ON LOAD GEARS

INSTALLATION, OPERATION

&

MAINTENANCE INSTRUCTIONS

TAPCHANGER TYPE PG

C O N T E N T S

1. INSTALLATION INSTRUCTIONS :

2. OPERATING INSTRUCTIONS :

3. MAINTENANCE INSTRUCTIONS :

Para H	**Maintenance Schedule**
Para I	**Removal of Insert**
Para J	**Contact Replacement of Divertor Switch**
Para K	**Replacement of Transition Resistances**
Para L	**Electrical Drive**
Para M	**Mechanism Box**
Para N	**Removal of Drive Motor.**

DRAWINGS

1. Fig. 1	**:**	**OIL SURGE OPERATED RELAY**
2. Fig 2	**:**	**CONSTRUCTION OF PG**
3. Fig 3	**:**	**INSTALLATION OF DRIVE SHAFT**
4. Fig 4	**:**	**SELECTOR TO DIVERTOR CONNECTION**
5. Fig 5	**:**	**HEAD ARRANGEMENT**
6. Fig 6	**:**	**HEAD TRANSPORT COVER FIXING**
7. Fig 7	**:**	**METHOD FOR RESISTANCE REMOVING**
8. Fig 8	**:**	**BEVEL GEAR BOX**
9. Fig 9	**:**	**MECHANISM BOX**
10. Fig. 10	**:**	**PRESSURE RELIEF DEVICE**
11. Fig 11	**:**	**LIFTING OF INSERT**
12. Fig 12	**:**	**PIPE BEND FOR OSR**
13. Fig 13	**:**	**TRANSPORT LOCKS ON 3 x PG I**
14. Fig 14	**:**	**SHEAR PINS**
15. ANNEXURE–I	**:**	**TROUBLE SHOOTING GUIDE**

NOTE : ALL THE ABOVE DRAWINGS, AND ANNEXURE – I ARE FILED AT THE END OF THIS MANUAL SERIATUM

TAPCHANGER PG

In this manual two aspects of Tapchanger PG are described. While the entire content of the manual provides useful information to both the Transformer manufacturer, and the final user, we may point out that certain paras are more relevant to the Transformer manufacturer. These are Paras A2, A3, A4, B1, B2, C1, C2, C3, C5, C6 & D. However, we do recommend that the final user reads through the entire Manual, inclusive of Paras meant specifically for the Transformer Manufacturer.

Please take note of "CAUTION" Note under Para A4 for any Installation, and Maintenance work.

1. INSTALLATION INSTRUCTIONS :

A1 : GENERAL DESCRIPTION OF STRUCTURAL PARTS OF TAPCHANGER TYPE PG :

Fig.2 shows the general structure of Tapchanger Type PG.

The following description applies to Single Phase, Two Phase, and Three Phase units. In certain applications, the Transformer may require Tapchanger arranged in two columns, or even three columns.

Tapchanger Type PG is intended for mounting into the main transformer tank. The Tap Selector, and the Pre Selector, which do not make or break any current, are intended to be immersed in the same oil as the main transformer tank. The Divertor Switch is housed in a Divertor Oil Vessel, and has its own oil system, which does not mix with the transformer oil.

The Tapchanger head forms the top part, and has to be mounted on the transformer roof plate, with an intervening gasket. This gasket is not in the scope of OLG supply.

The Head, Head Cover, and Divertor Oil Vessel complete with the bottom flange of the oil vessel form an oil container of the Divertor Switch. The Tap Selector hangs below.

A2 : MODE OF DESPATCH

Most of the Tapchangers belonging to series PG are of such a construction, that the Tapchanger can be installed through one circular cut out on the Transformer roof plate. In such cases, the Tapchanger is despatched from our works to the works of the Transformer manufacturer, in the following mode.

i. One case containing the complete Tapchanger without oil.
ii. Bevel Gear Box according to Fig.8.
iii. Pressure Relief Device, according to Fig.10.
iv. Mechanism Box according to Fig.9.
v. Oil Surge Operated Protective Relay according to Fig. 1.
vi. Coupling shafts with accessories

However, there are some Tapchangers belonging to the series PG, for instance, those with pre-selectors of such dimensions that the selector cannot be inserted through the cut out on the Transformer for carrying the Head Plate. In such cases, the Tapchanger is despatched from our works in the following mode.

i. One case containing the Head, Head Cover, Divertor Oil Vessel and bottom flange assembly, complete with the Divertor Switch insert placed within but without oil.

ii. Complete Tap Selector assembly, with the gear box at the top.

iii. Connectors between the Tap Selector, and Divertor Switch consisting of insulated copper leads with terminal lugs.

iv. Bevel Gear Box according to Fig.8.

v. Mechanism Box according to Fig.9.

vi. Oil Surge Operated Protective Relay according to Fig.1.

vii. Coupling shafts.

viii. Pressure Relief Device according to Fig.10.

A3. INSTALLATION IN TRANSFORMER :

For Tapchangers despatched assembled complete from our works (please see paragraph A2 above), the entire Tapchanger can be lifted from the transport case, using lifting lugs provided on the head cover (Please see Fig. 5) and installed in the transformer through a single cut out with an intervening gasket of suitable thickness (not included in OLG supply).

For such Tapchangers, further assembly instructions of this paragraph do not apply.

For the larger Tapchangers Type PG, which have to be despatched with the selector and divertor separately, assembly work must be carried out by the transformer manufacturer.

When despatching from our works, the Worm Gear shaft at the Head, the shaft end emerging from the bottom of the Divertor Oil Vessel (for the purpose of coupling to the Selector), and the Selector input Drive Shaft, are all locked by sheet Metal Lock plates. This is done, so that the Divertor, and Selector are in the same Tap Number, and are in proper sync.

Please ensure that you do not remove the temporary sheet metal locks, until you are completely ready to assemble the entire Tapchanger into your Transformer. For this purpose, they must be taken out of the cases, cleaned properly, and placed side by side. Only then, are the transport locks to be removed. Please ensure that once the transport locks are removed, neither the divertor, nor the selector is driven, because otherwise, synchronism is lost between the two.

The Divertor Oil Vessel Assembly complete with insert can be installed, through a cut out in the transformer roof plate with an intervening gasket of suitable thickness.

Fig.4 shows the way in which the Tap Selector is to be mounted at the bottom flange of the Divertor Oil Vessel.

The Selector is to be so positioned, that the extension drive shaft through the bottom of the oil vessel enters into the corresponding coupling of the selector drive.

Once the selector is in position, electrical connections between the Selector, and Divertor can be completed. Each of the leads is marked according to where it should be connected. Please ensure that the conducting surfaces are cleaned of dust, and other particles before installation.

A4. FEATURES ON THE HEAD & COVER :

The only parts of the Tapchanger itself that are visible outside the Transformer Tank are the Head & Head Cover, on to the latter of which is mounted a Worm Gear Box (See Fig.5).

The Worm Gear Box is fixed to the Head Cover by six bolts. By removing the bolts, the Worm Gear Box can be oriented in six directions as required. Please note that in some orientations, the drive shafts foul with projections on the head, and thus these orientations are not useful. The worm Gear Box must be tightened fully after re – orientation.

The pipe flanges are fully orientable through 360°, by loosening their holding clamps. If this facility is used, the clamps must be fully tightened afterwards to prevent leakage.

In this context, a general note of caution.

CAUTION :

In general all fasteners are locked with chemical thread sealant. Wherever possible there is additional mechanical locking with a locking plate. These locking plates can be re-used.

Because of the thread sealant, you will find all fasteners are very tight when you try to remove them. This is in order. The fasteners can be forced against thread sealant safely.

We do recommend the use of thread sealant like LOCTITE Make Grade No.242, or ANABOND 122 when re-installing the fastener in position. For this purpose, the remainder of the thread sealant applied earlier may be removed, using a Tap or Die, as the case may be. All the detritus must be blown out with compressed air, so that it does not get into the Divertor Oil Vessel again.

The Head cover gasket may shrink a little on long storage. Before filling with oil, please re-tighten all M 10 Bolts, BUT WITH FEEL, so as not to over-tighten and strip off threads. Torque wrench value : 4.9 kgf.m

Please note that there is a Glass Window, with a spring loaded Weather Cap on top, for showing Tap No.

B : TRANSFORMER MANUFACTURE :

B1 : PROCESSING THE TRANSFORMER :

The tapchanger may be processed along with the active core and coil assembly as in normal Transformer practice. The Mechanism Box Bevel Gear, and Oil Surge Protective Relay should not be processed in any case.

When the Transformer manufacturer specifies it, all internal Gaskets are made of Viton, to suit Kerosene Vapour Phase Drying. Otherwise, Gaskets are Nytrile, which can safely withstand Transformer drying process upto 100°C.

Always equalise one of the two Pipe Flanges on the Head to the Transformer Tank, so that the Divertor Oil compartment, and contents are thoroughly processed.

After processing, fill with processed Transformer oil at a temperature of not more than 90°C. It is desirable that oil BDV (at room temperature) should not be less than 50 kV in IS Cell.

It is necessary to air release, both from the Head Cover, and very importantly the Suction Pipe Flange to ensure that all divertor spaces are truly oil filled. Finally release air from the transformer space under the Head, using the Head mounted Air Release provision.

B2.COMPLETION OF INSTALLATION OF THE TAPCHANGER:

After the Transformer is processed, and the Tapchanger filled with oil, release air from the two Air release screws on the Head, and Head Cover. Top up oil if necessary.

Observe that the Air Release screws are captive. There is a gasket under the Brass Air Release screw, and another under its Weather Cap. Tighten both gaskets to ensure that no oil leaks.

Pipe connections can now be made to the Oil Surge Operated Relay Flange, through a gasket. (not part of OLG supply).

Install the Bevel Gear, and the Drive Mechanism Box (see para C also below).

C : INSTALLATION OF DRIVE SHAFTS :

C1. ALIGNMENT OF SHAFTS :

The Drive shafts are so designed, that they can be installed in position, after fixing the Tapchanger, the Bevel Gear, and the Drive Mechanism in their assigned position. (see Para C2 below).

Even though the drive shaft system tolerates a small degree of mis-alignment, it is best to set the Head, Bevel Gear, and Mechanism in good alignment, to minimise noise, and enhance leak free life.

For this purpose, it is best to adopt the following technique.

a) Align the shaft of the Worm Gear Box on Head with the Bevel Gear shaft, by adjusting the Bevel Gear Housing in its slots.

b) In Tapchangers with more than one column, it is essential to align all three Worm Gear Shafts.

c) Now align the Mechanism shaft exactly below the Bevel Gear Shaft, by adjusting the position of the Mechanism Cabinet.

If the Transformer manufacturer intends to remove the Mechanism and the Bevel Gear for Transport, it is recommended that after alignment, they are dowelled in position by at least two 8 dia. pins, so that they can be reset again correctly at site.

C2. INSTALLING THE DRIVE SHAFTS :

Fig.3 shows the manner in which the Drive shaft has to be installed.

All the heavy components, viz. The Tapchanger Head, the Bevel Gear, and the Mechanism Box may be installed on the Transformer in the final service condition, without reference to the Drive Shafts. The design of the Drive Shaft permits that the shafts can be installed easily between the fixed heavy mechanical parts.

The Drive arrangement consists of a square stainless steel tube with vernier couplings at each end. One half of the vernier couplings is attached to the end of the round shaft of the major component, namely the Head, the Bevel Gear, or the mechanism. The other half of the vernier coupling takes on the square drive tube. The drive tube is clamped on to the vernier coupling by means of removable triangular shaped clamping pieces which are bolted on to the vernier coupling by means of stainless steel fasteners. All these items are sent fixed in their respective positions at the time of despatch of the tapchanger from our factory. But we do not fully tighten the fasteners, so that you can take them off easily, install the square drive tube in position and then tighten.

After installing the tapchanger parts, the Transformer Manufacturer must measure the exact distance between the vernier couplings and cut the stainless steel tube to suit. (We normally send the Stainless Steel tubes about 100mm more than required). The tube can then be installed in position and clamped.

In case of re-installation at site of Drive Shafts which may have been taken off for transport, there is no need for further length adjustment of shafts. This would have been done already at the manuacturer's works.

C3. NOTE FOR THE TRANSFORMER MANUFACTURER :

For despatch of the Transformer to site, you may remove the drive mechanism and the vertical drive shaft for transport. You may also remove the Bevel Gear and the horizontal drive shaft depending on your convenience.

We request you to kindly ensure that all the vernier couplings, drive shafts and loose fasteners are properly accounted for and forwarded to site. We strongly recommend attachment of the couplings and their fasteners at respective shafts ends, as we do for despatching the Tapchanger to you. This will ensure that no mechanical detail is lost.

In order to compensate for likely loss of small items on the shopfloor, we send sufficient extra quantity of stainless steel fasteners and split pins with our despatch.

C4 INSTALLATION OF HORIZONTAL SHAFTS FOR MULTI COLUMN UNITS :

It is important that the horizontal drive shafts between the individual phase units are installed in such a manner that all the divertors definitely change over and, thereby complete a tapchange, before the common mechanism cuts off at the end of each tapchange. A small divergence between individual switchings of the divertors is however unavoidable and does not harm the equipment in any way.

To ease this job, OLG despatches all Tapchangers in a synchronised condition with the mechanism. However, it is very likely that during Transformer erection, both at the works and at site, the relative positions may be inadvertently disturbed.

It is therefore safer to always follow the procedure described below.

Turn each tapchanger by inserting a rod in the hole of the Worm Gear Box, or the Aluminium Vernier coupling. Bring each tapchanger to tap No.7, **from lower Tap Nos**. (Tap Nos. are visible through the Glass Window on the Tapchanger Head). Stop turning immediately as you hear the divertor discharge at Position 7 in each case.

Having brought all the three divertors to this position, you can install the horizontal drive shafts now, without disturbing the relative positions of the Worm Gear Shafts. Use the Vernier coupling to allow installation of square tube drives.

You must counter – check before completing this work that all the three divertors change over each time before the mechanism gets cut off by its own termination point. If you find any of the divertors is left behind, you must isolate the corresponding Worm Gear Box on both sides and charge the divertor in the required direction and re-couple. Provision of a Vernier arrangement in the coupling greatly eases their work.

If the mechanism cuts off before the Divertors, you can uncouple the vertical coupling, and adjust, using the vernier arrangement provided here also.

C5 : SETTING TAP NUMBERS IN SYNCHRONISM :

The basic principle in coupling the Tapchanger to the Mechanism is to ensure that the Divertor Switch of the Tapchanger changes first, and only thereafter, the Mechanism should complete its operation. This should happen on both Raise and Lower direction.

It is necessary, while coupling the Mechanism to the Tapchanger Head, to ensure that the Position Indicator on the mechanism shows the correct Tap Number. This necessity arises

i. At the Transformer Manufacturer's works, when first installing the Tapchanger on the Transformer.

ii. At site, if the Mechanism is detached for Transport.

iii. During service if any part of the Drive system is disturbed, accidentally, or for maintenance (e.g. re-painting).

The following procedure may be adopted.

1. Set Tapchanger at Position 7. Observe the Tap No. of the Tapochanger, through Glass Window at Head.

2. Before coupling the Mechanism to shafts, set the Mechanism to the same Tap No.7. Make sure the Green Label on the Tap change in progress wheel is central in the Window Mask (Fig.9)

3. Couple Drive Shaft, and rotate handle clockwise manually, till the Divertor change over. It requires approximately 23 – 24 Turns / Tapchange.

4. Observe how many turns of Crank Handle are required after changing over of Divertor to obtain the Green Label in the progress window.

   Say X (this may be fractional)
   Turns of Handle.

5. Now rotate Handle Counter-clockwise till Divertor changes over again. Observe how many turns of Crank handle are required after Divertor changes over again to obtain the Green Label in the progress window.

   Say Y

6. If X = Y, the Mechanism is synchronous already, and no further adjustment is required.

7. If not decouple mechanism, by pulling out M8 coupling pin at top of mechanism shaft.

   Calculate X – Y/2

a) If positive , turn Manual Handle X - Y/2 in clockwise direction, without allowing the rest of the Drive Tube to rotate.

b) If negative, turn Manual Handle Y - X/2 in counter-clockwise direction, without allowing the rest of the Drive Tube to rotate.

9. Re-insert M8 Pin, with minimum motion to align pre-drilled holes. Place Flat Wahser, and tighten Castle Nut with thread sealant. Insert split pin.

10. Take mechanism through all Tap Nos. by manually turning the handle, carefully noting that at each position, when the Green Label is central on the Window Mask, the Tap Nos. at the Head, and the Mechanism are same.

11. **CAUTION** : Approach both ends of the Tapping Range with caution. Check that both Electrical and Mechanical Limit Locks are operational.

12. It is advisable to repeat step 10 & 11 each time, for whatever reason, the Head and Mechanism become decoupled and have to be re-coupled. Electrical operation should be restored only after checking step 11 above.

C6 : SETTING UP ELECTRICAL OPERATIONS AT MANUFACTURER'S WORKS :

For instructions on setting up the Electrics, please see Para G1.

D : SUGGESTIONS ON TRANSPORT OF COMPLETE TRANSFORMER :

Since the components mounted on the Head Cover are at the highest part of the Transformer Tank, it is very likely that they may be struck by low tree branches during road transport from the Transformer manuacturer works to site.

We recommend that the Pressure Relief Device is always removed and despatched separately. The Pipe Bends for Buchholz, and suction pipe may also be optionally removed. If you decide to remove these items, do paste the corresponding gaskets with cellophane tape. So that they will not be missed.

However the worm Gear should not be removed. If desired to prevent low tree branches damaging the protruding Worm Gear at the top, during road transport of the Transformer, the Transformer manufacture may decide to add a temporary transport cover.

OLG can supply, at your option, a sheet metal transport protection cover for the head (See Fig.6).

In order to ease the job of re-installing all items removed for transport, and to make these instructions easy to follow, we recommend that both the Tapchanger, and the Mechanism are set at Position 7 for despatch.

2. OPERATING INSTRUCTIONS :

E. ON RECEIPT OF TRANSFORMER AT SITE

For greater safety against damage we recommend to the Transformer Manufacturer to use a Transport Security Cover on Top (See Fig.6). bolted to the Lifting Hooks of the Head cover. This may be removed first, and stored away separately, for future use.

Examine to see that the items on Head and Cover, particularly the Worm Gear Box, and Drive Shafts, have not been damaged in transit, and then complete installation of items (I) to (v) listed below.

It is possible that the Transformer manufacturer may remove, for the purpose of transport, some items from Head, and Head Cover (see Fig.5). Items removed will depend on the distance, and type of transport, as well as the Transformer Manufacturer's decision on safety of equipment. These are

i. Pressure Relief Device, Fig10.

ii. Pipe Bends for Oil Surge Operated Relay and Oil Suction Pipe (Fig.12)

iii. Oil Surge Operated Relay (Fig.1).

iv. Bevel Gear (See Fig.8).

v. Drive Mechanism (See Fig.9).

These will then be packed and despatched to you separately. They may be installed in position, after removing temporary blanking plates. In this context, see “CAUTION” Note under Para A4.

Items (i), (ii) and (iii) need Gaskets / “O” Rings underneath.

In case the Drive Shafts have also been taken off, they may be re-installed following carefully the procedure outlined in Para C2, C5. Please see also Para F below.

In case oil has been drained from the Divertor compartment, this will have to be filled, and Air released. Please use oil with a BDV of not less than 50 kV in IS Cell.

F : SETTING IN OPERATION AT SITE

If the Transformer manufacturer has observed our recommendation, you will receive the Tapchanger, and the Mechanism set at Position 7.

Before connecting the Electrical Drive, it is better to use the Mechanical Handle, and take the Tapchanger to both end positions once. At each position, ensure that the Tap Number shown in the Window on the Tapchanger Head is the same as that on the Mechanism.

Tap Numbers on the Mechanism appear in a Window provided for the purpose of observing Tap Numbers (see Fig. 9). Tap Numbers are inscribed on the edge of the Tap change in Progress Wheel, inside the Mechanism Cabinet.

You will also observe that the vertical edge of the Tap change in Progress Wheel has a painted Green Label. When operating the Tapchanger, always keep turning the handle till the Green label is Central in the progress window. It is at this position that you must read Tap Number.

At the end positions check that the Electrical Limit Switches have operated. Make a note of which switch operates at the “Raise Limit”, and which at the “Lower Limit”. Turn the handle further on, after the limit switches have operated. After about 3 to 5 turns of the handle, the Mechanical Limit system operates, and cuts off drive to the Tapchanger. This system re-sets automatically, when you reverse the handle.

G1 : ELECTRICAL OPERATION :

Set the Tapchanger in Position 7.

The operation of the Drive Mechanism has been fully tested at works before despatch. You should therefore have no problem of commissioning the equipment at site. We however recommend that you push in all the Fuse Carriers, Links, and the Terminal Blocks firmly home before commissioning, as they may have worked loose in transit.

Connect 3 Phase, 4 wire, 400 … 415V supply to the corresponding terminals on the Terminal Block, taking care to see that the Phase sequence is correct.

In certain cases, on customer specification, a separate Single Phase 220V supply is needed for working the Auxiliaries such as the Heater and Lights and Plugs. In such a case, connect the auxiliary supply also.

In case of an execution with Remote Tapchanger Control Cubicle, where the latter may not have been installed, certain temporary connections are to be made at the control wire Terminal Blocks. You will find a Label affixed on the inside of the Mechanism door giving you these details. After these links are complete, the Tapchanger is ready for Electrical Operation.

Switch on the Tapchanger supply Isolating Switch, and Heater Switch. Reset the Motor Protective Relay.

If the Local / Remote Control Selector Switch is provided in the Drive Mechanism Box (this is not always the case; it is sometimes provided in the RTCC) set it to “Local”.

By pressing the Operating Button marked “Raise” the Tapchanger will automatically run and complete one Tapchange and stop. Make sure “Raise” button causes Tap Number to increase, and “Lower” button causes the Tap Number to decrease. Otherwise, reverse the Phase sequence of the supply immediately.

Return to Tap No.7. Press the “Raise” button again but this time, while the Tapchanger is still running operate Limit Switch for Raise manually, which you would have already noted, according to the Instructions of Para F. Please take care of your fingers at that time. The Motor should now stop. Release the Limit Switch, and press “Raise” to complete the Tapchanger. Repeat corresponding procedure for “Lower” direction. This proves the Limits are working properly before you actually go to the limits.

G2 : A NOTE ON MECHANICAL END POSITION LIMITER :

This mechanism is equipped with a very advanced concept differential slip device for end position cut off. At the end positions, the motor may be safely run, without any damage being caused. When reversed, the differential slip mechanism automatically resets.

In some cases, during motor operation, the slip mechanism may make one or two “thud” noises before completely disengaging. This is acceptable, and does not represent any failure.

G3: SHEAR PINS

Mechanical Shear Pins as mentioned in Para G2, are not required for Mechanical Limit. Therefore, in the normal course, there are no Shear Pins requiring attention.

However, in the unlikely event of jamming of the drive to the Divertor or the Selector, it is necessary to limit the input torque so as not to cause severe damage. For this purpose, Shear Pins are provided in the Worm Gear Box at the Tapchanger Head (See Fig. 14). This Figure shows the details of the Shear Pins.

If you find that turning the input Worm Shaft of the Worm Gear Box does not appear to drive the Tapchanger, you may have to look at these Shear Pins.

CAUTION:

In case the Shear Pins are broken, it is necessary to investigate the cause before replacing them.

3. MAINTENANCE INSTRUCTIONS :

H : MAINTENANCE SCHEDULE

During your routine checking of Transformer oil condition, visually examine the Divertor Switch Oil, through the Tap Position Window,or by bleeding from the Air Release Screw on Head Cover. If it is too black, oil may be checked in IS Cell. If BDV is less than 20 kV we recommend Filtration/Replacement of oil.

Contacts of the Divertor Switch are subject to wear by arcing in the normal course. Examination of these contacts involves pulling out the insert (see Para I). We recommend physical verification of contact condition once in every 3 years, or 12000 operations, whichever is earlier.

I : REMOVAL OF INSERT :

For the purpose of maintenance, the Divertor Switch is made in the form of a removable Insert. The Insert must be pulled out of the Tap changer for maintenance of Divertor components such as contacts.

It is recommended when removing the Insert for the first time, that you take the help of OLG Staff.

It will not be necessary for the transformer manufacturer to remove the Insert when manufacturing the transformer. This is only a maintenance procedure.

The insert is a live part. It can only be removed with the Transformer switched off and grounded.

Before removing the Insert, always place the Tapchanger in Tap No.7. Ensure that Tap No.7 appears on the tap position window, before commencing removal operations. Do not operate the Drive Mechanism during the whole procedure.

The weight of the insert is approximately 105 Kgs. The insert length (max.) is 1450 mm. (see Fig. 11) .

To remove the insert, first remove the fasteners of the drive tube, and release from the extension of the Worm Gear shaft. In case of Tapchangers arranged in more than one column, this will have to be done on both shaft extensions of the Worm Gear. After completion of the maintenance procedure , the shafts will have to be re-installed, as per para C2,C5, of Installation Instructions.

If there is any piping work crossing the Tapchanger head, these may have to be temporarily removed. The Insert lift clear of the Head is a max. of 1,5 Mtrs. (220 kV, 3 Phase Unit).

Shut off the valve between the conservator, and the Tap changer Oil Surge Operated Protective Relay.

Remove the 20 Nos. M10 nuts securing the Head Cover to the Head (Please see CAUTION NOTE, Para A4, of Installation Instructions). The Head Cover can now be lifted off using the lifting lugs. Take care not to damage the gasket below. The Head Cover should not be shifted too much to the sides. as otherwise, the internal drive shafts may get damaged. It should be lifted as far as possible vertically.

By removal of 7 Nos. M8 Bolts securing the Insert Top flange to the Tapchanger Head Flange, the insert is ready for removal.

In general, care must be taken while removing or reinserting the Divertor Switch Insert. It should not foul with the Fixed parts of the Divertor Oil Vessel. This may damage the Insert, or the Suction Pipe, or the Insert Guide tube fixed in the Oil Vessel. The Suction Pipe and the Guide tube are provided to ensure that the Insert is raised and lowered in the correct peripheral position. However, too much load on these guides, due to gross misalignment may cause damage. Therefore, it is necessary to arrange the lifting gear exactly vertically overhead to the Insert, and attach ropes of equal length to the lifting hooks, and lift evenly so that the Insert does not get out of plumb, or rotate. Also, guide the Insert by hand as much as possible, so that all the circular plates and flanges of the Insert are properly guided through the central bore of the Divertor Oil Vessel Flange, without getting struck underneath.

The Insert has a number of spring loaded contacts located on the periphery of the Contact Cylinder. These engage with the fixed output contacts of the Divertor Oil Vessel. (Please See Fig. 2) The Suction Tube and the Insert Guide ensure correct peripheral alignment of these two sets of contacts. Therefore, while reinserting after any Inspection or Maintenance procedure, please ensure that the guide slots in the bottom most Flange of the Insert are located on these two items, and then lower gently without disturbing the Guides.

After completing maintenance, the insert may be replaced in the Tapchanger observing the same care regarding central insertion. In particular, please ensure that Tap No. found on the bottom aluminium flange of the divertor oil vessel is same as Tap No. in the insert Head. Further, lower the Insert making sure that the aspect of the hammer coupling at the bottom agrees with that of the slot of the matching part. You will observe that the hammer has one wider drive wedge and another narrower wedge, which should match the slot in the coupling.

It is important when lowering the Insert that it goes in centrally, so that the drive shaft alignment to the selector is reasonably maintained.

J. CONTACT REPLACEMENT OF DIVERTOR SWITCH :

The Divertor Switch contacts can be seen when the Insert is taken out, through the cutout windows in the Contact Cylinder.

If the contacts appear very worn, they can be replaced. However, contact replacement may need some initial training, since the entire Divertor has to be dismantled. We, therefore, recommend that at least till the user is familiar, On Load Gears may be called for replacement of Contacts.

If the Contacts are not worn excessively, the Insert may be used without any further major work. However, it is better to wash down the complete Insert to remove all carbon and other detritus. Wash down all the deposits on the walls of the Divertor Oil Vessel also, and then remove the dirty oil completely.

Examine also to make sure the transition resistances, and their connections are in good condition.

The opportunity of taking out the Insert can be used to examine the energy storage device. It does not need any maintenance. However, any undue developments, if noticed may be corrected at this stage. You may have to call On Load Gears in case you notice any damage.

Observe also that the spring loaded radial contacts on the side of the Contact Cylinder are in good condition, and that there is no evidence of overheating, arcing, or undue wear.

K. REPLACEMENT OF TRANSITION RESISTANCES :

Transition Resistances are an integral part o the Divertor Switch, and do not normally need maintenance or replacement .

In extreme cases, due to other faults, they may be damaged. In this case, please do not try to replace by winding resistances out of other material, but always insist on getting replacement from OLG.

To change Transition Resistance, pull out Insert as per Para I of Installation Instructions.

To find if the Resistances are indeed damaged, check with Ohm Meter between the two ends, against value shown on Name Plate. Variation upto ± 10% is acceptable, and shows the Resistances are intact.

The Transition Resistances are best replaced as an assembly, with complete Resistance Plates, Porcelain Edgings, Support Bracket, and Fasteners. When required, On Load Gears will supply the complete replacement Unit, shown in Fig. 7.

Before removing the Resistance assembly, it is necessary to remove the two ends of the resistance from the Fixed Main, and the Fixed Auxiliary Contacts of the Divertor Switch.. These Fasteners are marked in Fig. 7.

To remove the complete Resistance Assembly, after removing the two ends from the Fixed Divertor Switch Contact, it is necessary to remove the only one M8 Fastener which attaches the Resistance Unit to the Contact Cylinder. There is also an anti twist device consisting of a 5 dia Spring Dowel driven through the Contact Cylinder, and the Resistance Bracket. The Spring Dowel may be pushed into the Contact Cylinder by a 4mm dia steel pin. This will completely release the Resistance Unit.

The new Resistance Unit may be installed by the reverse process, taking into account that the two free ends must face towards the Divertor Switch Fixed Contacts. The ends are normally left longer than required, and must be trimmed to suit in Assembly.

Please do not forget to fix the two ends of the Transition Resistance to the respective Fixed Divertor Switch Contacts.

L : ELECTRICAL DRIVE :

As Annexure – I a trouble shooting guide is attached, which may be useful, in the event of minor problems arising after some time of operation.

In any case, to save your time and effort, we may add that many electrical problems are minor, and may be caused by loose connections, broken Fuses or leads. We suggest that you may use the Schematic Drawing attached to check for simple problems before calling for help. In particular some problem may arise in service due to dirt or dust in the slide ways of relays. Even though the Mechanism enclosure is dust proof, ingress of dust, or moisture is possible, if the door is not properly closed. Blowing air over the relay will sort out this problem quickly.

M : MECHANISM BOX :

The mechanism box does not need any maintenance.

It must be kept reasonably clean.

If you find that gears that are visible are dry, the gear teeth may be smeared with Moly grease slightly.

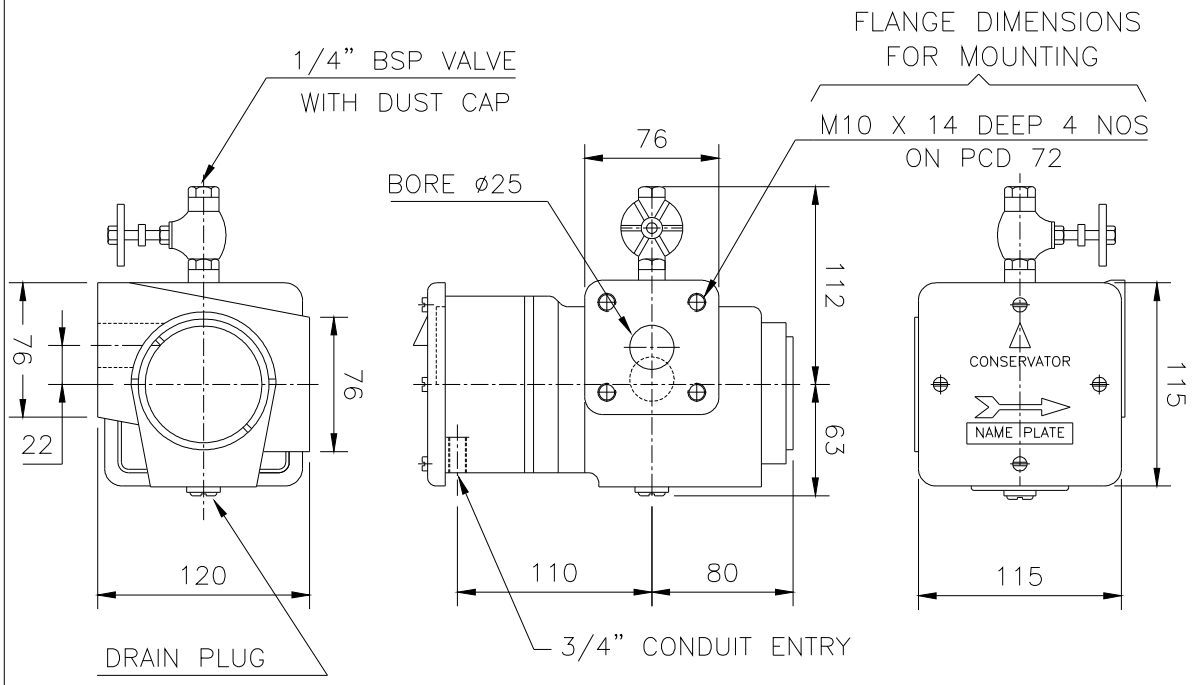
The Cabinet cover gasket may need inspection once in a while to check its integrity against moisture ingress. Check also that the anti condensation Heater is operational from time to time.

N : REMOVAL OF DRIVE MOTOR :

Normally this should not be necessary. However, if the motor is switched on at such a low voltage that it is stalled for a long time, there is a remote possibility that the motor may get damaged.

For removing the motor, disconnect the three supply leads. Removal of 4 Nos. M8 bolts on the securing flange releases the motor.

Lift the motor up vertically to clear the shaft mounted gear, (about 80mm) and then remove laterally. During the removal procedure, take care not to damage the gasket. If the gasket is damaged, it may be replaced.



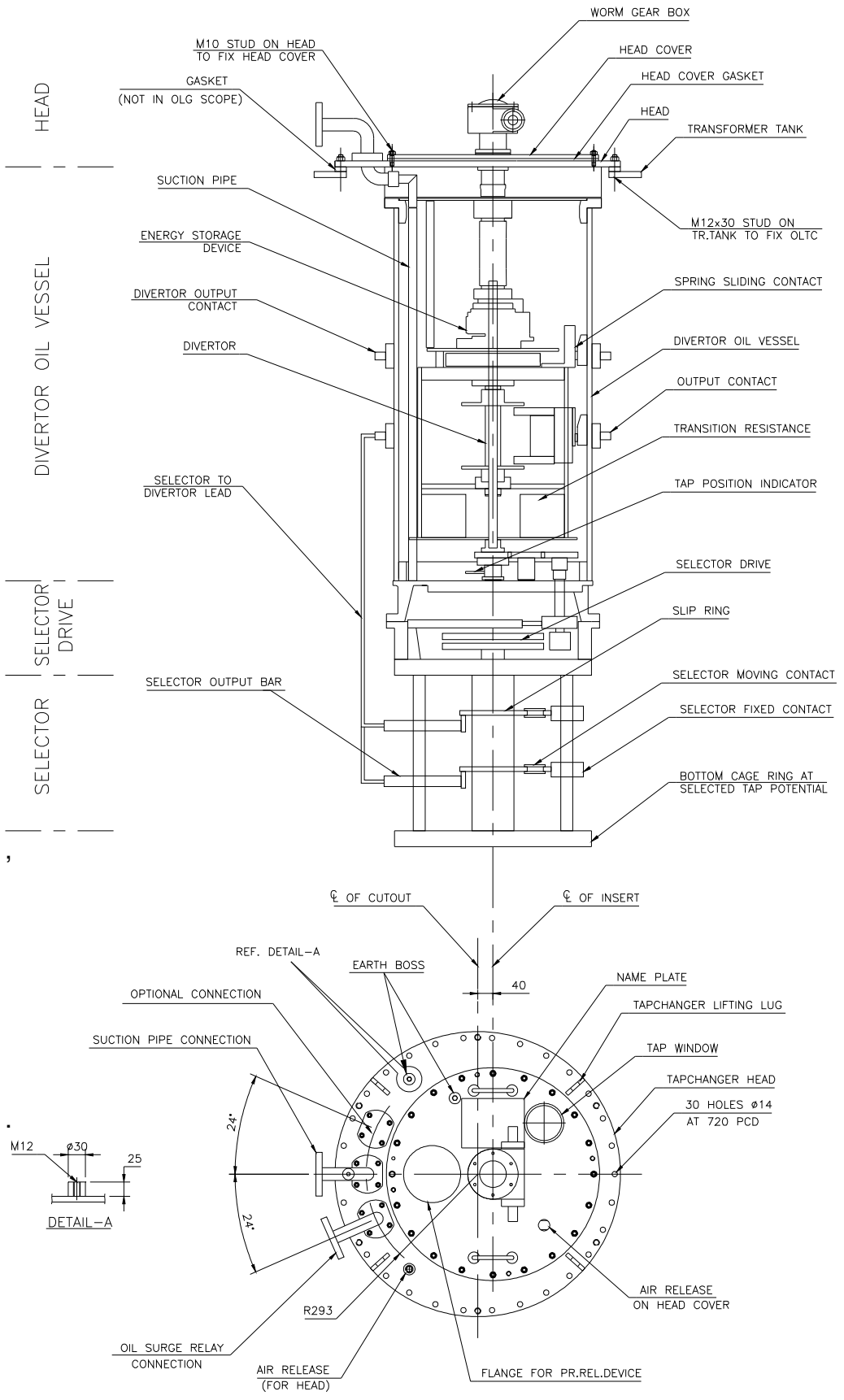
NOTE
1. ALL DIMENSIONS ARE IN MM.

WARNING:–
CARE MUST BE TAKEN TO ENSURE THAT BREATHER VENT & DRAIN HOLES ARE NOT OBSTRUCTED INCASE RELAY BE PAINTED AFTER INSTALLATION

MERCURY SWITCH RATING:–
THE MERCURY SWITCH IN THIS RELAY IS SUITABLE FOR MAKE AND BREAK 2 AMPS AT 250 VOLTS 50 C/S AC .OR DC.

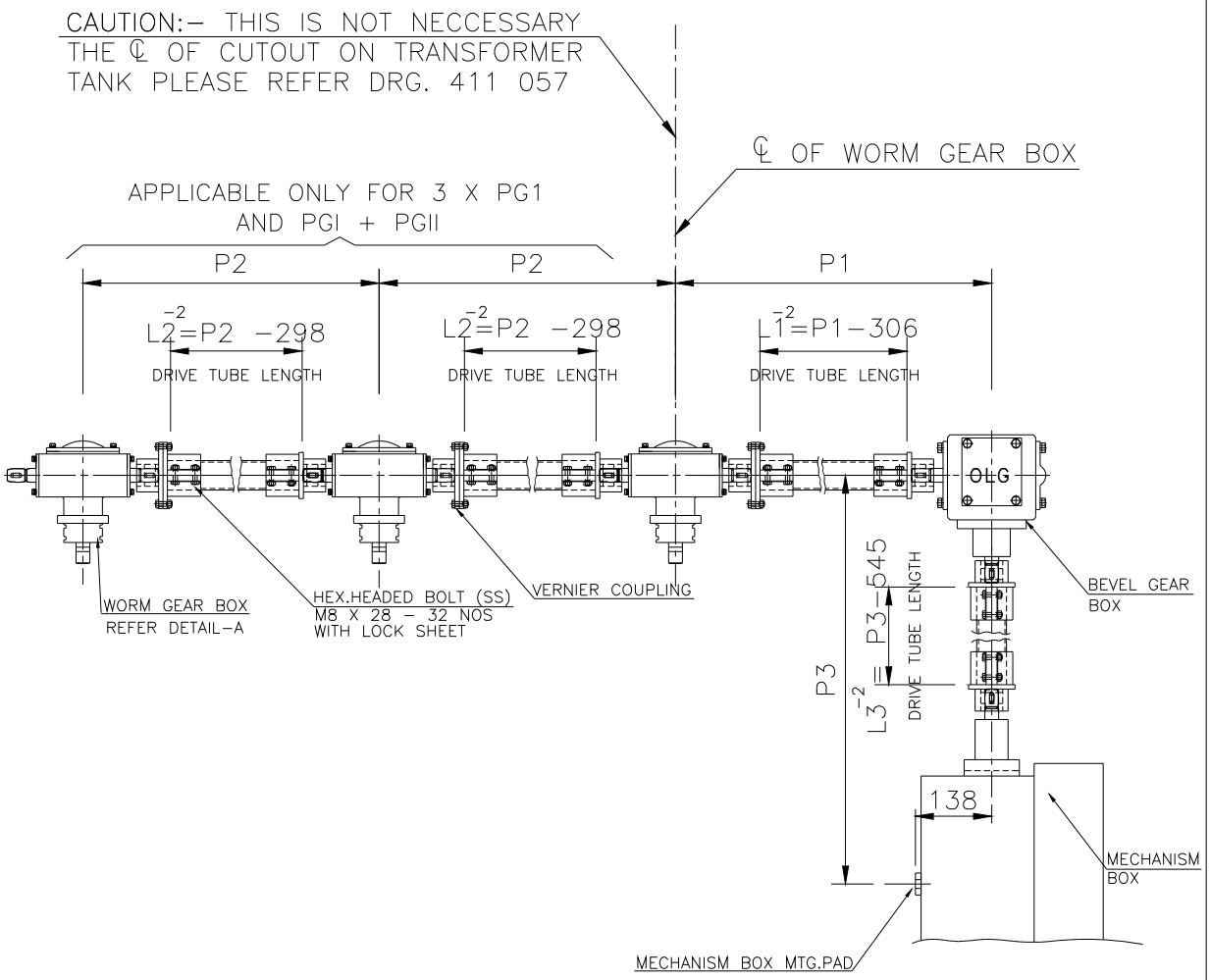
On Load Gears	OIL SURGE OPERATED RELAY	410 086	R1

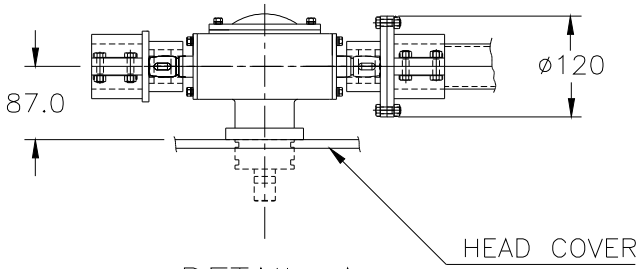
FIG. 1



On Load Gears	CONSTRUCTION OF PG (SCHEMATIC)	411 060	R 0

FIG–2





DETAIL–A

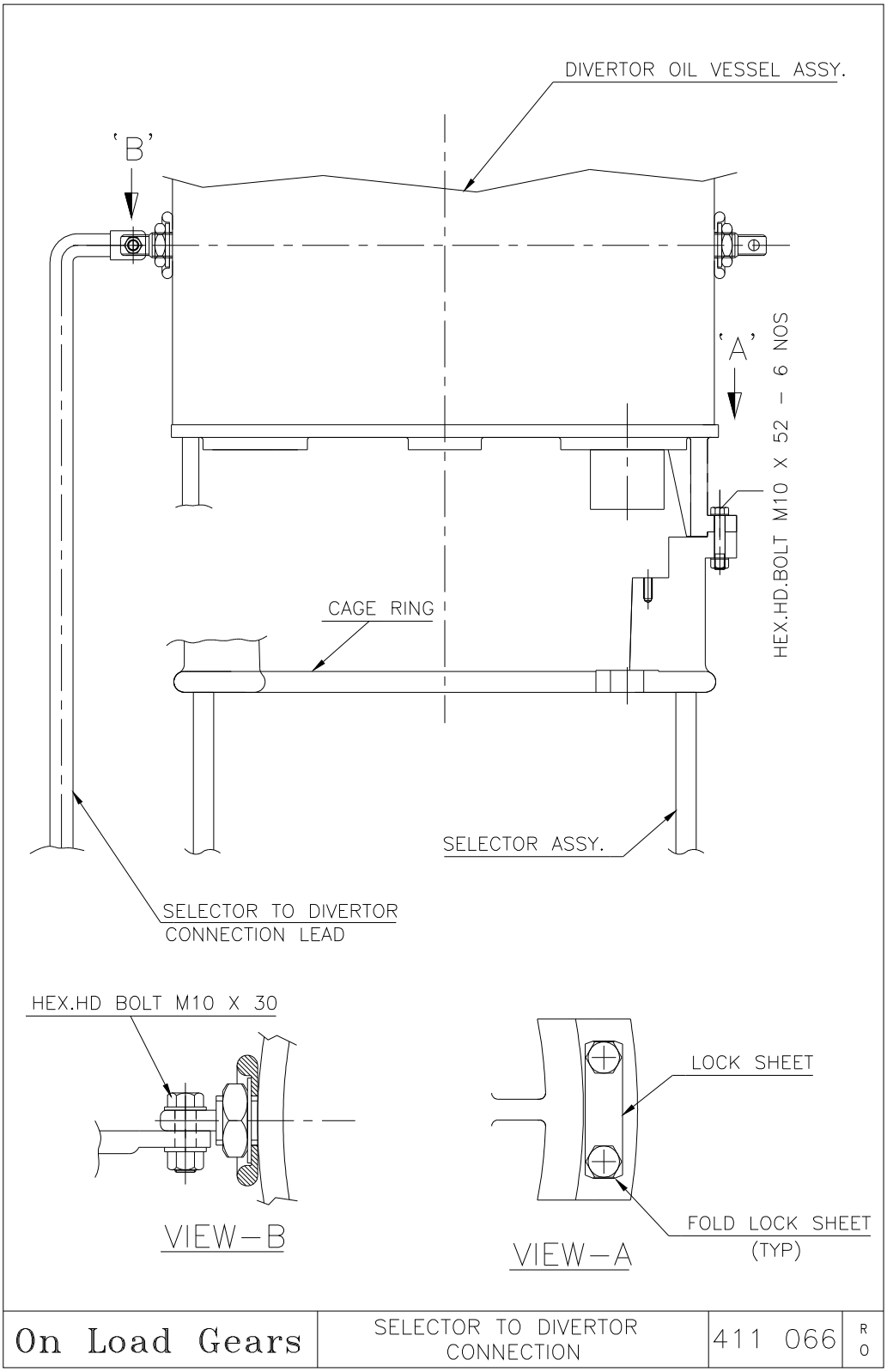
	MIN	MAX*
P1	518	3000
P2	760	3000
P3	685	3000

NOTES

1. ALL DIMENSIONS ARE IN MM.
2. L2,P2 NOT APPLICABLE FOR SINGLE COLUMN CASES
3. HEAD PITCHES NEED NOT BE SAME

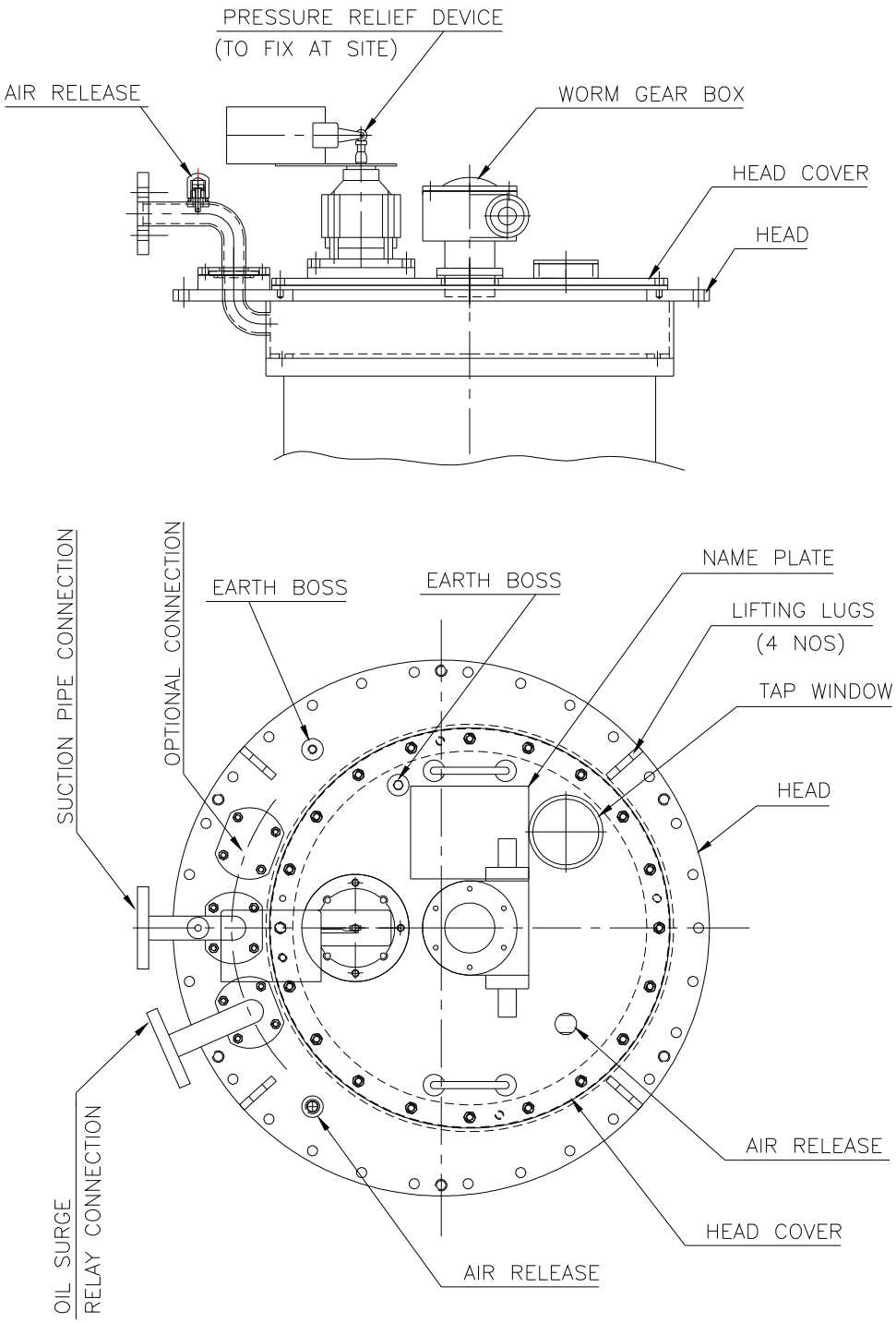
* BEYOND THIS LENGTH AN ADDITIONAL BEARING SUPPORT TO FIG23 IS REQUIRED.

On Load Gears	INSTALLATION OF DRIVE SHAFTS	410 070	R2



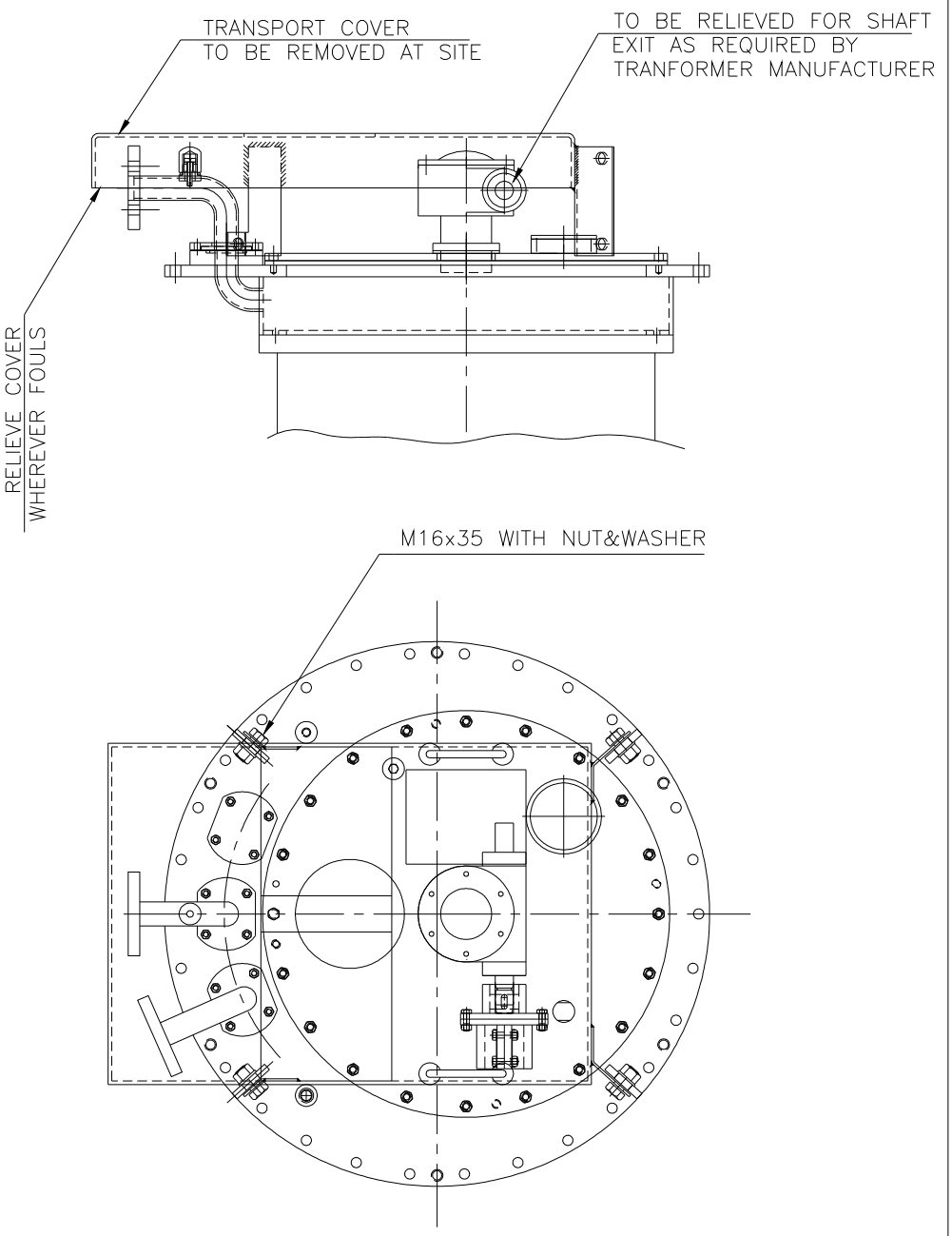
On Load Gears	SELECTOR TO DIVERTOR CONNECTION	411 066	R 0

FIG-4



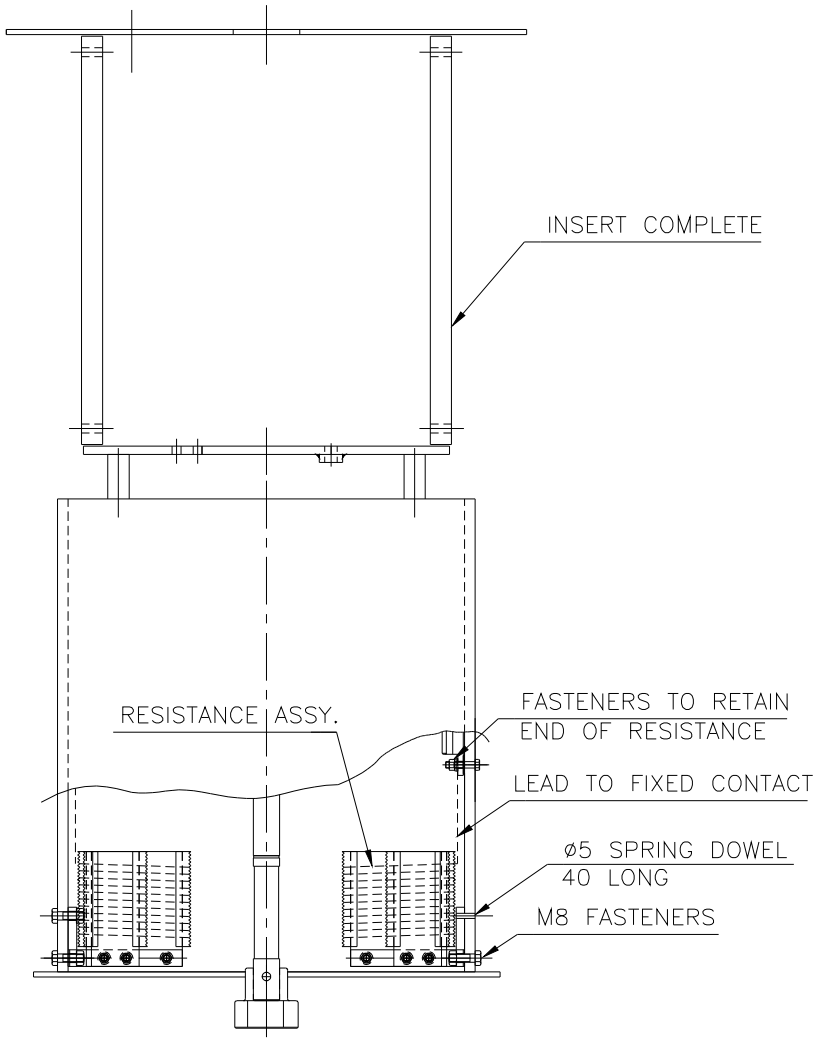
On Load Gears	HEAD ARRANGEMENT	411 068	R 0

FIG–5



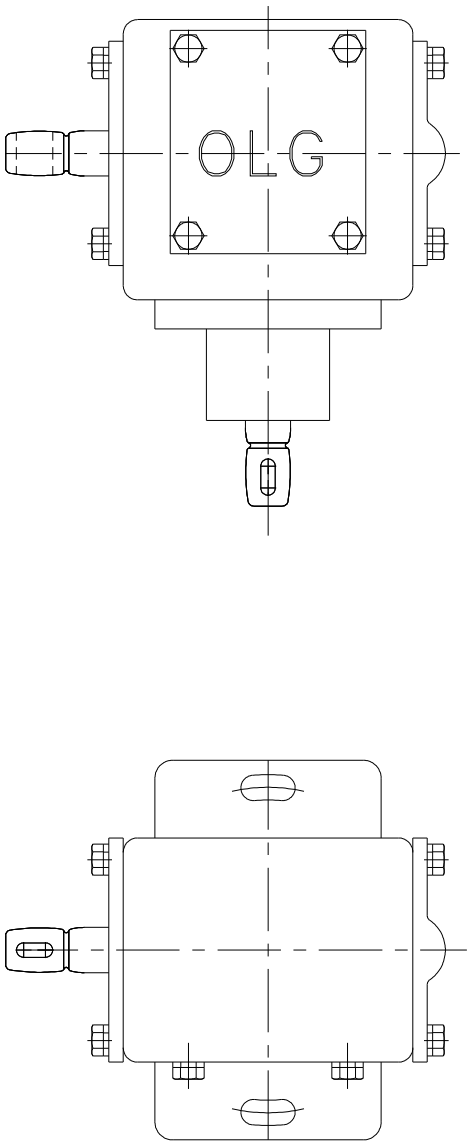
On Load Gears	HEAD TRANSPORT COVER (OPTIONAL)	411 069	R 1

FIG–6



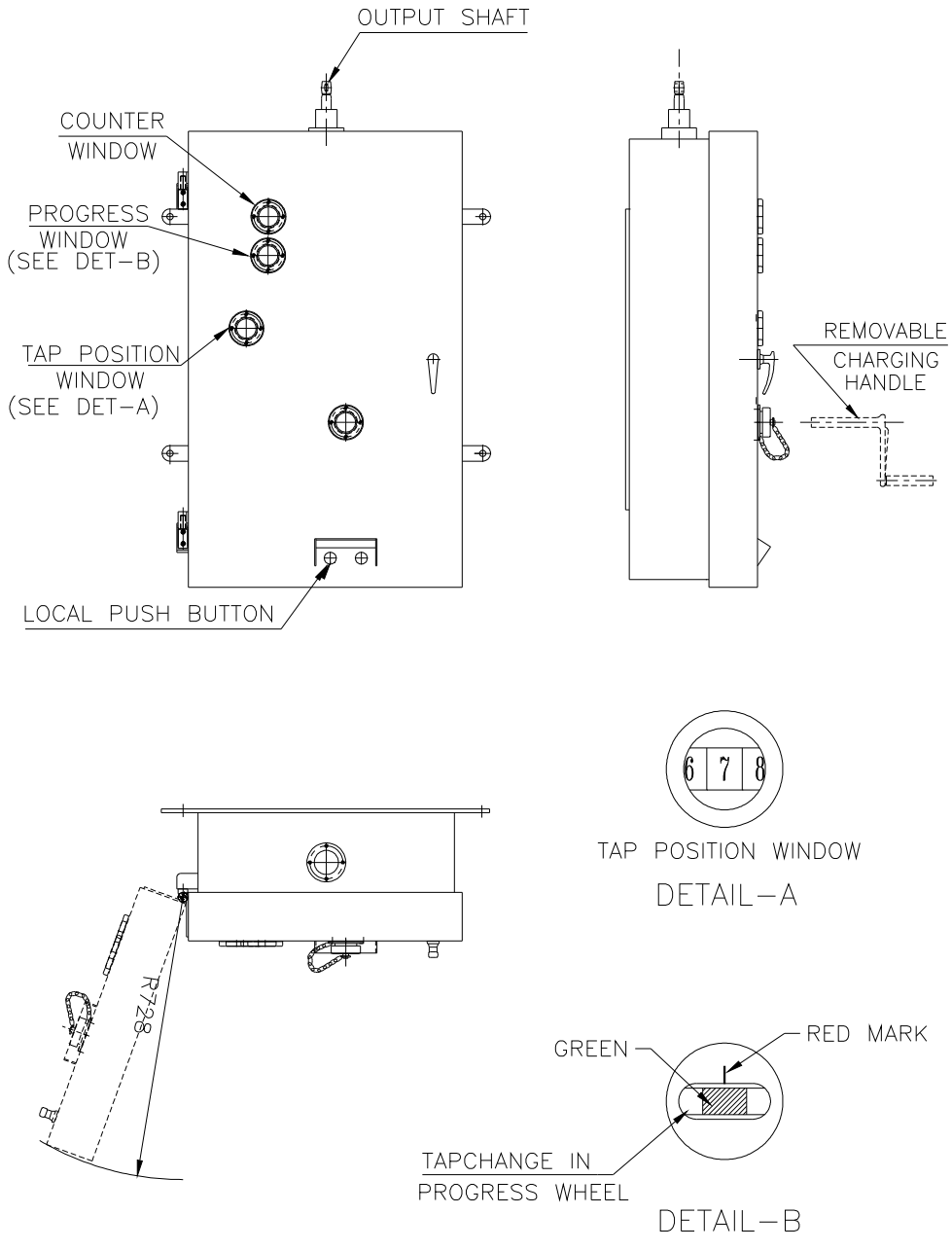
On Load Gears	METHOD OF RESISTANCE REMOVAL	411 061	R0

FIG–7



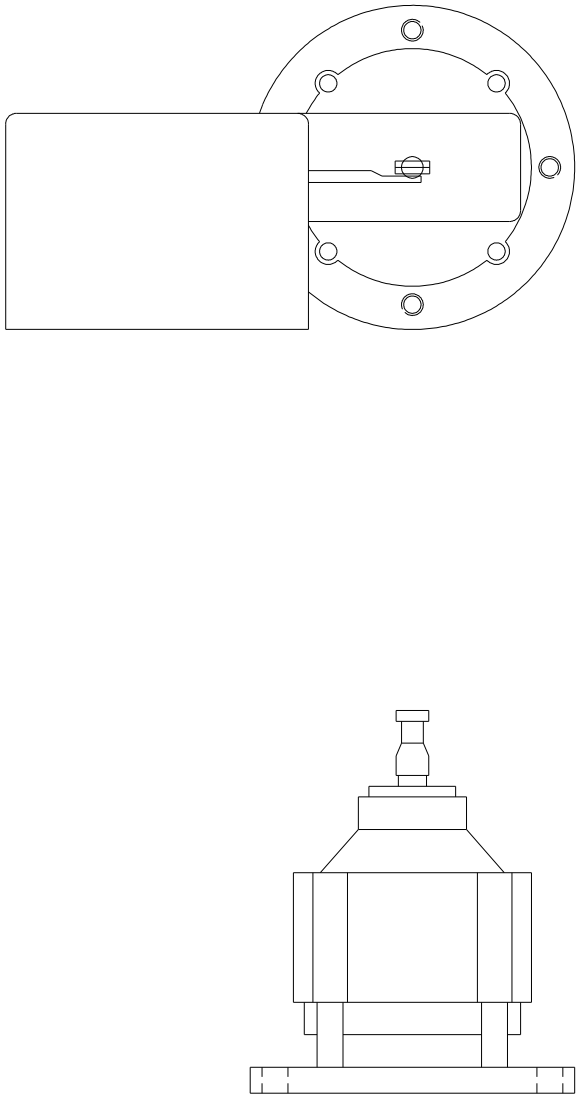
On Load Gears	BEVEL GEAR BOX	411 070	R 0

FIG–8



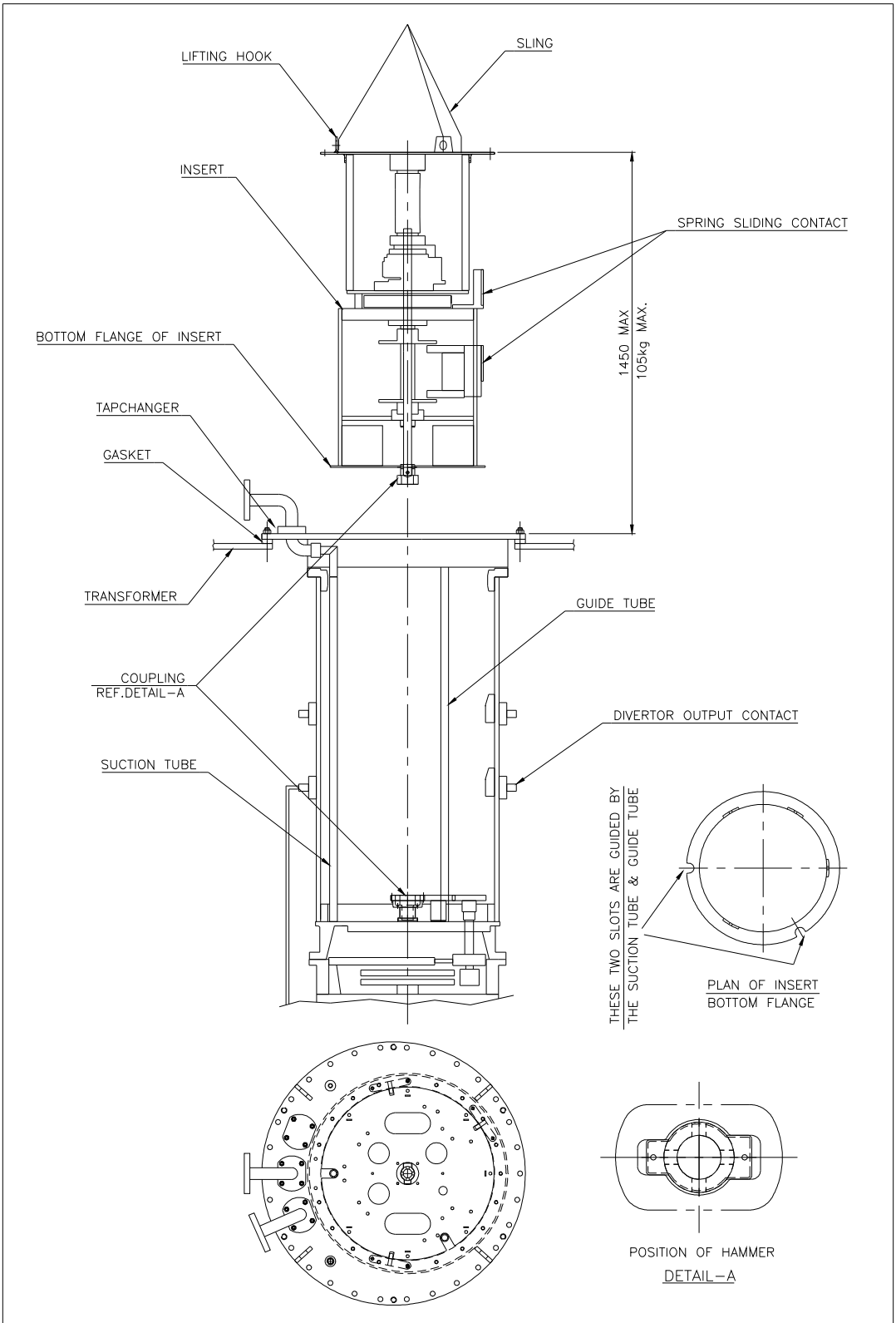
On Load Gears	MECHANISM BOX	410 055	R 0

FIG-9



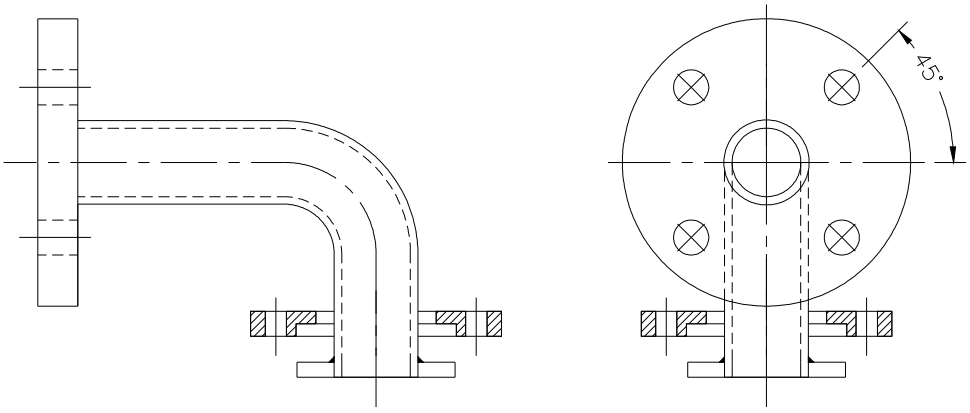
On Load Gears	PRESSURE RELIEF DEVICE	410 056	R 1

FIG–10



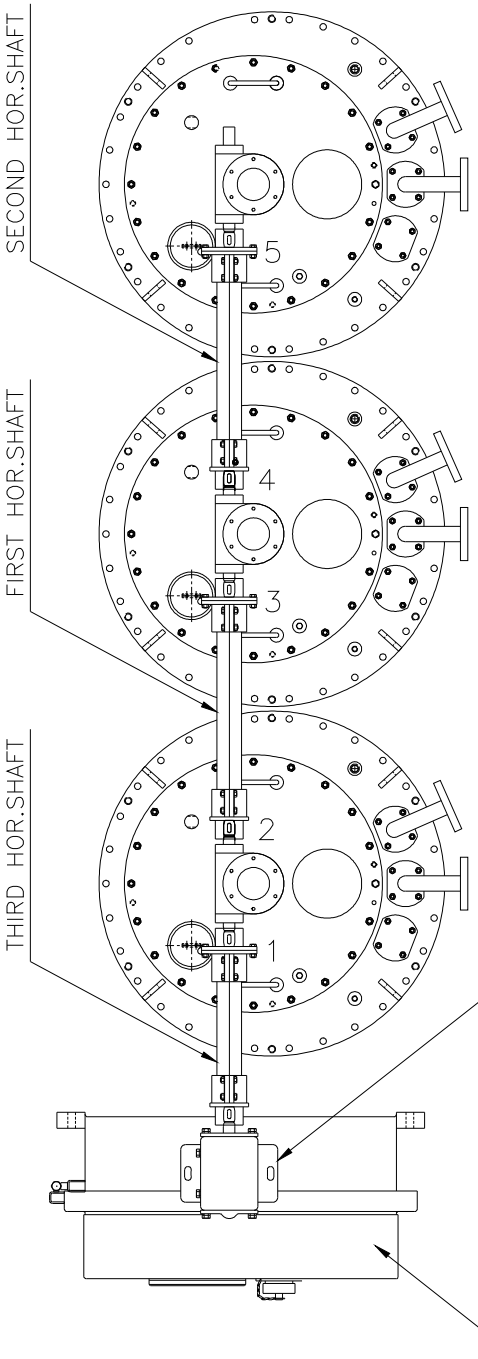
On Load Gears	LIFTING OF INSERT	411 077	R 0

FIG–11



On Load Gears	PIPE BEND FOR OSR	410 058

FIG–12

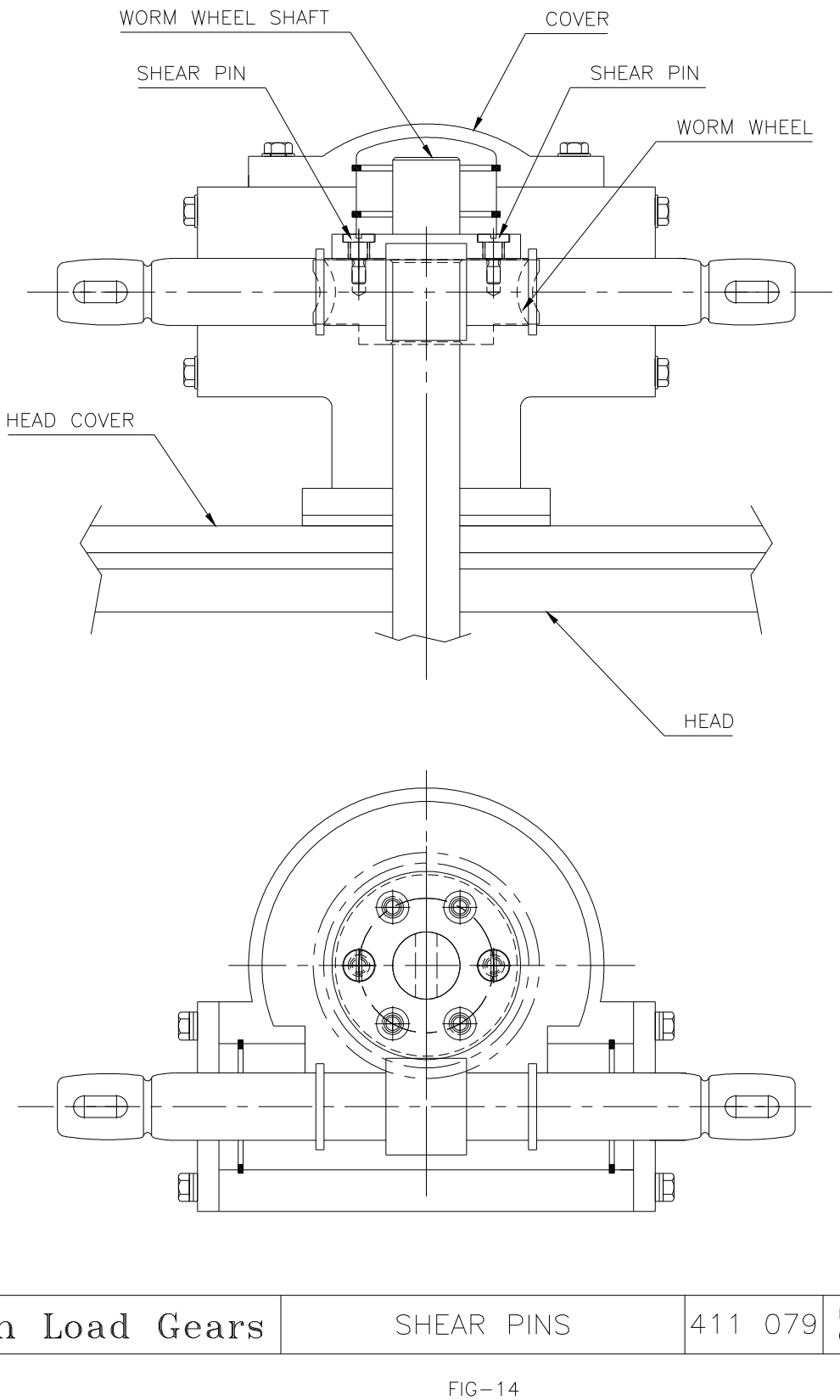


SEQUENCE OF REMOVAL OF LOCKS

1. TAKE OFF LOCKS 2 & 3
   – INSTALL FIRST HORIZONTAL SHAFT.
2. TAKE OFF LOCKS 4 & 5
   – INSTALL SECOND HORIZONTAL SHAFT.
3. TAKE OFF LOCK 1
   – INSTALL THIRD HORIZONTAL SHAFT. (TO BEVEL GEAR BOX)

On Load Gears	TRANSPORT LOCKS ON 3 X PGI	411 071	R 0

FIG–13



On Load Gears	SHEAR PINS	411 079	R 0

FIG–14

ANNEXURE – I

TROUBLE SHOOTING GUIDE FOR ELECTRICS IN DRIVE MECHANISM

Sl. Nr.	Nature of Problem	Solution
1.	Mechanism shows no life	a) Check supply at Terminal Block (TB) b) Check main and auxiliary Transformer Fuses c) Check for loose connection d) Check if crank handle switch stuck e) Reset motor Protective Relay manually
2.	Raise Button causes lowering of Tap NR. And vice versa	a) Reverse phase sequence of supply
3.	Mechanism over – runs Tap position, and starts Next tap change	a) Check contactor C3 Connections and sluggishness in sides b) Closed contacts damaged. Clean out c) Micro Switch b12/b14 stuck or Sluggish d) Check C4 & C5 Contactors stuck up
4.	Motor runs at end Positions also	a) Change phase sequence
5.	Stops in mid tap	a) Check Relay d17 connections for tightness b) Contacts damaged clean out