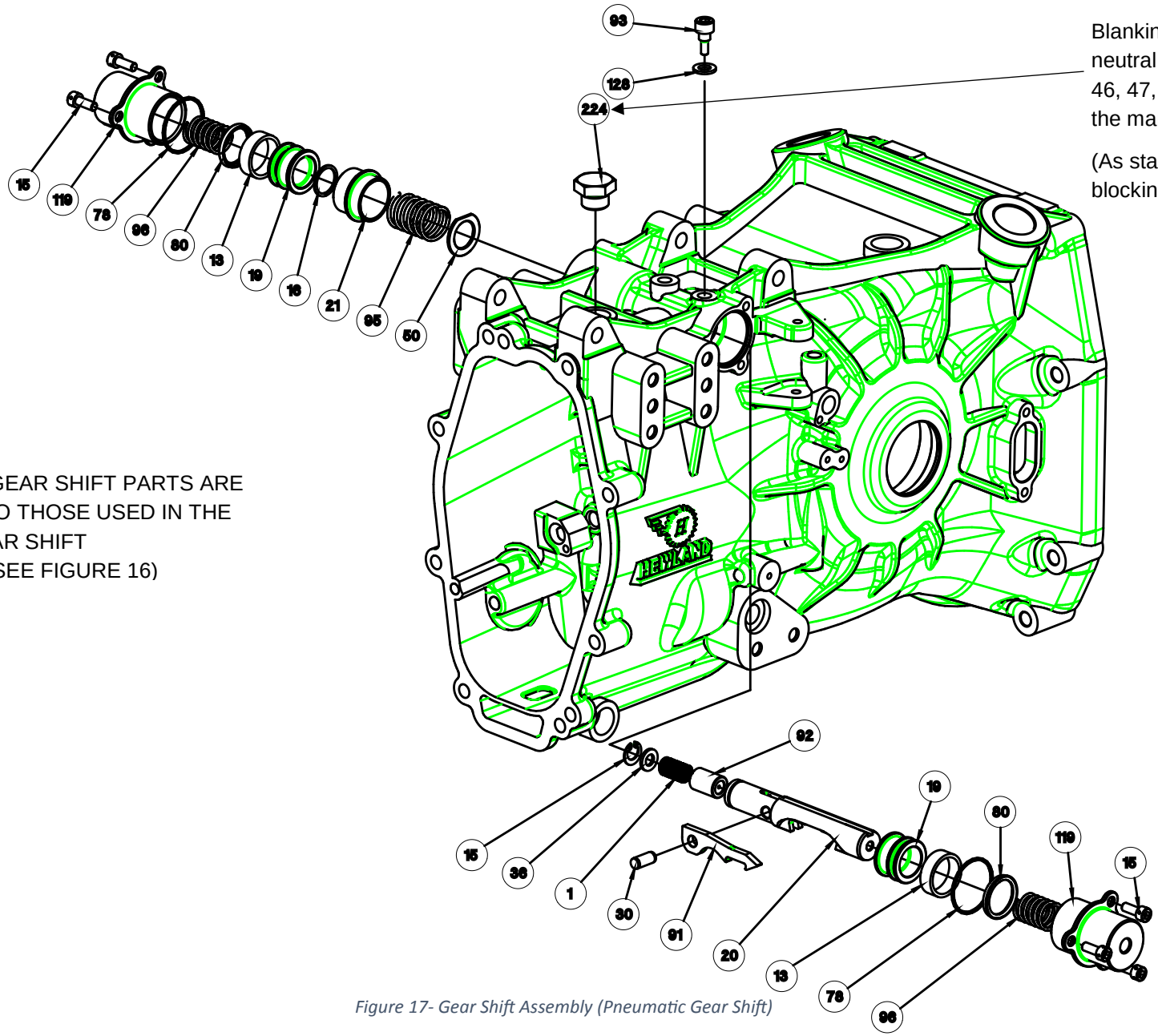


Figure 17- Gear Shift Assembly (Pneumatic Gear Shift)

INPUT ASSEMBLY

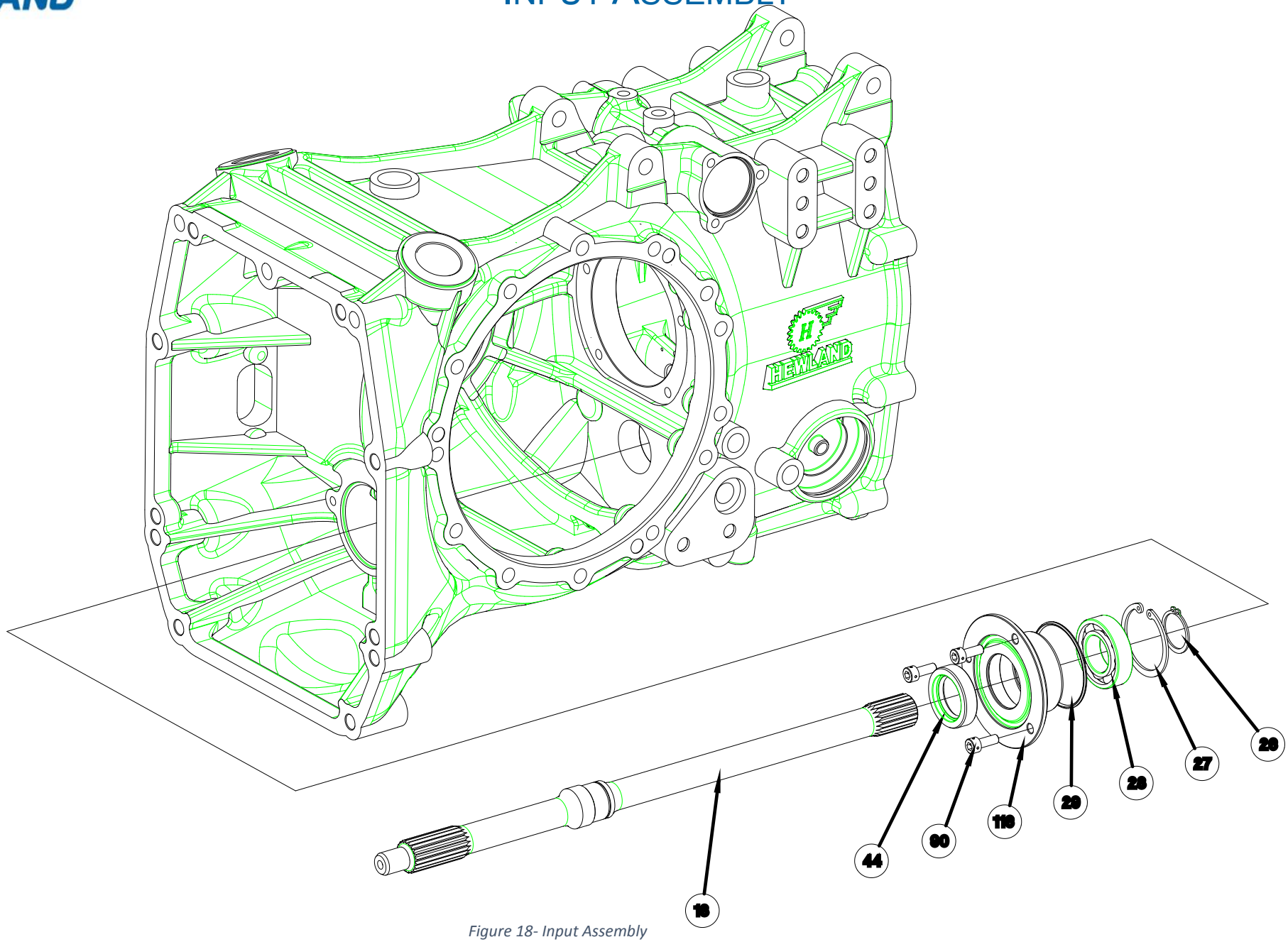


Figure 18- Input Assembly

BARREL/POTENTIOMETER INTERFACES

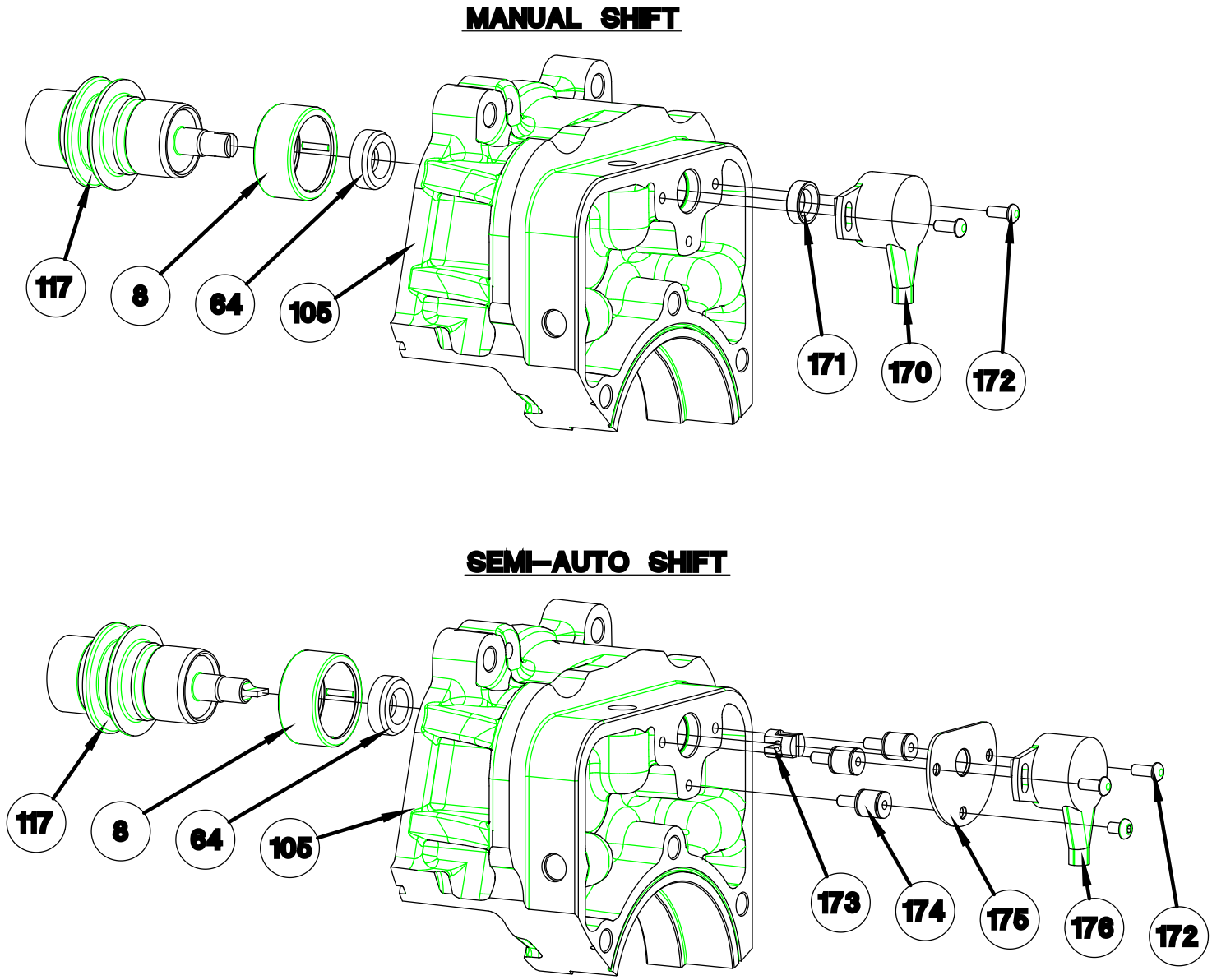
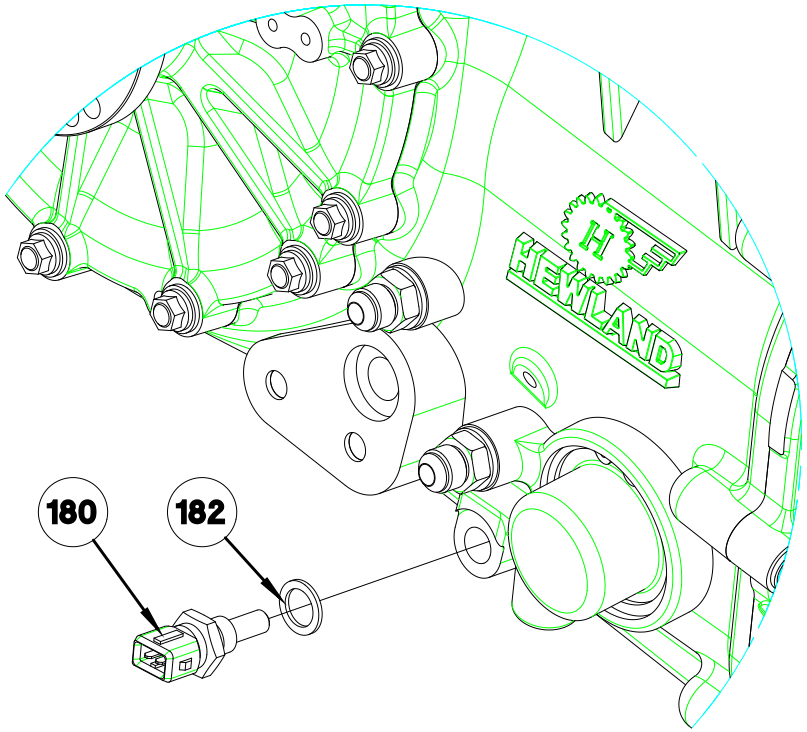
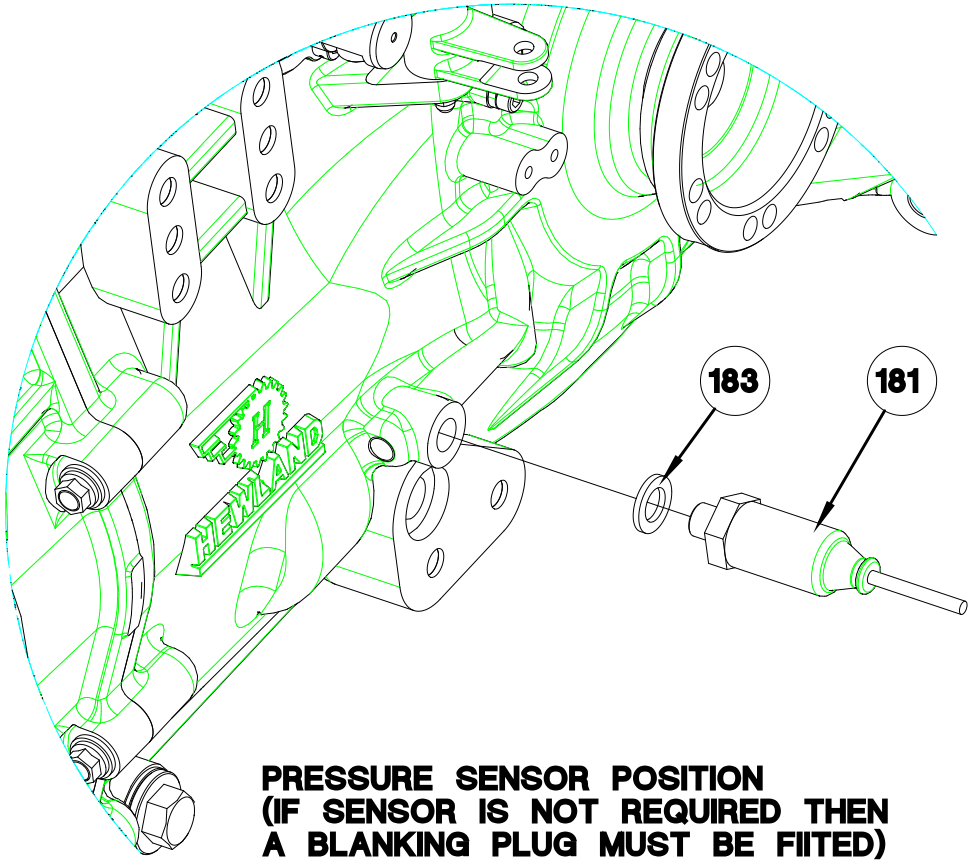


Figure 19- Barrel / Potentiometer Interfaces

TEMPERATURE & PRESSURE SENSOR POSITIONS



TEMPERATURE SENSOR POSITION (IF SENSOR IS NOT REQUIRED THEN A BLANKING PLUG MUST BE FIITED)



PRESSURE SENSOR POSITION (IF SENSOR IS NOT REQUIRED THEN A BLANKING PLUG MUST BE FIITED)

Figure 20- Temperature & Pressure Sensor Positions

PART NUMBERING

TMT-200				
Item No.	Stock Code	Qty	Description	Notes
1	102-260-9	1	COMPRESSION SPRING	
2	104-226-1	3	HUB	
3	104-226-2	6	NEEDLE ROLLER BEARING	
4	TE-**:**/**:**	1	PINION SHAFT GEARS	
5	104-234-4	1	LAYSHAFT SPACER	
6	104-RATIO-STD	4	104 GEAR ASSEMBLY	
7	105-234-8	1	DISC SPRING	
8	105-260-6	1	NEEDLE ROLLER BEARING	
9	400-021-4490-41	2	DOWTY WASHER	
10	BEA-001	1	ROLLER BEARING	
11	BEA-093	1	ROLLER BEARING	
12	BEA-141	1	BALL BEARING	
13	BEA-360	2	WEAR RING	
14	BEA-382	1	TAPER ROLLER OUTER	
15	CIR-082	1	CIRCLIP	
16	CIR-084	1	CIRCLIP	
17	CIR-189	1	CIRCLIP	
18	TMT-239-#	1	CLUTCH SHAFT	
19	CPK-260-2	2	PISTON	
20	CPK-260-3	1	SELECTOR RACK	
21	CPK-260-5	1	SELECTOR RACK WASHER	
22	CST-250-C	3	SELECTOR FORK ASSY	
23	DG-219-1A	2	CIRCLIP	
24	DG-222-1C	1	TAPER ROLLER BEARING	

TMT-200				
Item No.	Stock Code	Qty	Description	Notes
25	DG-232-A4D	3	CLUTCH RING	
26	DGB-239-0	1	EXTERNAL CIRCLIP	
27	DGB-244-10	1	INTERNAL CIRCLIP	
28	DGB-244-12	1	BALL BEARING	
29	DGB-244-14	1	O-RING	
30	DOW-063	1	DOWEL	
31	DTR-231-1	1	REVERSE CLUTCH RING	
32	DTR-260-7	1	BARREL SPACER	
33	EGT-237-1	1	REVERSE IDLER	
34	EGT-237-2	1	REVERSE IDLER SPIGOT	
35	F3A-202-9A	1	DOWEL	
36	F3D-236-1	30	WASHER	
37	FGC-205-1	2	TAPER ROLLER BEARING	
38	FGC-205-3	2	BALL BEARING	
39	FGC-205-4	2	LIP SEAL	
40	FGC-206-1#	A/R	SHIM	
41*	SPACER	1	SIDEPLATE SPACER	
42	FT-202-8	4	SOCKET SET SCREW	
43	FT-219-1A	1	CIRCLIP	
44	FT-244-11	1	OIL SEAL	
45	FTR-202-2	1	BEARING RETAINING PLATE	
46	FTR-210-35	1	PLUNGER	
47	FTR-210-36	1	PLUG	
48	FTR-237-1	1	REVERSE IDLER SPIGOT	

TMT-200				
Item No.	Stock Code	Qty	Description	Notes
49	FTR-237-2	1	SLEEVE	
50	FTR-260-4	1	SELECTOR RACK WASHER	
51	FTR-260-8	1	SPRING TRUNION	
52	HC-237-2	1	NEEDLE ROLLER BEARING	
53	HP-M-7039	1	DRUM WASHER	
54	HP-M-9004	1	MAGNETIC DRAIN PLUG	
55	HP-M-9037	1	BANJO JOINT	
56	HP-M-9038	2	SEALING WASHER	
57	HP-M-9039	1	BAJO BOLT	
58	HP-M-9042	1	DOWTY WASHER	
59	HP-M-9054	1	SOCKET CAP SCREW	
60	HP-N-9006	2	SOCKET CAP SCREW	
61	HYD-016	2	ADAPTOR	
62	LD-201-2	6	STUD	
63	LD-201-5	2	DOWEL	
64	LIP-041	1	OIL SEAL	
65	NCH-266	1	OIL FILTER	
66	NLT-223-2	1	PINION HEAD BEARING SHIM	
67	NLT-222	1	PINION HEAD BEARING	
68	SPACER	1	SIDEPLATE SPACER	
69	PINION SHAFT	1	PINION SHAFT	
70	CROWNWHEEL	1	CROWNWHEEL	
71	NMT-229	1	PINION SHAFT SPACER	
72	NMT-230-1	1	LOCKING RING	

TMT-200				
Item No.	Stock Code	Qty	Description	Notes
73	NUT-004	29	KAYNUT	
74	ORI-001	1	O-RING	
75	ORI-002	2	O-RING	
76	ORI-232	1	O-RING	
77	ORI-072	2	O-RING	
78	ORI-118	2	O-RING	
79	ORI-170	1	O-RING	
80	ORI-213	2	VL SEAL	
81	ORI-214	1	O-RING	
82	PCT-260-13	1	DRUM STOPPER	
83	PCT-260-3	1	COIL SPRING	
84	PLU-030	1	PLUG	
85	SCR-175	2	SOCKET CAP SCREW	
86	SCR-042	5	SOCKET CAP SCREW	
87	SCR-117	1	SOCKET CAP SCREW	
88	SCR-121	2	SOCKET SET SCREW	
*89	SCR-166	1	SOCKET SET SCREW (Version 1 to 16 maincases)	
*89	PLU-129	1	SEALING SCREW (Version 17 maincases & onwards)	
90	SGT-244-13	10	SOCKET CAP SCREW	
91	SPH1077-M3	1	PAWL	
92	SPH1078-M3	1	PLUNGER	
93	SCR-349	1	ANTI-ROTATION PIN	
94	SPR-058	1	COMPRESSION SPRING	
95	SPR-127	1	COMPRESSION SPRING	

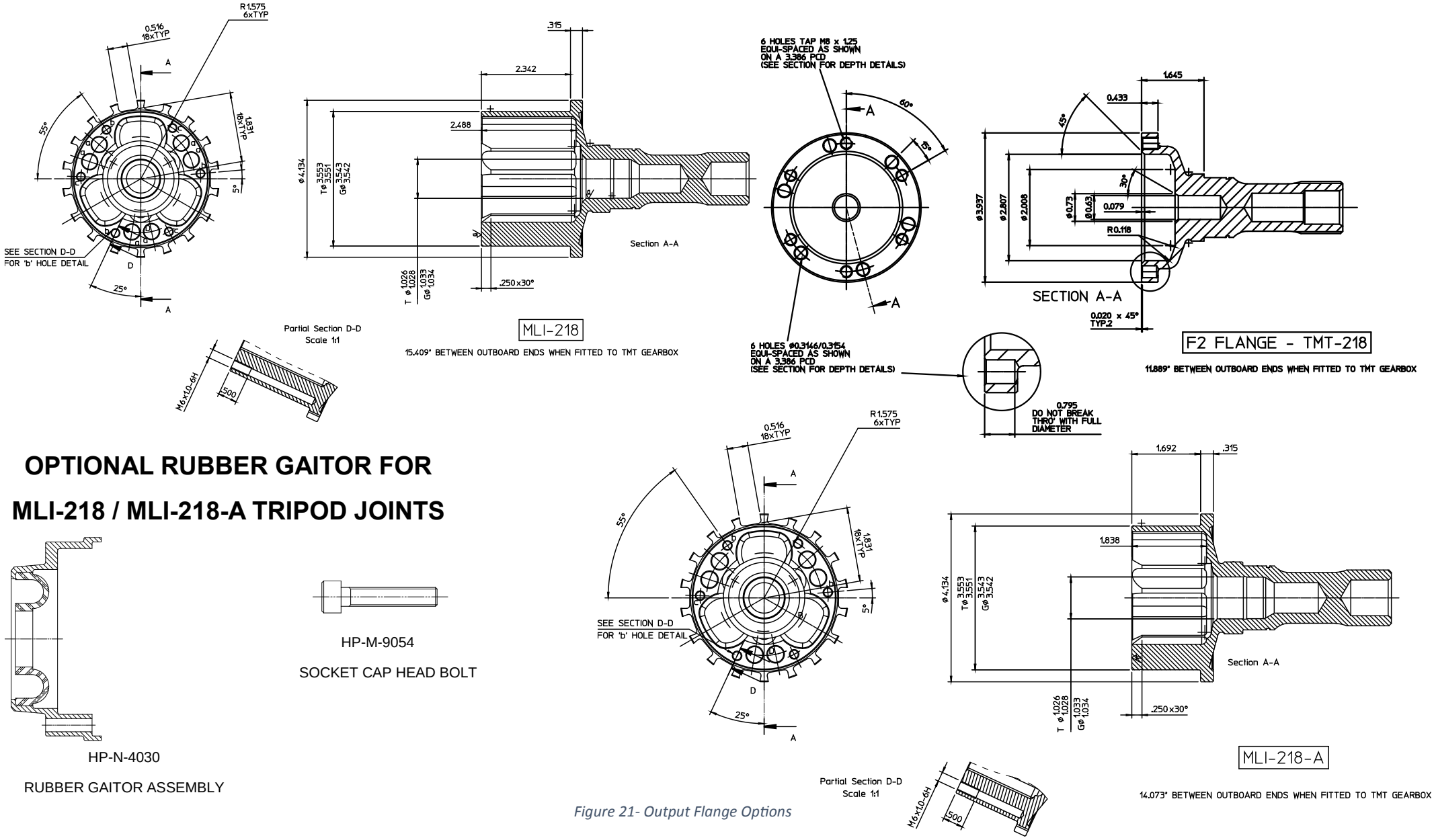
TMT-200				
Item No.	Stock Code	Qty	Description	Notes
96	SPR-131	2	SPRING	
97	SPR-142	1	COIL SPRING	
98	STU-036	8	STUD	
99	STU-074	13	STUD	
100	TE-**:**-INT	1	LAYSHAFT VARIANTS	
101	TE-234-2	1	BEARING INNER TRACK	
102	TMT-301	1	MAINCASE	
103	TMT-201-1	1	RATIO SPRAY RAIL	
104	TMT-201-2	1	SPRAY RAIL ASSEMBLY	
105	TMT-302	1	BEARING CARRIER	
106	TMT-205	1	SIDEPLATE	
107	OUTPUT FLANGE	2	OUTPUT FLANGE	
108	TMT-221-1	1	SPACER	
109	TMT-228	1	REVERSE INNER TRACK	
110	TMT-230	1	MAINSHAFT NUT	
111	TMT-231	1	REVERSE PINION GEAR	
112	TMT-234-1	1	OIL PUMP DRIVE	
113	TMT-239-	1	CLUTCH SHAFT	
114	TMT-246	1	SELECTOR RAIL	
115	TMT-249-A	1	REVERSE SELECTOR FORK	
116	TMT-258-1	1	SLAVE ADAPTOR CP3859	
	TMT-258-2	1	SLAVE ADAPTOR CP3759-3959	
117	TMT-260-M	1	MANUAL SELECTOR BARREL	
	TMT-260-S	1	SEMI-AUTO SELECTOR BARREL	

TMT-200				
Item No.	Stock Code	Qty	Description	Notes
118	TMT-260-1	1	BARREL BOLT	
119	TMT-260-4	2	PISTON HOUSING	
120	TMT-265-1	1	OIL PUMP ROTORS	
121	TMT-266	1	OIL FILTER	
122	TMT-266-1A	1	OIL FILTER COVER	
123	TMT-308	1	REAR COVER	
124	TPT-212	1	TPT DIFF ASSEMBLY	
125	VG-201-9	1	O-RING	
126	VG-221-1	10	CROWNWHEEL BOLT 7/16 UNF	8:35/9:35/10:31 CWP Ratio
	VG-221-1C	10	CROWNWHEEL BOLT 7/16 UNF	11:31 CWP Ratio
127	VG-222-1A	1	TAPER ROLLER BEARING EX LR	
128	WSH-028	1	WASHER	
129	MLI-223-1	1	CLAMP PLATE	
130	WSH-078	1	DOWTY WASHER	
150	TMT-260-5	1	RACK END COVER	
151	TMT-260-6	1	RACK SPACER	
152	TMT-260-7	1	RACK SEAL HOUSING	
153	FTR-260-3	1	RACK	
154	ORI-227	1	QUAD RING	
155	SPR-057	1	SPRING	
156	FTR-260-5	1	TRAVEL STOP SPACER	
157	HP-M-9008	1	SOCKET CAP SCREW	
158	LD-202-9	4	WASHER	
159	WSH-067	1	SHIM WASHER	
160	BEA-162	2	BEARING	

TMT-200				
Item No.	Stock Code	Qty	Description	Notes
161	FTR-260-2	1	SPACER TUBE	
162	FTR-260-7	1	BELL CRANK	
163	NUT-005	1	KAYNUT	
164	TE-201-4	1	BLANKING PLATE	
165	HP-M-9062	2	BLANKING PLATE SCREWS	
166	TE-234-1	1	SPACER	
170	ELC-024	1	MANUAL POTENTIOMETER	
171	TMT-260-2	1	POT SPIGOT	
172	HP-M-9062	3	SCREWS	
173	ZH147-01	1	OLDHAM COUPLING	
174	AVM-002	3	ANTI-VIBRATION MOUNTS	
175	TMT-202-1	1	MOUNTING PLATE	
176	TBA	1	SEMI-AUTO POTENTIOMETER	
180	ELC-036	1	TEMPERATURE SENSOR	
181	ELC-035	1	PRESSURE SENSOR	
182	WSH-007	1	DOWTY WASHER	
183	400-222-4490-41	1	DOWTY WASHER	
184	BEA-263	1	SPLIT BEARING	
201	400-021-4490-41	1	DOWTY WASHER	
202	BEA-374	1	BALL BEARING	
203	BEA-375	3	BALL BEARING	
204	CIR-021	1	CIRCLIP	
205	HYD-016	1	ADAPTOR	
206	HYD-059	1	ADAPTOR	

TMT-200				
Item No.	Stock Code	Qty	Description	Notes
207	LIP-041	1	OIL SEAL	
208	ORI-042	4	O-RING	
209	ORI-097	4	O-RING	
210	ORI-213	2	VL SEAL	
211	PNU-005	2	FLAPPER VALVE	
212	PNU-006	2	FLAPPER VALVE	
213	PNU-007	2	BACKING PLATE	
214	PNU-010	1	CYLINDER HEAD	
215	PNU-011	2	VALVE CARRIER	
216	PNU-012	1	CRANK SHAFT	
217	PNU-013	1	PISTON	
218	PNU-019	1	CYLINDER HEAD LH	
219	SCR-155	4	SOCKET CAP SCREW	
220	SCR-317	4	SOCKET BUTTON HD SCREW	
221	SCR-320	2	ANTI ROTATION PIN	
222	TMT-308-A	1	REAR COVER DRESSED	
223	WSH-090	1	DOWTY WASHER	
224	PLU-048	1	BLANKING PLUG	
225	SCR-209		SOCKET CAP SCREW	

OUTPUT FLANGE OPTIONS



OPTIONAL RUBBER GAITOR FOR MLI-218 / MLI-218-A TRIPOD JOINTS

HP-N-4030

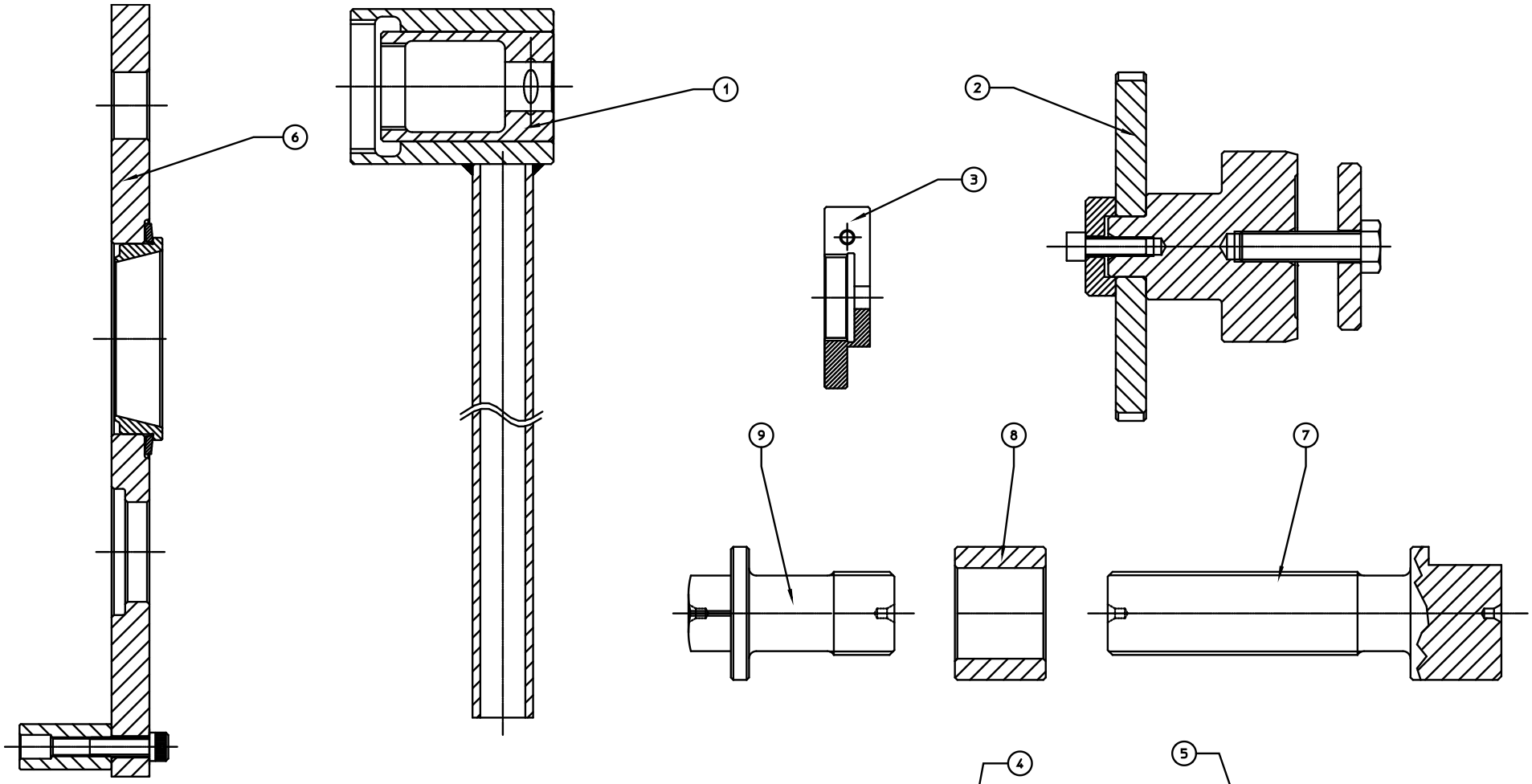
RUBBER GAITOR ASSEMBLY

HP-M-9054

SOCKET CAP HEAD BOLT

Figure 21- Output Flange Options

Transmission Tooling



Bill of Material		TMT-TOOLING	TOOLING ASSEMBLY
Position	Qty	PartNo	PartName
1	1	SK-1452	SOCKET & REACTION BAR
2	1	SK-1470-A	NMT GEARBOX TOOLS
3	1	SK-1913	NMT PINION TOOL
4	1	SK-2239	SEAL ASSEMBLY TOOL
5	1	SK-2240	PISTON ASSY TOOL
6	1	SK-2311	TMT FORK SETTING JIG
7	1	SK-838-A	DIFF HOLDING POST
8	1	SK-838-B	COLLAR (TPT DIFF PRELOAD TOOL)
9	1	SK-838-C	DIFF PRELOAD TOOL

Figure 22- Transmission Tooling

TMT Typical Oil System Layout

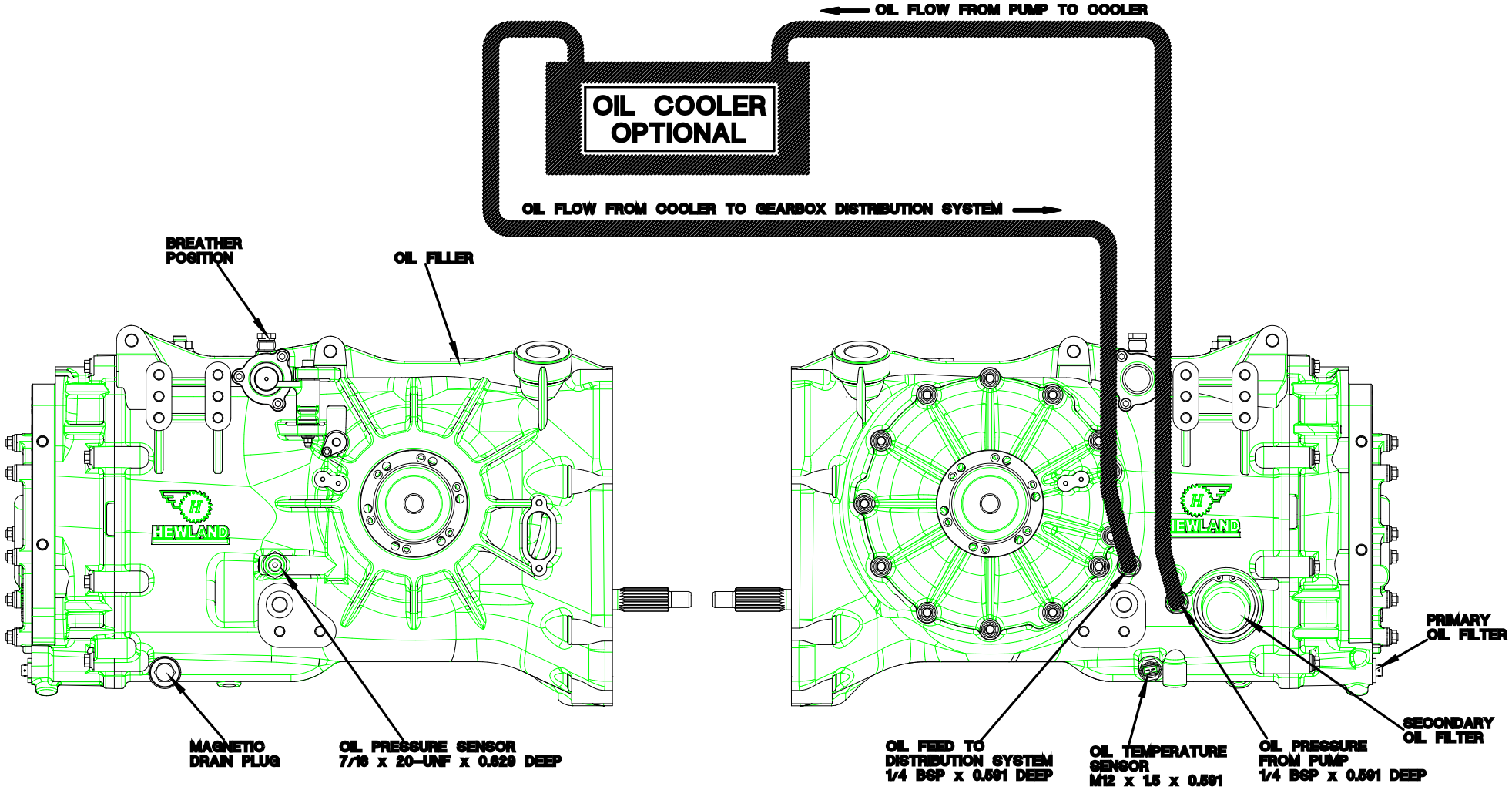


Figure 23- TMT Typical Oil System Layout

RUNNING WITHOUT AN OIL COOLER

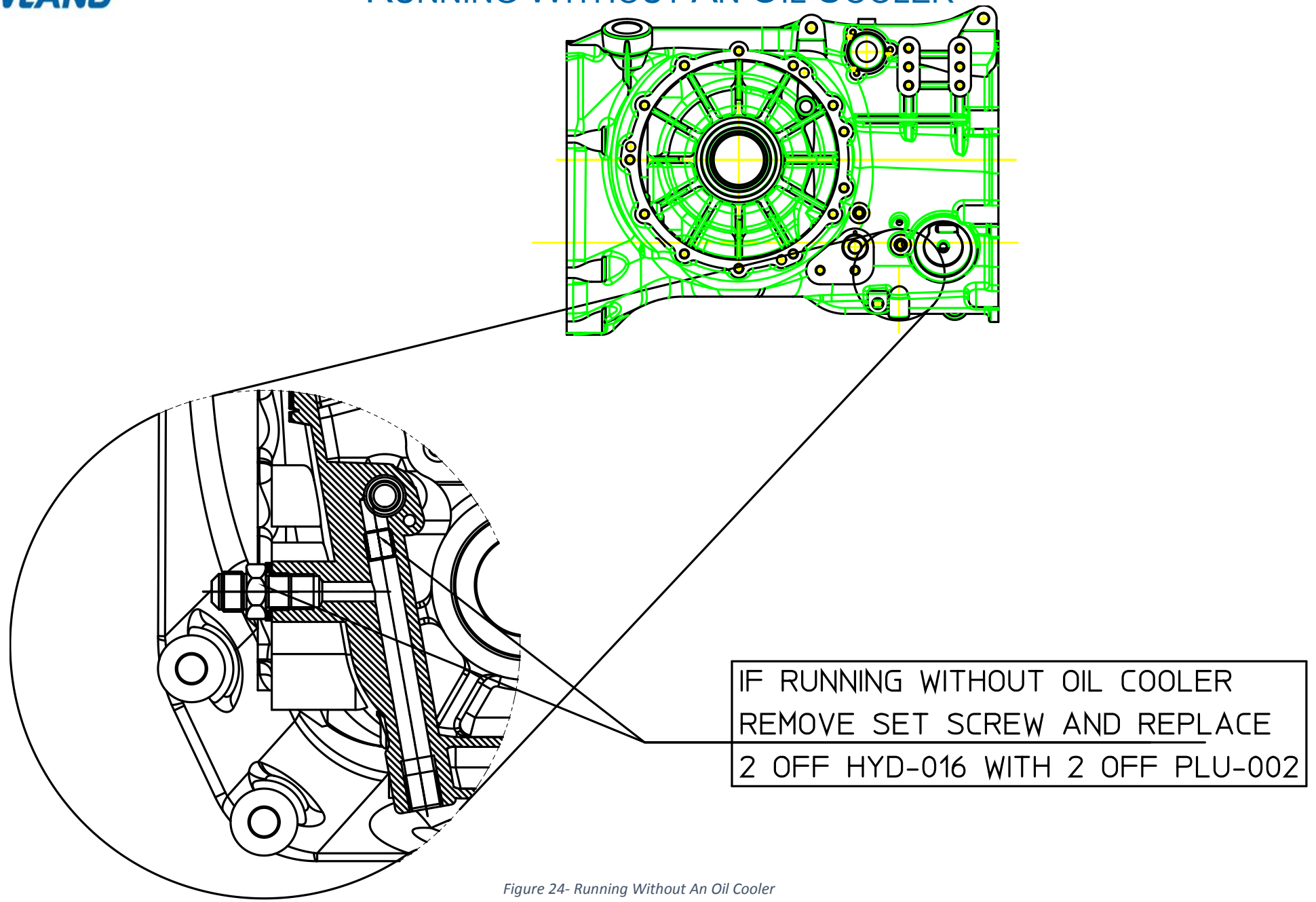


Figure 24- Running Without An Oil Cooler

REVISION HISTORY

ISSUE	MODIFICATION	PAGE	DATE	INITIALS
	1st Issue	-	16/01/2009	
	Item numbers 129 and 086 updated, amendments page added		15/10/2009	
	output flanges page added		20/01/2010	
	Seal tools added		23/06/2010	
	Part 224 added to page 26 & 32		13/10/2010	
	Page 07 item 71 changed to pinion shaft spacer for clarity, TMT-201 and TMT-202 changed to TMT-301 and TMT-302 respectively		25/10/2010	
	Running without oil cooler page added		01/11/2010	
	Page 34 - Tooling updated - SK-2212 and SK-2213 replaced by SK-2239 and SK-2240		14/09/2011	
	Page 04 - Torque rating corrected for 8:35 f/drive ratio		02/12/2011	
	Page 31 - Item 89 updated for new version of maincase		05/12/2011	
	AR Pin correctly shown for use with semi-auto shift not manual shift		07/02/2012	
	Page 33 - Optional Rubber Gaitor for MLI-218 and MLI-218-A Tripod Joints view added.		12/03/2012	
	Page 18 - Preload value table changed		26/05/2012	
	Page 32 - Item 166 changed		28/05/2012	
	Page 04 - Weights added for Aluminium / Magnesium Casings.		24/05/2013	
	Page 24 - Corrected item 184 to correct number		18/10/2013	
	Page 01 - Hewland standard disclaimer added to front of manual.		30/06/2014	
	Page 05 - Recommended torque table updated.		15/07/2015	
19	Manual updated to new layout and Gear Ratio range updated, CW bolt info added to Page 9 & 37.	ALL	14/10/2020	ADD
20	Page 06 – TMT specific torque values corrected	06	16/10/2020	RCME

Hewland Engineering Ltd
Waltham Road, White Waltham
Maidenhead, Berkshire, SL6 3LR, UK

+44 (0) 1628 827600
info@hewland.com
www.hewland.com