
TMQ AUTOPILOT

*MECHANICAL
DRIVE UNIT*

TMQ MECHANICAL DRIVE

PREVIEW:

TMQ Electronics manufactures a heavy-duty mechanical drive unit for 12 volt DC autopilot operation. This unit can also be used for 24 volt DC operation when a TMQ limiter is connected between control unit and motor unit.

The drive unit when properly installed, operated correctly and periodically maintained will provide a lifetime of satisfactory operation.

SPECIFICATIONS:

This unit comprises an integrated motor/gearbox assembly, which has attached a three pin dog type clutch mechanism.

Motor:

- Yaskawa PMED12CBG or PMEE12CBG
- Armature Stamped conductor disk shaped (print motor)
- Field Permanent magnet (ferrite)
- Speed Armature 3000 rpm at rated voltage no load
- Brushes Two brush (6 x 8 x 15mm)
- Casing Steel
- Voltage 16.5 VDC PMED / 21.5 VDC PMEE (maximum rating)
- Current 5.6 Amp PMED / 5.2 Amp PMEE (maximum rating)

Gearbox:

- Gears Spur three train drive
- Bearing Main shaft ball bearing - 608ZZ
- Shaft Output shaft diameter - 16mm
- Torque 140 Kg/cm (17.7 Nm) at output shaft
- Speed 30 rpm shaft speed at rated voltage
- Casing Cast aluminium

Clutch:

- Type 3 pin engaging – non slip
- Operation Solenoid 12 volt DC
- Bearings Main shaft – R10LL (ball) and HK1210 (roller)
- Shaft 5/8" diameter 304SS
- Casing Cast aluminium
- Sprocket 16 tooth standard 3/8" pitch x 1/4" width
- Chain 06B-1R simplex roller (for sprocket)
- Adjustment Nil external – set at factory or during service/repair

Limiter:

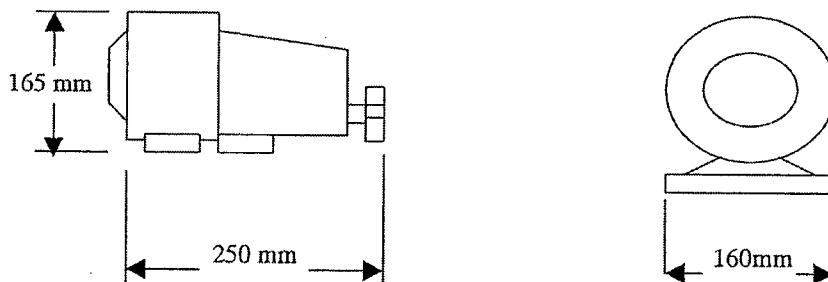
A TMQ limiter MUST be used when the drive unit is operated on a 24 volt DC supply.

- Case Pressed anodised aluminium
- Resistor 2 ohm 50 watt – in series with motor
- Resistor 12 ohm 20 watt – in series with solenoid
- Connection Barrier terminal strip
- Cable 4 metre x 4 core Aflex 30/025
- Cable connectors Crimp terminals - EJST 2-YS3A

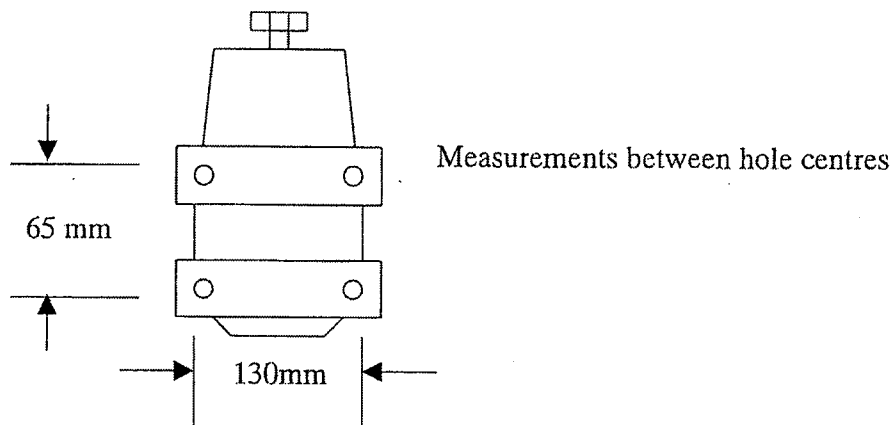
NOTE: Failure to use a limiter when operating the drive on 24 volts will result in burn out of the clutch solenoid and motor armature.

Drive Unit Dimensions:

- Length 250 mm
- Width 160 mm
- Height 165 mm



Mounting Hole Dimensions:



INSTALLATION:

Mounting Hardware:

The following hardware is supplied with the drive on initial purchase.

- Sprocket Driven sprocket 38 tooth 3/8" pitch
- Chain 5 Foot length 06B-1R simplex roller chain
- Link Connecting link to suit chain
- Fasteners 4 x 5/16" BSW hex bolts/nuts and washers
- Cable 4 metre x 4 core electrical cable (Aflex 30/025)
- Connectors Fitted to motor – Tab LIM-51T-250N
 Housing – 4M-250PP
 Fitted to cable – Receptacle LT1-51T-250N
 Housing – 4F-250N

Mounting instructions:

Pre mounting checks:

Before commencing the drive installation, the following checks should be carried out. If a problem is found during the checks, rectify it PRIOR to installing the drive unit.

- Does the steering system move freely and easily by hand?
 - Does the steering tighten at any spot during movement?
 - Does the driven sprocket fit the shaft? – it may have to be bored out.
 - Have you the necessary tools to do the job properly?
 - Is the vessel supply voltage 12 or 24 VDC?
 - Do you have a limiter if 24 VDC?
 - Are electrical cables long enough? *
1. Choose a position free from dirt and moisture.
 2. Avoid a place of excessive shock or high vibration
 3. Mount drive unit horizontally on a flat substantial surface parallel to driven shaft
 4. Fit all 4 mounting bolts/nuts/washers.
 5. Use anti corrosion compound on the mounting bolts. This will prevent the surfaces from "growing" together when oxidation of metal occurs.
 6. Allow sufficient room for the electrical cable connection.
 7. Fit driven sprocket (38 tooth standard) to shaft. Sprocket has a nominal borehole – this may have to be bored out to suit shaft size.
 8. Align the drive sprocket carefully with the driven sprocket.

9. Avoid sideways thrust on sprockets and chain to prevent premature wear.
 10. Tension chain carefully; chain may have to be shortened to suit installation. Do not over-tighten chain, nor leave it too loose.
 11. Lightly grease chain and sprockets.
 12. Connect electric cable and clip up and away from the sprocket and chain area.
 13. Test unit for correct operation on completion.
 - Motor drive should run freely.
 - Ensure driven load does not jam in operation.
 - Chain should not jump sprocket teeth.
 - Check correction direction of drive for autopilot command.
- * Electric cables can be extended if required. However, a cable of sufficient cross sectional area (current carrying capacity) must be used to prevent excess voltage drop.

Refer to diagrams for further information.

MAINTENANCE:

The drive unit is usually mounted in a position "out of sight – out of mind". As a consequence, regular maintenance is often forgotten to the detriment of the motor life.

However, with regular and periodic maintenance the drive unit will operate with minimum down time for many years.

There are very few wearing parts within the drive unit. One important exception is motor brushes, which should be immediately replaced when wear becomes excessive; otherwise, irreparable damage will occur to the motor armature.

Periodic maintenance:

The following should be checked at least once per year – more frequently under arduous operation.

- Chain – check wear, re-tension if necessary, clean, lightly re-grease
- Sprockets – check wear.
- Mounting bolts – check for oxidation around bolts, replace anti-seize compound if required, re-tighten.
- Electric cable – check for damage, check connections for corrosion, repair or replace if required.
- Motor brushes – check for wear (Minimum allowable length 7 mm), clean out excess carbon dust.

At least every three years the motor should be fully serviced. This will necessitate removal of the motor to a service workshop facility. The following checks and inspections should be carried out and excessively worn or damaged parts replaced:

- Motor brushes (7 mm minimum length)
- Clean out excess carbon dust with a light brush.
- Armature for wear (may be wiped clean but not with solvent).
- Armature for warping *
- Clutch pins for wear or rounding of ends – regrease lightly
- Clutch adjustment
- Main shaft bearings
- Slider movement on shaft – regrease lightly
- Examine for corrosion and water damage on all parts.
- Gearbox gears and bearings – do not use excessive grease
- Electrical cable and wires
- Electrical connectors
- Sprocket
- Solenoid

* If armature is removed, ensure spacer washers are replaced in exactly the same order as they were removed.

CLUTCH ADJUSTMENT:

There are no external adjustments for the drive clutch. The clutch is checked for adjustment during assembly and after each service or repair. Refer to clutch assembly drawings in conjunction with this procedure.

Pin position in barrel:

- Position three pins with springs into the barrel
- Hold barrel upright so that pins are vertical and resting on springs
- Check face of pins are 0.5mm set back from barrel face – if not, adjust spring tension slightly by stretching or compressing to achieve 0.5mm

Position of lever plate, disk and barrel:

- Assemble lever plate, disk and barrel (with pins and springs) to motor shaft. Use “Loctite” retaining compound for barrel position on shaft.
- Lever plate, disk and barrel are positioned so that each is touching the adjacent part and springs are 0.5 mm set back from barrel face.
- Tighten grub screws in barrel with “Loctite” thread lock compound.
- Ensure freedom of movement of all parts by moving lever plate forward.
- Move plunger (with lever) 12mm - check pins extend approx. 3mm from barrel face.
- Ensure no excess ‘Loctite’ is present on shaft or moving parts.

Solenoid plunger position:

- Fit solenoid plunger over lever plate arm.
- Check that end of plunger is just touching motor face without having to move the lever plate or compress the barrel springs. Adjust the bend in the lever plate arm if necessary.
- Ensure plunger moves freely in solenoid housing

Slider:

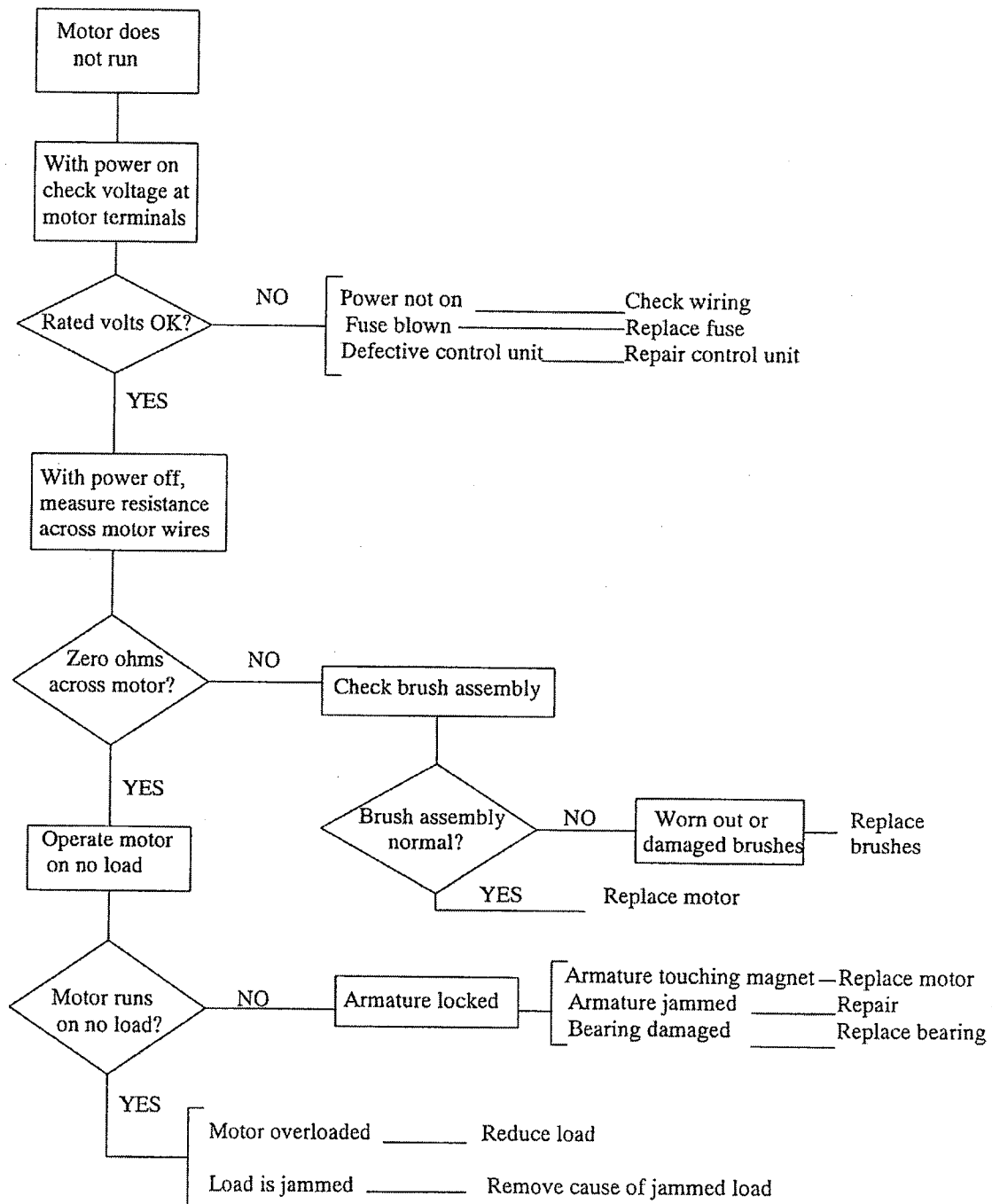
- Lightly lubricate the clutch shaft with grease
- Fit slider and spring on to shaft
- Push slider to compress spring and ensure free movement along shaft.
- Ensure slider returns to original position.

Assembly and testing:

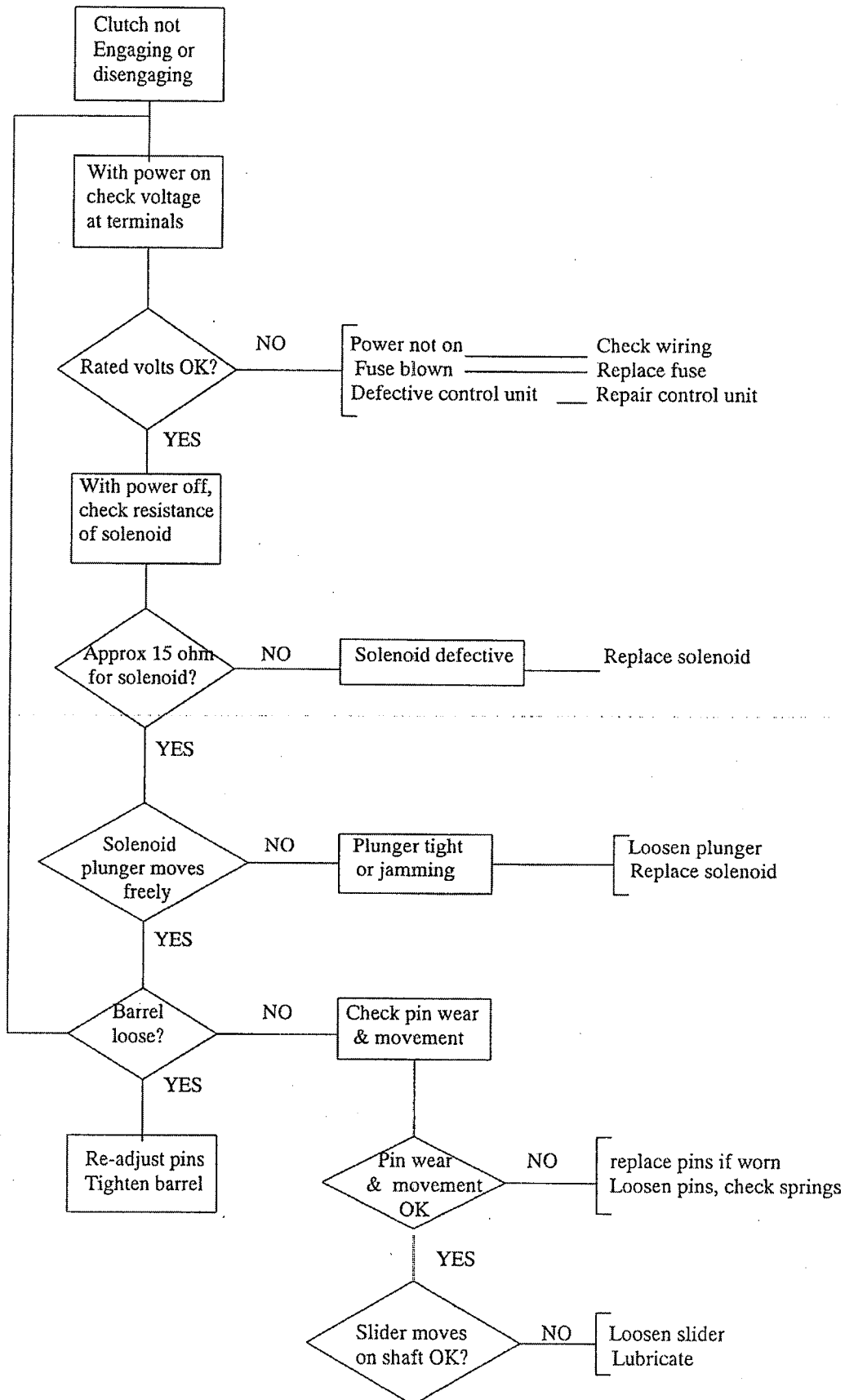
- Assemble the complete clutch to the motor unit.
- Test the solenoid operation by applying 12 VDC
- Ensure clutch pins engage slider by turning sprocket
- Remove power from the solenoid, ensure clutch pins disengage
- Repeat clutch testing for engagement of all positions.

TROUBLE SHOOTING:

Motor:



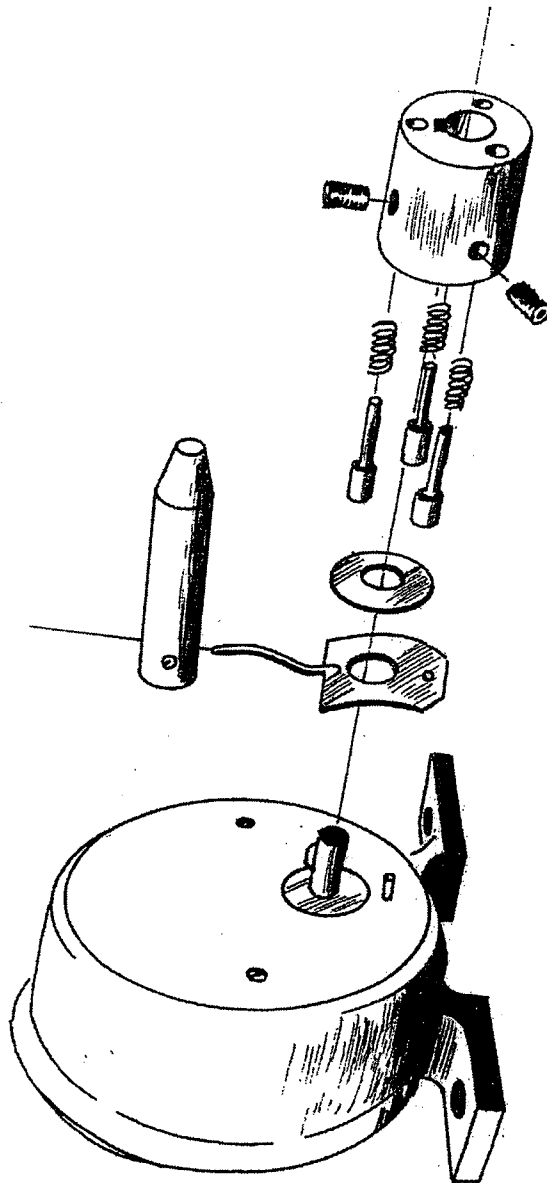
Clutch:



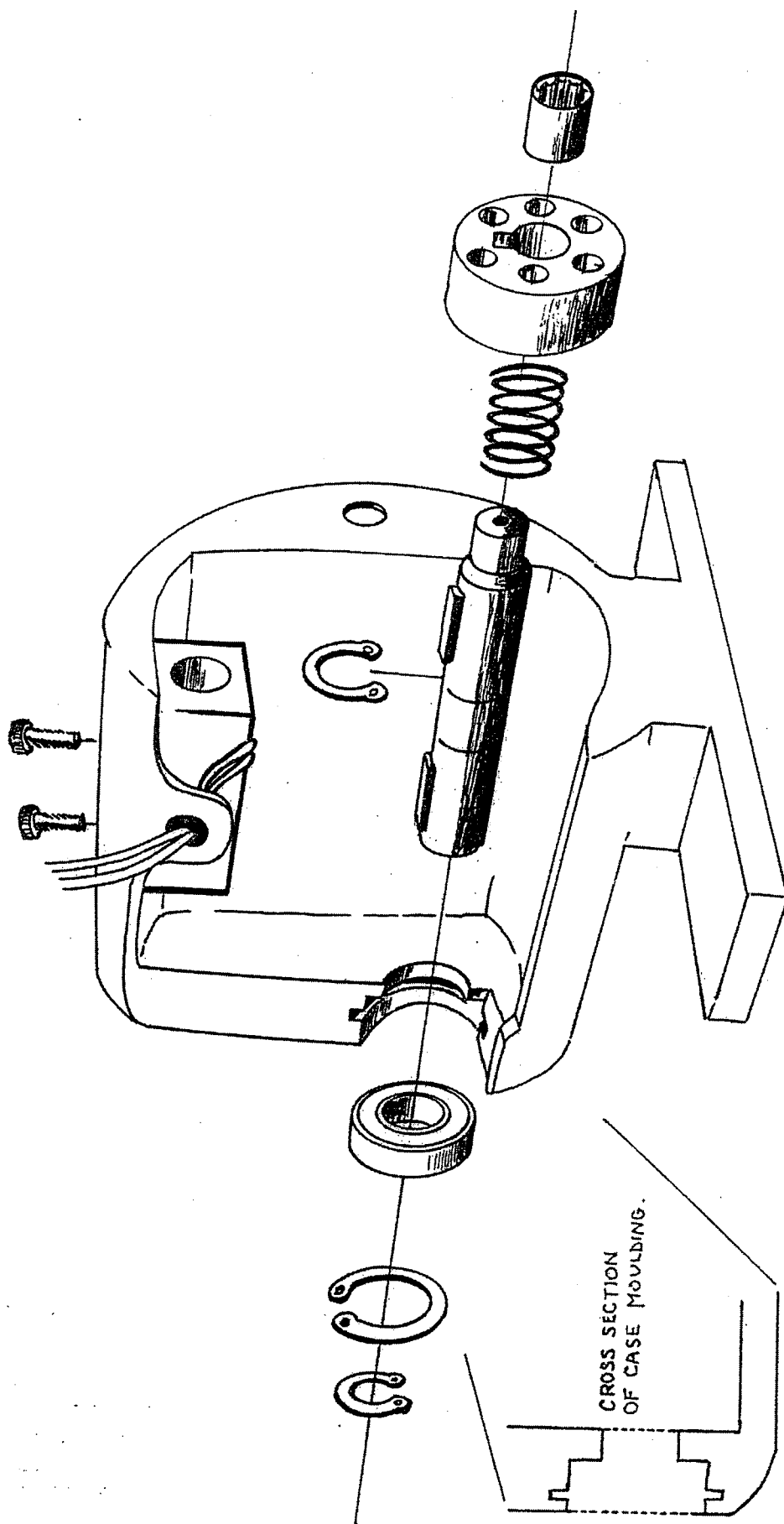
SPARE PARTS:

Assembly	Spare Part	TMQ Code	Remarks
Motor Motor Motor	Brush Bearing Cable	BRUPRI BEA608Z CABMEC	2 per set – replace at 7 mm Main shaft – sealed Motor cable
Clutch Clutch Clutch Clutch Clutch Clutch Clutch Clutch Clutch Clutch Clutch Clutch Clutch	Bearing Bearing Barrel Disk Lever Pin Shaft Slider Solenoid Spring Spring Sprocket	BEAR10LL BEAHK1210 BARREL CLUDIS LEVPLA CLUPIN SHACLU SLIDER SOLMEC SPRPIN SPRSLI SPR16T	Output shaft – ball bearing Barrel bearing – roller bearing Pin & spring barrel Pressure disk – pins Solenoid lever plate 3 per set – stainless Main clutch shaft Engaging slider mechanism Clutch pin solenoid 12 VDC Pin spring Slider spring 16 tooth sprocket – output shaft
Limiter Limiter Limiter Limiter	Resistor Resistor Terminal Cable	R2R50W R12R20W TERL1790A CABLIM	2 ohm 50 watt for motor 12 ohm 20 watt for solenoid Barrier terminal strip Limiter cable

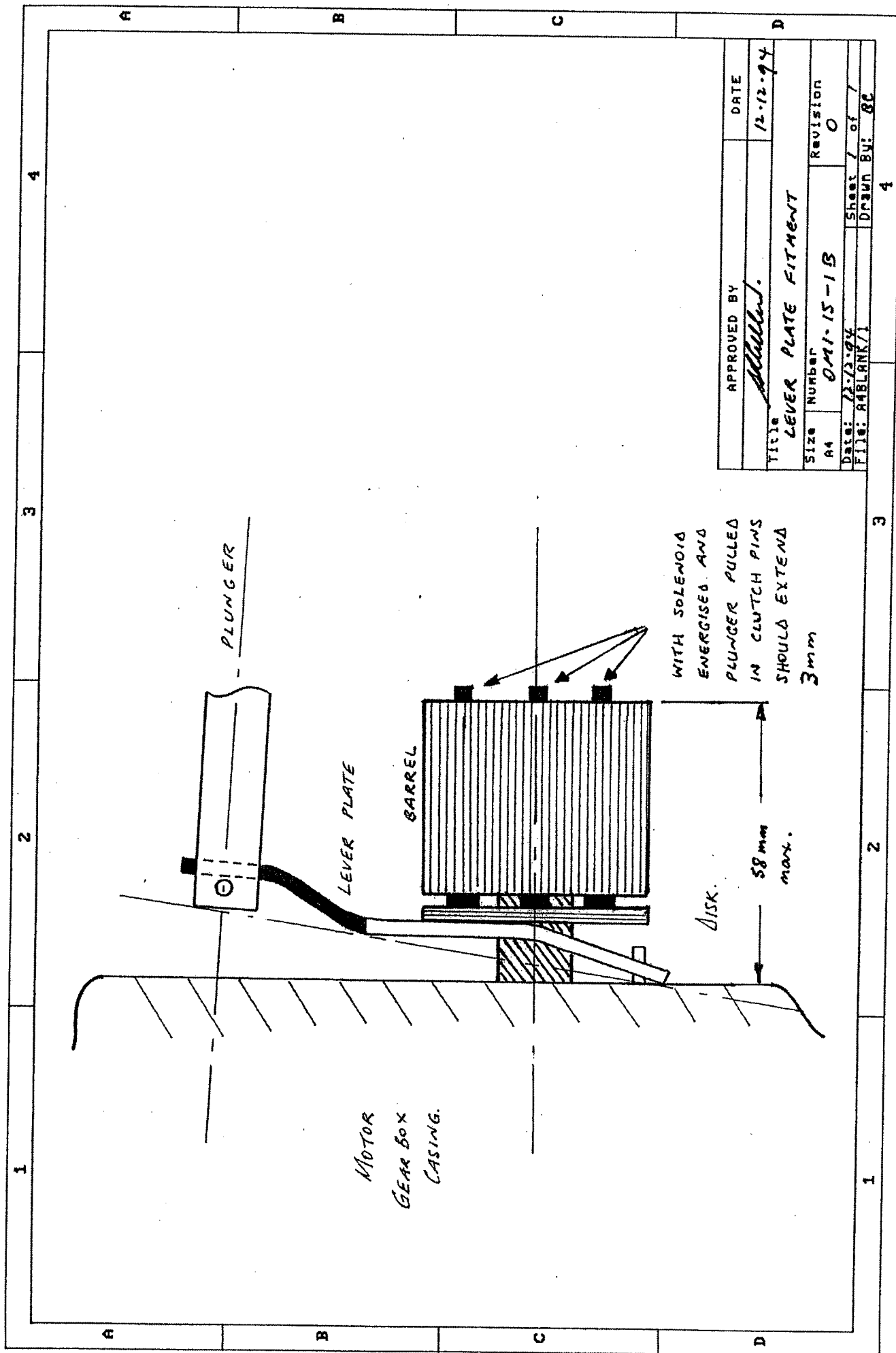
Note: The only spare parts available for the motor/gearbox assembly are brushes and bearing.



APPROVED	DATE
<i>[Signature]</i>	7-7-94
TMQ DWG. QA. NO.: 04115-8	
CLUTCH PARTS ASSEMBLY	
REVISION: 1	
DRAWN BY: H/L	DATE: 1
CHECKED BY: H/L	DATE: 1



APPROVED	DATE
<i>Miller</i>	7.7.94
TMQ DWG. QA. No.: OM 1.15-9	
CLUTCH CASTING ASSEMBLY	
REVISION: 1	
DRAWN BY: ML	DATE: 1



APPROVED BY	DATE
<i>[Signature]</i>	12.12.94
Title LEVER PLATE FITMENT	
Size A4	Number 0M1-15-1B
Date: 12.12.94	Revision 0
File: A4BLANK/1	Sheet 1 of 1
Drawn By: RC	

MECHANICAL CLUTCH ASSEMBLY

Ref: TMQ-DWG QA NO: OM 1.15-10

The following procedure is for the adjustment of the mechanical drive clutch assembly. The clutch will require the adjustment to be checked whenever the drive unit is serviced or repaired.

Clutch Parts:

- 1 Solenoid Plunger
- 2 Clutch Pin Head (3 pins per assembly)
- 3 Lever Plate
- 4 Disk
- 5 Barrel
- 6 Clutch Pin (engaging section)
- 7 Slider Mechanism
- 8 Solenoid Coil
- 9 Sprocket
- 10 Clutch Shaft
- 11 Slider Spring
- 12 Pin Spring
- 13 Clutch Casting
- 14 Clutch Shaft Main Bearing
- 15 Clutch Support Bearing
- 16 Motor Shaft

Clutch Operation:

In the disengaged state the sprocket [9] attached to the clutch shaft [10] is free to rotate in the bearings [14 & 16] when manually steering the vessel. The slider mechanism [7] is keyed to the clutch shaft and therefore rotates with the shaft.

The clutch engages when power is applied to the solenoid coil [8]. The plunger [1] is drawn into the coil pulling the lever plate [3] forward. The lever plate pushes against the disk [4] which in turn pushes the clutch pins [2 & 6] forward to engage the slider mechanism. The clutch then turns as a whole unit when the motor shaft [16] turns.

Adjustment of clutch:

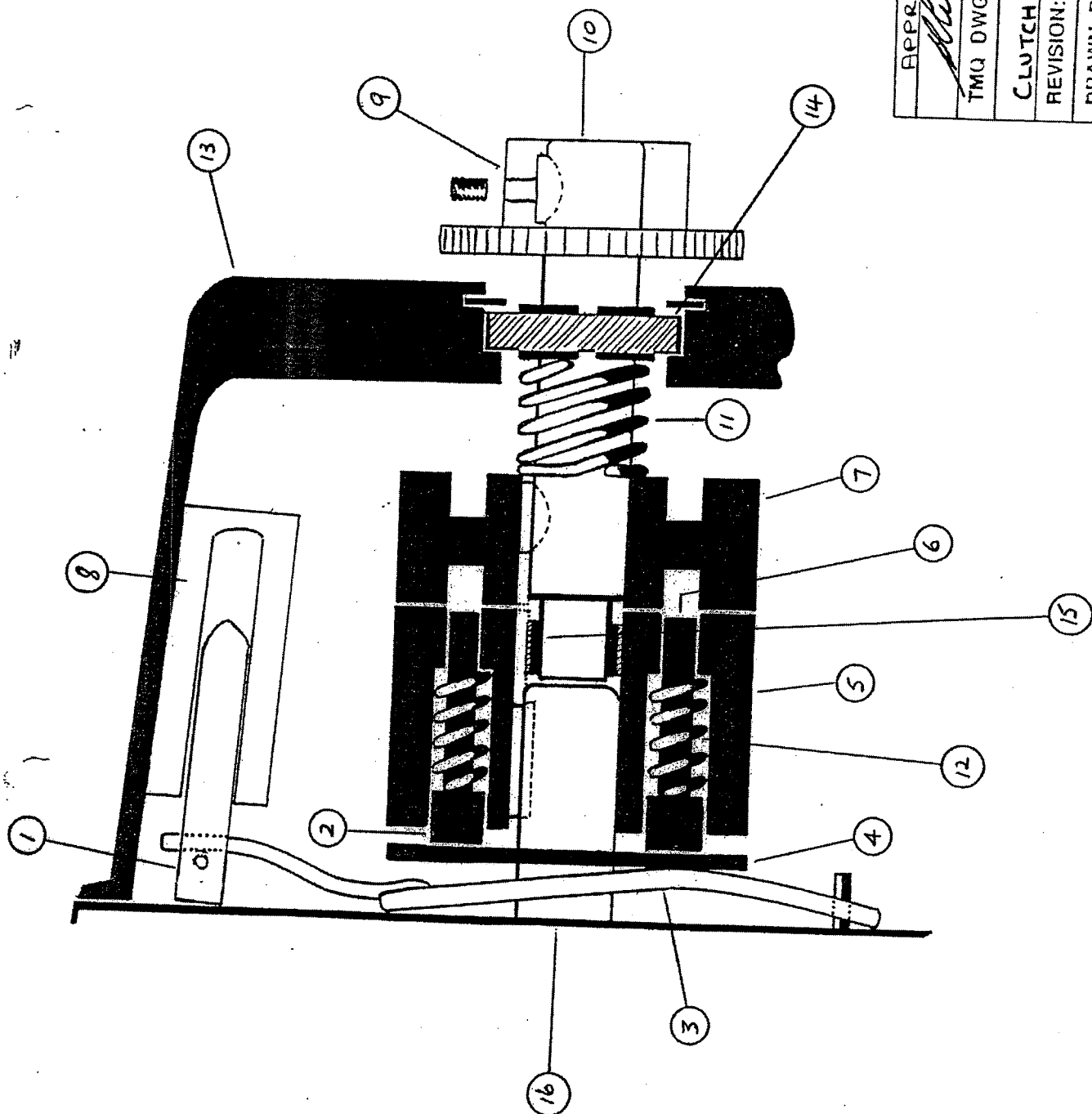
Adjustment of the clutch parts can only be done with the clutch casting removed from the motor body.

Motor section of clutch assembly:

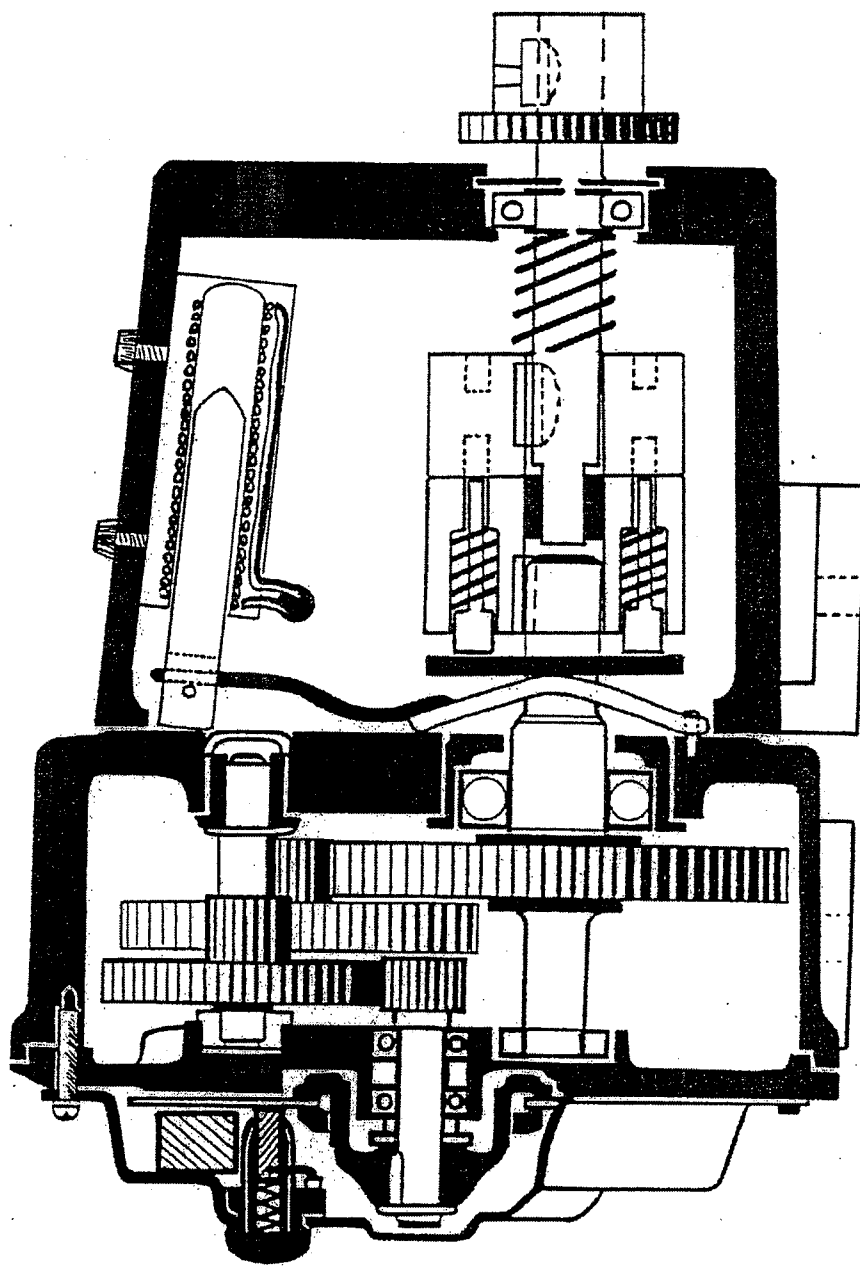
1. The lever plate, disk, pins, springs and barrel are assembled onto the motor shaft as shown in the drawing.
2. In the disengaged state the lever plate, disk and pin heads should all be in contact with each other **without** any tension exerted by the pin springs. The face of clutch pins [6] should be approximately 0.5 mm back from the face of the barrel end. The back of the solenoid plunger should also be just touching the motor body face (it may be necessary to slightly adjust the bend in the lever plate arm to achieve this).
3. The barrel is locked onto the motor shaft by two socket set (grub) screws. **"Loctite" or similar thread locking compound should be used when tightening the grub screws.**

Clutch housing section of clutch assembly:

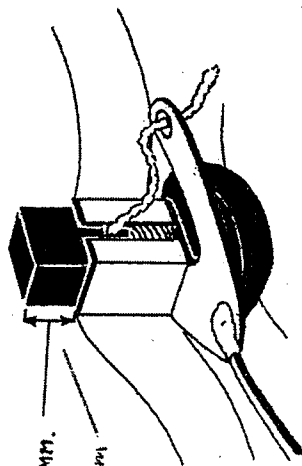
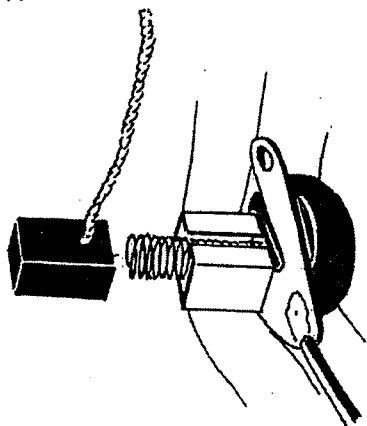
4. The slider should be free to move along the clutch shaft under the spring tension.
5. The clutch housing is mated to the motor body and held by two socket head cap screws. When assembling the housing to the motor ensure the clutch shaft engages the barrel support bearing and the plunger fits into the solenoid coil.
Note: The plunger must not be tight in the solenoid coil.
6. For correct operation the plunger should move into the solenoid coil about 1/2 inch (12 -13 mm) which causes the clutch pins to engage the slider by 1/8 inch (3 mm).
Note: The pin movement can be checked by moving the plunger 1/2 inch and noting the distance the pins extend beyond the barrel face when the clutch housing is removed from the motor body.



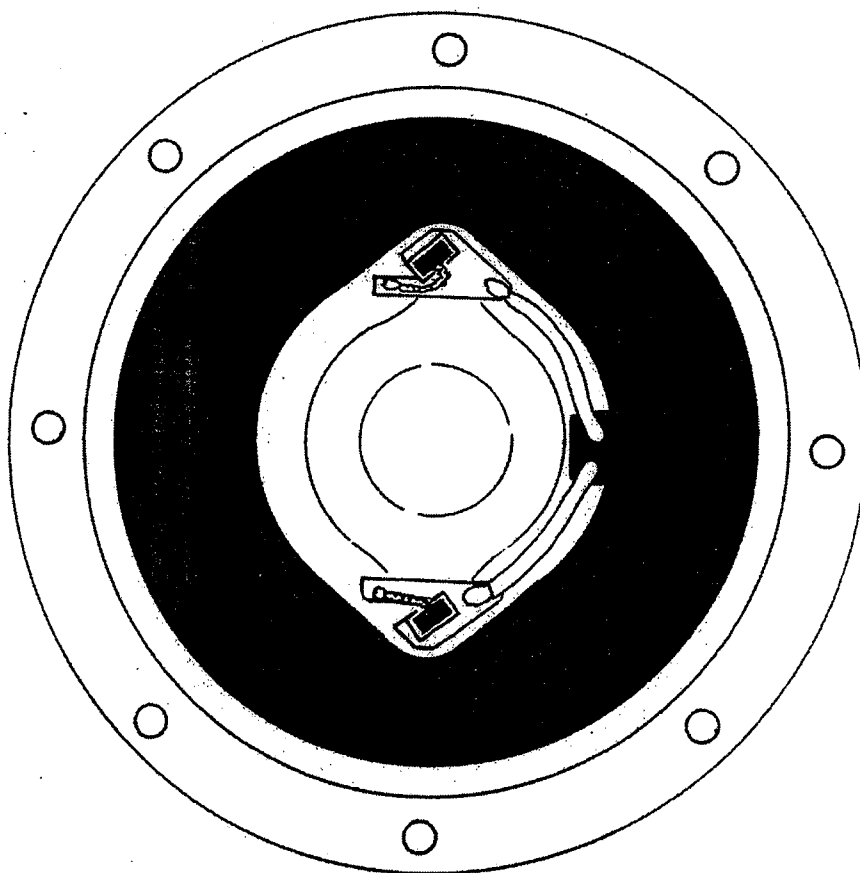
APPROVED	DATE
<i>[Signature]</i>	7-7-94
TMQ DWG. QA. NO.: OM1-15-10	
CLUTCH ASSEMBLY	
REVISION: 1	
DRAWN BY: <i>[Signature]</i>	DATE:
CHECKED BY: <i>[Signature]</i>	QC:



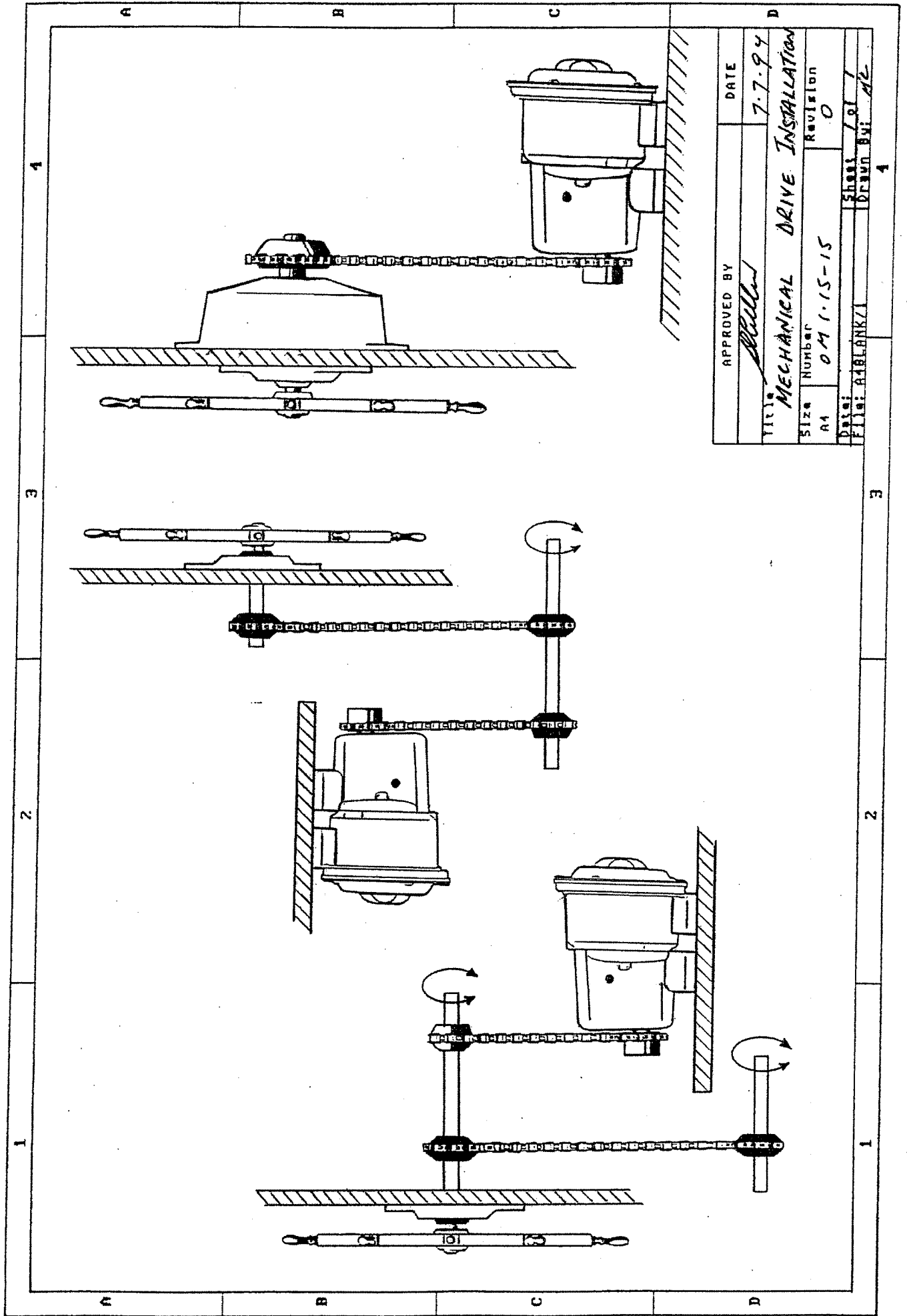
APPROVED BY		DATE	
<i>[Signature]</i>		7-7-94	
TITLE MECH. DRIVE - CROSS SECTION			
SIZE A4	NUMBER OM 1-15-11	REVISION 0	
DATE: 7-7-94		SHEET 1 of 18	
FILE: A4BLANK/1		DRAWN BY: M.L.	



NEW 11 mm.
WORN 7mm
minimum



APPROVED	DATE
<i>Handwritten signature</i>	25 5 93
TMQ DWG. QA. No.: OM 1-15-12	
PRINT MOTOR BRUSH ASS.	
REVISION: 1	
DRAWN BY: ML	
DATE: 25-5-93	
CHECKED BY: <i>Handwritten initials</i>	



APPROVED BY	DATE
<i>[Signature]</i>	7.7.94
TITLE: MECHANICAL DRIVE INSTALLATION	
SIZE	Revision
A4	0
Number 04115-15	
Date:	Sheet 1 of 1
File: A4BLANK1	Drawn By: A2-

