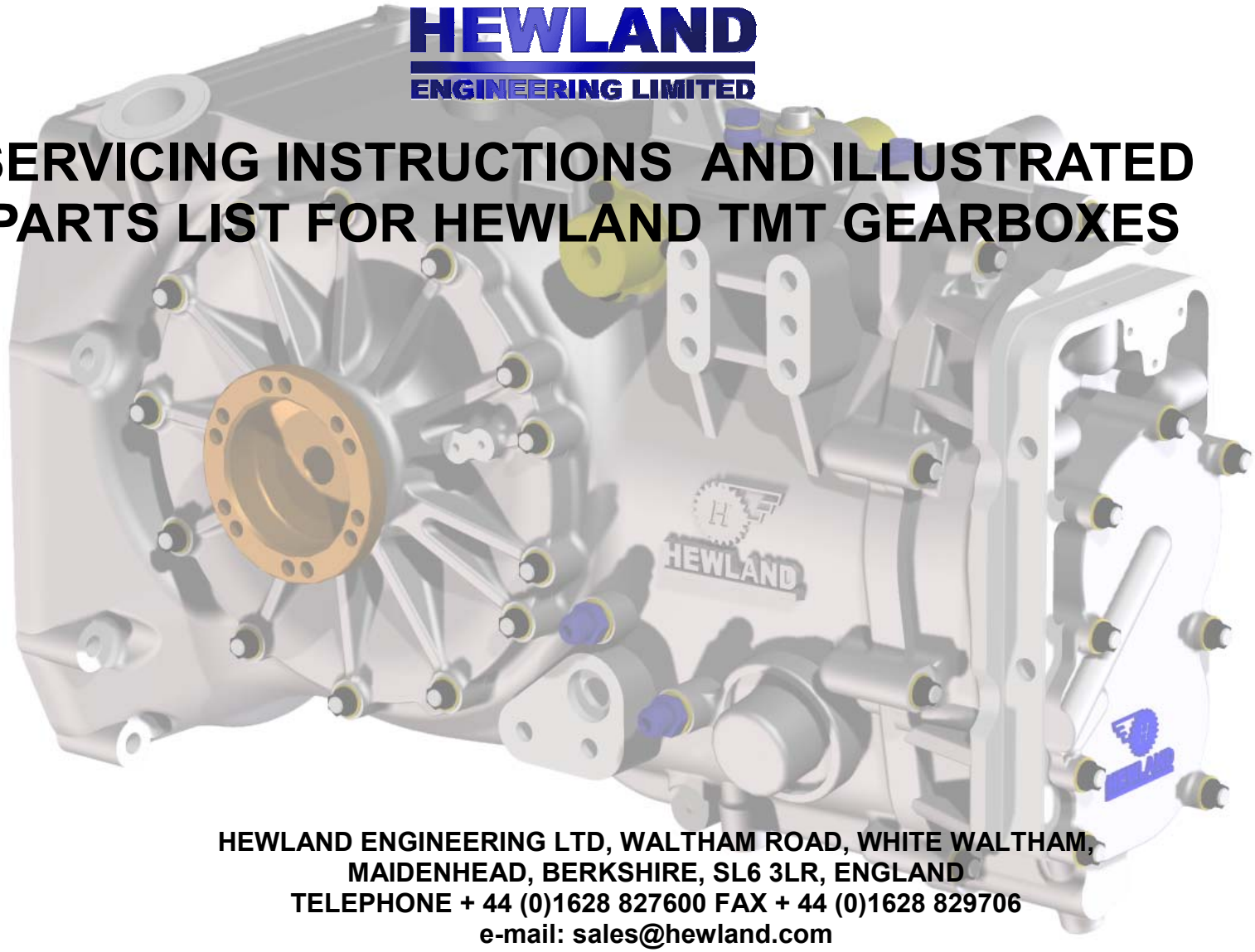
HEWLAND
ENGINEERING LIMITED

# SERVICING INSTRUCTIONS AND ILLUSTRATED PARTS LIST FOR HEWLAND TMT GEARBOXES

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## ILLUSTRATIONS

## 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 0.857:1
Final drive ratios 8/35, 9/35, 10:31 & 11/31
Clutchshafts made to customer's requirements

| | |
|---|---|
| Weight | 109 lbs (49.5Kg) |
| Oil type | SAE 80 or 90 |
| Oil quantity | 3.1 pints (1.75 litres) Not Including cooler or external pipe work. |
| Maximum torque | 320 lbs.ft (430 Nm) - *reduced to 210 lbs.ft (285Nm) for 8:35 final drive*. |

## RECOMMENDED FITTING TORQUES

General nut and bolt torque settings:-

| RECOMMENDED TIGHTENING TORQUES FOR METRIC COARSE SERIES BOLTS CLASS 12.9 | | | |
|---|---|---|---|
| THREAD | (Nm) | (lbs.ins) | (lbs.ft) |
| M5 | 6.7 | 59 | 4.9 |
| M6 | 11.2 | 99 | 8.3 |
| M8 | 27.3 | 242 | 20.2 |
| M10 | 53.9 | 477 | 39.8 |

| RECOMMENDED TIGHTENING TORQUES FOR UNIFIED FINE SERIES BOLTS CLASS 12.9 | | | |
|---|---|---|---|
| THREAD | (Nm) | (lbs.ins) | (lbs.ft) |
| 1/4 | 14.2 | 126 | 10.5 |
| 5/16 | 28.4 | 252 | 21.0 |
| 3/8 | 52.2 | 462 | 38.5 |
| 7/16 | 82.5 | 731.0 | 60.9 |

| RECOMMENDED TIGHTENING TORQUES FOR UNIFIED COARSE SERIES BOLTS CLASS 12.9 | | | |
|---|---|---|---|
| THREAD | (Nm) | (lbs.ins) | (lbs.ft) |
| 1/4 | 12.5 | 110 | 9.2 |
| 5/16 | 25.6 | 227 | 18.9 |
| 3/8 | 46.0 | 407 | 33.9 |

| RECOMMENDED TIGHTENING TORQUES FOR METRIC COARSE SERIES K-NUTS | | | |
|---|---|---|---|
| THREAD | FITTING TO EN16T STUDS | | |
| | (Nm) | (lbs.ins) | (lbs.ft) |
| M5 | 8.4 | 75 | 6.2 |
| M6 | 12.7 | 112 | 9.3 |
| M8 | 27.0 | 239 | 19.9 |
| M10 x 1.50 | 40.0 | 354 | 29.5 |
| M10 x 1.25 | 50.0 | 443 | 36.9 |

Specific nut and bolt torque settings:-

(Where Specific nut and bolt details are a similar size to General nut and bolt details, the tightening torques listed in this section must be adhered to for these components.)
Barrel Bolt tightening torque = 35 lbs.ft (48 Nm)
Pinion shaft nut tightening torque = 120 lbs.ft (163 Nm)
Crownwheel bolt tightening torque = 75 lbs.ft (100 Nm) *(Lockwire must also be applied to these bolts.)*

## GENERAL NOTES

a) Read these instructions carefully and with reference to the illustrations.

b) Before dismantling the gearbox, see that a clean tray is available, in which to place the parts.

c) Thoroughly clean and inspect all parts before reassembly. Discard any worn or damaged components and replace with new ones.

d) Use only genuine Hewland parts as replacements. These are manufactured in our workshops to the fine tolerances necessary and are rigorously inspected.

e) Always ensure that locknuts, and oil seals are in good condition when reassembling.

f) All studs and screws must be Loctited or wirelocked in position, unless stated otherwise

g) 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 seatings 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.

h) Oil:
Fill the gearbox through the oil filler hole on top of the maincase. The oil will find it's 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.

| PART NUMBER | RATIO | MOUNTING DISTANCE | ITEM (41) | ITEM (68) |
|---|---|---|---|---|
| NLT-221-CW | 9/35 | 2.200” | FGC-205-2A | NMT-205-2A |
| NMT-221-BW | 10/31 | 2.316” | FGC-206-2A | NMT-205-2 |
| NMT-221-AW | 11/31 | 2.316” | FGC-206-2A | NMT-205-2 |

Refer to page 19 for part references.

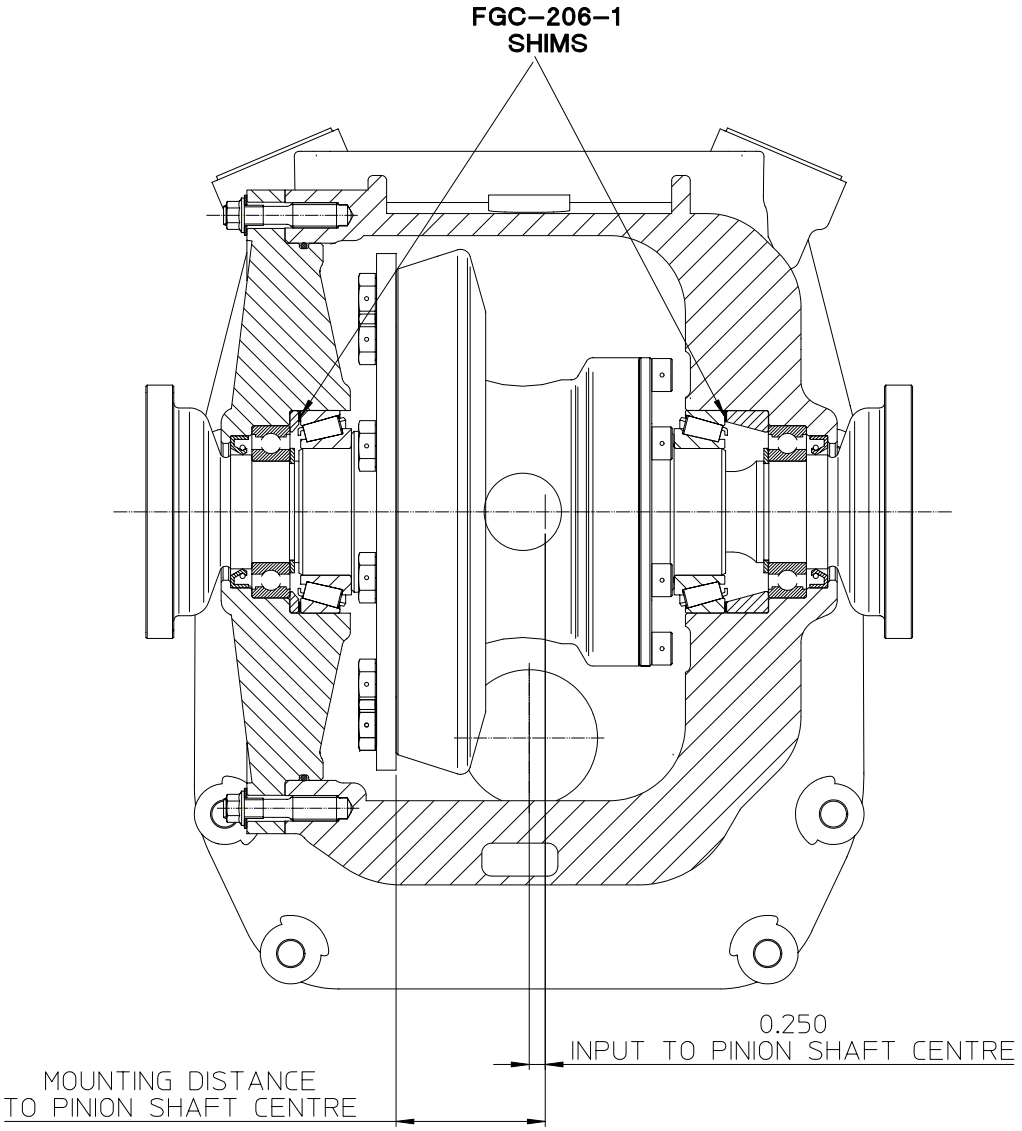



FIGURE 1

## PINION HEIGHT SETTINGS

Requires special tool No.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 it's 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.

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).

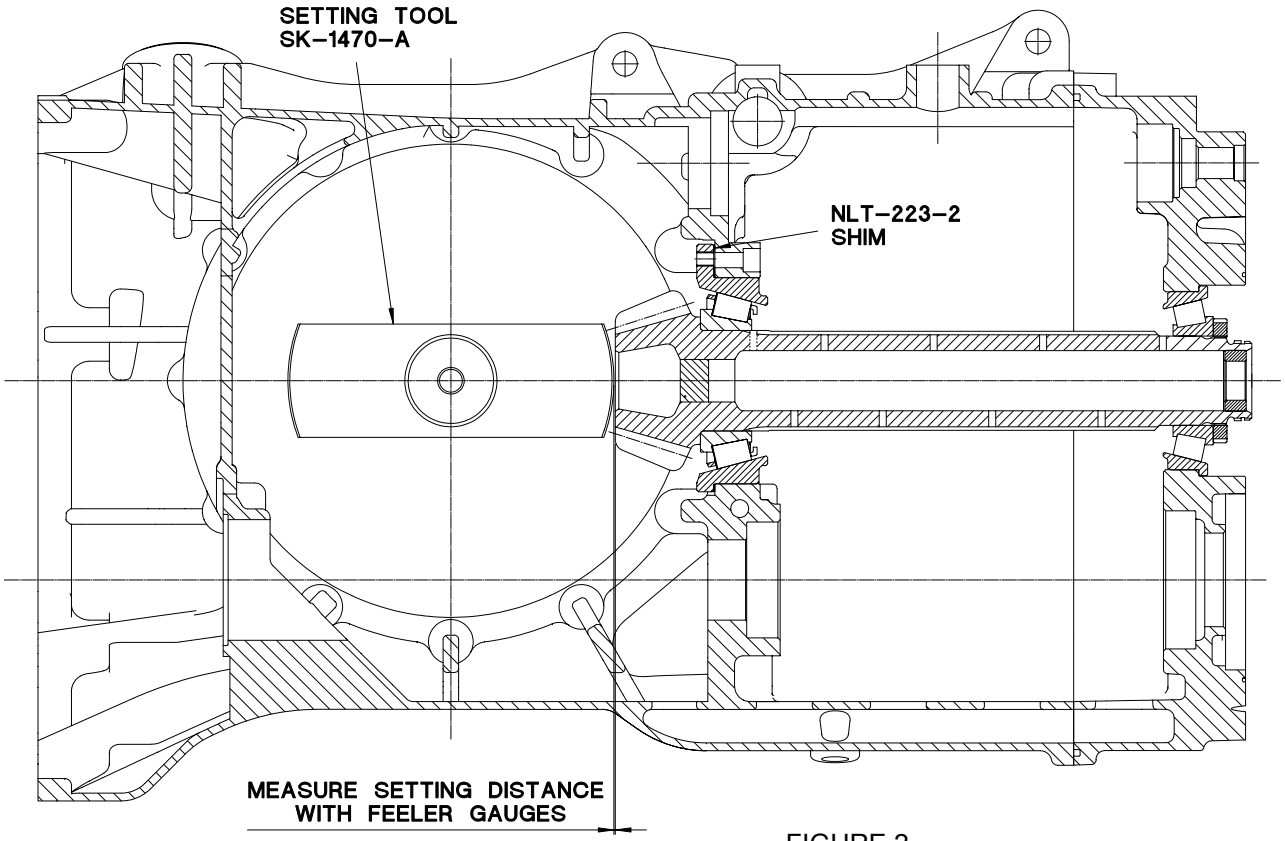



FIGURE 2

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

**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 it's bearings.
If necessary adjust the preload across the bearings by grinding the pinion shaft spacer (71) on it's 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.

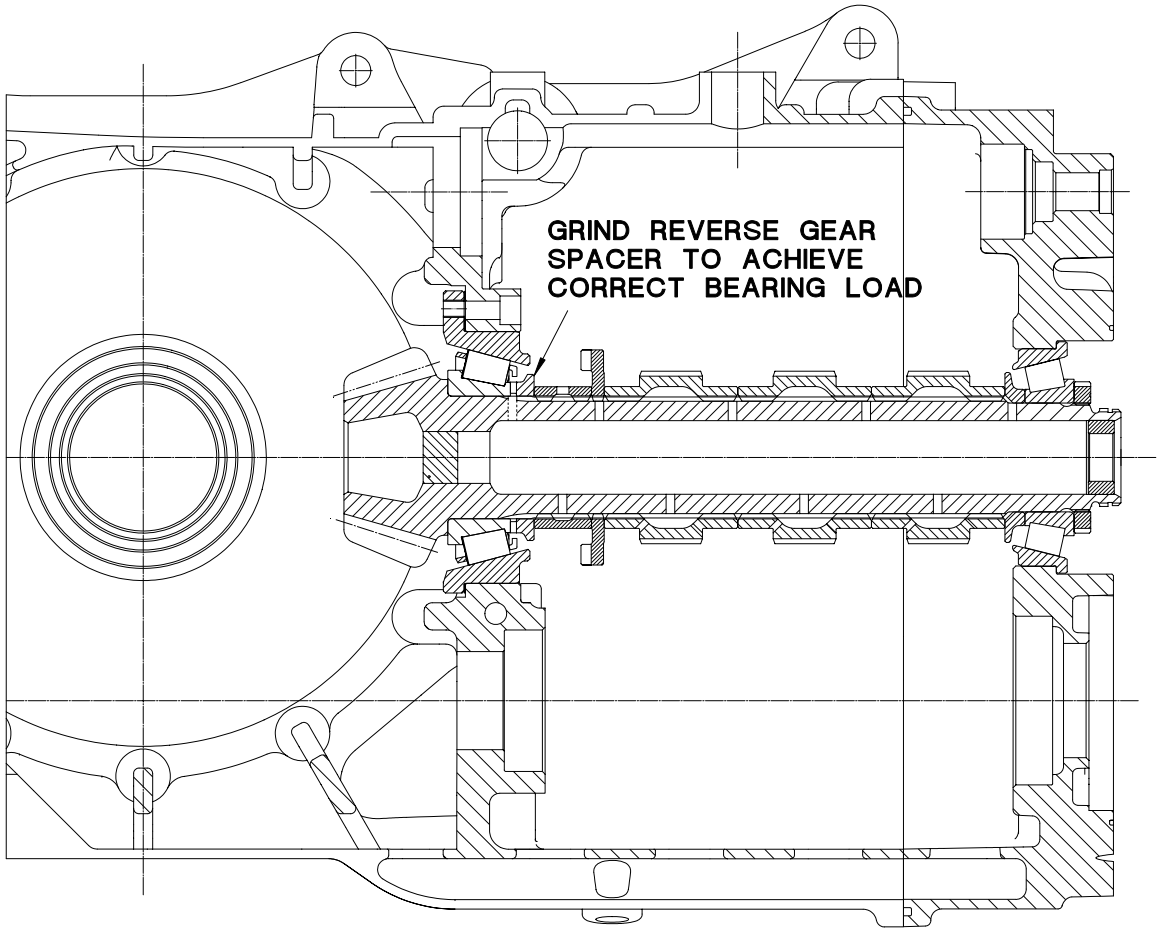



FIGURE 3

**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.**

## CROWNWHEEL & PINION BACKLASH SETTING

Requires special tool No. 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.

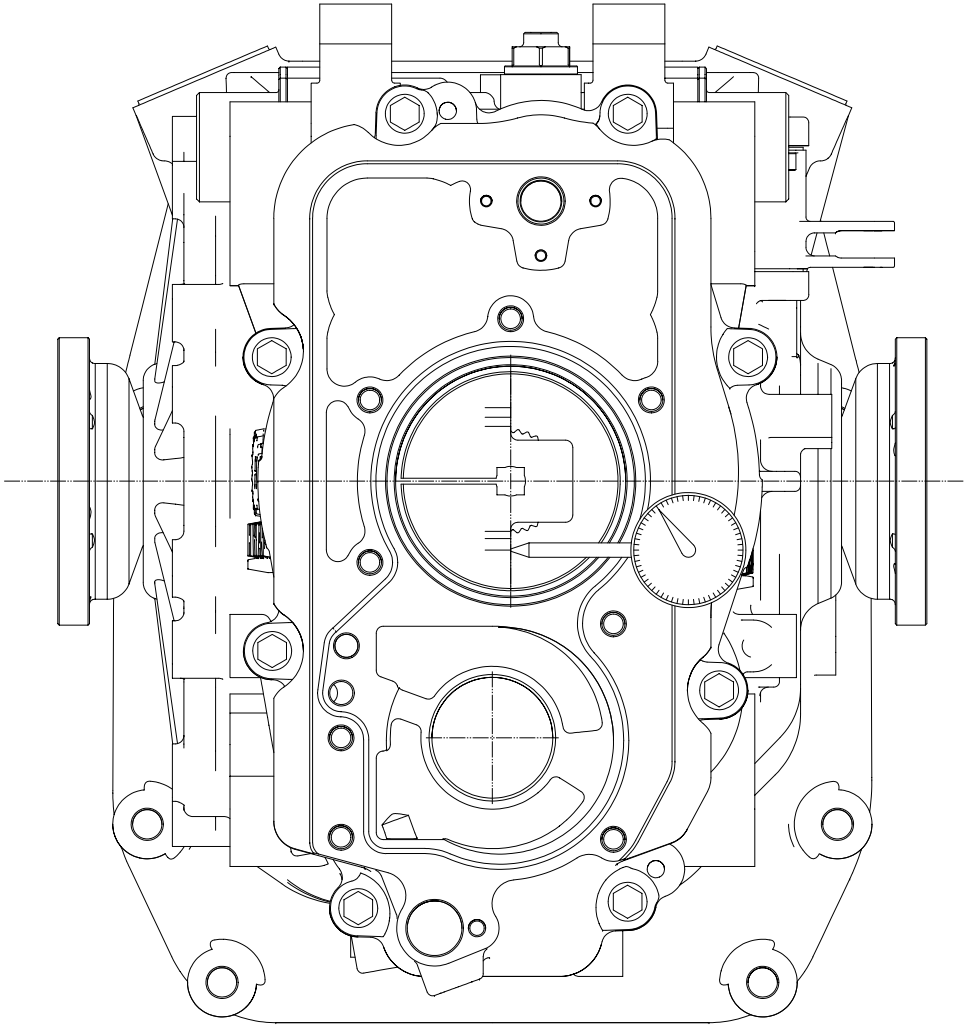


FIGURE 4

## SEQUENTIAL BARREL SETTING

Requires special tool No. 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.

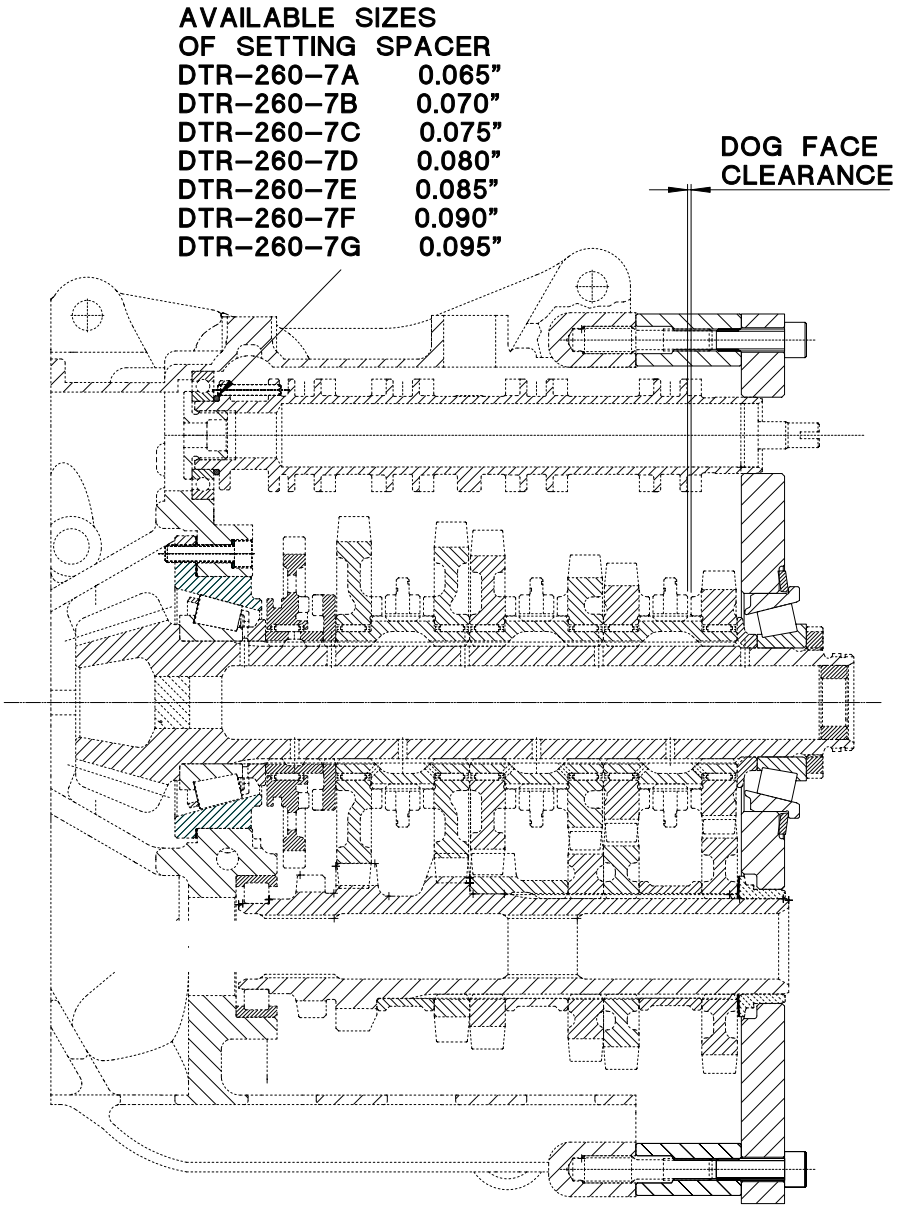



FIGURE 5

## GEARBOX ASSEMBLY (Manual Gear Shift)

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

b) 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.

c) 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).

d) 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).

e) 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.

f) 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.

g) 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.

h) 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).

## GEARBOX ASSEMBLY (Manual Gear Shift)

j) 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).

k) 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 12 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.

l) The bearing carrier (105) can now be fitted with the barrel oilseal (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.

m) 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.

n) 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.

p) 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.

r) 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)

a) All assembly details are as for the manual gear shift with the exception of the rack.
b) 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.
c) 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.
d) 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

a) With a drip tray placed beneath the gearbox, remove the magnetic drain plug (54) and drain the oil.
b) 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).
c) Remove the retaining ring (72), the locknut (110) and the pinion bearing inner race (24).
d) 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.
e) 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.
f) 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 12 for details.
g) 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.
h) Reassembly is the reverse of disassembly. Take care, when refitting the gear cluster into the maincase, to ensure location of the layshaft into it's bearing.

Refer to page 19 for part references.

## POWERFLOW DIFFERENTIAL

This powerflow differential unit is designed with versatility as it's 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 dependant 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 6 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.

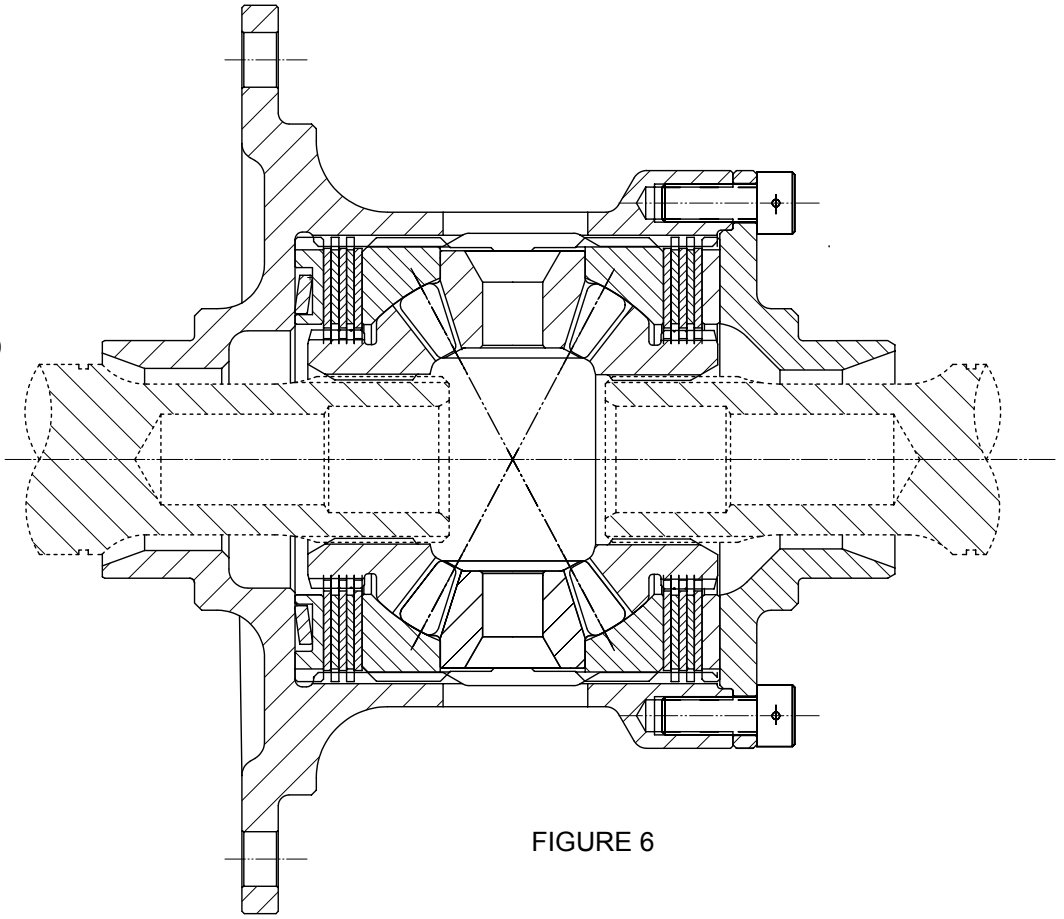


FIGURE 6

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 7

# 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–213–8 | 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**

| | | CARRIER | |
|---|---|---|---|
| SPRING | CS-1401 | PHR-213-3 | PHR-213-3B |
| SPR-038 | 0 LBSFT | 50 LBSFT | 95 LBSFT |
| SPR-065 | 0 LBSFT | 65 LBSFT | 80 LBSFT |

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

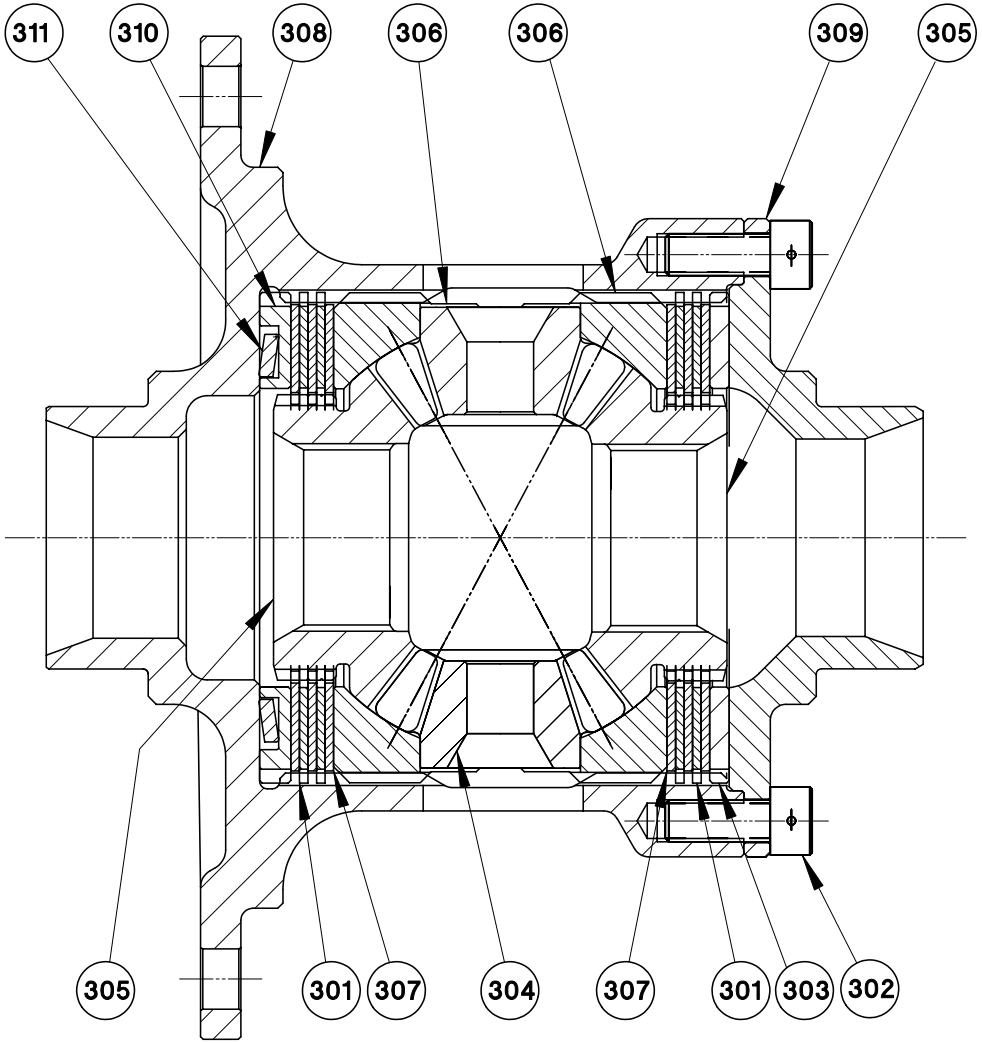



FIGURE 8

# ILLUSTRATED PARTS LIST

# OUTPUT ASSEMBLY

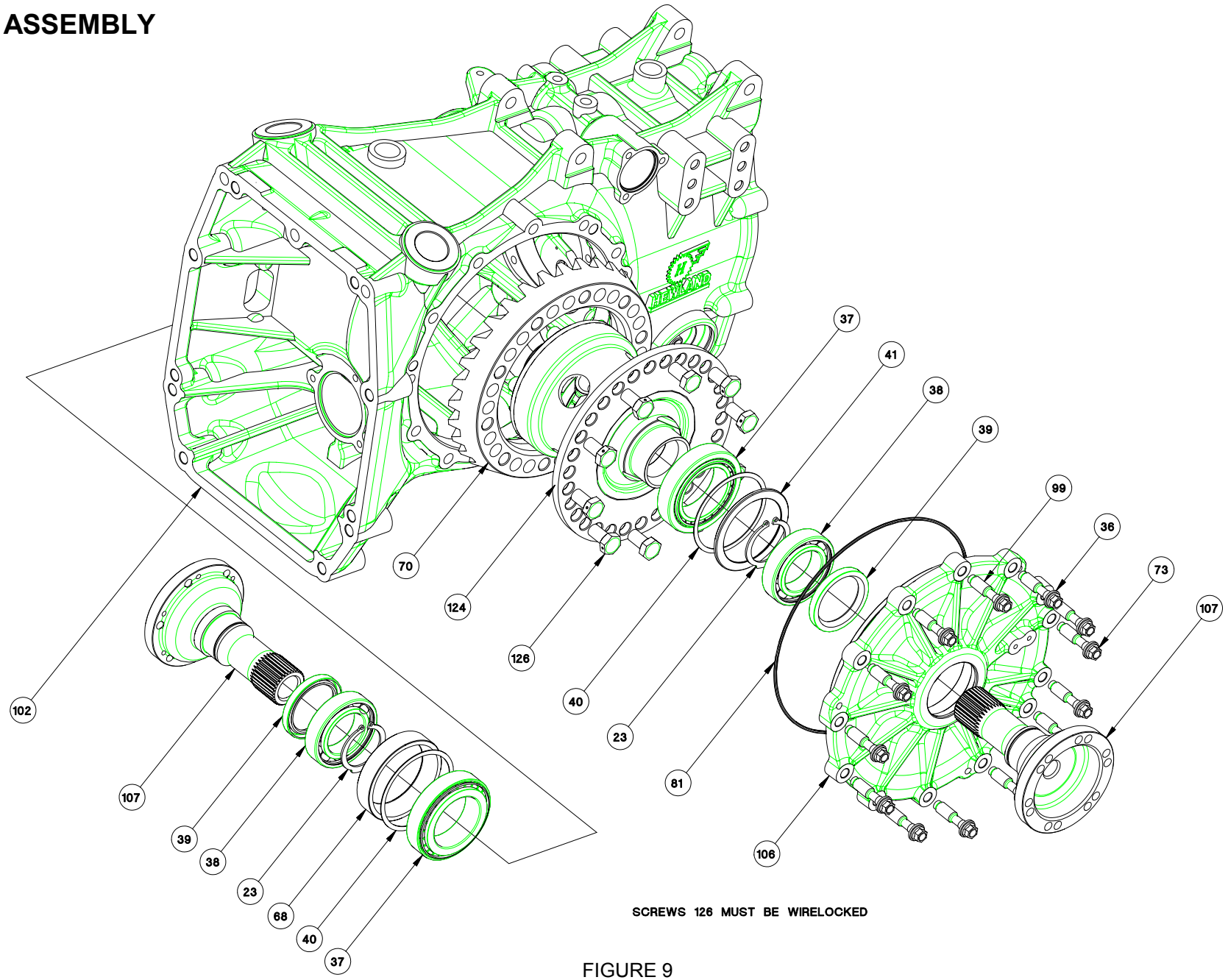



FIGURE 9

## **CASING PARTS** (WITHOUT INTEGRAL GEAR SHIFT COMPRESSOR)

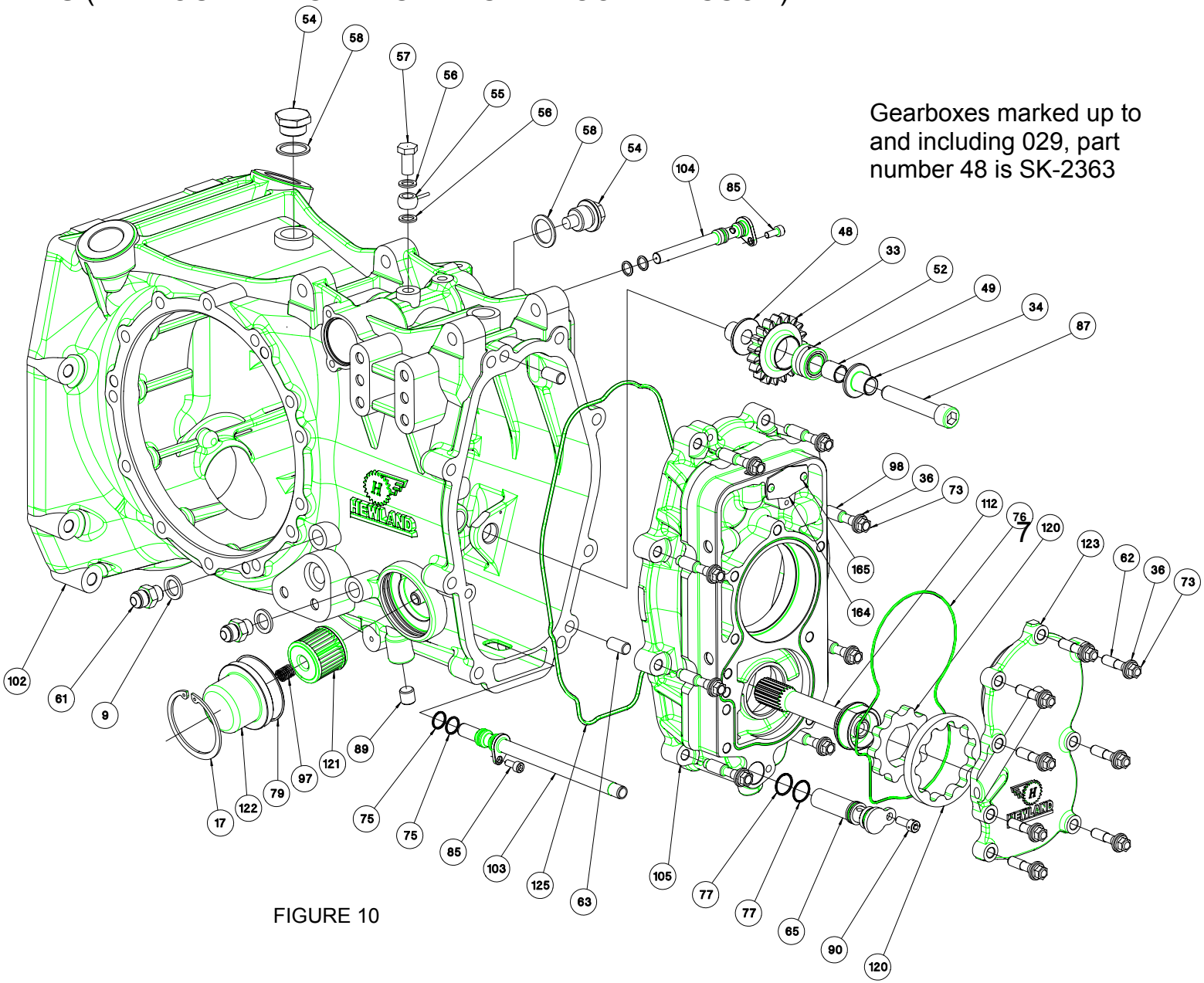
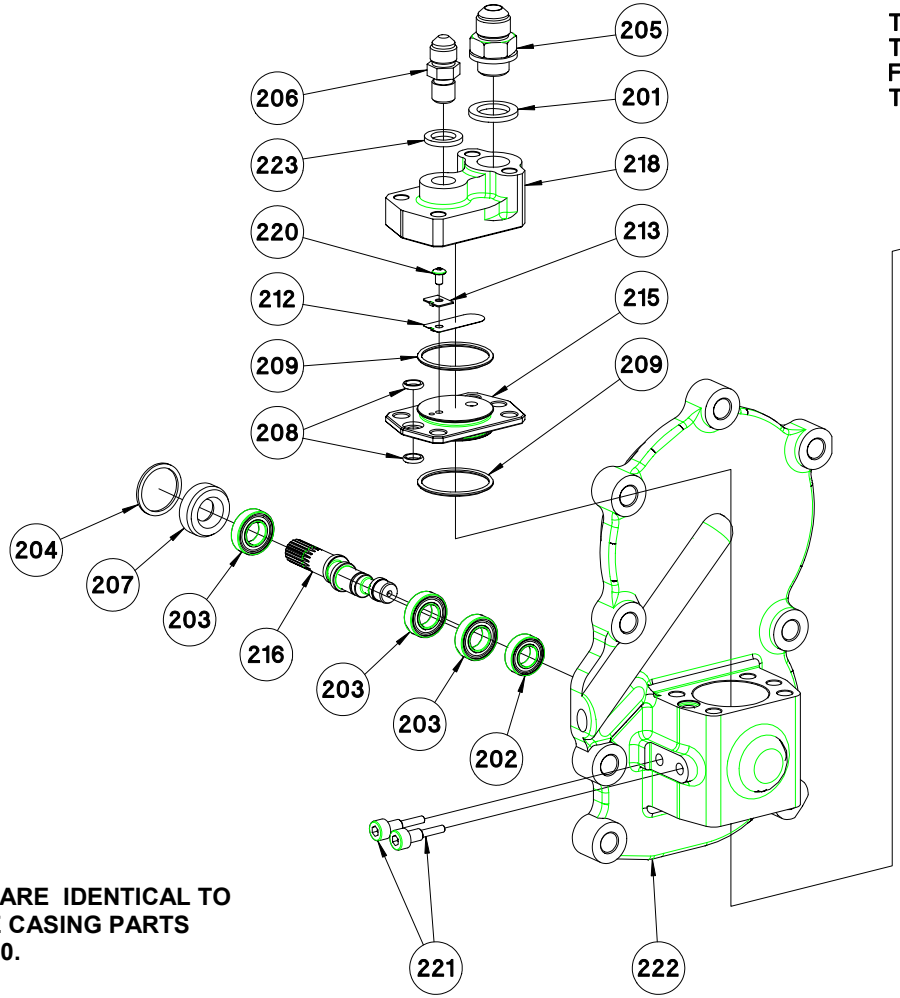
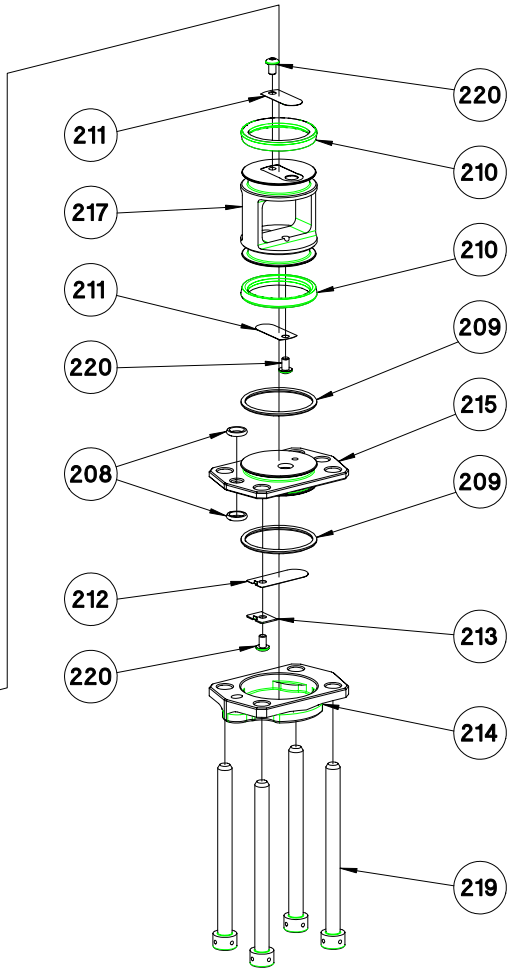



FIGURE 10

# **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 10.**

FIGURE 11

# LAYSHAFT ASSEMBLY

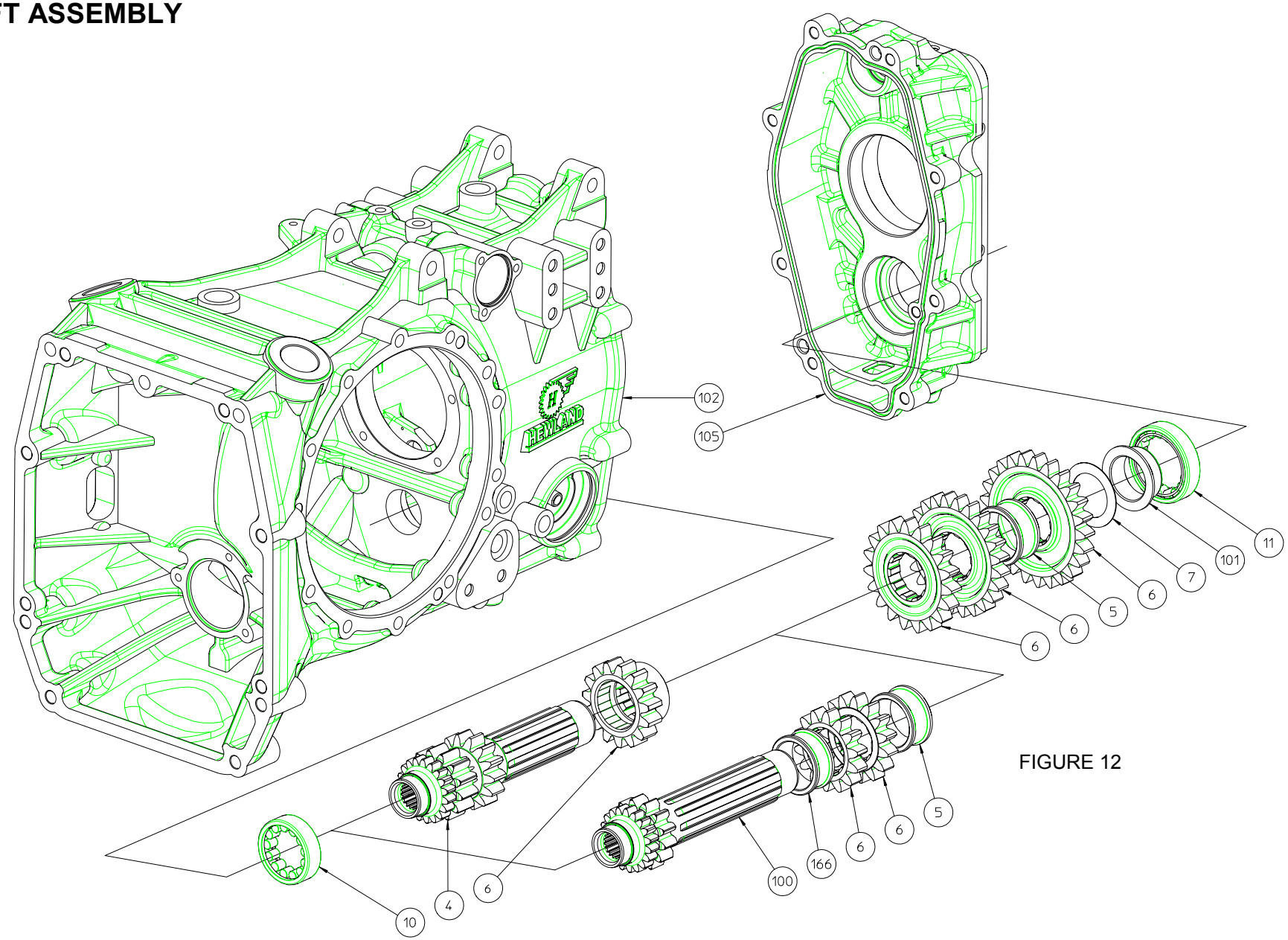



FIGURE 12

# PINION SHAFT ASSEMBLY

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

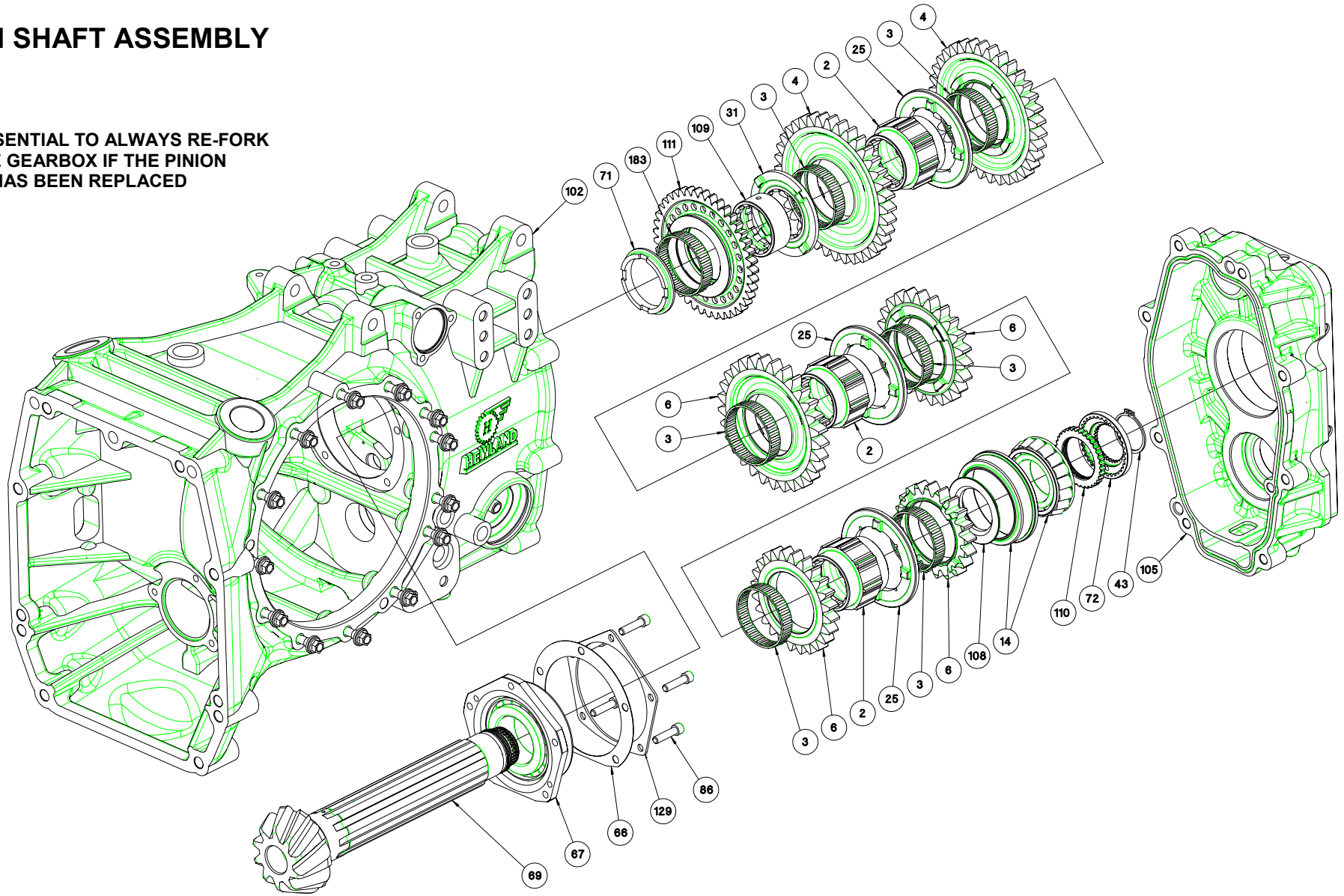



FIGURE 13

## **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**

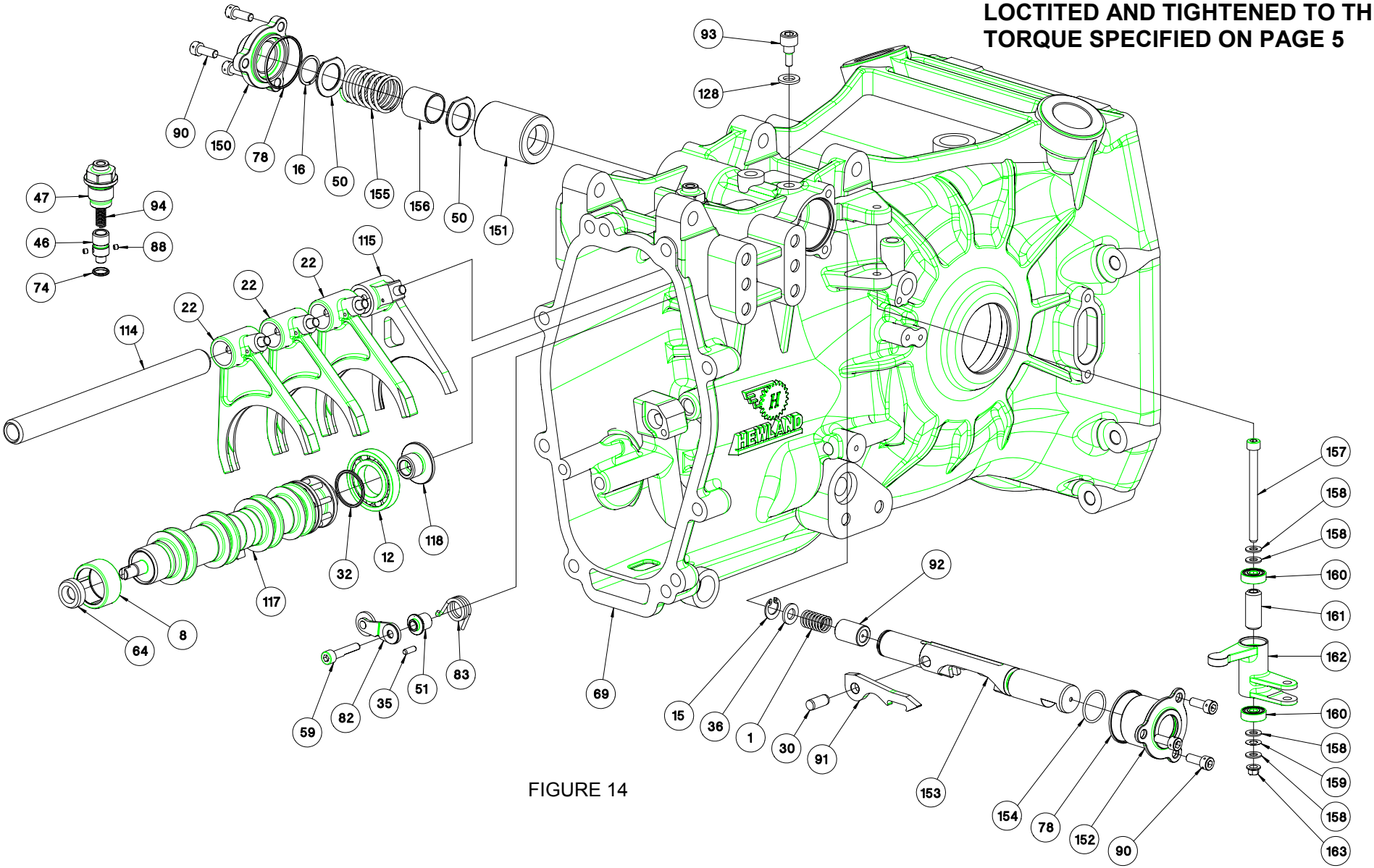
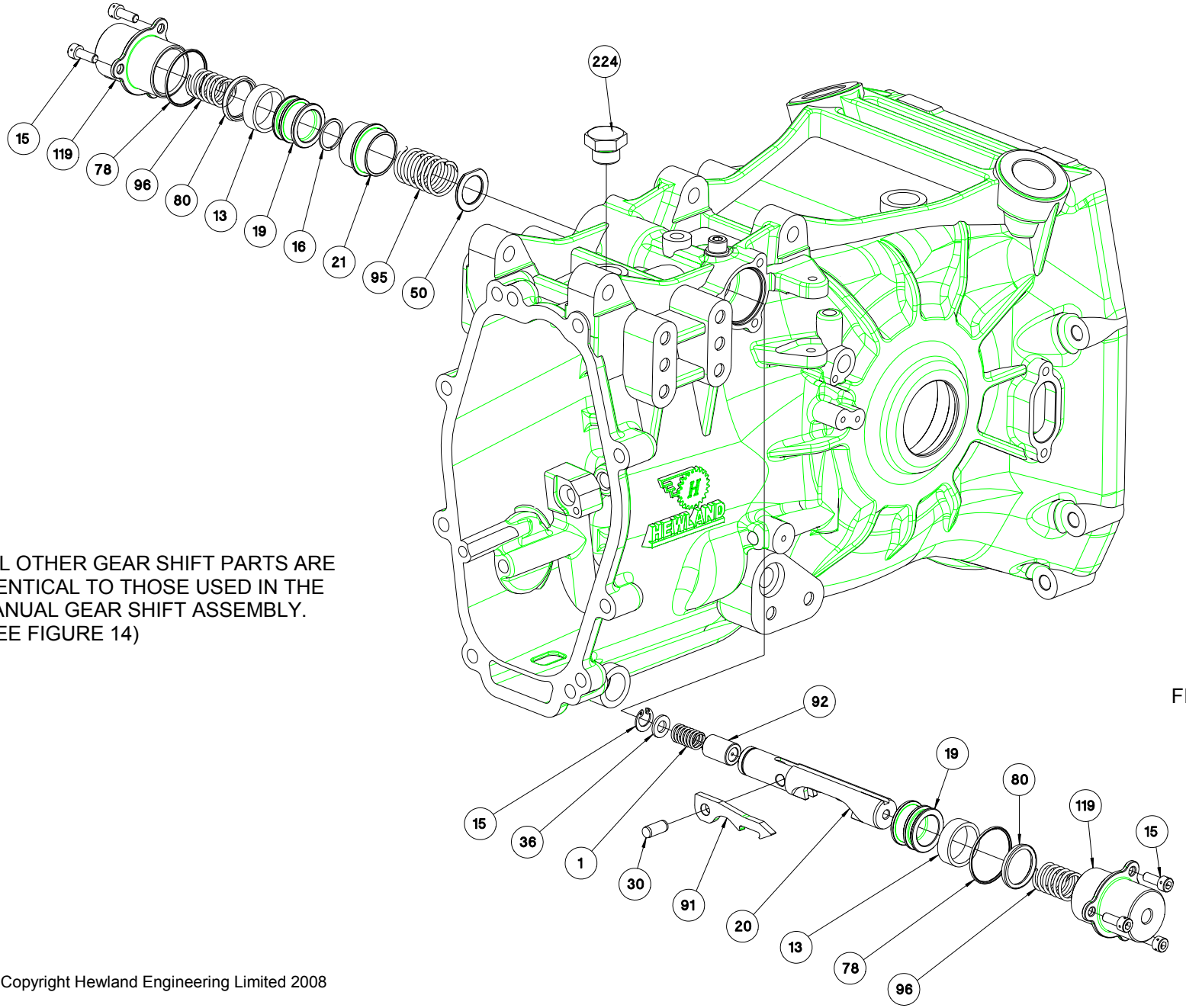



FIGURE 14

## **GEAR SHIFT ASSEMBLY** (PNEUMATIC GEAR SHIFT ONLY)




ALL OTHER GEAR SHIFT PARTS ARE IDENTICAL TO THOSE USED IN THE MANUAL GEAR SHIFT ASSEMBLY. (SEE FIGURE 14)

FIGURE 15

# INPUT ASSEMBLY

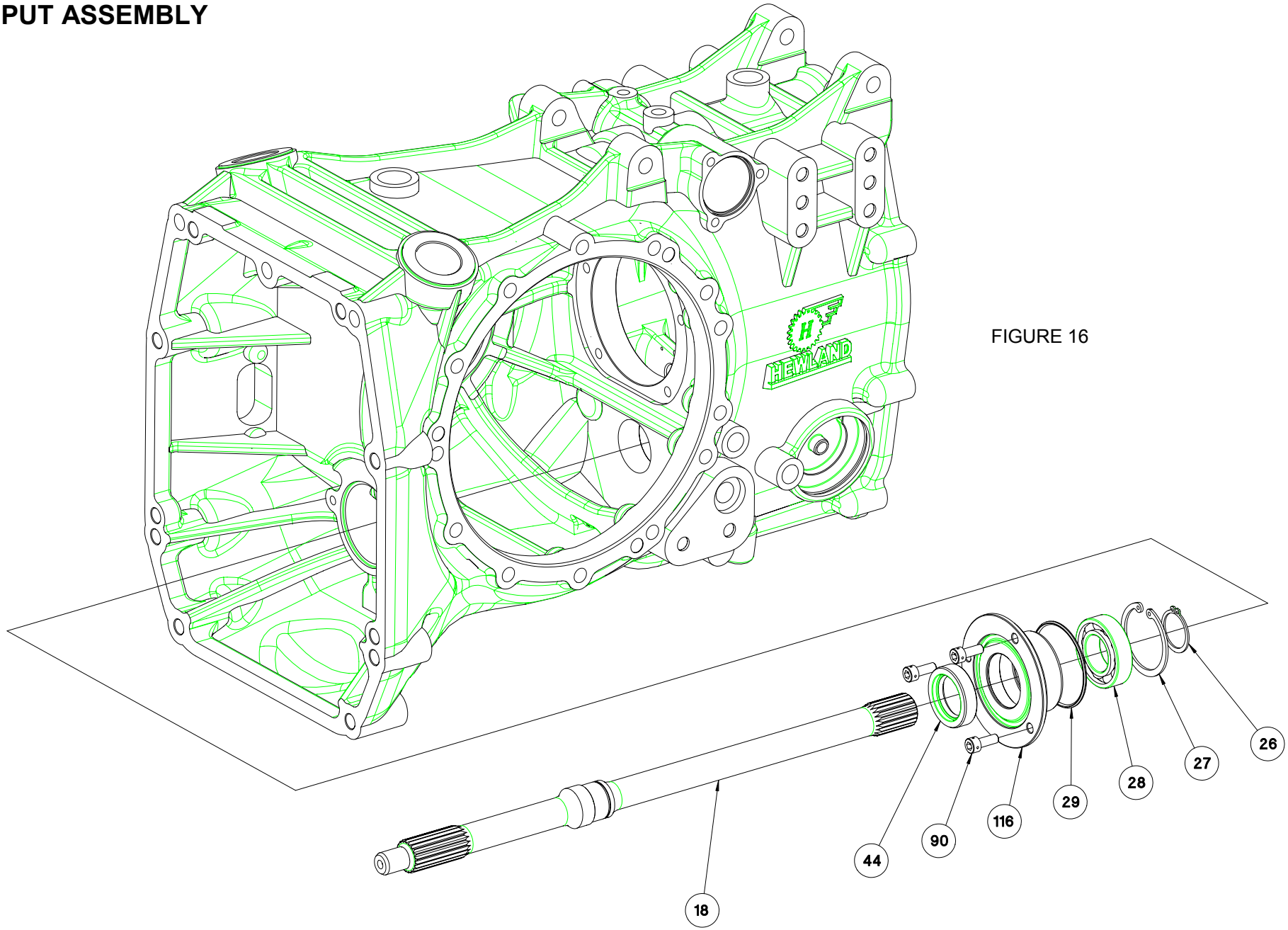
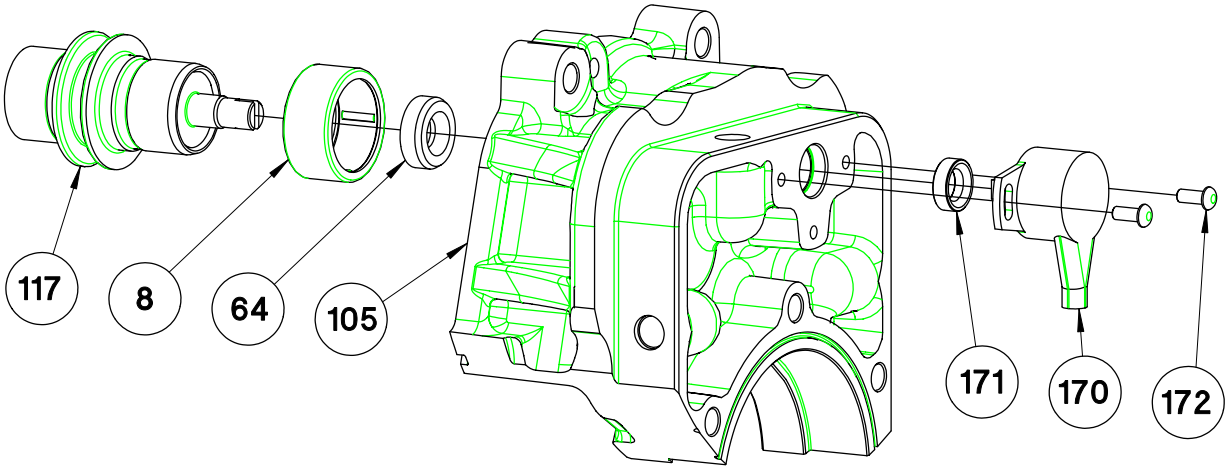



FIGURE 16

## BARREL/POTENTIOMETER INTERFACES

MANUAL SHIFT




SEMI–AUTO SHIFT

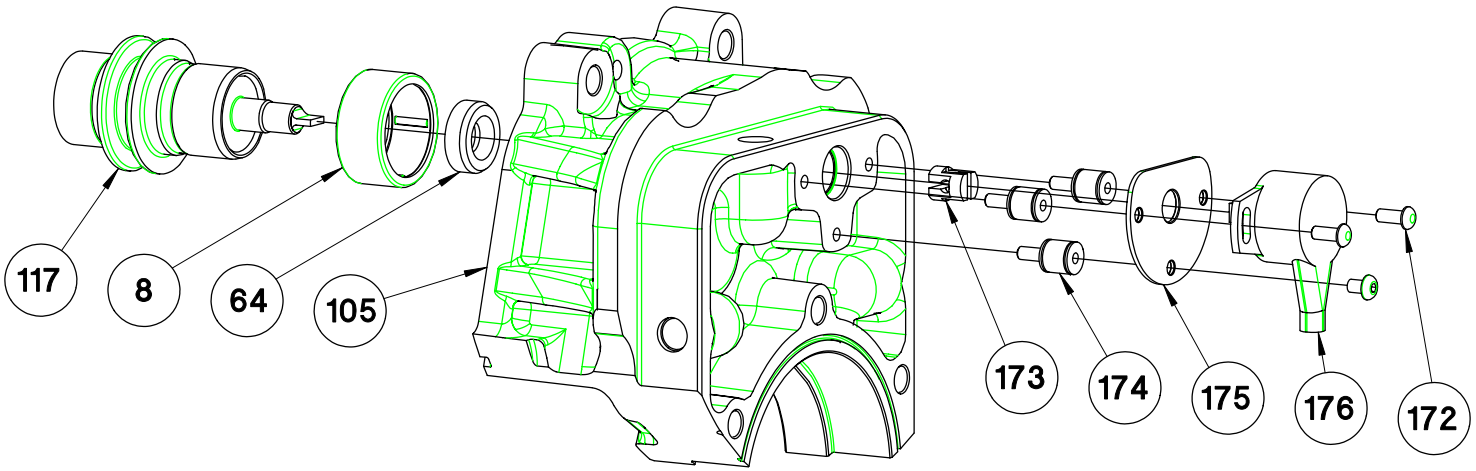
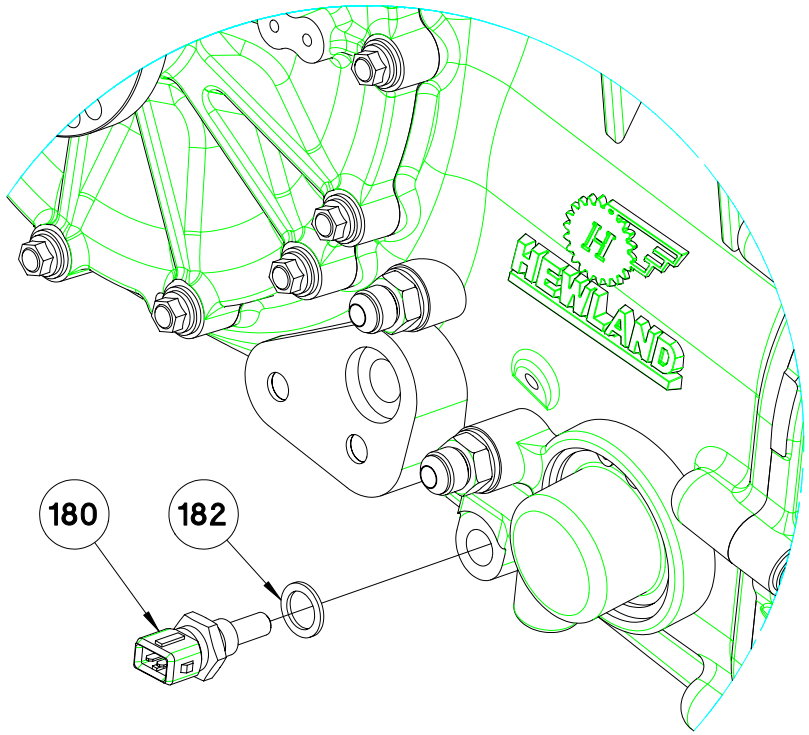
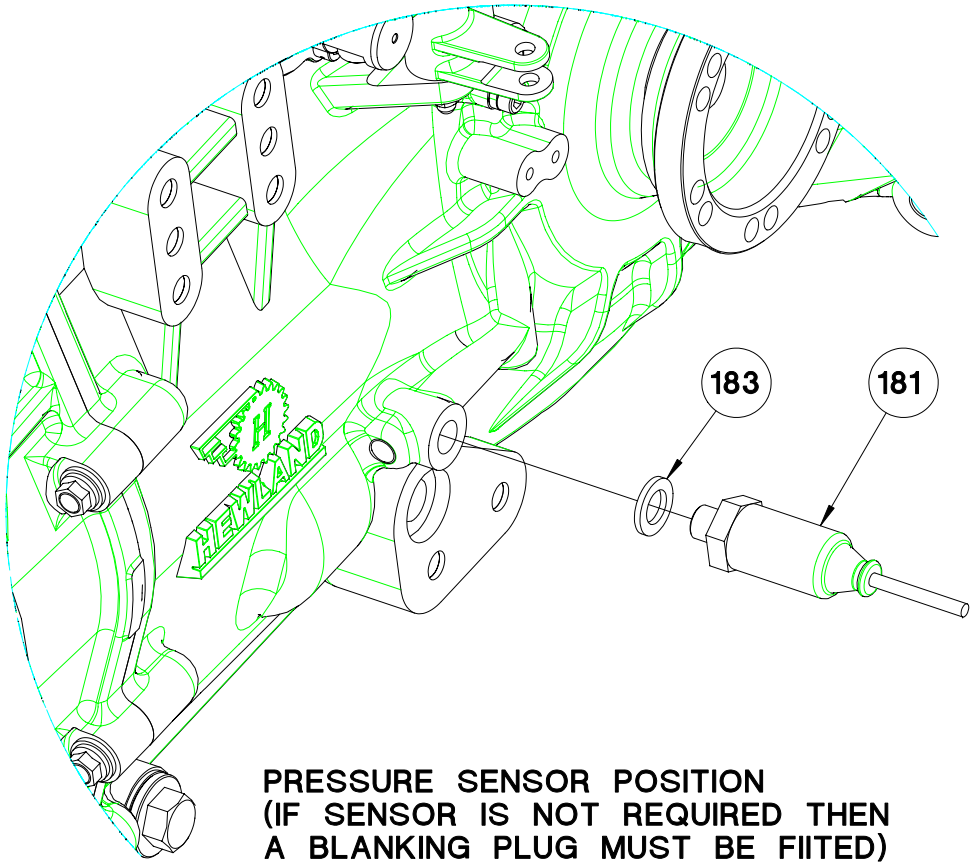



FIGURE 17

# 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 18

| Item No | Part Number | Description | Qty |
|---|---|---|---|
| 1 | 102-260-9 | COMPRESSION SPRING | 1 |
| 2 | 104-226-1 | HUB | 3 |
| 3 | 104-226-2 | NEEDLE ROLLER BEARING | 6 |
| 4 | TE-**:**/**:** | PINION SHAFT GEARS | 1 |
| ✳ 5 | 104-234-4 | LAYSHAFT SPACER | 1 |
| 6 | 104-RATIO-STD | 104 GEAR ASSEMBLY | 4 |
| 7 | 105-234-8 | DISC SPRING | 1 |
| 8 | 105-260-6 | NEEDLE ROLLER BEARING | 1 |
| 9 | 400-021-4490-41 | DOWTY WASHER | 2 |
| 10 | BEA-001 | ROLLER BEARING | 1 |
| 11 | BEA-093 | ROLLER BEARING | 1 |
| 12 | BEA-141 | BALL BEARING | 1 |
| 13 | BEA-360 | WEAR RING | 2 |
| 14 | BEA-382 | TAPER ROLLER OUTER | 1 |
| 15 | CIR-082 | CIRCLIP | 1 |
| 16 | CIR-084 | CIRCLIP | 1 |
| 17 | CIR-189 | CIRCLIP | 1 |
| 18 | TMT-239-# | CLUTCH SHAFT | 1 |
| 19 | CPK-260-2 | PISTON | 2 |
| 20 | CPK-260-3 | SELECTOR RACK | 1 |
| 21 | CPK-260-5 | SELECTOR RACK WASHER | 1 |
| 22 | CST-250-C | SELECTOR FORK ASSY | 3 |
| 23 | DG-219-1A | CIRCLIP | 2 |
| 24 | DG-222-1C | TAPER ROLLER BEARING | 1 |
| 25 | DG-232-A4D | CLUTCH RING | 3 |
| 26 | DGB-239-0 | EXTERNAL CIRCLIP | 1 |
| 27 | DGB-244-10 | INTERNAL CIRCLIP | 1 |
| 28 | DGB-244-12 | BALL BEARING | 1 |
| 29 | DGB-244-14 | O-RING | 1 |
| 30 | DOW-063 | DOWEL | 1 |
| 31 | DTR-231-1 | REVERSE CLUTCH RING | 1 |
| 32 | DTR-260-7 | BARREL SPACER | 1 |
| 33 | EGT-237-1 | REVERSE IDLER | 1 |
| 34 | EGT-237-2 | REVERSE IDLER SPIGOT | 1 |
| 35 | F3A-202-9A | DOWEL | 1 |
| 36 | F3D-236-1 | WASHER | 30 |
| 37 | FGC-205-1 | TAPER ROLLER BEARING | 2 |

| Item No | Part Number | Description | Qty |
|---|---|---|---|
| 38 | FGC-205-3 | BALL BEARING | 2 |
| 39 | FGC-205-4 | LIP SEAL | 2 |
| 40 | FGC-206-1# | SHIM | A/R |
| 41 | FGC-206-2A | SIDEPLATE SPACER | 1 |
| 42 | FT-202-8 | SOCKET SET SCREW | 4 |
| 43 | FT-219-1A | CIRCLIP | 1 |
| 44 | FT-244-11 | OIL SEAL | 1 |
| 45 | FTR-202-2 | BEARING RETAINING PLATE | 1 |
| 46 | FTR-210-35 | PLUNGER | 1 |
| 47 | FTR-210-36 | PLUG | 1 |
| 48 | FTR-237-1 | REVERSE IDLER SPIGOT | 1 ++ |
| 49 | FTR-237-2 | SLEEVE | 1 |
| 50 | FTR-260-4 | SELECTOR RACK WASHER | 1 |
| 51 | FTR-260-8 | SPRING TRUNION | 1 |
| 52 | HC-237-2 | NEEDLE ROLLER BEARING | 1 |
| 53 | HP-M-7039 | DRUM WASHER | 1 |
| 54 | HP-M-9004 | MAGNETIC DRAIN PLUG | 1 |
| 55 | HP-M-9037 | BANJO JOINT | 1 |
| 56 | HP-M-9038 | SEALING WASHER | 2 |
| 57 | HP-M-9039 | BANJO BOLT | 1 |
| 58 | HP-M-9042 | DOWTY WASHER | 1 |
| 59 | HP-M-9054 | SOCKET CAP SCREW | 1 |
| 60 | HP-N-9006 | SOCKET CAP SCREW | 2 |
| 61 | HYD-016 | ADAPTOR | 2 |
| 62 | LD-201-2 | STUD | 6 |
| 63 | LD-201-5 | DOWEL | 2 |
| 64 | LIP-041 | OIL SEAL | 1 |
| 65 | NCH-266 | OIL FILTER | 1 |
| 66 | NLT-223-2 | PINION HEAD BEARING SHIM | 1 |
| 67 | NLT-223-A | PINION HEAD BEARING HOUSING | 1 |
| 68 | NMT-205-2 | SIDEPLATE SPACER | 1 |
| 69 | NMT-221-#P | PINION SHAFT | 1 |
| 70 | NMT-221-#W | CROWNWHEEL | 1 |
| 71 | NMT-229 | PINION SHAFT SPACER | 1 |
| 72 | NMT-230-1 | LOCKING RING | 1 |
| 73 | NUT-004 | KAYNUT | 29 |
| 74 | ORI-001 | O-RING | 1 |



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

| Item No | Part Number | Description | Qty |
|---|---|---|---|
| 75 | ORI-002 | O-RING | 2 |
| 76 | ORI-232 | O-RING | 1 |
| 77 | ORI-072 | O-RING | 2 |
| 78 | ORI-118 | O-RING | 2 |
| 79 | ORI-170 | O-RING | 1 |
| 80 | ORI-213 | VL SEAL | 2 |
| 81 | ORI-214 | O-RING | 1 |
| 82 | PCT-260-2 | DRUM STOPPER | 1 |
| 83 | PCT-260-3 | COIL SPRING | 1 |
| 84 | PLU-030 | PLUG | 1 |
| 85 | SCR-175 | SOCKET CAP SCREW | 2 |
| 86 | SCR-042 | SOCKET CAP SCREW | 5 |
| 87 | SCR-117 | SOCKET CAP SCREW | 1 |
| 88 | SCR-121 | SOCKET SET SCREW | 2 |
| *89 | SCR-166 | SOCKET SET SCREW (Version 1 to 16 maincases) | 1 |
| *89 | PLU-129 | SEALING SCREW (Version 17 maincases & onwards) | 1 |
| 90 | SGT-244-13 | SOCKET CAP SCREW | 10 |
| 91 | SPH1077-M3 | PAWL | 1 |
| 92 | SPH1078-M3 | PLUNGER | 1 |
| 93 | SCR-349 | ANTI-ROTATION PIN | 1 |
| 94 | SPR-058 | COMPRESSION SPRING | 1 |
| 95 | SPR-127 | COMPRESSION SPRING | 1 |
| 96 | SPR-131 | SPRING | 2 |
| 97 | SPR-142 | COIL SPRING | 1 |
| 98 | STU-036 | STUD | 8 |
| ✳ 99 | STU-074 | STUD | 13 |
| 100 | TE-**:**-INT | LAYSHAFT VARIANTS | 1 |
| 101 | TE-234-2 | BEARING INNER TRACK | 1 |
| 102 | TMT-301 | MAINCASE | 1 |
| 103 | TMT-201-1 | RATIO SPRAY RAIL | 1 |
| 104 | TMT-201-2 | SPRAY RAIL ASSEMBLY | 1 |
| 105 | TMT-302 | BEARING CARRIER | 1 |
| 106 | TMT-205 | SIDEPLATE | 1 |
| 107 | OUTPUT FLANGE | OUTPUT FLANGE | 2 |
| 108 | TMT-221-1 | SPACER | 1 |
| 109 | TMT-228 | REVERSE INNER TRACK | 1 |
| 110 | TMT-230 | MAINSHAFT NUT | 1 |
| 111 | TMT-231 | REVERSE PINION GEAR | 1 |

| Item No | Part Number | Description | Qty |
|---|---|---|---|
| 112 | TMT-234-1 | OIL PUMP DRIVE | 1 |
| 113 | TMT-239- | CLUTCH SHAFT | 1 |
| 114 | TMT-246 | SELECTOR RAIL | 1 |
| 115 | TMT-249-A | REVERSE SELECTOR FORK | 1 |
| 116 | TMT-258-1 | SLAVE ADAPTOR CP3859 | 1 |
| | TMT-258-2 | SLAVE ADAPTOR CP3759-3959 | 1 |
| 117 | TMT-260-M | MANUAL SELECTOR BARREL | 1 |
| | TMT-260-S | SEMI-AUTO SELECTOR BARREL | 1 |
| 118 | TMT-260-1 | BARREL BOLT | 1 |
| 119 | TMT-260-4 | PISTON HOUSING | 2 |
| 120 | TMT-265-1 | OIL PUMP ROTORS | 1 |
| 121 | TMT-266 | OIL FILTER | 1 |
| 122 | TMT-266-1 | OIL FILTER COVER | 1 |
| 123 | TMT-308 | REAR COVER | 1 |
| 124 | TPT-212 | TPT DIFF ASSEMBLY | 1 |
| 125 | VG-201-9 | O-RING | 1 |
| 126 | VG-221-1 | CROWNWHEEL BOLT 7/16 UNF | 8 |
| 127 | VG-222-1A | TAPER ROLLER BEARING EX LR | 1 |
| 128 | WSH-028 | WASHER | 1 |
| 129 | MLI-223-1 | CLAMP PLATE | 1 |
| 130 | WSH-078 | DOWTY WASHER | 1 |
| 150 | TMT-260-5 | RACK END COVER | 1 |
| 151 | TMT-260-6 | RACK SPACER | 1 |
| 152 | TMT-260-7 | RACK SEAL HOUSING | 1 |
| 153 | FTR-260-3 | RACK | 1 |
| 154 | ORI-227 | QUAD RING | 1 |
| 155 | SPR-057 | SPRING | 1 |
| 156 | FTR-260-5 | TRAVEL STOP SPACER | 1 |
| 157 | HP-M-9008 | SOCKET CAP SCREW | 1 |
| 158 | LD-202-9 | WASHER | 4 |
| 159 | WSH-067 | SHIM WASHER | 1 |
| 160 | BEA-162 | BEARING | 2 |
| 161 | FTR-260-2 | SPACER TUBE | 1 |
| 162 | FTR-260-7 | BELL CRANK | 1 |
| 163 | NUT-005 | KAYNUT | 1 |
| 164 | TE-201-4 | BLANKING PLATE | 1 |
| 165 | HP-M-9062 | BLANKING PLATE SCREWS | 2 |

| Item No | Part Number | Description | Qty |
|---|---|---|---|
| ✳ 166 | 104-234-4 | SPACER | 1 |
| 170 | ELC-024 | MANUAL POTENTIOMETER | 1 |
| 171 | TMT-260-2 | POT SPIGOT | 1 |
| 172 | HP-M-9062 | SCREWS | 3 |
| 173 | ZH147-01 | OLDHAM COUPLING | 1 |
| 174 | AVM-002 | ANTI-VIBRATION MOUNTS | 3 |
| 175 | TMT-202-1 | MOUNTING PLATE | 1 |
| 176 | TBA | SEMI-AUTO POTENTIOMETER | 1 |
| 180 | ELC-036 | TEMPERATURE SENSOR | 1 |
| 181 | ELC-035 | PRESSURE SENSOR | 1 |
| 182 | WSH-007 | DOWTY WASHER | 1 |
| 183 | 400-222-4490-41 | DOWTY WASHER | 1 |
| 184 | BEA-263 | SPLIT BEARING | 1 |
| 201 | 400-021-4490-41 | DOWTY WASHER | 1 |
| 202 | BEA-374 | BALL BEARING | 1 |
| 203 | BEA-375 | BALL BEARING | 3 |
| 204 | CIR-021 | CIRCLIP | 1 |
| 205 | HYD-016 | ADAPTOR | 1 |
| 206 | HYD-059 | ADAPTOR | 1 |
| 207 | LIP-041 | OIL SEAL | 1 |
| 208 | ORI-042 | O-RING | 4 |
| 209 | ORI-097 | O-RING | 4 |
| 210 | ORI-213 | VL SEAL | 2 |
| 211 | PNU-005 | FLAPPER VALVE | 2 |
| 212 | PNU-006 | FLAPPER VALVE | 2 |
| 213 | PNU-007 | BACKING PLATE | 2 |
| 214 | PNU-010 | CYLINDER HEAD | 1 |
| 215 | PNU-011 | VALVE CARRIER | 2 |
| 216 | PNU-012 | CRANK SHAFT | 1 |
| 217 | PNU-013 | PISTON | 1 |
| 218 | PNU-019 | CYLINDER HEAD LH | 1 |
| 219 | SCR-155 | SOCKET CAP SCREW | 4 |
| 220 | SCR-317 | SOCKET BUTTON HD SCREW | 4 |
| 221 | SCR-320 | ANTI ROTATION PIN | 2 |
| 222 | TMT-308-A | REAR COVER DRESSED | 1 |
| 223 | WSH-090 | DOWTY WASHER | 1 |

| Item No | Part Number | Description | Qty |
|---|---|---|---|
| 224 | PLU-048 | BLANKING PLUG | 1 |

✳ THESE PARTS, PLUS AN ADDITIONAL (6) , ARE REQUIRED IF THE ALTERNATIVE 1ST GEAR ONLY INTEGRAL LAYSHAFT IS REQUIRED.

# OUTPUT FLANGE OPTIONS

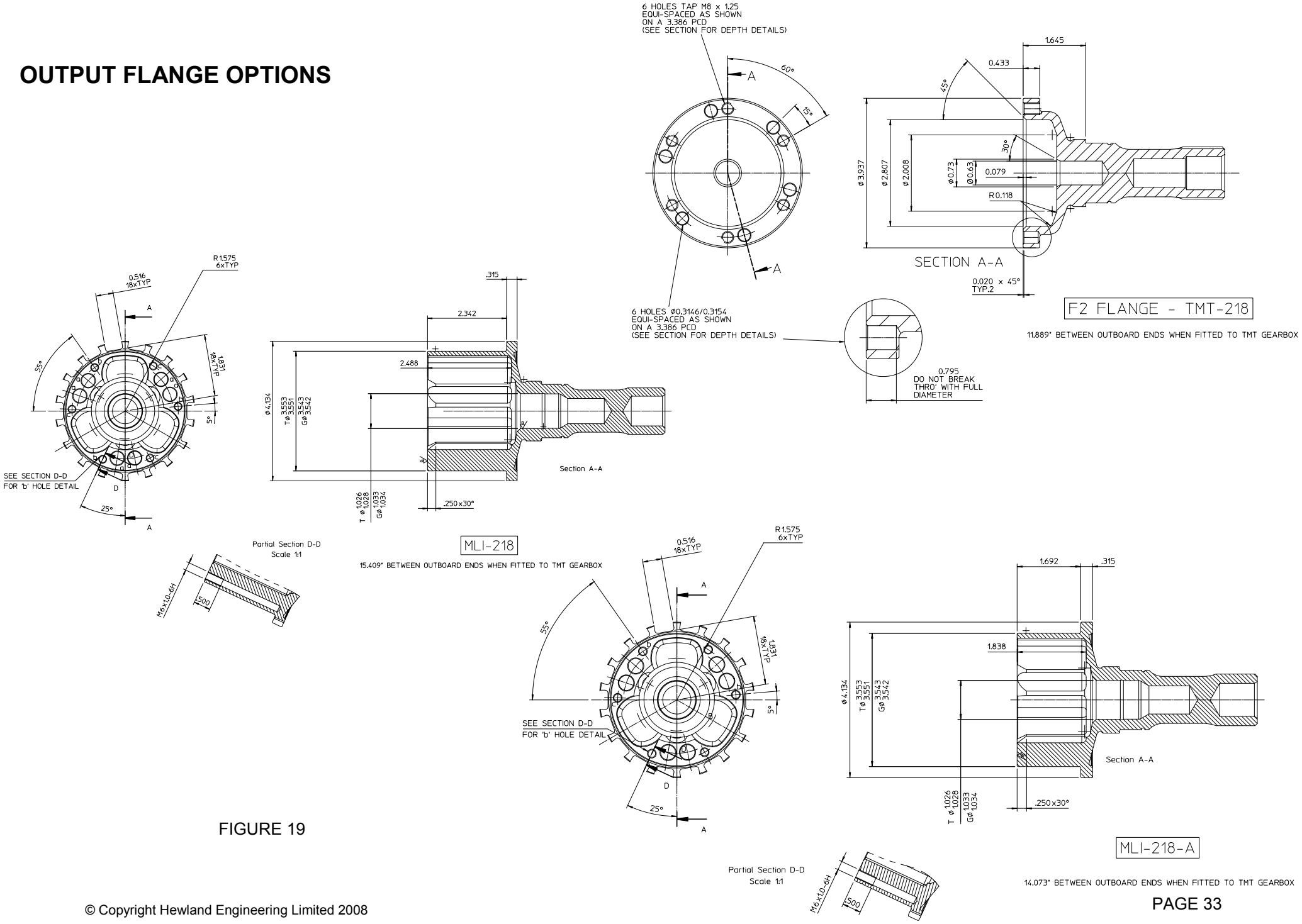
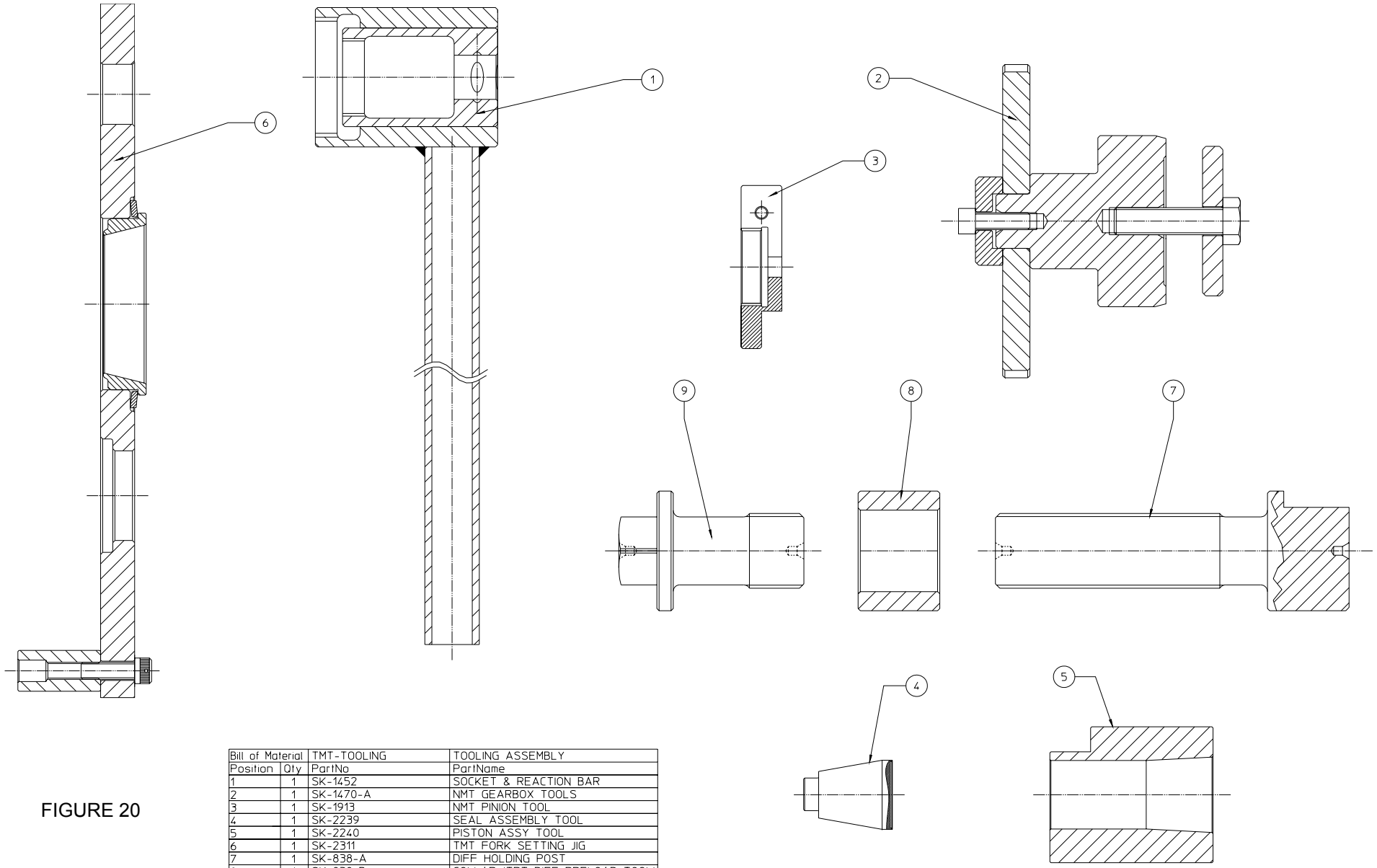



FIGURE 19

# GEARBOX 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 20

# TMT TYPICAL OIL SYSTEM LAYOUT

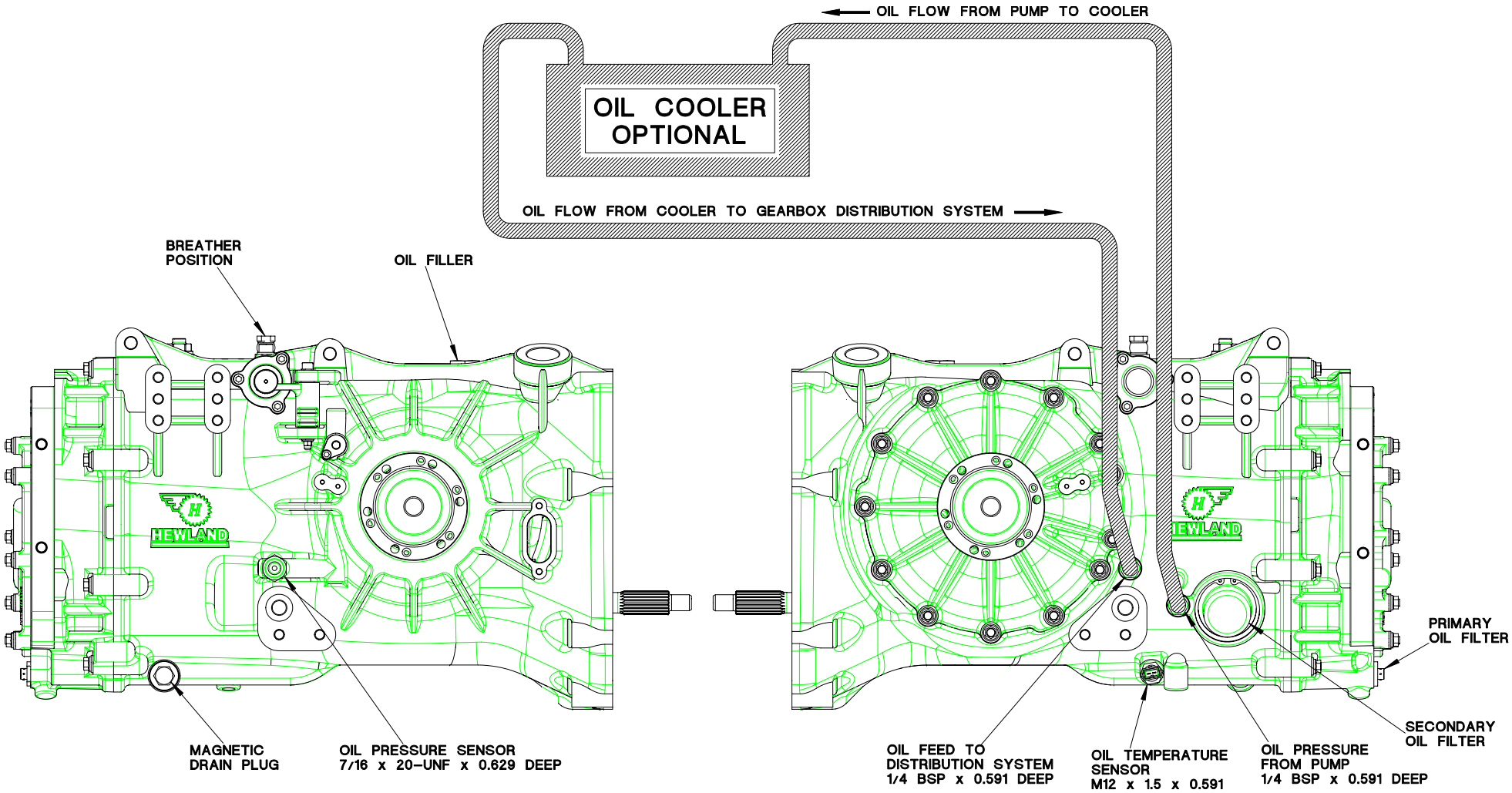
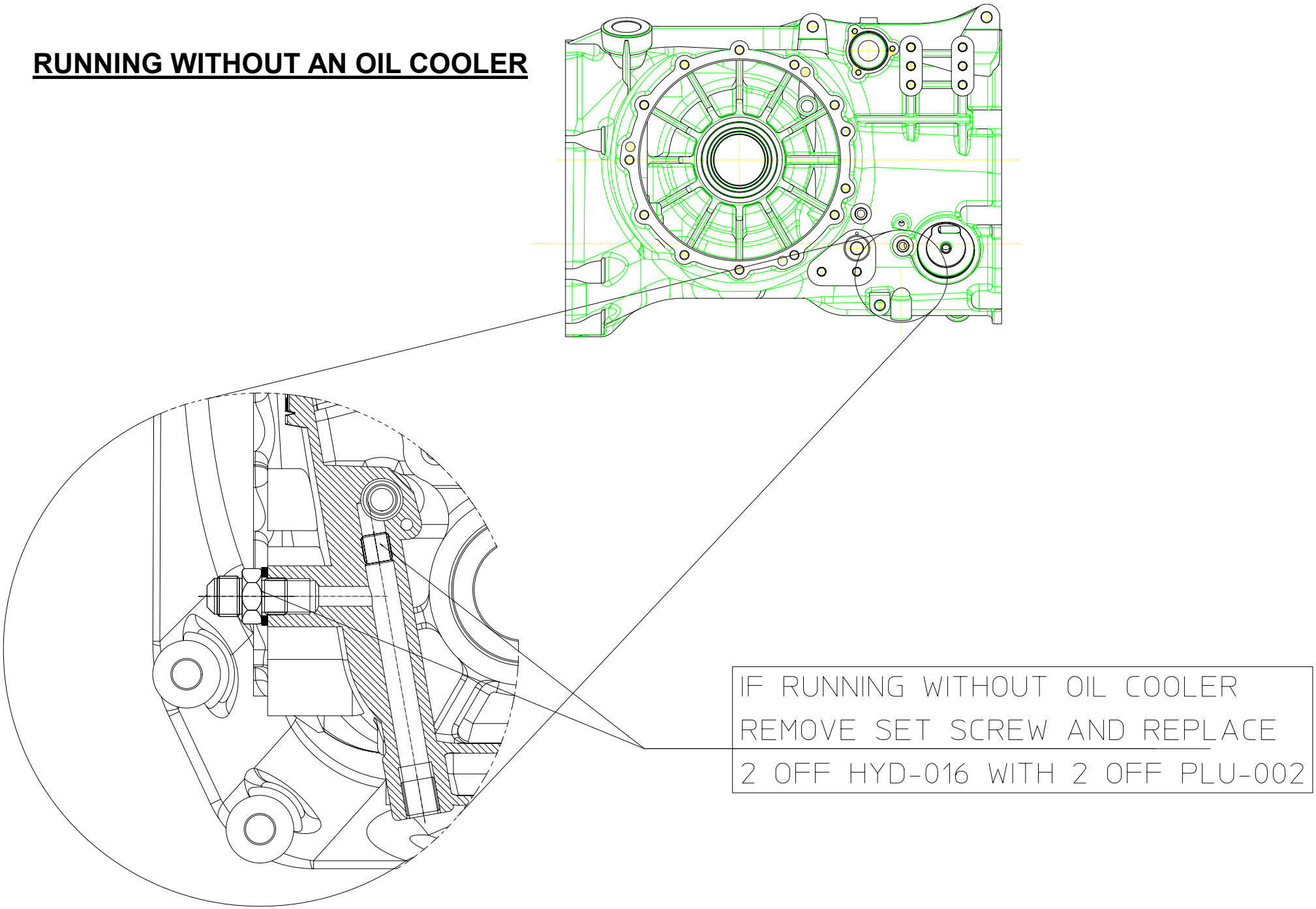



FIGURE 21

# RUNNING WITHOUT AN OIL COOLER



## Amendments

| Date | Modification |
|---|---|
| 16/01/2009 | 1st Issue |
| 15/10/2009 | Item numbers 129 and 086 updated, amendments page added |
| 20/01/2010 | output flanges page added |
| 23/06/2010 | Seal tools added |
| 13/10/2010 | Part 224 added to page 26 & 32 |
| 25/10/2010 | Page 7 item 71 changed to pinion shaft spacer for clarity, TMT-201 and TMT-202 changed to TMT-301 and TMT-302 respectively |
| 01/11/2010 | Running without oil cooler page added |
| 14/09/2011 | Page 34 - Tooling updated - SK-2212 and SK-2213 replaced by SK-2239 and SK-2240 |
| 02/12/2011 | Page 4 - Torque rating corrected for 8:35 f/drive ratio |
| 05/12/2011 | Page 31 - Item 89 updated for new version of maincase |