# Web-Tech Australia Pty Ltd

# Model WT1700 Weighfeeder

# Installation, Operation & Maintenance Manual

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# Web-Tech Australia Pty Ltd

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# INTRODUCTION

The Web-Tech 1700 series of weighfeeders consist of a range of medium to heavy duty belt weighfeeders capable of handling various products at throughput rates from 0.1 tph. to 40 tph.

The 1700 series can be ordered as an enclosed or open unit. Depending on the application, the belt will be either fitted with "Flexowall" belt edging or left flat. If the application requires flexowall, then the inlet chute will be split to facilitate the removal of the belt for service.

A wide variety of motor and gearbox assemblies can be applied to the 1700 series, shaft mounted right angle drive and helical inline chain driven being the most common. Those applications which require turn downs in excess of approximately 12:1 can be fitted with DC motors. Judicious use of motors, gearboxes and drive sprockets often allow the use of AC motors even where moderate turn downs may be required.

Inverters are not normally supplied by Web-Tech as our customers have a wide range of preferences. However, we can supply these devices if requested.

The weighing element is a single roll type, utilising a flexure arrangement and a shearbeam load cell. Normally, the load cell is rated for the expected maximum load +10 – 20% overload.

Speed sensing is provided by a digital encoder mounted on the non-driven pulley and sized to provide no more than 800 Hz to the electronic integrator when the belt is running at full speed.

Both the load cell and encoder are energised by the electronic integrator and field wiring terminates into junction boxes on the feeder stringers.

The electronic integrator has been designed to provide all the control signals required to run a weighfeeder. It requires 240VAC at 0.5A or 110 VAC at 1A to power it. Menu driven routines allow operators to enter variables, calibrate the feeder (zero and span) and control the P.I.D. loop output.

## Please read all sections of the manual before placing the weighfeeder into service.

# DELIVERY/UNPACKING

Your weighfeeder has been crated for protection during transit. The electronic integrator is normally packed separately. Upon delivery, please ensure that all components have arrived and have not been subject to any form of damage.

## The basic components are:

- Weighfeeder complete with Gearmotor, Loadcell(s) and Belt Speed Sensor (Tacho)
- Masterweigh Integrator
- Masterweigh Enclosure
- Calibration Bar(s) or chain

## Optional:

- Speed Controller (A.C. Inverter or D.C. Controller)
- Remote instruments
- Spare Parts
- Scraper Conveyor

## If in doubt about any aspect of the delivery, contact:

**Web-Tech Australia Pty Ltd**
**11 Electronics Street**
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**Australia**

**Ph: 61 7 3841 2844**
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## Unpacking:

1. If the crate shows signs of damage, report to carriers and Web-Tech. Remove the top and sides of the crate (if applicable).

2. Remove any small items of equipment also in the crate.

3. Lift the feeder clear of the crate using web slings or the lifting points provided. Care must be taken at this point to avoid damage to machine.

4. Carefully examine the feeder for signs of damage at this point. Look also for parts that may have worked loose during transit. Phone Web-Tech if in doubt.

5. Carefully locate weighfeeder into its operating position.

# INSTALLATION

1. After the weighfeeder has been placed into position, check the level of weighfeeder in all directions and pack under the mounting feet if necessary.

2. Do not "pull up" any gaps between mounting feet and support structure, as this may induce twisting into the weighfeeder frame. Always shim up any gaps. (Note: The feeder is a precision instrument and must not under any instances support any ancillary structures, inlet or discharge chutes).

3. Bolt up infeed and discharge connections. Use some form of sealant or rubber between flanges. Once again, make sure that no loads are transferred to any part of the feeder during this operation.

4. Protect conveyor belt if welding or oxy work is carried out in the area. Note if the loadcell is in place remove it before welding.

5. Remove covers from "ACCESS" side (if an enclosed model) of weightfeeder (opposite side to gearmotor).

6. Support the weight of the belt steering mechanism with one hand (Caution – the mechanism is heavy) and remove the steering mechanism transit pin. Gently lower the steering mechanism onto the belts. Keep the pin in a known location (eg. Inside the Masterweigh enclosure), as it is used during belt removal.

**7. Check the following:**

a. All idler rolls are located correctly and are vertically aligned.
b. All fasteners are tight.
c. No foreign material is on the belt or in inlet chute.

**Procedures for Checking of Vertical Alignment and Rectification:**

(Note: The following procedure will have been carried out at the factory prior to shipment. However, settlement can occur and often does occur during shipment which will cause vertical alignment errors.)

**Refer to Drawing 1700-04.**

(The feeder must be level before proceeding). Vertical alignment is critical if accurate and reproducible results are to be obtained. The following procedure must be used to check the vertical alignment.

1. Tie off two (using 30kg breaking strain fishing line) stringlines at the head and tail pulley either side of the belt, making sure that the lines traverse the weigh area. The head and tail pulleys will be lower than the carry rolls (the tail only about 1mm) as measured from the middle of the roll. The stringlines should be tied off very tight.

Note: If stringline is unavailable, use a 2-metre rule, edge onto the rolls for the above test.

2. Look along both lines for vertical height discrepancies (-0mm/+0.25mm) use the jacking screws provided to obtain the above tolerances.

3. Once the vertical alignment has been checked and verified, for all carry rolls, remove the line.

Note: The striker bar must be in contact with the loadcell prior to any alignment taking place.

**Now proceed to the wiring up of the system.**

# ELECTRONIC/ELECTRICAL INSTALLATION

## Wiring:

(Refer to Drawing Nos.WTMW1-01, LCJBOX-01and TACH-01)

It should be noted that there are many wiring permutations that can be adopted. They are determined by the configuration of your system. Make sure the above drawings cover your particular configuration prior to proceeding.

Web-Tech mentions types of cable that can be used between certain components on its feeder in its drawings. We only mention these cables as references only.

If an inverter is used and Web-Tech supplied the unit, the wiring diagram will be found in the accompanying manual.

Note: Full consideration must be given to the relevant state/country wiring codes when installing medium and high voltage wiring.

Wiring between the Tachometer and the local junction box and between the loadcell and the local J-Box will have been done at the factory.

Before wiring up the feeder to the integrator, wire in the 240/110v to the power supply PCB, making sure the voltage switch is set to the correct voltage.

Now wire up both the loadcell and tachometer to the integrator. If the distance the wire has to run between the feeder and the integrator is in excess of 50 metres - consult the factory.

**DO NOT RUN THIS WIRING ALONGSIDE ANY CABLES CARRYING HIGH OR MEDIUM VOLTAGES. IF IN DOUBT - CONSULT THE FACTORY**

Masterweigh controls the feeders flow rate by adjusting the belt speed. This is done via a 4/20mA current loop, which should now be wired to the inverter.

**DO NOT POWER UP AT THIS POINT.**

**CHECK YOUR WIRING AGAIN.**

**NOW POWER UP.**

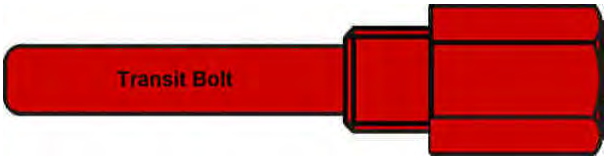
The weighfeeder is now ready for field commissioning.

The 1700 weigh feeder series is fitted with a dual/axis flexure style weigh frame. For servicing ease the load cell is fitted to the outside of a stringer.

To protect the loadcell during transportation a transit bolt has been fitted to the stringer. The pin screws into the stringer and engages with the weigh frame, thus, preventing load being applied to the loadcell. This bolt must be removed prior to running the feeder.

When removing the bolt make sure the frame does not drop onto the loadcell load wire.

The bolt and lock nut fitted to the stringer Acts as an overload stop and has been set at the factory.

# FIELD COMMISSIONING

## Field Commissioning:

Field Commissioning consists of the following steps:

1. Run the belt empty and check belt tracking.
2. Check tracking when belt is full.
3. Zero the feeder and calibrate against static calibration bars.
4. Check Calibratation against material test.

### 1. Belt Tracking (Empty):

The weighfeeder has been run in the factory for approximately 8 hours prior to shipping. However, the weighfeeder should be run without material for approximately 4 hours to prove that the tracking is correct.

Set Masterweigh 1 PID output to manual and ramp up the P.I.D., 4/20mA output to 100%. (Menu 13).
Comprehensive details relating to the operation of Masterweigh can be found in the "Operation" section of this manual.

Note: If the belt runs in the wrong direction, stop the belt and swap over any two phases at the motor. "Be Careful": isolate, tag out etc.

Observe the belt running at 100% output. If the belt steering mechanism is working to track the belt (this is evident by noting if either of the two vertical rolls of the belt steering mechanism are constantly in contact with the belt), then apply some tension to the belt via the telescopers. (See Drawing 1700-01 and 1700-03 for details).

Make small adjustments and allow time (at least 10 revolutions) before making any further adjustments.

**DO NOT OVERTENSION THE BELT.** The ideal tension is just sufficient to drive without slippage under load.

Tighten locknuts on take-ups when completed.

### 2. Checking of Tracking (with belt full of material).

It is essential that the belt tracking be checked when carrying material. It is normal that for some applications, the belt will track slightly different when empty to when carrying material.

If adjustment is required, adjust take-ups as per the previous "Belt Tracking (Empty)" instructions.

### 3. Zeroing the Feeder

The calibration of the weighfeeder has been carried out at the factory, however, it must be checked after installation.

A data sheet should have been supplied with the other documentation in this manual. This data sheet shows the value of the calibration weights, as well as the values that have been programmed into each of the Masterweigh menus.

Check all menus to see that the programmed information is as per the data sheets. If they agree, carry out zero and span calibration procedure as per the Masterweigh section in this manual. (Getting Started Zero and Getting Started Spanning/Calibration)

# FIELD COMMISSIONING (CONTD)

## 4. Material Test:

If possible, a material test should be carried out to confirm static calibration.

A material test involves weighing a known amount of material prior to or after passing over the weighfeeder, and comparing the results obtained from the weighfeeder.

The quantity of material required depends on the capacity. A "rule of thumb" value would be six (6) minutes running time at maximum capacity eg:

Capacity = 10 tph

$$\text{Therefore } \frac{10{,}000\text{kg}/60\text{ mins}}{6\text{ mins}} = 1000\text{kg}$$

If a correction factor is required to the calibration after the material test is carried out, the static calibration bar(s) should have the same factor applied to their result ie; if calibration bar(s) were originally calculated as representing 75% of capacity and material tests proved that weighfeeder was weighing 2% light, then the calibration bar(s) actually represented 77% of capacity.

The target values for the "Fixed Weight Calibrate" menu of Masterweigh must be altered accordingly. The easiest method to apply the correction to the calibration bars is to place them on the feeder immediately after performing an empirical calibration, then starting a fixed weight calibration. At the end of the calibration, observe the "Accumulated Mass total:" and write it down, then PRESS ABORT. Now enter the observed mass total as the new Target Weight.

Refer to Masterweigh manual for details regarding material calibration under "Empirical Calibration".

# MAINTENANCE

## Periodic Maintenance:

The maintenance schedule varies depending on the application and environment that the weighfeeder operates in.

The following is a guide only and may be varied to suit conditions.

## Daily Interval:

- Check Belt Tracking
- Clean any material spillage/build up from around weighfeeder.

## Monthly Interval:

- Check oil level in gearbox
- Check condition of belt and repair any damage
- Remove any build up from around pulleys and idler rolls
- Check height weights of and condition of skirts on inlet chute and side skirts.
- Check belt has sufficient tension
- Grease all bearings including those on scraper conveyor (if supplied)
- Lubricate drive chain if sprocket drive belt type.
- Lubricate chain on scraper conveyor (if supplied)
- Check tightness of all fasteners
- Re-calibrate weighfeeder

## Yearly Interval:

- Check wear on all mechanical items, particularly inlet chute and shear gate.
- Drain and replace oil in gearbox(s) – (refer to SEW manual) check loadcell tare output

## Belt Changing:

### Belt Removal

(Refer to 1700-01) Two or three man job!

The 1700 series of weighfeeders are of a cantilevered design. That is, supports on the opposite side to the motor can be removed, without the system collapsing or being damaged. (If the correct procedures are adhered to).

This feature allows for easy belt changing.

After familiarising yourself with the layout of the feeder and the relevant terminology, follow the following procedures:

1. Set Masterweigh into the manual mode via Menu 13.

2. Close off the material feed and run the belt until it is completely empty.

**NOW SWITCH OFF THE POWER AND TAG OUT**

3 If the feeder is an enclosed model, remove the doors from the access side, and remove the door support pillars. The support pillars are bolted at the top and bottom.

4. If your feeder is fitted with flexowall belt edging for material containment, then follow the following procedure: (If not, proceed to 4.)

Remove the lower portion of the split inlet chute, which is bolted to the upper section. The lower section should then be completely removed and stored.

5. Remove the carry side belt scraper.

6. Lift the belt steering mechanism and lock it into its transit position by passing the transit pin through the hole in the stringer .and into the hole in the steering mechanism arm.

7. Slacken the telescopers right back to the minimum extension point.

# MAINTENANCE

# MAINTENANCE (CONT'D)

### Belt Removal (Cont'd):

8. Remove the belt skirts and if a flat belt is installed, slide the inlet chute skirts up.

9. Locate and remove the support structure on the opposite side of the feeder to the motor. This is achieved by removing the sealing plugs and accessing the fixing bolts that are inside the R.H.S. the bolts should be removed using a socket and extension bar.

10. At this point the support legs can be removed by gently tapping out using a soft mallet. The feeder will drop slightly to one side when the legs are removed.

11. Pull off the belt now, making sure that the bottom of the belt does not foul on the belt steering mechanism.

## Belt Replacement:

**CHECK THE NEW BELT FOR BELT TRAVEL ARROWS AND CORRECTLY ORIENTATE**

1. Using at least three people, offer the belt up to the pulleys.

Hint: If talcum powder is applied to the inside of the belt, it will act as a lubricant and assist belt installation over the pulleys.

2. Simultaneously rotate and push the belt until it is centred over the pulleys. Make sure that the bottom of the belt does not foul the belt steering mechanism.

3. Replace the legs using the removal procedure in reverse. **IF THE LEG WILL NOT FIT IN, OWING TO SAG, USE A PORTABLE JACK TO GENTLY LIFT UNTIL THE LEGS JUST FIT INTO PLACE.**

4. Fit the remainder of the ancillaries in reverse order to the disassembly procedure.

5. Refer to drawing 1700-01
The correct belt tension is achieved by alternately tensioning each telescoper until the aligning mark on the belt tensioning drive is aligned with the apex of the diamond on the side rail.

6. Finally, the procedures for belt tracking that were discussed earlier in the manual in the Field Commissioning section should be observed.

## Gearbox Maintenance:

Refer to SEW maintenance manual

# OPTIONAL EQUIPMENT

## Speed Controller:

Web-Tech weighfeeders may be supplied with either an A.C. or D.C. speed controller. The speed controller is used to either manually control the belt speed and therefore material throughput, or can be used in an "Automatic" mode whereby the speed of the belt is automatically adjusted by the Masterweigh controller to maintain a setpoint of material throughput.

A separate manual is supplied for the speed controller. Please follow the manufacturers' instruction regarding installation/set up.

## Scraper Conveyor: (If Applicable)

Scraper conveyors are optionally supplied on Web-Tech weighfeeders. The function of the scraper conveyor is to remove any accumulated material from the floor of the weighfeeder. The scraper conveyor has been run at the factory and should be ready for operation.

## Electrical Connection:

The scraper conveyor is driven by a 3-phase A.C. motor from an appropriate supply. The direction of the scraper conveyor should have the scraper blades drag material to the discharge end.

The motor should not be connected in parallel to the conveyor drive motor if an inverter is used in conjunction with the drive motor.

## Mechanical Maintenance:

**Daily Interval:**

- Check tracking of scraper conveyor chains
- Check condition of scraper blades

**Monthly Interval:**

- Check out level in gearbox
- Check chain tension
- Grease all bearings
- Lubricate chain/sprockets (use Dry Lubricants

**Yearly Interval:**

- Drain & replace oil in gearbox (see SEW manual for type and quantity)
- Check all mechanical items for wear

## Chain Tension: - (If Applicable)

The scraper conveyor does not require much tension to operate correctly. Adjust take-ups so that scarper blades are horizontal, and apply approximately the same amount of force on the floor at both ends of the scraper blades.

## Chain Tracking: (If Applicable)

If the scraper chains are tracking to one side, and the sprocket teeth are continually in contact with the side links of the chains, track the chains by adjusting the take-ups in the same manner as tracking the conveyor belt.

# OPTIONAL EQUIPMENT (CONT'D)

## Remote Instruments:

### Chart Recorder/Rate Meter:

A Chart Recorder or Rate Meter may be supplied to record/indicate the rate of material passing over the weighfeeder. Either one of the instruments should be connected to the "Rate Output" channel (4-20mA) on Masterweigh. Multiple instruments can be connected Refer to the Masterweigh connection diagram/manual for connection details.

Refer to the manufacturers' instructions for installation procedure for Chart Recorder or Rate Meter.

Contact Web-Tech if spare pens/paper are required for the Chart Recorder.

Totaliser:-A Totaliser may be supplied to record the accumulated tonnage that has passed over the weighfeeder. The remote totaliser should be connected to the "Pulse Output" of the Masterweigh Integrator. Refer to the Masterweigh connection diagram/manual for connection details.

# GETTING STARTED

**NOTE: The following procedures <u>will normally</u> have been carried out at the factory. Only carry out the following procedures if major repairs have been carried out on the feeder or the electronics has lost memory.**

This section includes a minimum of basic information to get you started. Detailed procedures are to be found in "Masterweigh Operation".

The set up sequence is:

- Enter pulses/revolution
- Zero
- Span
- Fine tuning

Most Weighfeeders require to be zeroed and spanned. The time required to zero and span a system is determined by the belt-speed and length. It is recommended that a minimum time of the greater of 5 revolutions or about 5 minutes be used. Note, the longer the time and hence more belt revolutions, the better.

## Entering Pulses per Revolution:

To input this time into Masterweigh, mark the weighfeeder belt with chalk, or paint a particular point on the belt. If there is already a distinguishing mark on the belt use that. Select a static point that can be easily used as a reference point to start and stop counting belt revolutions. Set the Weighfeeder running.

Masterweigh should now be switched on. Press "Menu" key and then "./+" to advance to Menu Entry No. 2. If the instrument is new, it may show the following:

```
Menu Entry : 2
Pulses per rev = 1000   Revs = 5
```

This is a factory entry and will change to the application values when entered. To gain access to change these values to your application, press the "Enter" key. The display will now change to the following:

```
Manual Entry of Pulses/Rev
Press Enter to Continue
```

This entry is used when the number of pulses per revolution is known and is not applicable to a new installation. Press the "Enter" key to advance and the display will change to the following:

```
Manual Entry of No. of Revs
Press Enter to Continue
```

Once again, this entry is not normally used in a new installation. Press the "Enter" key to advance and the display will change to the following:

```
To start belt pulse count, Press E
Pulses counted =   0   Time =   0
```

You should now wait until the mark on the belt coincides with the selected reference point and as they coincide press the "Enter" key. The display will now change to the following:

```
To stop belt pulse count, Press E
Pulses counted = yyyy  Time = xxx
```

xxx = Time elapsed since pressing the "Enter" key.

# GETTING STARTED (CONT'D)

Now Masterweigh is counting the pulses coming from the tachometer and the elapsed time. When the minimum time or the minimum number of belt revolutions has occurred, then the "Enter" key is again pressed when the mark on the belt passes the reference point.

Note: Web-Tech advises using 5 belt revolutions, assuming that 5 belt revolutions take longer than 5 minutes, and that full belt revolutions only are used.

The display will now change to the following:

| |
|---|
| Enter number of belt revolutions? 9<br>Pulses counted = yyyy Time = xxxx |

Where yyyy = number of pulses counted.
xxxx = the elapsed time in seconds.

You should now enter the number of complete belt revolutions. When the correct number of revolutions have been entered, press the "Enter" key and Masterweigh will calculate the number of pulses per revolution and the display will change to the following:

| |
|---|
| Pulses per belt revolution =xxxx<br>Press E to Save, otherwise press A |

By pressing the "Enter/E" key the calculated data is stored in Masterweigh memory and will be used as a time base for zeroing and spanning/calibrating.

The display will now return to Menu 2 entry display showing the new data. If the A key was pressed no calculations would be done and the display would show previously stored data.

## Zeroing Masterweigh:

Advance to Menu No. 3 by pressing the + key. The display will now look like the following:

| |
|---|
| Menu Entry : 3<br>Zero cal = 0.010 mV 0.010 mV |

Press the "Enter" key to gain access to the menu. The display will now look like the following:

| |
|---|
| Manual entry of zero error, 0.000<br>or press Enter to continue |

At this point you could enter that value you found in Menu 8 earlier. If you don't remember, don't worry, as Masterweigh will calculate it later.

Note that the entry of data at this point only assists Masterweigh in finding an average zero and does NOT negate the requirement to run the zero test. Press enter again, the display will change to the following:

| |
|---|
| Press E to continue<br>Mass rate = a.aaa |

Where a.aaa shows the current mass rate zero error if the belt is running.

This data is raw, that is, not adjusted by the computer and will be changing frequently. This information is mostly used by technicians.

# GETTING STARTED (CONT'D)

Press the "Enter" key again and the display will change to the following:

| |
|---|
| (Zero reset) To start zero cal, Press E<br>Mass rate = 0.000 Revs = 0.0 |

Masterweigh is now ready to zero and will, as soon as the "Enter" key is pressed again. Masterweigh did not start executing its zeroing immediately because it gives time to make sure that the belt is empty (most important). After confirming that the belt is empty, press the "Enter" key to start the zeroing. The display will now change to the following:

| |
|---|
| To abort calibration, Press A<br>Mass rate = a.aaa Revs = x.x |

Where,
a.aaa = the zero error.
x.x = the number of revolutions completed.

Once Masterweigh has completed the test the display will change to the following:

| |
|---|
| To calculate new calibration, Press E<br>Mass total = z.zzz Revs = x.x |

Where,
z.zzz = the totalised value of the mass rate found during the routine.
x.x = the number of belt revolutions.

By pressing the "Enter" key at this point, Masterweigh will calculate a new zero. If something went wrong during the test, eg. material did accidentally get onto the belt, pressing the "Abort/A" key will cancel the test.

Following the pressing of the "Enter" key, Masterweigh will display the zero as a voltage output from the load-cell and once again give you the ability to cancel out the result.
Masterweigh will also cancel the tests if the results from that test fall outside preset limits. See the section "Load Zero Calibration" in Masterweigh Operation.

## Spanning/Calibration:

There are three ways of calibrating/spanning Masterweigh:

- By passing material over the belt, weighing that material and then entering that value into Masterweigh via Menu 5.
- Using a weigh chain.
- Using supplied calibration bars.

This part of the manual will deal only with method 2.

Refer to the calibration data sheet supplied with your system and the sample sheet at the rear of this manual.

The calibration chains supplied have been manufactured to weigh approximately 70% of the load that the weighframe will carry when the maximum flow rate (as detailed in the client's data sheet) is achieved.

With the belt stopped, attach the calibration chain support arm to the feeder, and hook all of the supplied calibration chains onto the support arm.

Now set the weighfeeder running and advance Masterweigh to Menu 4 and enter that Menu by pressing the "Enter" key.

# GETTING STARTED (CONT'D)

'The display will change to the following:

| |
|---|
| Manual entry of span factor, 0.000<br>or press Enter to continue |

Normally with a new installation data would not be available at this stage, as Masterweigh calculates this parameter, however this entry is useful if span adjusting is required at a later date.

Press the "Enter" key and the display will change to the following:

| |
|---|
| Current weight = 60.000 tonnes<br>Enter target weight? 0.000 tonnes |

After entering your target weight and pressing the "Enter" key, the display will change to the following:

| |
|---|
| Press E to continue<br>Mass rate = mmmm |

Where mmmm = the current mass rate prior to span adjustment.

On pressing E once again the display changes to the following:

| |
|---|
| To start span calibration, Press E<br>Mass rate = 0.000 Revs = 0.0 |

This display indicates that Masterweigh is ready to start and requires that the "Enter" key be pressed again.

On pressing the "Enter" key the display will change to the following:

| |
|---|
| To abort span calibration, Press A<br>Mass rate = m.mmm Revs = r.r |

Where,

m.mmm = the current mass rate prior to calibration

r.r = the belt revs that have elapsed.

When Masterweigh has timed out, the display will automatically change to the following:

| |
|---|
| To calculate new calibration, Press E<br>Mass total = tt.ttt Revs = r.r |

Where tt.ttt = Mass total

r.r = Number of revs.

On pressing the "Enter" key Masterweigh uses the target weight and the found mass total to calculate it's new span factor.

**NOTE: The above calibration data will not be stored in the Masterweigh working memory until the following key sequence has been carried out.**

**1. Press "Menu"**

**2. Press "E/Enter" key.**

**If "A/Abort" is pressed instead of "E/Enter" then the new calibration information is lost and Masterweigh uses previous data. The same loss occurs if power is lost during calibration.**

# GETTING STARTED (CONT'D)

## Fine Tuning

Now that the system is running it can be fine-tuned.

## a) Null Level

Most conveyor belts have sections that are much heavier or lighter than the average weight of the belt. To stop Masterweigh adding small amounts of weight to its total during those periods when the belt is running empty, Masterweigh has a menu entry that is called "Null". The joint in the belt is a major cause of small amounts of weight being added to the totaliser and the effects of the joint can be seen by entering Menu 6. The display will change to the following:

```
Enter a new null level?  0.000
Mass rate = 0.165 tonnes/hour
```

By running the belt empty (in this menu) the raw empty belt mass rate can be observed. As the joint or any other belt abnormality passes the weighing element, observe the highest mass rate value achieved over a few belt revolutions and enter a null value just higher than the mass rate noted.

## b) Autozero Tracking

Material sometimes builds up on the conveyor belt and the weigh area, even though belt scrapers are used, and Masterweigh's weigh area is narrow. Masterweigh can automatically compensate for these build-ups if Menu 7 is activated.

Advance Masterweigh to Menu 7. At the point of entry Masterweigh displays the following, if no entry has been previously entered:

```
Menu Entry : 7
Zero track if   < 20.0   for   4 revs
```

This display tells us that Masterweigh will automatically performs a zero calibration when the recorded mass rate is less than 20 tonnes per hour and stays below that value for the duration of five belt revolutions. Should material start to flow, Masterweigh immediately cancels the Autozeroing and works with previously set values.

As some conveyors experience surges of material, then run empty, as part of the plant's normal operating conditions, Masterweigh can, if instructed, delay any autozeroing process for a predetermined time.

You can program the Masterweigh so that it will initiate an automatic zero calibration if the mass rate has been below a threshold (The auto zero level) for a qualifying delay, then the Masterweigh will perform an automatic zero calibration over a number of belt revolutions.

To enter the Autozero menu, press the "Enter" key and the display will change to the following:

```
Auto zero level = 20.000 tonnes/hour
Enter new level ?        0.000
```

At this point a new mass rate threshold level can be entered.

On pressing the "Enter" key again, the display will change to the following:

```
Auto zero period = 5 revs
Enter new period?
```

It is best to set this to the same number of belt revolutions as when the zero and span were set. However, fewer whole revolutions can be used if preferred. (Note, by entering 0 into this entry, the Autozero mode is switched off).

If the "Enter" key is pressed once again, the display will change to the following:

| |
|---|
| Delay before auto zeroing = 60 secs<br>Enter new delay ? 0 |

Enter the new delay time the system should wait before initiating an auto-zero.

**Note: When the autozero is running, a lower case "z" appears on the display. When load is detected it will be switched off.**

Should an "E" appear where the "z" normally appears, it means that the signal from the load-cell has gone negative with respect to the normal load-cell output. The lower the autozero tracking level selected, the more sensitive Masterweigh is to detecting a relatively negative signal. the appearance of the "E" during normal operation signifies to the operator that the weighframe should be inspected for mechanical damage or positional change. The "E" can also appear if the conveyor belt is damaged, with pieces missing etc.

# OPERATION MANUAL

## Masterweigh 1 Integrator

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## Masterweigh 1 Operation

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**Drawings:-**

WTMW1-01
MW1-DIS
MW1 LINKS
MW1 TACHO
LCJB-01
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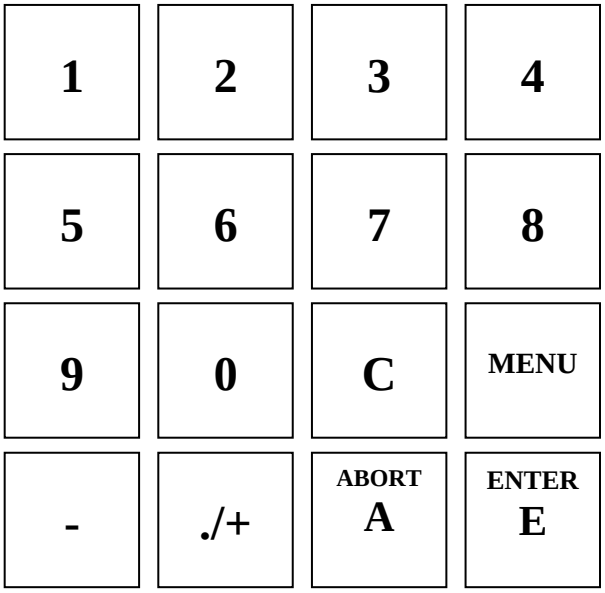
# KEYBOARD AND LAYOUT FUNCTIONS

## KEYBOARD LAYOUT




**Masterweigh 1 can operate in a protected security or open mode depending on the initial security configuration.** See "Security" for set up details. The following text assumes that the operator has gained access to the system.

### SECURITY CODES

If Masterweigh 1 has been ordered with the security pass system activated, entry to the menus will be restricted. (Two four-digit codes will have been supplied to nominated persons in your company).

One code (low level) allows the code holder limited access to any data in the menus, for inspection only. The other code (high level) is needed for access to menus and to make modifications to constants, start calibration sequences, etc. Note that no access is given if no code is entered.

If security codes have been activated, on pressing the Menu key, the computer waits for the four-digit code. If no attempt is made to enter a code then the display returns to MRMT format after 30 seconds. If an invalid code is detected, the display returns to MRMT format immediately. If a security code is detected then limited or complete access is gained to the menus, as appropriate. Once the menu format is exited the code will have to be re-entered for further access.

## KEY FUNCTIONS

### Menu

This key switches between the main display mode showing "Mass Rate/Mass Total" (MRMT) and the "Menu" mode.

### (-) and (./+)

When in "Menu" mode, pressing the (+) or (-) key once will go forward or backward one menu entry. If either key is held down, the menu changes will repeat at a rate of approx. 5 per second. When entering data, the (./+) key is the decimal point.

### A/Abort

When in the "Menu" mode and entering changes or new data, this key enables the user to abort the changes and restore the existing entries. The top-level menu screen is then displayed.

### C/Cancel

Similar to "Abort", except that the current screen data only is cancelled and the existing entries restored. The display remains at the current screen.

### E/Enter

In menu mode, the key accepts the default setting or confirms any data entered and moves to the next level in the operating sequence.

In MRMT display mode, if the “Enter” key is pressed, the current CPU (central processor unit) status is displayed and also the number of times the CPU has been restarted.

If the display is flashing, the CPU fault status may be viewed by pressing the enter key in the MRMT display mode.

# MENU ENTRY 1 – Parameter Setup

The setup menu is used for initial setup of the Masterweigh, for examination of these parameters whenever desired and during periodic recalibrations.

**1**

| |
|---|
| Menu entry: 1<br>Parameter setup |

**2**

| |
|---|
| Current Capacity = 1000.000tonnes/hour<br>Enter new capacity? 0.00 |

**3**

| |
|---|
| Mass total increment = 1.000 tonnes<br>Enter new inc. (1 - 0.001)? 0.000 |

**4**

| |
|---|
| WARNING: Calibration data<br>Do Not Modify - Press A to continue |

**5**

| |
|---|
| Calibration zero = 4.365 millivolts<br>Enter new zero ref.? 0.000 |

**6**

| |
|---|
| Precision ref. = 34.315 millivolts<br>Enter new precision ref.? 0.000 |

**7**

| |
|---|
| Current pulse width = 300m/s<br>1 = 100, 2 = 200, 3 = 300 |

**8**

| |
|---|
| Press E for LCD test, else press E<br>When display test is complete, Press E |

1. At Menu Entry 1, press Enter to examine or modify these parameters.

2. The current weigh capacity is displayed. A new value may be keyed-in. Then press Enter to continue. Otherwise press Enter with no data entry to retain existing values and continue. This value sets the 100% point for the 4-20mA mass rate output signal. Note that the system can measure mass rates above this value (assuming the instruments remain within their normal operating range), and higher values will be shown on the screen and totalised. However, the 4-20mA mass rate output signal will show 20mA for all mass rates above this value.

Note that units can be changed to tons, lbs or kg if preferred, within Menu Entry 18.

3. This entry displays and allows alteration to the mass total increment. This increment is used for both the mass rate and the mass total displays.

Enter the new value required and press the Enter key. No change is made if Enter is pressed without data entry.

Note that the increment set is the increment required to cause one pulse output from the electronic counter. Also, do not change the increment in normal operation, as the change in setting will invalidate any existing accumulated mass total.

4. A warning message now appears, since the user shouldn't usually change the following parameters.

5. During initial setup and periodic recalibration, zero reference and precision reference millivolt figures must be entered. The data is keyed in and Enter pressed to save the values. The values shown here should be the same as those engraved on to the main board. If no data is entered but the enter key is pressed then no data change is made.

6. See 5 above

# MENU ENTRY 1 – Parameter Setup

7. This step displays and allow alteration to the remote counter pulse width. This value is limited to the values shown. Pressing one of the numeric keys on the keypad that corresponds to the values shown, will set that value as the pulse width. One pulse is output each time the mass total increases by one increment (as set in step 3 above).

Enter a pulse width that will match the remote counter response time. Consider the following when selecting this value: The pulse output can go no faster than the value you just selected, but the accumulation of the mass total may, and so the remote totaliser will fall behind the actual mass total. E.g. if the pulse width is set to 100mS, then at it's fastest rate, the output will be on for 100ms, then off for 100ms. This will give a maximum output of 5 complete pulses per second (100mS on and 100mS off = 200mS per total pulse). Therefore, if the feeder is running faster than 5 increments per second (Max 18000 increments per hour), then the remote total will be wrong. Eg for an increment value of 0.01tonnes, the limit will be 180tph.

8. Press E to test the display or A to abort the test. This step tests the display by turning on each display segment, which will show up any faulty segments.

# MENU ENTRY 2 – Pulses per Belt Revolution Calibration

This calibration is carried out with the belt moving. The number of complete belt revolutions over a time period are counted by the operator, and the Masterweigh counts the pulses returned from the speed sensor device. The revolutions are then entered using the keypad and the pulses/rev calculated by the Masterweigh and then saved.

To enable the revolutions to be counted, a point on the belt should be marked with paint, and a suitable point on the framework chosen close to the belt. The count is then started as the belt mark passes this point and stopped as the mark again passes this point after the greater of 5 minutes or 5 belt revolutions.

1

| |
|---|
| Menu entry: 2<br>Pulse per rev = 1000 Revs =5 |

2

| |
|---|
| Manual entry of Pulses/Rev 0<br>or press Enter to continue |

3

| |
|---|
| Manual entry of No of Revs 0<br>or press enter to continue |

4

| |
|---|
| To start belt pulse count, Press E<br>Pulse counted = 0 Time = 0 |

5

| |
|---|
| To stop belt pulse count, Press E<br>Pulses counted = 0 Time = 0 |

6

| |
|---|
| Enter number of belt revolutions?<br>Pulses counted = 0 Time = 0 |

7

| |
|---|
| Pulses per belt revolution = 0<br>Press E to save, otherwise press A |

1. At Menu Entry 2, press Enter to proceed with calibration.

2. If the pulses per rev are known, then manually key in the number of pulses and press E. Otherwise simply press E to continue.

3. Manually key in the number of revs (for the above number of pulses) and press E.
Otherwise press E to continue.

4. At the moment the belt mark passes the fixed point chosen, press E to start the Masterweigh counting pulses, and start counting revolutions. Note that the display panel will show the counting.

5. After at least 5 minutes, press E again to stop the count as the mark passes the fixed point.

6. Key in the number of revolutions counted, and press E to confirm.

7. Press E to save the number of pulses/rev just calibrated, otherwise press A to abort and return to the original values (if any).

# MENU ENTRY 3 – Load Zero Calibration

This menu entry enables the operating zero to be calibrated. A specified number of belt revolutions are run (as determined by Menu 2), with no material or calibration weights on the belt. If the zero is correct then the mass total accumulated over the period will be zero. The display shows the currently stored value in millivolts, as read at the load-cell input including any contribution made by the autozero function.
Note that the zero value is automatically adjusted if the excitation voltage changes.

1

```
Menu entry:  3
Zero cal. = 2.563mV        2.563mV  ZTrck
```

2

```
Manual entry of Zero Error,          0.000mV
or press Enter to continue
```

3

```
Press E to continue
Mass rate =  0.000
```

4

```
(Zero reset)  To Start zero cal, Press E
Mass rate  =  0.000      Revs =     0.0
```

5

```
To Abort zero calibration, Press A
Mass rate  =  0.000   Revs  =    0.0
```

6

```
To calculate new calibration, Press E
Mass total =       1.150    Revs =       10
```

7

```
Zero error =     2.756 millivolts
Press E to save, otherwise press A
```

1. At Menu Entry 3, press Enter to proceed.

2. (Optional) Using a digital voltmeter, measure the belt zero error value (in millivolts) at the loadcell, or read the mV level displayed in menu 8.

Manually key in the value to the Masterweigh and press the Enter key to accept. Otherwise, press Enter with no data entered to continue with no change.

Note that entering this value does not negate the need to perform a zero calibration.

3. The live zero error is now displayed as a mass rate. Press Enter for the loadcell calibration procedure.

4. The mass total will now display zero. Check that the belt is empty, and then press the Enter key to begin the zero calibration test.

5. The difference between the current loadcell zero and the actual load reading is accumulated over the test duration, which is the total number of belt revolutions specified in menu 2.

The test can be aborted at any time by pressing the Abort key. If the test is aborted, the "working copy" of the load zero is reinitialised from the stored load zero calibration value. This "working copy" normally includes contributions from both the load zero calibration (as carried out in this menu entry) and the auto zero tracking function. It is thus possible by entering the menu to this level and then aborting to reinitialise the working copy of the load zero and remove any auto zero tracking contribution.

# MENU ENTRY 3 – Load Zero Calibration (Cont'd)

6. This display will come up automatically when the belt has completed the required number of revolutions. The measuring phase of the test has finished and the resulting mass total is displayed. This mass total should be approximately zero, however if non-zero then a new loadcell zero may be required.

Press the Enter key to display the millivolt offset resulting from this test.

7. The new loadcell zero, or offset, is displayed in millivolts. Press the Enter key to save this value as the new loadcell zero, or press Abort to exit without saving.

# MENU ENTRY 4 – Fixed Weight Calibration

This menu entry allows the automatic calibration of the load-cell span. The test is run over a preset number of belt revolutions, as set in Menu 2, during which calibration weights (or weigh chains) are placed on the belt or weighframe. A mass total is accumulated in the course of the test. This total is then compared with an expected or "target" weight and the span adjusted accordingly. A load zero calibration should generally be performed (Menu 3) before running this procedure. The display shows the currently stored loadcell span value.

1

```
Menu entry :  4
Fixed weight calibrate, span =    222.1
```

2

```
Manual entry of Span Factor,     0.000
or press Enter to continue
```

3

```
Current Target Weight  = 120.8 tonnes
Enter new value?     0.000 tonnes
```

4

```
Press E to continue
Mass rate  =     0.000
```

5

```
To Start span calibration, Press E
Mass rate  =   0.000   Revs =    0.0
```

6

```
To Abort span calibration, Press A
Mass rate = 1543.00  Revs=2
```

7

```
To calculate new calibration, Press E
Mass total = 120.000   Revs = 10
```

8

```
New span factor =  223.580
 Press E to save, otherwise press A
```

9 (Seen only if span invalid)

```
Span of 345678.123 is invalid
Press A to continue
```

1. Press Enter when at Menu Entry 4 to proceed.

2. At this stage the belt span factor can be set manually by entering the desired span factor and pressing the Enter key. If no value has been entered, then no change is made to the stored value and the next level is entered.

3. The target weight is the mass total that is expected over the number of belt revolutions as currently set (Menu 2) when the calibration weights are in place and hence are simulating a load on the weigh frame. This target weight may at this point be changed to suit the calibration weights being used. Note that this value will generally be determined by running this procedure and recording the result, immediately after performing an empirical calibration. (Menu 5).

If a new value is entered then pressing the Enter key will save this as the new target weight. If the Enter key is pressed without entering a target weight, then no change to the stored value occurs.

4. The current mass rate is shown, the number of belt revolutions is zeroed. Press the Enter key to start the test.

5. Once started the test will run until the currently specified number of belt revolutions has been counted. (Refer Menu 2).

6. During this step the weight is totalised over the specified number of belt revolutions, after which time the totalisation is automatically stopped. If the Enter key is pressed during the test, then the totalisation will be terminated, with a mass total of zero. The test can be aborted at any time by pressing the Abort key.

# MENU ENTRY 4 – Fixed Weight Calibration (Cont'd)

7. The resulting mass total is displayed along with the number of belt revolutions counted. Press the Enter key to calculate the new span calibration factor.

8. The new derived load-cell span is displayed. Press the Enter key to save this value as the new loadcell span. Press the Abort key if this value is not to be stored, and the previous span value will be used for the span.

9. Should the span value calculated be outside the range 0.1 to 3000 then the Masterweigh will display a warning message. Under these circumstances the new span will not be saved, and the unit will revert to the value previously stored.

# MENU ENTRY 5 – Empirical Span Calibration

This menu entry enables the entry of manual belt totalisations and the resultant re-calculation of the loadcell span. To use this calibration facility, it is necessary to weigh a quantity of material with the belt scale and then to accurately determine the actual mass of that material by independent means (ie. via a weighbridge). The two totals are then entered and the Masterweigh computes the new span factor.

1

```
Menu entry :  5
Empirical calibration, span =    211.7
```

2

```
Enter weighbridge total?   0.000
```

3

```
Enter belt scale total?   0.000
```

4

```
New span = 205.6, Previous=211.7
Press E to save, otherwise press A
```

1. At Menu Entry 5, press Enter to proceed.

2. Enter the exact mass total, as measured by the weighbridge or other accurate method. Press Enter when the data is correct.

3. Enter the mass total as measured by this Masterweigh unit. Press Enter.

4. Press Enter to store the new span value as the loadcell span calibration factor. Press Abort if no update is required.

# MENU ENTRY 6 - Null Level

This entry displays the level below which the load is considered to be zero, and the mass rate display will show zero, no increment of the mass total will occur, no pulses will be output to the e.m. pulse counter and the mass rate analog output will be set to 4.0mA.

1

```
Menu entry :  6
Null level =  20.000 tonnes/hour
```

2

```
Max mass rate = 20.237
Press clear to reset max
```

3

```
Enter a new null level?   22
Mass rate =    20.657 tonnes/hour
```

1. At Menu Entry 6, press Enter to proceed.

2. This feature traps and displays the maximum mass rate and can be used to determine the null level. (See note below)

3. Key in the new null level of zero. Press Enter when the data is correct.

**Note:** The null level is used to mask variations in mass rate caused by variations in the belt weight, due to the belt splice etc. To select the null level, observe the mass rate shown over several belt revolutions with the belt running completely empty (i.e no product or calibration weights). Take note of the highest mass rate reached, and then enter a value slightly higher than this level. E.g. if the max mass rate was 20 select 22 as the null level. On a correctly installed and aligned weigher, this figure should be approximately 1% of capacity.

# MENU ENTRY 7 – Auto Zero Tracking

This entry specifies the level below which automatic zero tracking occurs and the number of belt revolutions required before a new zero level is established in the Masterweigh.

The auto zero mode will not be entered, or continue unless the mass rate remains below the specified level. The value is normally set at approximately 1.5% of capacity. A qualifying time delay period is also provided to ensure that the belt is completely free of material.

Should it be necessary to clear the present auto zero value, then this can be done by entering Menu 3 (load zero calibration), then aborting after starting the test. A "z" will be displayed at the right hand side, bottom line, of the main mass rate/mass total display, when the auto zero conditions are met and the Masterweigh is collecting data for a possible new zero level. Note: The auto zero tracking procedure is inhibited under the following conditions: -

- Masterweigh not in the mass rate / mass total display mode

or

- Input tacho frequency less than 5.0Hz.

1

```
Menu entry :  7
Zero track if < 20.0 for    5 revs
```

2

```
Auto zero level =   20.000 tonnes/hour
 Enter new level?   0.000
```

3

```
Auto zeroing period =    5 revs
Enter new period?    0
```

4

```
Delay before auto zeroing =   60 secs
 Enter new delay?     0
```

1. At Menu Entry 7, press Enter to proceed.

2. Enter the new autozero level in mass rate units and press the Enter key. If the Enter key is pressed with no data entry then the stored value remains unchanged.

3. Enter the period required (in belt revolutions) over which autozeroing occurs. Note that the number of belt revolutions should be chosen such that the total zeroing period is of the order of 15 minutes or more. This will ensure that accurate zero levels are produced.

**Note** that the actual zero level used by the Masterweigh will not be updated until a zeroing period has been completed. If a new value is entered and the Enter key is pressed then that value is saved, otherwise no update occurs.

4. This entry enables the qualifying delay time to be set. Choose a time that will ensure that all material is off the belt. The delay time commences when the mass rate falls below the minimum level set above.

# MENU ENTRY 8 – Loadcell Input

This entry displays the loadcell input in millivolts. The displayed value is unaffected by the load zero, load calibration, and zero tracking functions. In addition to the loadcell value, the entry displays the excitation voltage as currently sensed by the Masterweigh. It is displayed to the nearest volt only, i.e. 10V implies a voltage in the range 9.501 to 10.5V. The excitation value is updated once every 3 minutes. This display is provided to enable a user to confirm that the Masterweigh is correctly sensing the excitation voltage and thus that all links etc. are correctly installed. Incorrect excitation sensing will result in inaccurate and unstable mass rate measurements.

1

| |
|---|
| Menu entry : 8<br>Load cell = 16.235mV, (Exitn. = 10V) |

1. This menu is for display only.

# MENU ENTRY 9 - Tacho Frequency

This entry displays the current tacho frequency in hertz, (the input range is 5Hz to 1000Hz) and switches between software or hardware inputs.

1

| |
|---|
| Menu entry : 9<br>Tacho Frequency=50.005 Hertz |

2

| |
|---|
| Tacho source = Hardware<br>Press Clear to change, Enter to accept |

3

| |
|---|
| Tacho source = Simulated<br>Press Clear to change, Enter to accept |

1. Press "E" to enter the menu to select the source of the tachometer signal.

2. Press "C" to change (or toggle) between the available pulse sources which are :

- Hardware – input signal to the system as generated by the speed sensor ( magnetic pick-up or optical tachometer )
- Simulated – an internally generated 100Hz signal that is always on.

3. Press "E" to accept and return to the Menu Entry 9.

# MENU ENTRY 10 – High Alarm Setpoint

This entry displays the level that must be exceeded by the mass rate, for the period specified, before a high alarm is generated. When the alarm is generated, the high alarm relay is energised. The alarm indication is cleared, the relay is de-energised, and the delay period reset as soon as the mass rate returns below the high alarm set point.

1

```
Menu entry :  10
High alarm = 800.000 Delay =   60 secs
```

2

```
High alarm level = 800.000 tonnes/hour
Enter new level?    0.000
```

3

```
 Alarm delay =    60 secs
 Enter new delay?     0
```

1. Press the Enter key at Menu Entry 10 to change the settings.

If no change is keyed in and the Enter key is pressed, the values are unchanged. If an alarm level of zero is entered, then the high alarm is disabled.

2. Enter the period required, in seconds, for the mass rate to exceed the high alarm level, before high alarm is generated.

Then press the Enter key. If no data is entered and the Enter key is pressed, then no change occurs to the stored delay.

# MENU ENTRY 11 – Low Alarm Setpoint

This entry specifies the level below which, and the delay that must be exceeded before a low alarm output is generated. When the alarm is generated, the low alarm relay is energised. The alarm indication is cleared, the relay is de-energised, and the delay period reset as soon as the mass rate returns above the low alarm set point.

1

```
Menu entry :  11
Low alarm = 100.000 Delay =   60 secs
```

2

```
Low alarm level =  100.000 tonnes/hour
Enter new level?    0.000
```

3

```
Alarm delay =    60 secs
Enter new delay?     0
```

1. Press the Enter key at Menu Entry 11 to change the settings.

2. If no change is keyed in and the Enter key is pressed, the values are unchanged. If an alarm level of zero is entered, then the alarm function is disabled.

3. Enter the delay (in seconds) required before a low alarm is generated, then press the Enter key. If no data is entered and the Enter key is pressed, then no change occurs to the stored data.

# MENU ENTRY 12 – Print Parameters List

The data to be printed is output via the RS232 serial data port, which is provided on the Masterweigh. The communication parameters are as follows:

| | |
|---|---|
| Baud Rate 19.2kB | Stop Bits 1 |
| Data Bits 8 | No Parity Check |

1

| |
|---|
| Menu entry : 12<br>Press E, to print parameter list |

1. Press the Enter key at Menu Entry 11 to print the current stored values of the various weigh parameters.

Note that some versions of software have had this feature disabled. The menu will still be present, but pressing the Enter key will do nothing.

# MENU ENTRY 13 - Auto/Manual Control of MW PID Output

The current operating mode of the PID output, "Auto" or ""Manual", is displayed at the bottom right corner of the display. Additionally, when the PID output is in manual mode an upper case "M" is displayed in the bottom right corner of the main "mass rate/mass total" menu.

1

| |
|---|
| Menu entry: 13<br>PID O/P Auto/Manual Mode = Auto |

2

| |
|---|
| Rate = 286.472 S.P. = 300.0 O/P = 53%<br>+/- controls O/P, Press Enter when done |

3

| |
|---|
| PID O/P Mode = Auto<br>Press Clear to change, Enter to accept |

1. Press Enter key at Menu Entry 13. The current measured values of mass rate, PID setpoint and the manual mode PID output settings are displayed

.

2. When operating in automatic mode, the PID output performs as previously, the output being based on the current mass rate, PID setpoint and PID constants. When operating in manual mode, the PID output is forced to the value displayed (for the manual mode PID output) as a percentage of 4-20mA. The value of the manual mode PID output can be increased or decreased by using the '+' or '-' keys. The keys increment/decrement the output in 0.5% steps, to take advantage of the maximum analog output resolution of the Masterweigh. The +/- keys are auto repeating if pressed for more than one second, to allow fast setting of the desired manual mode PID output value. Note that when manually entering PID values, the values can roll over. Eg. if the current value is 100% and the + key is pressed, the output will become 0%. If the current value is 0% and the - key is pressed, the output will become 100%. The PID value can also be set by 2-digit key entry ie a PID value of 56% can be entered by pressing the 5 and then the 6 digit keys. The range of the manual mode PID output is automatically limited to values between 0 and 100% (4-20mA). Press the Enter key to move to the next level.

3. Pressing the Clear key toggles the current PID output mode and the display will indicate any mode changes. Pressing the Enter key will accept the PID output mode currently displayed and return to Menu Entry 13.

# MENU ENTRY 14 – PID Parameters

The Masterweigh includes a proportional/ Integral/Differential (PID) control loop for use in controlling mass flow rate. The PID variable for the controller is the current mass flow rate as displayed by the Masterweigh. The output from the controller is via a 4-20mA analog output (channel 2). The controller output is updated once per second, and would normally be used to control belt speed.

1

```
Menu entry :  14
PID parameters        PID action: forward
```

2

```
Local setpoint =  800.000 tonnes/hour
Enter new value?    0.000
```

3

```
Proportional term =    0.700
Enter new value?     0.000
```

4

```
Integral term =   0.050
Enter new value?  0.000
```

5

```
Integral lower limit =  -0.500
Enter new value?  0.000
```

6

```
Integral upper limit =    0.800
Enter new value?  0.000
```

7

```
Differential term =   0.000
Enter new value?   0.000
```

8

```
Output offset term =   0.000
 Enter new value?    0.000
```

1. Press Enter at Menu Entry 14.

2. Enter a new set point in mass units if required. This value will only be used in the control algorithm if the setpoint mode is set to “Local” in Menu 15. Pressing Enter without typing new data will move the display to the next entry without altering the stored data.

3. Enter a new proportional gain term if required, or press Enter only to leave data unchanged.

**NOTE:** The proportional term is "normalised" by the Masterweigh such that a gain of 1, an error of 100% full load capacity (as currently set in Menu 1), will cause a full scale (100%) out current.

4. Type in a new integral term, or Enter only to leave data unchanged.

**NOTE:** The integral term is "normalised" by the Masterweigh such that with an integral term of 0.01 and an error equal to the current capacity (as set in Menu 1), 1% will be added to the current output level each 0.5 second. (Or say 10% for an integral term of 0.1)

5. This entry allows the operator to prevent Masterweigh decrementing the integral term below a set value, thus preventing "wind-up".

6. This entry allows the operator to prevent Masterweigh incrementing the integral term above a set value, thus preventing `wind-up`.

7. Enter a new differential term, or press Enter to retain existing data. The differential (or derivative) term is normalised such that with a differential term of 1, a change in error equal to the current capacity in 1 second, will cause an instantaneous output of 100%.

8. Enter a new output offset term if required, or press Enter only to leave the current output unchanged.

**Note:** The output offset term is "normalised" by the Masterweigh such that, with an output offset term of 0.1, the normal PID controller output will have added to it a value equal to 10% of full-scale.

# MENU ENTRY 14 – PID Parameters (Cont'd)

9

| |
|---|
| Feed forward term = 1.000<br>Enter new value? 0.000 |

10

| |
|---|
| PID action: Forward Enter new value?<br>Forward = 1 Reverse = 2 0 |

11

| |
|---|
| Volumetric restart period = 5 sec<br>Enter new value? (Max 20) 0 Sec |

12

| |
|---|
| Volumetric restart threshold = 5,0 %<br>Enter new value? (Max 50) 0.0% |

13

| |
|---|
| To zero accumulated Integral press E<br>Else press A |

9. The feed-forward control component operates by multiplying the set point value by the entered feed-forward term and adding the result onto the PID control algorithm calculated output value.

Feed-forward control has a beneficial effect on controller response time and stability when the process being controlled has a long time delay. The feed-forward term can be set to zero for control applications where it is not required. Enter the new value for the feed-forward term. If no value for the feed-forward term is entered, then no change is made to the currently stored value.

10. This changes the PID action between forward and reverse, which will invert the PID output action from 4-20mA to 20-4mA

11. Enter the new Volumetric restart period, (maximum period allowed is 5 sec) and then press the Enter key. If the Enter key is pressed with no data entry then the stored value remains unchanged.

12. Enter the new Volumetric restart threshold, (maximum value allowed is 50%) and then press the Enter key. If the Enter key is pressed with no data entry then the stored value remains unchanged.

13. It may be desirable to zero an accumulated integral in the PID controller; for example, after the Masterweigh is left operating when the belt has been stationary for some time. At this stage pressing the Enter key will zero the accumulated integral. If abort is pressed instead, then the current accumulated integral will remain unchanged.

The **volumetric restart** feature works in the following way. When the belt stops (detected by the tacho input being less than 5Hz), the MW1 stores the PID output value 1 second before the belt stopped. When the belt is restarted, and the stored value is above the "Volumetric Restart Threshold", then the PID output is held at the stored value for the "Volumetric Restart Period". If the setpoint was changed while the belt was stopped, the PID output value will be set to a value of the stored value multiplied by the ratio of the current setpoint over the setpoint when the belt stopped. There is a divide-by-zero test in case the setpoint was set to 0 when the belt was stopped; in which case the output is not scaled.

The Volumetric Restart Threshold is used to prevent the system from oscillating, where if the PID goes low enough to stop the belt, and the belt is then restarted the output will be held at the previous value, which will stop the belt, etc, etc, etc. If the PID value recorded when the belt stopped is below the Volumetric Restart Threshold, a normal restart will occur, i.e. no Volumetric Restart action.

# MENU ENTRY 15 & 16 – Remote Setpoint

The Masterweigh can accept a feed rate setpoint from the keypad or by reading a current flowing in an external 4-20mA current loop. (Note: The setpoint can also be set from the RS232 communications port. This is easily achieved with the multi-drop Masterweigh network adaptors, which are an optional supply. Please contact Web-Tech if you require more information on the Masterweigh Network. )

If the remote signal input is enabled, the input signal is converted to a mass rate where 4mA represents 0 units and 20mA represents full scale belt capacity.

The remote setpoint is displayed in Menu 16 in units of mass.

1

| |
|---|
| Menu Entry : 15<br>Remote Setpoint Mode = On |

2

| |
|---|
| Remote Setpoint = On<br>Press Clear to change, Enter to accept |

3

| |
|---|
| WARNING: Calibration Data<br>Do Not Modify – Press A to continue |

4

| |
|---|
| Remote Setpoint 4mA<br>Press Clear to calculate new calibration |

5

| |
|---|
| Remote Setpoint 20mA<br>Press Clear to calculate new calibration |

At Menu Entry 15, press Enter to proceed.

1. The remote setpoint will be displayed as "On" or "Off" depending on whether remote setpoint operation has been enabled or not.

2. Pressing "C" (Clear) will toggle the remote setpoint operation either "On" or "Off".

3. The display drops through on pressing "E" to the above warning message. If you do not wish to calibrate the current loop input, press "A". To calibrate the input, press “E”, and perform the following steps to calibrate the remote setpoint.

4. Press "C" while injecting a 4mA signal from an external device.

5. Press "C" while injecting a 20mA signal from an external source as above.

The display will now revert back to Main Menu 15 heading displaying:

| |
|---|
| Menu Entry 15<br>Remote Setpoint Mode = ON |

This menu displays the current setpoint value, and the setpoint mode, as below:

| |
|---|
| Menu Entry: 16<br>Setpoint = 1001.334 tonnes/hr. Remote |

If the setpoint is set to a value below the null level as set in menu 6 the PID 4-20mA output is set to 4 mA. The display will show Nulled as shown below.

This feature prevents the Masterweigh from starting the belt when the remote setpoint is used to stop the belt and noise on the 4-20mA signal may be interpreted as a signal.

| | |
|---|---|
| Menu Entry : 16 | Nulled |
| Setpoint = 0.074 tonnes/hr | Remote |

# MENU ENTRY 17 – Modification of Filter Constants

Filtering can be applied to the following functions:

- Displayed mass rate
- 4-20mA mass rate output
- cascade controller output to PID controller ( ie. remote setpoint )
- mass rate output to PID controller
- PID controller output.

The level of filtering is specified by a constant, which may be in the range 1 second to 120 seconds. Time constants greater than 120 seconds have the same effect as a 120 second constant. A time constant of 1 second is equivalent to no filtering. Time constants greater than 1 second introduce a delay in the rate of change of the filtered function.

1

| |
|---|
| Menu entry : 17<br>To modify Filter factors press Enter |

2

| |
|---|
| Display Time constant is 1 secs<br>Enter new Time constant 0 |

3

| |
|---|
| Rate O/P Time constant is 1 secs<br>Enter new Time constant 0 |

4

| |
|---|
| Cascade Time constant is 1 secs<br>Enter new Time constant 0 |

5

| |
|---|
| PID I/P Time constant is 1 secs<br>Enter new Time constant 0 |

6

| |
|---|
| PID O/P Time constant is 1 secs<br>Enter new Time constant 0 |

1. Press Enter to modify the display filter time constant.

2. The display mass rate filter time constant is shown. When a time constant of greater than 1 is selected, the main mass rate display is damped. A new value for the display filter constant may be entered.

3. The 4-20mA mass rate output filter time constant is now displayed. A new value for the mass rate output filter constant may be entered.

4. The time constant for cascade control to PID input filter is displayed. A time constant of greater than 1 will cause the cascade input signal to be damped before being applied to the PID control algorithm. A new value for the Cascade filter constant may be entered.

5. The PID controller input filter time constant is displayed. A time constant of greater than 1 will cause the mass rate signal, which is fed back to the PID input, to be damped before it is applied to the PID control algorithm.
A new value for the PID input filter constant may be entered.

6. The PID controller output filter time constant is displayed. A time constant of greater than 1 will cause the PID control algorithm output signal to be damped before it is output via the 4-20mA output. A new value for the PID output filter constants may be entered. Operation now returns to Menu Entry 17.

**Note: At each step, pressing the Enter key will save the new value. If a new value has not been entered, then the current value is unchanged.**

# MENU ENTRY 18 – Modification of Displayed Units

The displayed units for mass rate may be selected from one of the options shown below. The displayed units for mass total will be the same as those selected for mass rate. The belt speed displayed in menu 19 will be shown in meters/sec or feet/min depending on the units selected for MRMT.

1

| |
|---|
| Menu entry : 18<br>To modify displayed Units, Press E |

2

| | | |
|---|---|---|
| 1 = tonne/hr | 2 = kg/hr | 3 = kg/min |
| 4 = ton/hr | 5 = lb/hr | 6 = lb/min |

1. Pressing the Enter key will advance the display to the select mass units.

2. To select the required mass rate unit's press the appropriate number key associated with it, then press the Enter key.

Numbers greater than 6 will not change the currently displayed mass total and mass rate units.

Pressing the Enter key without entering a new unit number will not change the currently displayed units.

# MENU ENTRY 19 - Belt Speed Indication

This entry displays the current belt speed in metres/second or feet/minute, depending on the mass rate units selected in menu 18.The calculation is based on the total belt length in metres.

1

| |
|---|
| Menu entry : 19<br>Belt speed = 3.10 metre/second |

2

| |
|---|
| Current belt total length = 200.000 m<br>Enter new belt total length 0.000 m |

3

| |
|---|
| Enter measured belt speed in m/minute<br>0.000 Press E for belt length |

4

| |
|---|
| Calculated belt length = 197.698 metres<br>Press E to Save, otherwise press A |

1. This entry shows the current calculated belt speed. Press Enter once to enter new total belt length in metres.

2. The current value for the belt length is shown. If the belt length is known, enter it here.

3. If the belt length is not known, and an accurate belt speed has been physically measured from the belt itself, the Masterweigh can calculate the belt length. Enter the measured belt speed in the units shown, then press E to calculate the new belt length.

4. If you entered a belt speed, this value will be the calculated belt length. If it seems correct, Press enter to save the value, or abort to ignore the calculation. Note that if you entered a belt length in step 3 and not a belt speed in step 4, this value will be meaningless. Press E to continue.

# MENU ENTRY 20 – Clearing Mass Total

| |
|---|
| Menu entry : 20<br>Press C, to clear Mass Total |

1. When the mass total on the "mass rate/mass total" display (MRMT) is to be zeroed, press C at Menu Entry 20. The integrator then cancels all totalised figures.

Press Menu, then Enter to return to the MRMT display.

# RESETTING MASTERWEIGH

Under some circumstances Masterweigh's memory can be corrupted so that correct operation of the unit is not possible. This condition can occur if Masterweigh has been subjected to severe electrical noise or spikes.

These phenomena usually occur on 240/110V AC power lines, however they can also appear on the loadcell input cables as well as the tachometer cables. Masterweigh has been protected as far as possible; however, severe noise or spikes can get through.

Once any part of memory has been corrupted Masterweigh will detect it and automatically flag an error. If the corruption has only changed data, an error may not be detected and some erroneous results may occur. The only way to clear the memory of this data is by re-initialising.

Switching off and on will not clear the memory. The act of re-initialising causes all the calibration data to be lost and replaced by default factory data. The calibration data specific to your application can easily be re-entered if you have kept a note of what was in the menus.

Menu 1 however, does have specific data which is engraved on the main PCB under Calibration zero and Precision ref.

**LOG ALL CALIBRATION DATA, AS YOU MAY NEED TO MANUALLY RE-ENTER IT AT A LATER DATE.**

**TO RE-INITIALISE MASTERWEIGH PROCEED AS FOLLOWS:**

**(For software versions 2.9 & over only)**

1. Switch off Masterweigh.

2. Simultaneously press the Minus and Enter keys.

3. With both the above keys pressed switch Masterweigh on.

4. The display will now show the message:

   Press C to Configure
   Any other key to continue

5. Now press the C key and Masterweigh will return to normal running mode.

6. To check that configure has been accepted, press E key. Display will read:

   System normal - Reset = 3 (+ to clear)
   Configure = 2 (- to clear)

Note: Each time Masterweigh is powered up, reset figure increments one count. Configure number remains the same unless another configure is attempted, whereupon the count increases by one.

7. Press E key to return to running mode.

8. Values in all menu entries will now default to factory values.

9. Ensure precision zero and span voltages are entered in Menu 1 correctly before entering all other data values in following menus.

**REMEMBER**:
**YOU MUST EITHER RECALIBRATE OR ENTER YOUR ORIGINAL CALIBRATION DATA.**

# FACILITIES AVAILABLE

## Introduction

The Masterweigh is a precision microprocessor based instrument for accurate integration of mass totals in belt scale and weighfeeder applications. A wide range of facilities are provided, each of which is described below.

Note that detailed information relating to the keyboard operating command procedures is to be found earlier in this manual.

## Load Cell Input and Excitation

The Masterweigh is designed to accept a loadcell millivolt signal in the range 0 to 32 millivolts with a resolution of approximately 4 microvolts.

An on-card voltage source provides excitation for the load-cell. This source can provide excitation for up to seven 350 ohm loadcells in parallel.

The excitation is not precisely controlled, but is maintained within approximately 1 percent of the set value. The Masterweigh monitors the excitation voltage and automatically compensates for any voltage change, which may occur.

The excitation is adjustable over a wide range to enable optimum performance to be obtained from a wide variety of loadcells.

The Masterweigh may be configured to provide either a positive excitation voltage referenced to ground (unipolar) or a plus/minus (bipolar) voltage, by configuration of links. The positive voltage is continuously adjustable from +9 to +12 volts. The negative voltage is set at -12 volts. The Masterweigh is factory set for a unipolar excitation of 10 volts.

Following adjustment of the excitation, allow a minimum of 30 seconds for the Masterweigh to update its internal excitation reading before proceeding with calibration functions.

The approximate value of the excitation voltage sensed by the Masterweigh is displayed in Menu 8. This should match the voltage sensed at terminals 19 and 20, if link LK3 is correctly installed, and should be checked when configuring the Masterweigh. (Allow 30 seconds for update of display after adjusting the excitation).

Incorrect configuration of excitation sensing will cause erratic mass rate readings.

The millivolt input accepts either a differential millivolt signal or a half-bridge input and will operate accurately over a common mode range of minus 8 to plus 8 volts. The input is overload protected to plus or minus 35 volts on either terminal with the Masterweigh energised, and plus or minus 20 volts on either terminal when not energised. Transient overload capacity is much higher than this continuous rating, and depends on the duration of the overload.

The analog digital conversion is performed using voltage to frequency conversion techniques, thereby providing excellent rejection of signal noise over a wide frequency range.

With the exception of short periods allocated to self-calibration and reading of the auxiliary input channel, the Masterweigh is continuously monitoring the load-cell input rather than periodically sampling, as is the case for systems which use dual-slope integrating converters. This results in a more accurate measurement of the rapidly fluctuating input signal from the load-cell.

# FACILITIES AVAILABLE (CONT'D)

## Loadcell Input and Excitation (Contd.)

Careful design of the input circuitry ensures excellent rejection of common-mode signals both AC and DC.

Note: The excitation voltage regulators are overload and short-circuit protected, however, short circuiting of the excitation output will interfere with normal operation of analog input circuitry and the RS232 interface.

**Caution: Application of an external voltage source to the excitation terminals may cause serious damage to the Masterweigh.**

No calibration or adjustment of the Masterweigh analog inputs is required, other than the calibration of the current loop input in menu 15. Gain and zero are automatically adjusted by the reference. This automatic calibration is repeated once every 30 seconds, whenever the Masterweigh is energised.

After energising the Masterweigh, always allow a minimum of thirty (30) seconds for this automatic calibration to be performed before initiating a span or zero calibration sequence.
(Note: If Masterweigh has not been energised for some time, allow 3 minutes before initiating the above).

An auxiliary analog input channel has been provided for sensing of a 0 to 20mA signal for cascade control or blending functions. The input includes a 1 ohm burden on the current loop, and thus drops 20 millivolts at 20mA. It is not an isolated input, and thus the current loop must include an appropriate ground reference.

The input will operate over a common mode range of -8 to +8 volts. The loop supply would normally be earthed at the transmitter end. It must be earthed at one point only. The input circuitry provides excellent common mode rejection of AC noise, however, the peak AC noise voltage must not exceed 8 volts.

If the Masterweigh is not earth referenced, then one side of the auxiliary input must be connected to the adjacent ground (shield) terminal to provide a voltage reference point. (Refer to Section "Earthing" for a discussion of the earth reference link).

The maximum allowable input overload current is 500mA. The maximum allowable continuous voltage on either input terminal is plus or minus 35V DC or AC measured with respect to the Masterweigh ground (plus or minus 20 volts with the Masterweigh de-energised).

Note: The auxiliary input may be converted to a millivolt input by removing the current shunt resistor R22. The input will then have the same characteristics as the loadcell input.

## Tacho Input and Supply
## a) Electrical Characteristics

The tacho input is designed to accept a voltage input of 2.5 to 50 volts peak and so will accept either a TTL or sinusoidal voltage input. The input threshold voltage is +1.2 volts at the positive input with respect to the negative input. The negative input is directly connected to the Masterweigh grounds. Avoid earthing this input in the field, as it will create ground loops.

The tacho input will not accept frequencies in excess of 900 Hz (approx.).

# FACILITIES AVAILABLE (CONT'D)

## Tacho Input and Supply (Contd.)

A regulated +5 volt supply is provided for energising a digital pulse generator. This supply is rated at 200mA maximum and is overload and short-circuit proof with fold-back current limiting.

It may be necessary to briefly remove the load after removing a short circuit in order to reset the protection circuit. Short-circuiting of the tacho +5 volt supply will not affect the Masterweigh CPU operation.

**CAUTION: Application of an external voltage source to the tacho supply terminals may cause damage to the Masterweigh.**

## b) Frequency Selection

The tacho generator should be selected and fitted to provide a frequency input to the Masterweigh within the range 5 to 1000 Hz, to ensure compatibility & accurate measurement.

Note that the tacho frequency has no affect on the rate at which the load cell signal is sampled.

## Pulse Output

The Masterweigh provides a pulse output for external accumulation of the mass total. One 100-millisecond pulse is output each time the least significant mass total digit displayed is incremented by 1 count. A minimum of 100 milliseconds is guaranteed between pulses, thereby providing a maximum pulse rate of 5 pulses per second. (100 milliseconds on, plus 100 milliseconds off).
**NOTE:** Pulse width can be changed in Menu 1 to 100m/s, 200m/s or 300m/s.

The output is a current-limited transistor driver, which can drive loads of up to 500mA. It is short-circuit protected. The driver operates with any supply voltage up to 45 volts DC and can use either an internal or external supply as required.

The internal supply is an unregulated DC supply of normal 28 volts. It is brought into circuit by appropriate configuration of links on the Masterweigh board. This internal supply is rated to a maximum continuous current of 400mA and may vary over the range 25 - 35 V DC, depending on mains voltage fluctuations and load.

Note that this supply can also be used for the analog output current loops. To use an external supply, reconfigure the links and connect a DC supply to the "28V DC" terminal adjacent to the pulse output. The pulse output is optically isolated and floats independent of the Masterweigh ground. The 28V DC supply provided on the Masterweigh is isolated from the digital ground to allow configuration of a fully isolated pulse or analog output. The 28V DC supply is rated at 400mA maximum and is overload and short- circuit protected.

## Analog Outputs

The Masterweigh provides two independent, fully isolated analog output channels. The outputs operate over a 4-20mA range and provide a resolution of better than 0.5%. They operate as a loop-powered configuration and therefore derive their operating power from the 4mA residual loop current. A minimum of 20 volts is required to operate with zero ohms load, rising by 1 volt for every 50 ohms of load, ie. 30 volt supply required for 500 ohm load.

# FACILITIES AVAILABLE (CONT'D)

## Analog Outputs (Contd.)

The output can operate with supply voltage of up to 50 volts and provides excellent rejection of power supply ripple and noise. The loop power supply thus need not be heavily filtered or regulated.

An unregulated DC supply is provided on the Masterweigh board, which can be used to energise the analog loops and the external pulse counter.

This supply provides a nominal 28V DC and is isolated from the Masterweigh ground. Links are provided on the board to enable this supply to energise either or both the analog outputs.

Note that if a common supply is used for the two outputs, they are no longer independently floating and cannot be referenced to separate earthing points.

To use an external loop supply, configure the links on the board appropriately and connect the external supply in series with loop in question.

Shorting the calibration link associated with each channel allows the span calibration of the outputs to be easily performed. This forces the digital input to full scale and allows easy adjustment of the full-scale current using the potentiometer provided.

There is no provision for zero adjustment on the analog outputs.

## Earthing

The Masterweigh power supply provides transformer isolation from the mains input and can thus be operated in a floating mode if required.

For safety reasons it is recommended to reference the unit to earth. This is achieved by installing the soldered earth link "ETH LK" located adjacent to the main power connector J1. This link is normally installed at the factory and may be cut if it is desired to "float" the unit.

## Display Backlighting

The liquid-crystal display used in the Masterweigh provides LED backlighting for improved readability under adverse light conditions.

Should backlighting not be required then it can be disabled by removing link 15. Note that inserting link 15 while the unit is running may cause a reset to occur. If EL backlighting is being used (there is a yellow or black transformer in position U57, not a resistor), it is recommended that link 15 not be installed unless the inverter output is connected to a display module (Connector J2), as damage to the inverter may otherwise result.

# USER CONFIGURATION

Refer to Dwg. T144-12 `Link Configuration Details".

## LK1 Excitation Selection

This link allows the user to select either a unipolar or bipolar excitation voltage.

Refer also to Section "Load-cell Input and Excitation".

Unipolar is used for excitation voltages in the range 9 to 13 volts. Selecting bipolar allows a plus/minus excitation with a total voltage within the range 21 to 25 volts.

## LK2 On-Board Half Bridge

This link allows use of input devices, which have a half bridge configuration.

When linked for half bridge input, the negative side of the `loadcell` input is disconnected from the terminal block (J6), and instead connected to an on-board half bridge circuit. This half bridge is energised from the excitation as supplied to the external device.

The zero point is adjustable via RV2. (Refer to Section "Potentiometer Adjustments, RV2").

## LK3 Excitation Feedback Sensing

The Masterweigh monitors the excitation voltage level, to enable correction for small voltage fluctuations. If the gain of the unit is changed to allow a different input voltage range, then this link must be changed to provide the appropriate excitation sensing voltage.

Link (LK7) determines the gain of the input, and thus the appropriate configuration of LK3.

Refer "Link Configuration Detail" drawing for options.

## LK4, LK5 Precision Reference Selection

The Masterweigh continuously calibrates its input circuitry against its precision reference source.

When the gain of the unit is changed via link 7, these 3 links must be re-configured as shown on the "Link Configuration Detail" drawing.

Note: The auto calibration of the unit via the precision reference affects all inputs and displayed quantities, including the millivolts displayed in menu 8.

To confirm that this auto calibration is working correctly, check the zero and scaling of the millivolt display against a meter, accurate within 0.1 %.

## LK7 Analog Gain Selection

This link selects between the two alternative input voltage ranges.

The input voltage ranges available are:-0 - 35 mV and 0 - 3.5 V

Note that the Masterweigh will read inputs of more than double these nominal full scale values, however a linearity error of the order of 0.25% may be introduced at these levels.

Note: Links LK3, LK4, LK5 and LK6 must be re-configured when LK7 is changed.

# USER CONFIGURATION (CONT'D)

**LK8, LK9 External Pulse Counter Power Supply**

These links allow the Masterweigh to be configured to use either an internal or external power supply for the pulse counter output. Please refer to Pulse Output Section for details. When linked for external supply, an external power supply must be connected between terminals 5 (`EXT 28V DC') and 7 (`Gnd').

**LK10, LK11 Full-scale Calibration: Analog Outputs**

When installed, these two links force their respective analog output channels to full scale to simplify the calibration procedure.

With the exception of the microprocessor output latches and opto isolators, all normal circuitry of the respective analog output channel is used, thus providing a useful check of the D/A converter, output amplifier, and pass transistor.

Refer Section "Potentiometer Adjustments, RV4, RV5" for calibration details.

Ensure that these links are removed after calibration or testing, to allow normal output current control.

**LK12, LK14 Analog Output Supply Selection**

These links allow the Masterweigh to be configured to use either an internal or external loop power supply for each of the two analog output channels.

Note that these outputs are "loop powered" and thus do not have separate power supply terminals.

If external loop supply is selected, an appropriate power supply must be connected in series with that current loop.

**LK13 Memory Map Select**

This link is provided to enable possible elimination of the monitor EPROM at a later date. The link is factory installed to select the 27256 EPROM with a base address of 0000.

**LK15 Power Supply for Electro Luminescent Backlighting**

If EL backlighting is being used (there is a yellow or black transformer in position U57, not a resistor), installing this link connects power to the DC to AC inverter which supplies approximately 100V AC to the backlighting panel in the display module. If the board is set up for LED backlighting (there is a resistor in position U57), this link connects power to the LED backlight.

Note: Connecting or disconnecting the backlighting while the Masterweigh is running may cause the system to reset due to current inrush into the inverter circuit. It is recommended that the inverter not be energised without a display module connected. (Display module connects at J2).

**LK16, LK17, LK18**

LK16 is not currently allocated.

Links LK17 and LK18 form part of the standard RS232 interface. They allow the user to select the state of the two data control inputs to the Masterweigh.

DTR - Data Terminal Ready and
RTS - Ready To Send

Install links LK17 and LK18 in all cases except where it is specifically required that one or both of these signals originate from the external serial device. RTS can be used by an external device to suspend data transmission.

# POTENTIOMETER ADJUSTMENTS

**RV1 Excitation Level Adjustment**

This potentiometer allows adjustment of the excitation output voltage, as discussed in Section "Facilities Available, Load-cell Input and Excitation".

The excitation voltage may be monitored at terminals 19 and 20 on screw terminal block J6.

**RV2 Half Bridge Zero Adjustment (Not used by Masterweigh)**

This adjustment is used only when the on-board half bridge is enabled (LK2).

The potentiometer should be adjusted so that there is a small positive voltage input, as displayed on menu 8, when the external half bridge device is at its minimum output state.

**RV3 Low Voltage Threshold Adjustment**

**a) Function**

The Masterweigh incorporates a low voltage detection circuit on the +5 volt logic supply to ensure that spurious CPU operations will not occur during start-up, shut down or "brown-out".

The circuit clamps a reset on the unit whenever the supply is not within specification. The circuit includes 0.15 volts of hysteresis and operates as follows: -

. Below 4.70V - Continuous reset to CPU
. Above 4.85V - Normal run mode
. Reset is released at 4.85V on rising supply
. Reset activates at 4.70V on falling supply

This potentiometer is normally set and sealed at the factory.

**b) Initial Set Up**

Connect an adjustable DC supply to pins 5 and 12 of J1. (Mains supply board disconnected).

Connect a meter to the +5V rail of the Masterweigh and a logic probe to the system reset pin. (Pin 6 of U43).

Slowly increase the input voltage until the reset condition clears. Note the voltage at which this occurs.

Adjust RV3 until the reset clears at 4.85V with a rising input. Verify that the reset reactivates at approximately 4.7V with a falling supply.

**RV4, RV5 Analog Output Span Adjustment**

Potentiometers RV4 and RV5 are used to adjust the full-scale output current of the analog output channels. The output circuit is designed to have a zero error sufficiently low such that no adjustment is necessary.

To adjust an output channel, first ensure that a suitable power supply is connected in the loop. Connect an accurate current meter in series. Using the calibration links LK10 and LK11, force the output to full scale. Use the potentiometer to set the current to the desired level - usually 20.0mA.

Note that when using a one and a half digit meter of limited resolution, it may be preferable to set the current at 19.98mA to allow a lower meter range to be used.

**RV6 Display Viewing Angle Adjustment**

Adjust this potentiometer for optimum display viewing conditions. Note that some darkening of the display may occur with large increases in ambient temperature. Normal contrast will return as the temperature returns to normal.

# RS232 INTERFACE

## Description

The Masterweigh unit provides a general purpose RS232 interface port. This port enables connection to a VDU, printer or another computer, for remote information display, or print out of the system configuration parameters.

The interface is normally configured for operation at 19200 Baud, with eight data bits and one stop bits. There is no received parity check, and no transmitted parity bit.

The maximum recommended transmission distance is 100 metres, using a shielded cable, however, this depends on the environment in which the cable is being run.

## Print Function

The primary use of the RS232 port to a Masterweigh user is to enable print out of all system set-up parameters. Such a print out may be done to a display terminal, or a hard copy unit.

If a "receive only" device (no keyboard) is being used, then the parameter print out may be initiated from the Masterweigh keyboard via Menu 12. All system parameters are listed, with English language descriptions for ease of interpretation. Note that this feature is not available with all versions of software.

## Commands Available

Note: HHHH is a hexadecimal number
[ ] indicates an optional parameter.

This list of commands is available on software version AUSR_F02. Earlier versions of software may have slightly different commands available.

Basic Commands:

**?** - Displays the list of available commands.

**Time** - displays the time since the Masterweigh was last restarted or reset, in the format HH:MM:SS.

**Tacho** - displays the current tacho frequency in hertz.

**VF** - displays the instantaneous load cell input in terms of counts from the V to F converter, where 8000 counts = nominal full scale.

**Header** - displays the EPROM header information and software version number.

**Configure** - resets all parameters to default if the “C” key on the Masterweigh keypad is pressed after initiating this command. Use this command to initialise a new board, or to reinstate the non- volatile memory, if its contents have become corrupted.

**Restart** - software restart of the Masterweigh

**Outoff** - freezes the current loop outputs at their current value. To restart, use the restart command. Web-Tech technicians should only use this command.

Note: Add the suffix –R after a command to execute it repeatedly, or –RL to execute repeatedly and feed a new line. These options are only available on the commands Time, Tacho, and VF.

# RS232 INTERFACE (CONTD.)

## Automatic logging commands

The Masterweigh has been equipped with several commands that provide repetitive listings of certain parameters, to allow logging of these parameters. The logs will continue to print the data until any byte is sent to Masterweigh from the communications port or the Masterweigh is reset.

Logging commands available are:

**TCLOG** - starts a log of the tachometer input frequency in hertz, writing a new value on a new line approximately 5 times a second.

**LCLOG** - starts a log of the load cell input signal in milli-volts, writing a new value on a new line approximately 5 times a second.

**MRLOG** - starts a log of the following parameters: Mass Rate (in mass rate units), setpoint (in mass rate units), PID output (in %), tachometer frequency (in hertz), load cell input (in mV). The list of values are all sent on one line per sample with space delimiting, and each sample is on a new line (ie CR and LF is sent after each sample). This log produces one sample (one copy of the value of each parameter) per second.

## Modbus interrogation commands

The Masterweigh can be interrogated and controlled via a sub-set of the modbus commands, which are Query and Modify. If you wish to use these commands, please contact Web-Tech for the protocol format and the address listing.

Other commands available on earlier software versions are:

**DUMP** HHHH [HHHH]
Hexadecimal memory dump over specified range.

**IDUMP** HHHH
Interactive display of memory contents in a range of formats. Type? For a list of options when IDUMP.

**FREE** Displays units of free CPU time.

**PARAMETERS** Displays all current system parameters.

**EXIT** Exit to the debug monitor. (May require change of Monitor EPROM).

# MEMORY COMPONENTS

## 1. EPROMS

The Masterweigh uses 1 or 2 EPROMS, one for program storage (U2: 27256, essential), and one for storage of the monitor (U6: 2764, optional), which normally will never be changed.

The EPROM sizes are as follows: -

| | |
|---|---|
| Monitor: | 2764, 8 kB available, 2 kB used (Note: Only 2 kilobytes are addressable in this EPROM location on the Masterweigh board). |
| Program: | 27256, 32 kB available, 24 kB used (version 9) |

(Note: EPROMS must be 250ns or faster).

The windows on the EPROMS should be covered when not being erased, to prevent accidental erasure.

The program EPROM includes a check sum, which is continuously verified during normal operation. Errors are flagged on the main display.

**CAUTION: Always ensure EPROMS are inserted with correct orientation. Reverse insertion will destroy the EPROM**

## 2. STATIC RAM

The Masterweigh uses 2 kB of low power static RAM.

## 3. NOV-RAM

NOV-RAM is the non-volatile memory in which all configuration data is stored. 256 bytes are provided.

This technology does not use batteries and will store data indefinitely without power.

Checksums are maintained on all data in NOV-RAM to detect data corruption or hardware failure.

Refer to the following Section "Hardware Self Checks".

# HARDWARE SELF CHECKS

## Introduction

The Masterweigh software performs a number of internal checks to ensure system integrity. Should any fault be detected, the display will commence flashing and a fault message will be displayed if the enter key is pressed when the display is in the MRMT mode.

## EPROM Checksum

The program data in EPROM is checksummed at startup and repeatedly whilst the system is running.

The checksum is stored in the 3rd and 4th locations of the EPROM and is the complement of the two LS bytes of the total of all bytes in the EPROM.

## RAM Check

The RAM is checked at start up using a simple read/write test, bottom up then top down. Any error detected will be flagged by a flashing display.

Note that since all RAM is used by the Masterweigh this test can be performed only at start up when the RAM is not in use.

## NOV-RAM Checksum Error

This indicates that data has been altered in the NOV-RAM, or in the RAM image of the NOV-RAM, without the checksum having been recomputed. This would generally indicate a software problem or operator corruption of data. This message will also be displayed if the data stored in the NOV-RAM has been corrupted (or not previously configured).

To correct a NOV-RAM checksum Error in the field, try the following procedure:

RAM Image corrupted - turn off the power momentarily to recall the correct data from NOV-RAM.

**IF THE ABOVE FAILS, REFER TO PAGE MW19 -"RESETTING MASTERWEIGH".**

# HARDWARE SETUP AND TROUBLESHOOTING

## Initial Set up

Items, which will need initial calibration and possibly, periodic recalibration are as follows: -

. Power supply under voltage level setting
. Analog output span adjustment
. Precision reference voltage calibration

## Power Supply Voltage Level Sensing

An undervoltage detection circuit is incorporated in the Masterweigh to ensure that spurious CPU execution does not occur during start up, shut down or 'brown out'.

Refer to Section "Potentiometer Adjustments, RV3" for further information.

## Analog Output Span Adjustment

Each of the two analog output channels include a potentiometer for adjustment of the full scale span.

Refer Section "Potentiometer Adjustment, RV4, RV5" for further information.

Note that there is no provision for adjustment of the zero on these analog outputs. Should either zero out by greater than 0.4 mA at the 4.0 mA level then check for "out-of-spec" components.

## Precision Reference Voltage Calibration

The Masterweigh employs state-of-the-art auto- calibration techniques to establish and maintain highly accurate analog input circuitry. An extremely stable voltage source provides zero and span reference inputs.

Masterweigh uses these to establish the zero offset and gain of the input circuit, and thus compensates for drift due to temperature and ageing of components. It also means that the initial gain and zero offset of the analog to digital conversion and pre-amplifier circuitry is not critical, and thus component tolerances may be relaxed.

Note that the auto-calibration includes the effect of all components, which affect the accuracy of the load-cell input.

The reference circuit provided, although very stable with temperature and time, is not tightly controlled as far as initial voltage is concerned. It is therefore necessary at an early stage in the set up of the unit, to measure the actual reference voltages and to enter them into the system for storage in NOV-RAM. The values should then be checked whenever maintenance of the Masterweigh is undertaken.

Ensure that the meters used for checking the voltages are accurate to better than 0.1 % of reading at a measured voltage of 25 millivolts.

**The voltage calibration proceeds as follows: -**

- Obtain a very accurate, high resolution digital voltmeter suitable for measurements at 5 and 25 millivolts with a minimum accuracy and resolution of +/- 5 microvolts for both measurements.

- Using pointed probes, connect the meter negative to the shunt on LK6 and the positive negative to the shunt on LK5, this is the "zero calibration" value and should be approximately 5 millivolts.

- Keeping the negative on LK6, move the positive to the shunt on LK4. This is the "span

# HARDWARE SETUP AND TROUBLESHOOTING (CONT'D)

calibration" value and should between 25 and 35 millivolts.

Using the keypad, access menu 1 and enter the zero and span values, and save on return to the main display. Allow thirty (30) seconds for the system to recalibrate in accordance with the new values.

## Analog Circuitry Notes

The input is an 8 channel differential multiplexer chosen for its input overvoltage withstand capability, low leakage current, and matching of on resistance between channels.

The AD524 instrumentation amplifier is chosen for its excellent gain and zero stability, common mode rejection, and low input bias and offset currents.

Whilst the exact zero setting is not critical, it is important that we have a "live" zero to ensure satisfactory operation of the voltage to frequency (V/F) converter, with a zero volts sign at the load-cell input.

**The zero is established by R71 and R72 and can be checked as follows:**

Apply a short-circuit to the load-cell input and, if no load-cell is connected to establish a ground path, make a connection between the input and the analog ground (shield) terminal to ensure that the input does not float outside the common-mode range of the input circuitry. With the Masterweigh operating normally measure the voltage at pin 9 of the AD524.

Since the multiplexer selects the load-cell input for 23/25ths of the input time, the voltage seen
on a sampling digital voltmeter is typically quite stable and will be that signal due to the Load cell input. (Ignore occasional deviant readings due to sampling of the cascade input).

The signal level due to the shorted input should be approximately 1 percent of full scale or at that point AD524, Pin 9, approximately 30mV, and not less than 20 mV. **Note** that this voltage is measured with respect to analog ground (Pin 6 of the AD524).

The V/F converter operates over the frequency range 0-200 kHz, for a voltage range after the AD524 of 0-3.2 volts (corresponding to a load-cell input of 32 millivolts).

Note that the V/F converter will accept inputs of up to 10 volts, as configured, with a corresponding frequency of approximately 600 kHz. Some loss of linearity occurs above 200 kHz however.

## Watchdog Circuit

The Masterweigh incorporates a watchdog circuit to ensure that a restart will occur should CPU execution be upset by some extraordinary event. The watchdog time-out period will be in the range 1-2 seconds. The watchdog may be disabled for hardware debugging purposes by temporarily removing C30.

## Signature Analysis

A 16 pin DIL pad arrangement is provided in line with the 8 CPU data lines to allow fault isolation on boards with CPU address, data, or control line faults. To use this facility, the 8 tracks between the pads would be cut and a socket soldered into place. The socket then provides access to the data lines.

A 16-pin DIL header can be used to restore the connection after any bus fault is rectified.

# FIELD TERMINAL STRIP

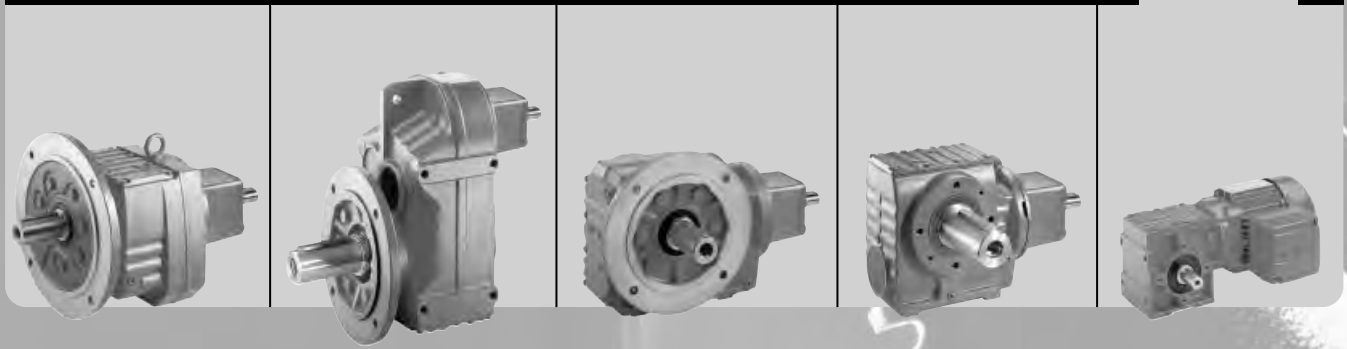
| TERMINAL No. | |
|---|---|
| 1 | P.I.D O/P 2, 4-20 mA, current in |
| 2 | P.I.D O/P 2, 4-20 mA, current out. |
| 3 | Rate O/P 1, 4-20 mA, current in |
| 4 | Rate O/P1, 4-20mA, current out. |
| 5 | External +28 V, (20-40 volt external supply for pulse output) |
| 6 | Pulse output, (0-500 mA) |
| 7 | Ground for external supply and pulse output |
| 8 | Tacho pulse input, (2.5 to 50 volt, 5 to 800 Hz) |
| 9 | Tacho generator supply, (+5V, 200 mA max.) |
| 10 | Digital ground for tacho generator. |
| 11 | Auxiliary input 2, 0-20 mA, current in |
| 12 | Auxiliary input 2, 0-20 mA, current out |
| 13 | Ground: Reference and/or shield for auxiliary inputs. |
| 14 | Auxiliary input 1, 0-20 mA, current in |
| 15 | Auxiliary input 1, 0-20 mA, current out |
| 16 | Ground/shield for load cell input |
| 17 | Load cell input, 0-32 mV, positive input |
| 18 | Load cell input, 0-32 mV, negative Input |
| 19 | Load-cell excitation, positive output (9-13V) |
| 20 | Load-cell excitation, negative output (0 or –12V). |

SEW EURODRIVE

# Gear Units
# R..7, F..7, K..7, S..7 Series, Spiroplan® W

Edition

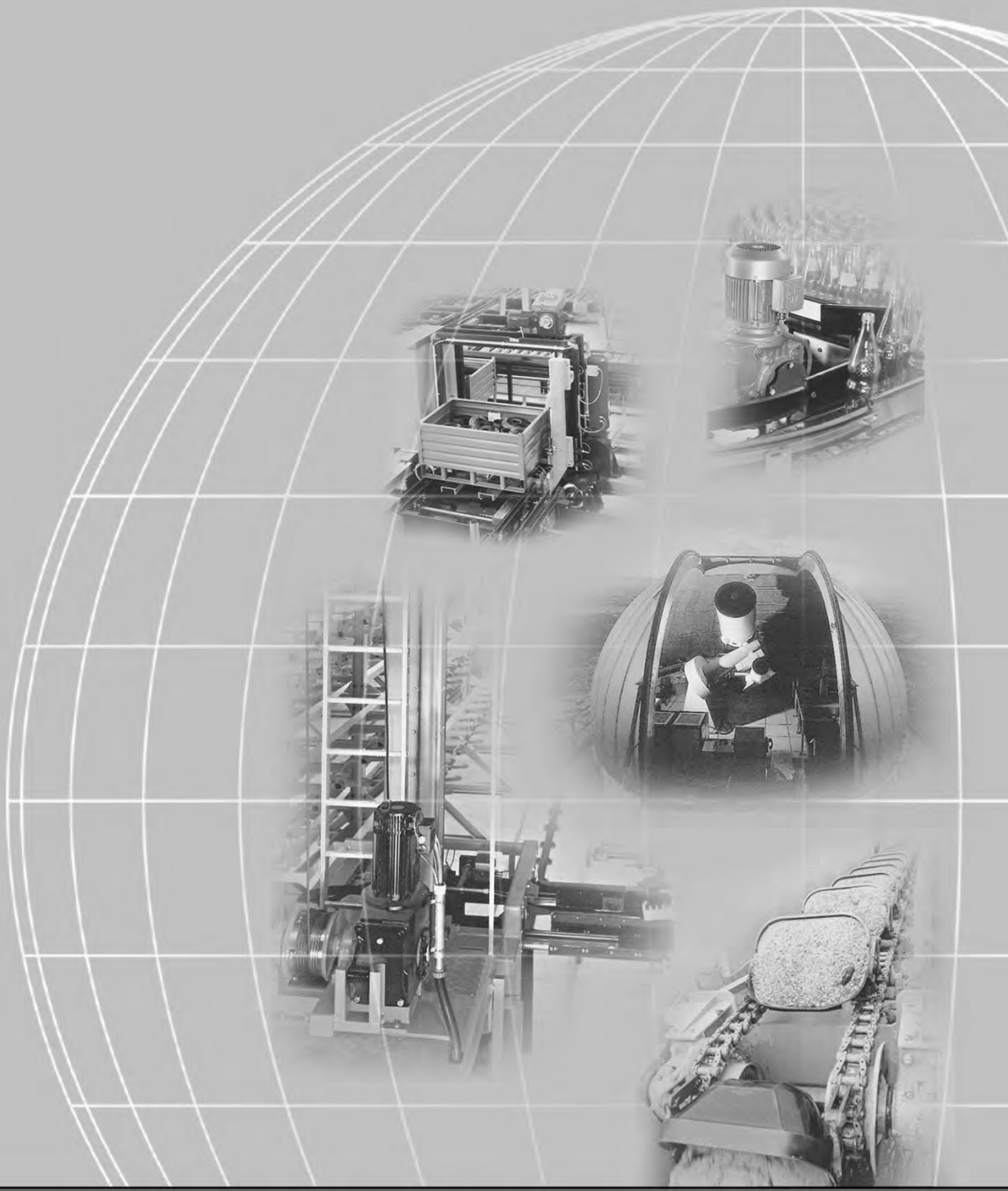
*05/2001*



## Operating Instructions

**10503013 / EN**

SEW
EURODRIVE



# SEW-EURODRIVE

# Contents

# 1 Important Notes

***Safety and warning notes***

**Please note the safety and warning notes in this publication!**

**Electrical hazard**
Could result in: death or severe injuries.

**Imminent danger**
Could result in: death or severe injuries.

**Dangerous situation**
Could result in: slight or minor injuries.


**Damaging situation**
Could result in: damage of drive and operating environment.

Operating hints and useful information.

Close adherence to the Operating Instructions is the prerequisite for fault-free operation and fulfillment of any rights to claim under guarantee. Please start reading the Operating Instructions prior to operating the drive!

Keep Operating Instructions in vicinity of unit since it contains important informtion on service procedures.


- **Adjust lubricant fill amount and position of breather valve when changing mounting position (see section "Lubricants" and "Mounting Positions").**
- **Please see notes in section "Setup" / "Setup of Gear Unit!"**

***Disposal***

**(please observe the most current regulations):**

- Dispose of housing parts, gears, shafts and anti-friction bearing of gear units as stell scrap. The same applies to gray cast iron parts unless there is separate collection service.
- Some worm gears are made of non-ferrous metals and must be disposed of accordingly.
- Collect waste oil and dispose according to local guidelines.

**Changes to edition 04/2000 are indicated by gray bars in the margin**

# 2 Safety Notes

***Preliminary remarks***

The following safety notes are principally concerned with the use of gear units.

If using **geared motors**, please also refer to the safety notes for motors in the corresponding operating instructions.

**Please also take account of the supplementary safety notes in the individual chapters of these operating instructions.**

***General***

During and after operation, geared motors and gear units have live and moving parts and their surfaces may be hot.

**All work related to transport, putting into storage, setting up/mounting, connection, startup, maintenance and repair may only be carried out by qualified specialists in accordance with**

- the corresponding detailed operating instructions booklet(s) and wiring diagrams
- the warning and safety signs on the gear unit/geared motor
- the specific regulations and requirements for the system and
- national/regional regulations governing safety and the prevention of accidents

**Severe injuries and damage to property may result from**

- incorrect use
- incorrect installation or operation
- removal of required protective covers or the housing when this is not permitted

***Designated use***

These geared motors/gear units are intended for industrial systems. They correspond to the applicable standards and regulations.

The technical data and the information about permitted conditions are to be found on the nameplate and in the documentation.

It is essential for all specified information to be observed!

***Transportation / Storage***

**Inspect the delivered goods for any shipping damage as soon as you receive the delivery. Inform the shipping company immediately. It may be necessary to preclude startup.**

Tighten installed transportation lugs firmly. They are only designed for the weight of the geared motor/gear unit; do not attach any additional loads.

**The installed lifting eyebolts meet DIN 580. The loads and guidelines listed in the standard have to be observed. If there are two transportation or lifting eyebolts installed on the geared motor, you have to use both of them for transportation. The direction of the tensile force is not to exceed an angle of 45°to meet the guidelines set forth in DIN 580.**

Use suitable, sufficiently rated handling equipment if necessary. Remove any transport fixtures prior to startup.

| | |
|---|---|
| ***Setup / Installation*** | See notes in sections "Setup" and "Installation/Removal!" |
| ***Startup / Operation*** | Check whether the direction of rotation is correct in **decoupled** status (also listen out for unusual grinding noises as the shaft rotates).<br>Secure the shaft keys for test mode without output elements. Do not render monitoring and protection equipment inoperative even for test mode.<br>Switch off the geared motor if in doubt whenever changes occur in relation to standard operation (e.g. increased temperature, noise, vibration). Determine the cause; contact SEW if necessary. |
| ***Inspection / Maintenance*** | See notes in section "Inspection/Maintenance!" |

# 3 Gear Unit Design

The following illustrations represent design principles. They are merely reference tools for the spare parts lists. Deviations according to gear unit size and design are possible!

## 3.1 Basic design of a helical gear unit

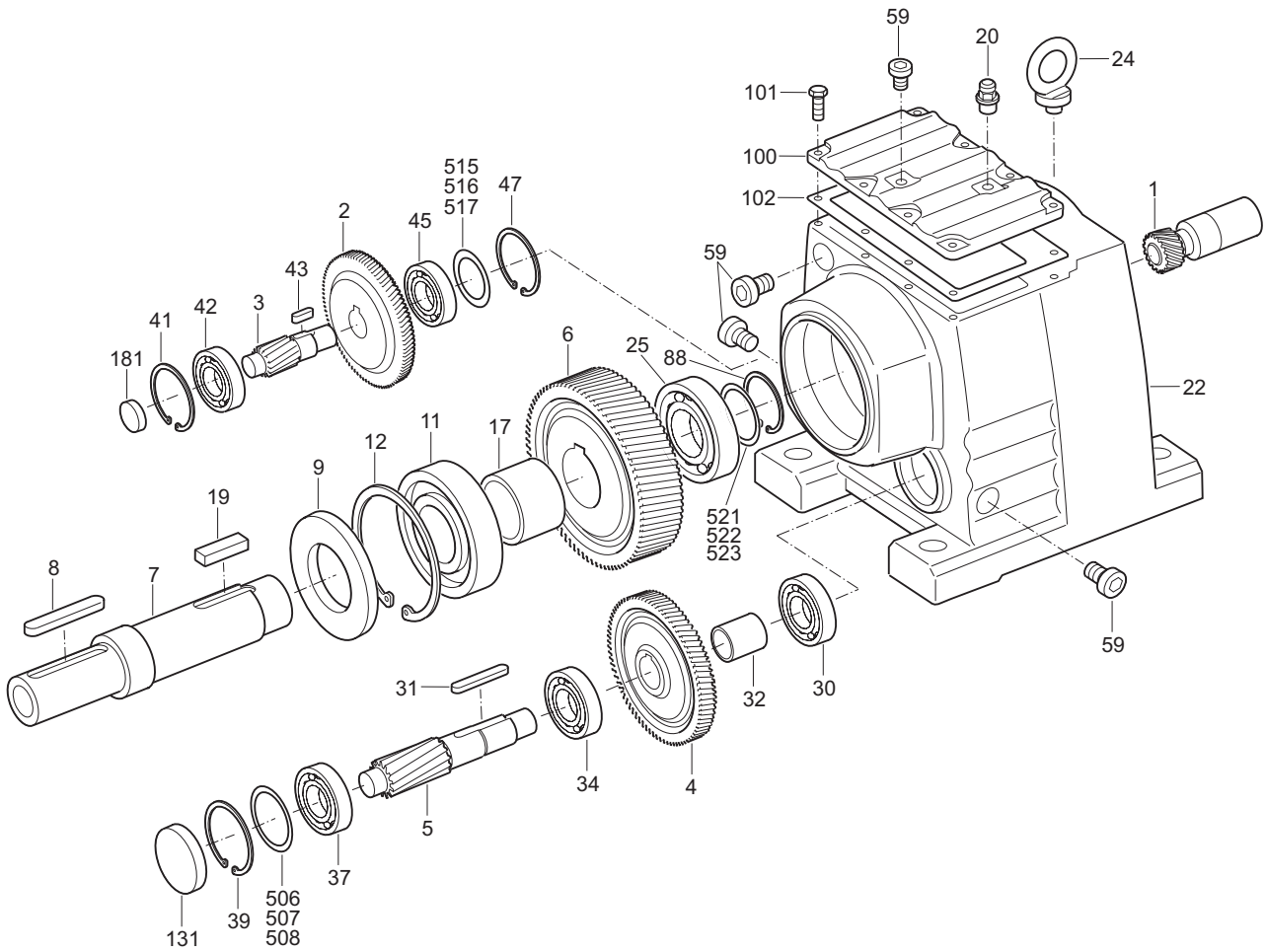



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*Fig.1: Basic structure of helical gear units*

### Legend

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Pinion | 19 | Key | 42 | Deep groove ball bearing | 507 | Shim |
| 2 | Gear | 20 | Breather valve | 43 | Key | 508 | Shim |
| 3 | Pinion shaft | 22 | Gear unit housing | 45 | Deep groove ball bearing | 515 | Shim |
| 4 | Gear | 24 | Lifting eyebolt | 47 | Circlip | 516 | Shim |
| 5 | Pinion shaft | 25 | Cylinder ball bearing | 59 | Screw plug | 517 | Shim |
| 6 | Gear | 30 | Deep groove ball bearing | 88 | Circlip | 521 | Shim |
| 7 | Output shaft | 31 | Key | 100 | Cover | 522 | Shim |
| 8 | Key | 32 | Spacer tube | 101 | Hex head screw | 523 | Shim |
| 9 | Oil seal | 34 | Cylinder ball bearing | 102 | Gasket | | |
| 11 | Deep groove ball bearing | 37 | Deep groove ball bearing | 131 | Cap | | |
| 12 | Circlip | 39 | Circlip | 181 | Cap | | |
| 17 | Spacer tube | 41 | Circlip | 506 | Shim | | |

## 3.2 Basic design of a parallel shaft helical gear unit

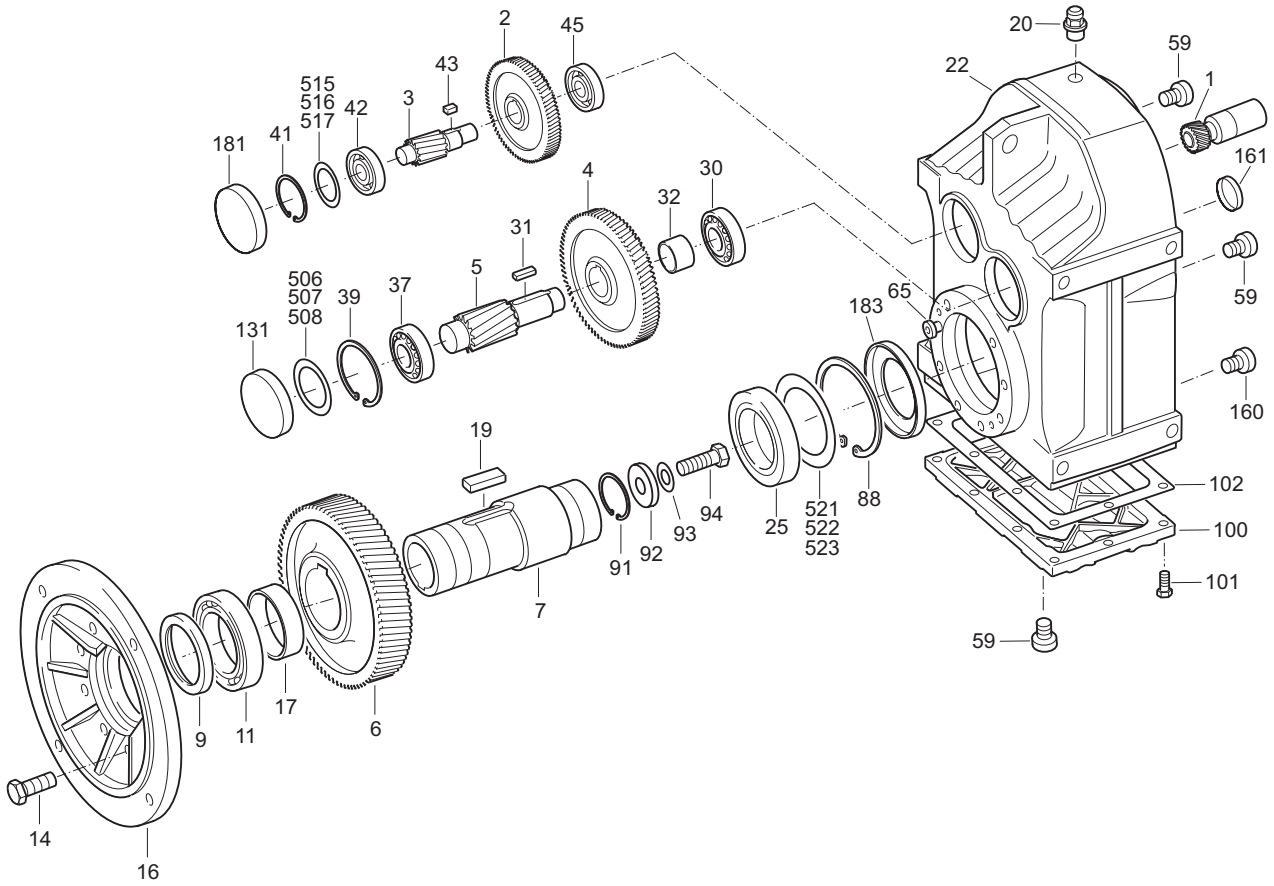


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*Fig. 2: Basic design of a parallel shaft helical gear unit*

### Legend

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Pinion | 22 | Gear unit housing | 91 | Circlip | 184 | Oil seal |
| 2 | Gear | 25 | Deep groove ball bearing | 92 | Disc | 506 | Shim |
| 3 | Pinion shaft | 30 | Tapered roller bearing | 93 | Lock washer | 507 | Shim |
| 4 | Gear | 31 | Lockwasher | 94 | Hex head screw | 508 | Shim |
| 5 | Pinion shaft | 32 | Spacer tube | 100 | Cover | 515 | Shim |
| 6 | Gear | 37 | Tapered roller bearing | 101 | Hex head screw | 516 | Shim |
| 7 | Hollow shaft | 39 | Circlip | 102 | Gasket | 517 | Shim |
| 9 | Oil seal | 41 | Circlip | 131 | Cap | 521 | Shim |
| 11 | Deep groove ball bearing | 42 | Deep groove ball bearing | 160 | Plug | 522 | Shim |
| 14 | Hex head screw | 43 | Key | 161 | Cap | 523 | Shim |
| 16 | Output flange | 45 | Deep groove ball bearing | 165 | Plug | | |
| 17 | Spacer tube | 59 | Screw plug | 168 | Protection cap | | |
| 19 | Key | 81 | O-ring | 181 | Cap | | |
| 20 | Breather valve | 88 | Circlip | 183 | Oil seal | | |

## 3.3 Basic design of a helical-bevel gear unit

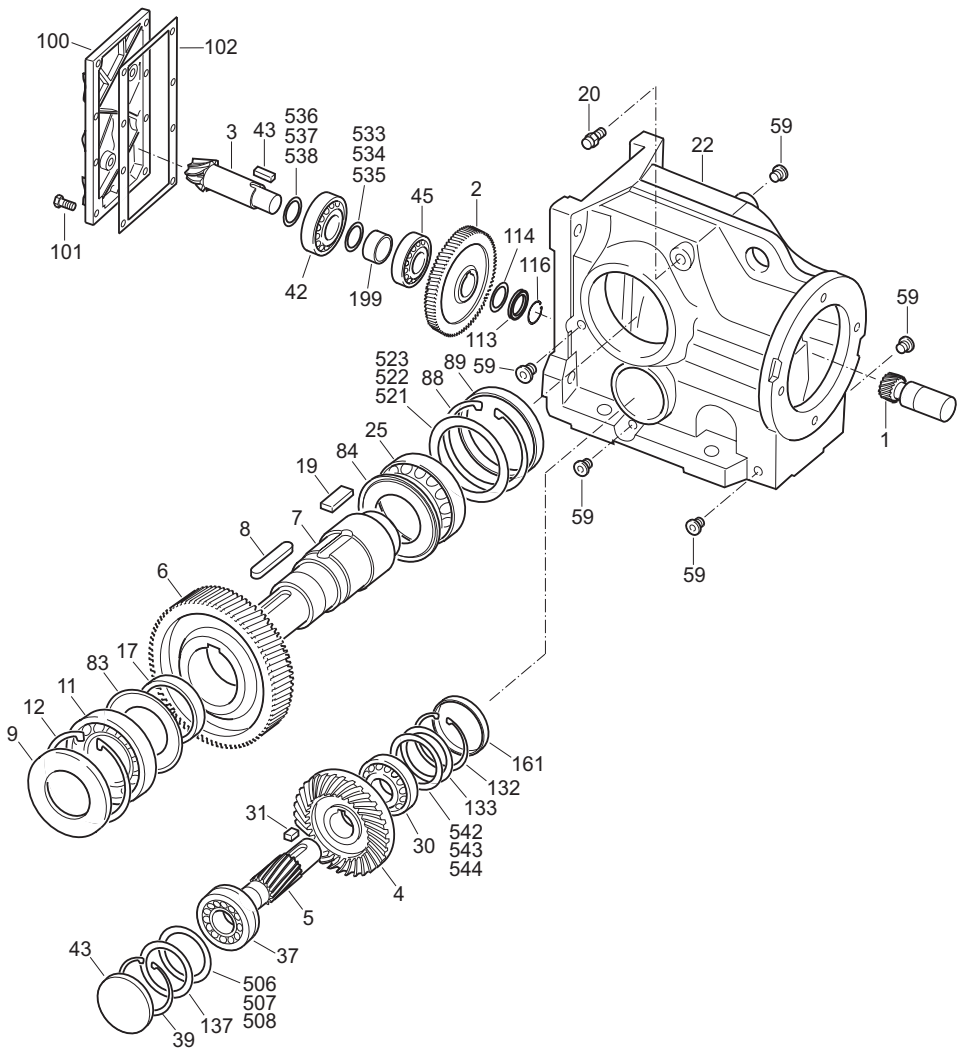


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*Fig.3: Basic design of a helical-bevel gear unit*

### Legend

| | | | |
|---|---|---|---|
| 1 Pinion | 25 Tapered roller bearing | 102 Adhesive and sealant | 523 Shim |
| 2 Gear | 30 Tapered roller bearing | 113 Wing nut | 533 Shim |
| 3 Pinion shaft | 31 Key | 114 Locking plate | 534 Shim |
| 4 Gear | 37 Tapered roller bearing | 116 Thread retention | 535 Shim |
| 5 Pinion shaft | 39 Circlip | 119 Spacer tube | 536 Shim |
| 6 Gear | 42 Tapered roller bearing | 131 Cap | 537 Shim |
| 7 Output shaft | 43 Key | 132 Circlip | 538 Shim |
| 8 Key | 45 Tapered roller bearing | 133 Spacer | 542 Shim |
| 9 Oil seal | 59 Screw plug | 137 Spacer | 543 Shim |
| 11 Tapered roller bearing | 83 Nilos ring | 161 Cap | 544 Shim |
| 12 Circlip | 84 Nilos ring | 506 Shim | |
| 17 Spacer tube | 88 Circlip | 507 Shim | |
| 19 Key | 89 Cap | 508 Shim | |
| 20 Breather valve | 100 Gear unit cover | 521 Shim | |
| 22 Gear unit housing | 101 Hex head screw | 522 Shim | |

## 3.4 Base design of a helical-worm gear unit

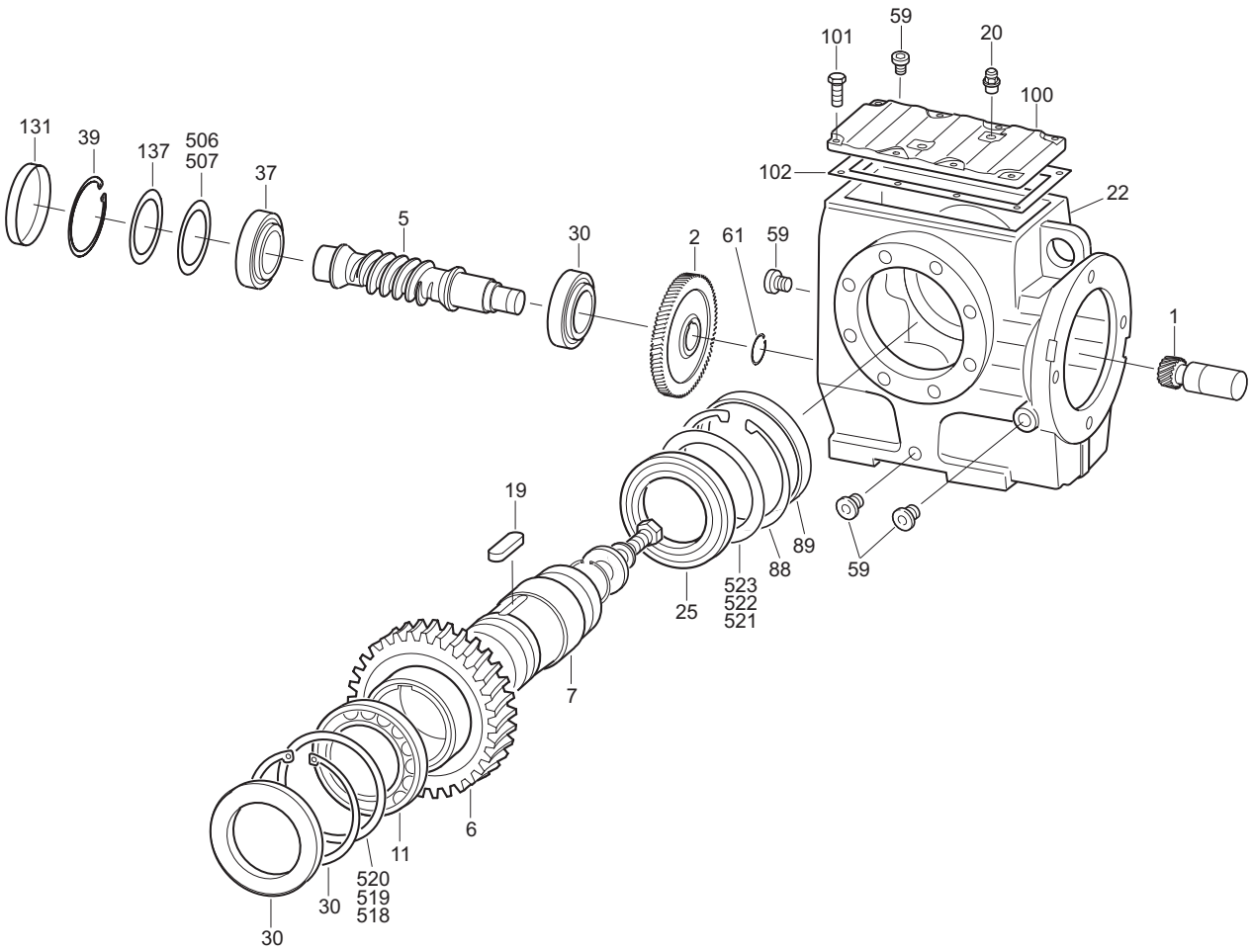


*Fig. 4: Basic design of a helical-worm gear unit*

### Legend

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Pinion | 19 | Key | 61 | Circlip | 507 | Shim |
| 2 | Gear | 20 | Breather valve | 88 | Circlip | 518 | Shim |
| 5 | Worm | 22 | Gear unit housing | 89 | Cap | 519 | Shim |
| 6 | Worm gear | 25 | Tapered roller bearing | 100 | Gear unit housing | 520 | Shim |
| 7 | Output shaft | 30 | Tapered roller bearing | 101 | Hex head screw | 521 | Shim |
| 9 | Oil seal | 37 | Tapered roller bearing | 131 | Cap | 522 | Shim |
| 11 | Tapered roller bearing | 39 | Circlip | 137 | Spacer | 523 | Shim |
| 12 | Circlip | 59 | Screw plug | 506 | Shim | | |

## 3.5 Basic design of a SPIROPLAN® gear unit

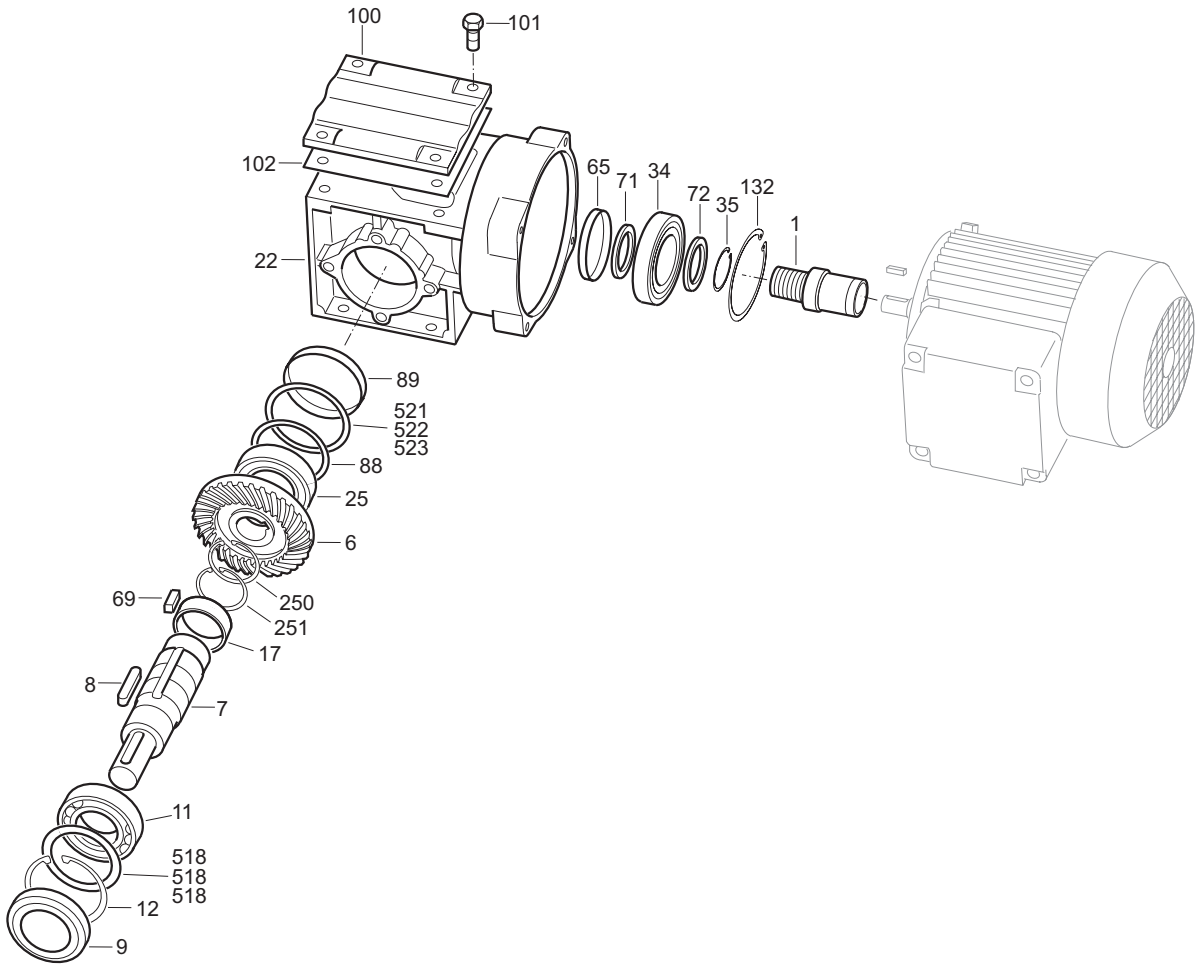


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*Fig. 5: Basic design of a SPIROPLAN® gear unit*

### Legend

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Pinion | 19 | Key | 88 | Circlip | 251 | Circlip |
| 6 | Gear | 22 | Gear unit housing | 89 | Cap | 518 | Shim |
| 7 | Output shaft | 25 | Deep groove ball bearing | 100 | Gear unit cover | 519 | Shim |
| 8 | Key | 34 | Deep groove ball bearing | 101 | Hex head screw | 520 | Shim |
| 9 | Oil seals | 35 | Circlip | 102 | Gasket | 521 | Shim |
| 11 | Deep groove ball bearing | 65 | Oil seal | 132 | Circlip | 522 | Shim |
| 12 | Circlip | 71 | Spacer | 183 | Oil ring | 523 | Shim |
| 17 | Spacer tube | 72 | Spacer | 250 | Circlip | | |

# 4 Mechanical Installation

## 4.1 Required tools / material

- Set of spanners
- Torque wrench (for shrink discs, AQ motor adapter, input shaft assembly with centering shoulder)
- Mounting device
- Shims and distance rings, if necessary
- Fastening devices for input and output elements
- Lubricant (e.g. NOCO® fluid)
- Agent for securing screws, e.g. Loctite 243 (for input shaft assembly with centering shoulder)

***Mounting tolerances***

| Shaft end | Flanges |
|---|---|
| Diameter tolerance according to DIN 748<br>• ISO k6 for solid shafts with ∅ ≤ 50 mm<br>• ISO m6 for solid shafts with ∅ > 50 mm<br>• ISO H7 for hollow shafts<br>• Center hole according to DIN 332, shape DR.. | Centering shoulder tolerance according to DIN 42948<br>• ISO j6 with b1 ≤ 230 mm<br>• ISO h6 with b1> 230 mm |

## 4.2 Before you begin

***The drive may only be installed if***

- the entries on the name plate of the drive match the mains power supply,
- the drive is undamaged (no damage caused by transport or storage) and
- it is certain that the following requirements have been fulfilled:

- **with standard gear units:**
  ambient temperature according to lubricant table in section lubricants (see standard), no oil, acid, gas, vapors, radiation, etc.
- **with special versions:**
  drive configured in accordance with the ambient conditions
- **with helical worm/Spiroplan® W gear units:**
  no large external mass moments of inertia which could exert a retrodriving load on the gear unit
  [where h' (retrodriving) = 2 – 1/η < 0.5 self-locking]

## 4.3 Preliminary work

The output shafts and flange surfaces must be thoroughly cleaned of anti-corrosion agents, contamination or such like (use a commercially available solvent). Do not let the solvent come into contact with the sealing lips of the oil seals – material damage!

***Long-term storage of gear units***

Gear units of the "extended storage" type have

- a mineral oil fill (CLP) or synthetic oil fill (CLPHC) suitable for the mounting position so the unit is ready to run. However, you should still check the oil level prior to startup (see section "Inspection/Maintenance" / "Inspection/Maintenance work").
- a higher oil level with synthetic oil CLP PG). Correct the oil level prior to startup (see section "Inspection/Maintenance" / "Inspection/Maintenance work").

## 4.4 Installing the gear unit

The gear unit or geared motor must be mounted/installed in the specified mounting position on a level[1], vibration-absorbing and torsionally rigid support structure (Spiroplan® gear units are not dependent on mounting position). Do not tighten housing legs and mounting flanges against each other and pay attention to the approved overhung and axial loads

Use only bolts of 8.8 quality for installation of the geared motors

Use bolts of **10.9 quality** for fastening of flanges to transmit the rated torques listed in the catalog for the following helical geared motors in flange design (RF..) and in foot/flange version (R..F):

- RF37, R37F with flange-∅ 120 mm
- RF47, R47F with flange-∅ 140 mm
- RF57, R57F with flange-∅ 160 mm


**Oil check screws, drain screws and breather valves have to be freely accessible!**

At this point of assembly, please check that the oil filling is as prescribed for the mounting position (see "Lubricants" / "Lubricant fill levels" or data on nameplate). **In case of mounting position change, adjust lubricant filling quantities accordingly.**

Please consult our service department, if the mounting position for K gear units is changed to M5 or M6 or within these mounting positions.

Please consult our service department, if the mounting position of S units in sizes S47 ... S97 is to be changed to mounting position M2.

Use plastic inserts (2 – 3 mm thick) if there is a risk of electrochemical corrosion between the gear unit and the driven machine (connection between different metals such as cast iron and high-grade steel)! Also fit the bolts with plastic washers! Ground the housing additionally – use the grounding bolts on the motor.

*Installation in damp areas or in the open*

Gear units are supplied in corrosion-resistant versions for use in damp areas or in the open air. Any damage to the paintwork (e.g. on the breather valve) must be repaired.

1. Maximum permitted flatness error for flange mounting (approximate values with reference to DIN ISO 1101): with → flange 120...600 mm max. error 0.2...0.5 mm

***Gear unit venting***

No ventilation is required for R17, R27 and F27 gear units in mounting positions M1, M3, M5 and M6 as well as Spiroplan® W gear units.

All other gear units are delivered by SEW ready for the mounting position with the breather valve and transport fixture fitted.

**Exceptions**:

Gear units for long-term storage, in pivoting or inclined mounting positions are supplied with a screw plug installed in the provided vent hole. Prior to startup, the customer must replace screw plug at the highest location by the supplied breather valve.

- **With geared motors** for long-term storage, pivoting or inclined mounting positions, the supplied breather valve is located in the **motor terminal box**.
- **With gear head units** that have to be vented on the input side, the breather valve is supplied in a plastic bag.
- **No** breather valve will be supplied **for gear units in enclosed design**.

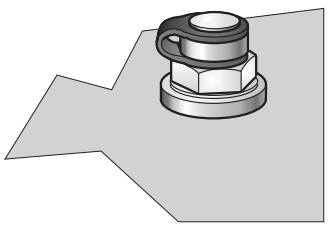
*Activating the breather valve*

**Usually the breather valve is activated in the plant. Should this not be the case, the transport fixture must be removed from the breather valve prior to the startup of the gear unit!**

**1.** Breather valve with transport fixture

**2.** Remove transport fixture

**3.** Activate breather valve



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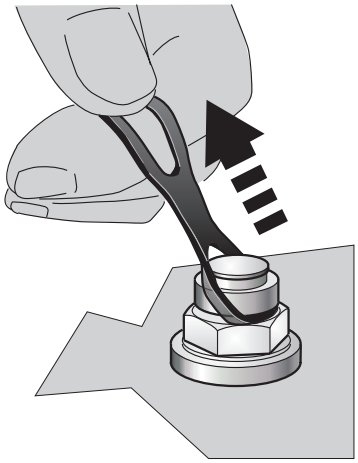
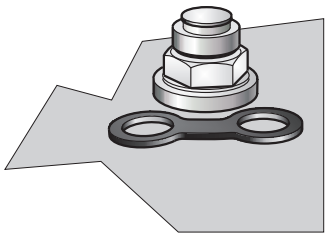


02054BXX



02055BXX

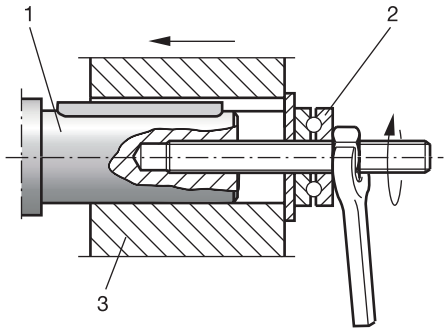
***Painting the gear unit***

Cover breather valve and oil seals with protective tape prior to painting or partly re-painting the drive. Remove adhesive strips when the paint job is finished.

## 4.5 Gear units with solid shaft

***Installation of input and output elements***

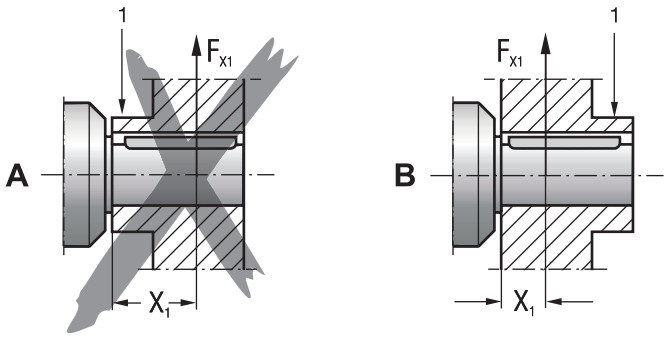
The following illustration is an example of a moutning device for mounting couplings or hubs onto gear unit or motor shaft ends. It may be possible to dispense with the thrust bearing on the mounting device.




1) Gear unit shaft end
2) Thrust bearing
3) Coupling hub

03371BXX

The following illustration displays the correct mounting arrangment **B** of a gear wheel or sprocket to prevent excessively high overhung loads.




1 = Hub

A = incorrect
B = correct

03369BXX

- Only use a mounting device (see Fig. 1) for installing input and output elements. Use the center bore and the thread on the shaft end for positioning purposes.
- **Never drive belt pulleys, couplings, pinions, etc. onto the shaft end by hitting them with a hammer (damage to bearings, housing and the shaft!).**
- **In the case of belt pulleys, make sure the belt is tensioned correctly (in accordance with the manufacturer's instructions).**
- Power transmission elements should be balanced after fitting and must not give rise to any impermissible radial or axial forces (see Fig. 2 / permitted values see the "Geared Motors" catalog).

**Note:**

Assembly is easier if you first apply lubricant to the output element or heat it up briefly (to 80-100 °C).

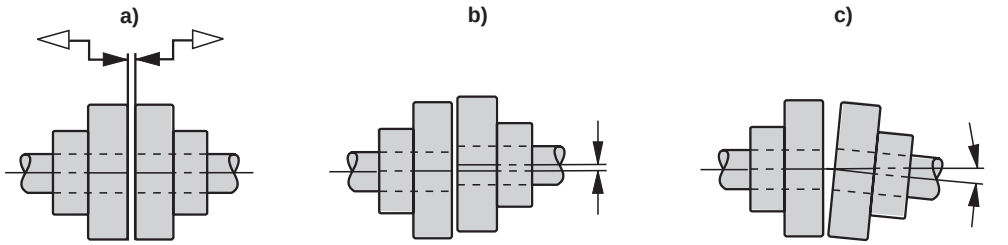
***Installation of couplings***

Harmonize the following factors according to the manufacturer's recommendation when installing couplings:

a) maximum and minimum distance

b) axial misalignment

c) angular misalignment




03356AXX

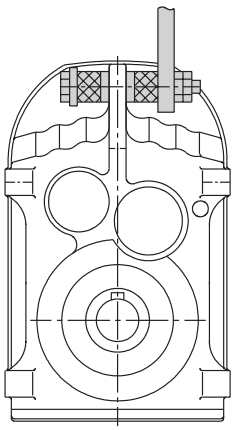
*Fig. 6: Distance and misalignment with coupling installation*

**Drive and output elements auch as belt pulleys, couplings, etc. must be equipped with a touchguard!**

## 4.6 Installation of torque arms for shaft-mounted gear units

Do not strain torque arms during installation!

***Parallel shaft helical gear units***

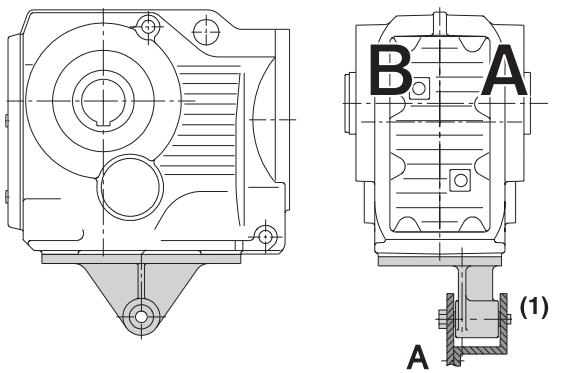


01029BXX

*Fig. 7: Torque arm for parallel shaft gear units*

***Helical-bevel gear units***

- Bushing with bearings on both ends → (1)
- Install connection end B as a mirror image of A

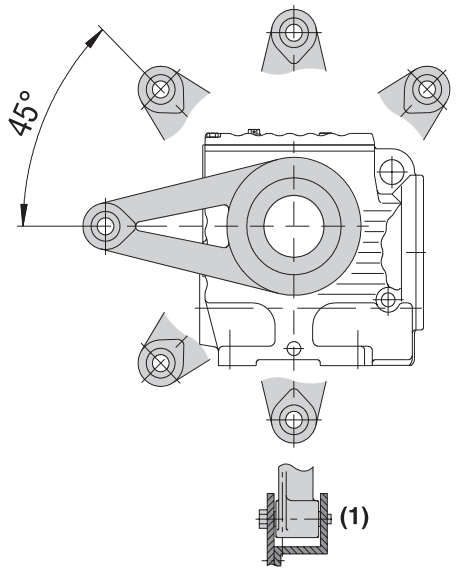



01030CXX

*Fig. 8: Torque arm for helical-bevel gear units*

***Helical-worm gear units***

- Bushing with bearings on both ends → (1)

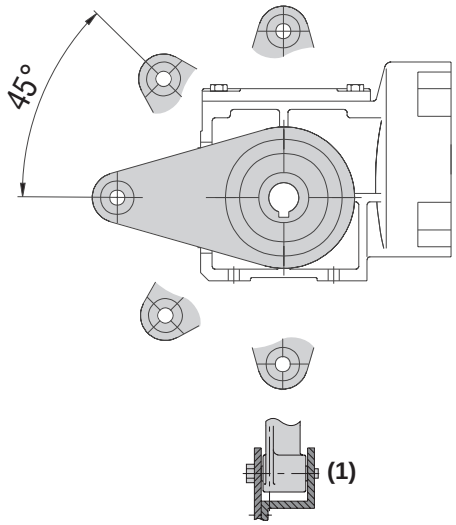



01031CXX

*Fig. 9: Torque arm for helical-worm gear units*

***SPIROPLAN® W gear units***

- Bushing with bearings on both ends → (1)




02050CXX

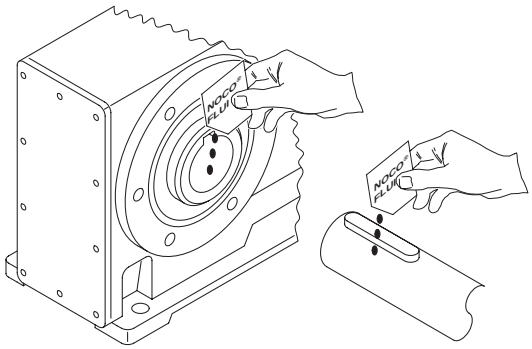
*Fig. 10: Torque arm for SPIROPLAN® W gear units*

## 4.7 Installation/removal of shaft-mounted gear units with key or splines

Note the construction notes in the Geared Motors catalog when designing the customer shaft!

***Installation notes***

1. Apply NOCO® fluid

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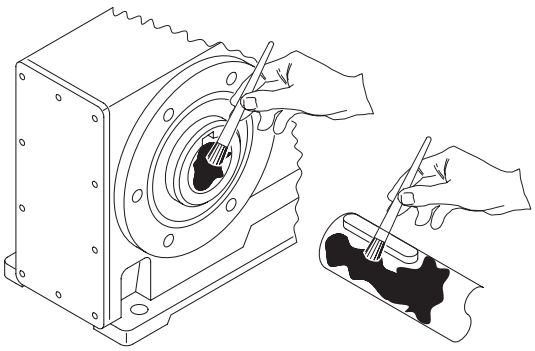
2. Distribute NOCO® fluid evenly

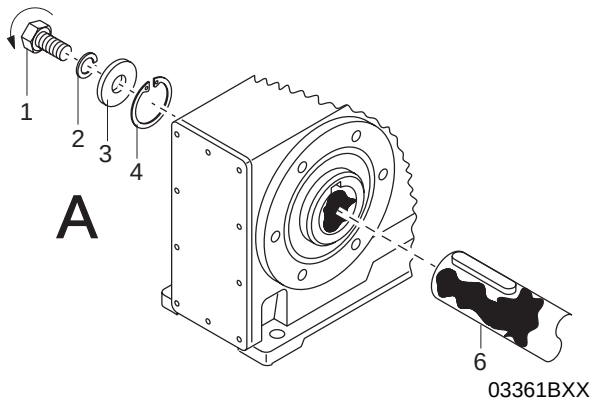


02043AXX

3. Install shaft and secure axially

   (installation will be made easier by using a mounting device)

   **3A: Installation with standard components**

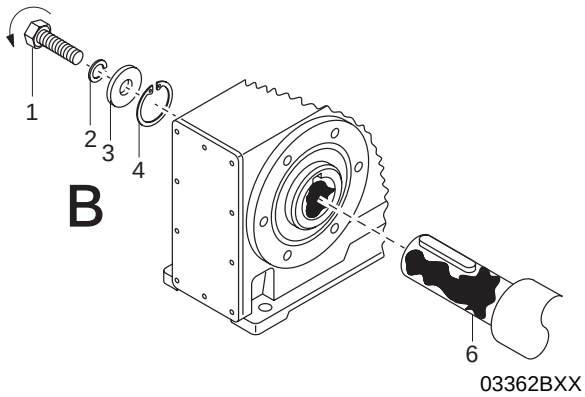



03361BXX

1 short retaining screw (standard components)
2 lock washer
3 washer
4 circlip
6 customer shaft

**3B: Installation with SEW installation/removal kit** (→ page 22)

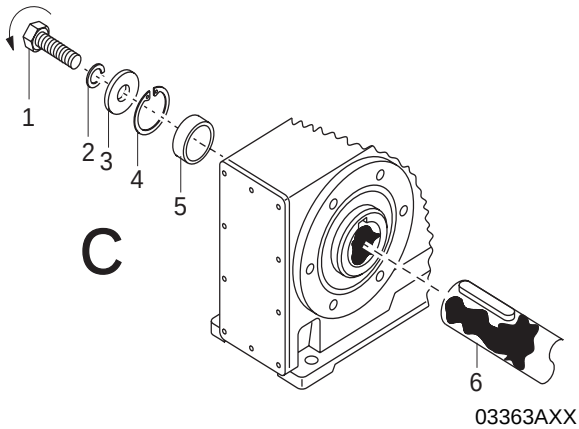
– Customer shaft **with** contact shoulder




1 retaining screw
2 lock washer
3 washer
4 circlip
6 customer shaft with contact shoulder

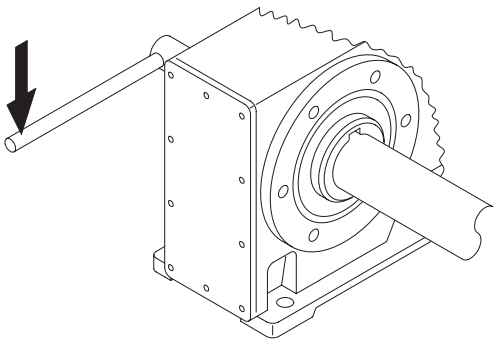
**3C: Installation with SEW installation/removal kit** (→ page 22)

– Customer shaft **without** contact shoulder




1 retaining screw
2 lock washer
3 washer
4 circlip
5 spacer tube
6 customer shaft without contact shoulder

4. Tighten retaining screw with corresponding torque (see table).




| Screw | Torque [Nm] |
|---|---|
| M5 | 5 |
| M6 | 8 |
| M10/12 | 20 |
| M16 | 40 |
| M30 | 80 |
| M24 | 200 |

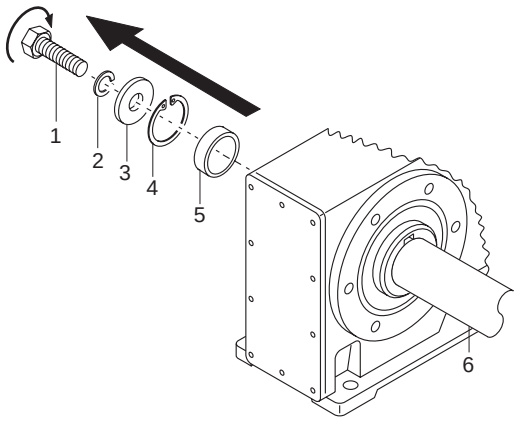
**Note:**

We recommend you also loosen the customer shaft between the two contact surfaces to prevent contact corrosion!

***Removal notes***

The description applies only to gear units that were installed with the SWE mounting/ removal kit (→ page 22) (see previous description, points 3B or 3C)

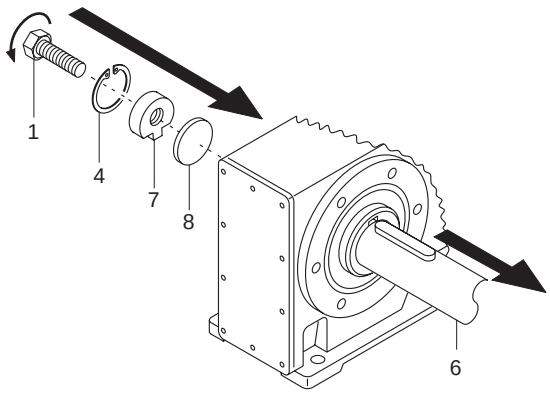
1. Loosen the retaining screw 1.
2. Remove parts 2 to 4 and the spacer tube 5, if installed.




1 retaining screw
2 lock washer
3 washer
4 circlip
5 spacer tube
6 customer shaft

03366AXX

3. Install the removal washer 8 and the locknut 7 from the SEW installation/removal kit between customer shaft 6 and circlip 4.
4. Reinstall the circlip 4.
5. Reinstall the retaining screw 1. You can now remove the gear unit from the shaft by tightening the screw.

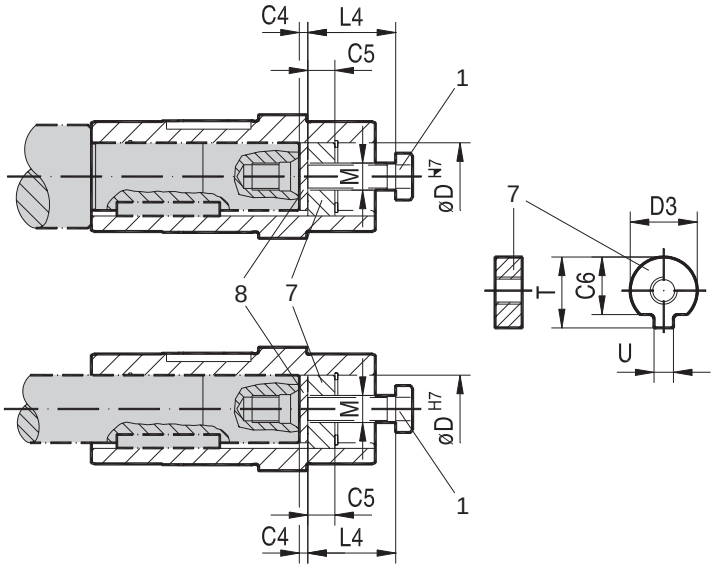



1 retaining screw
4 circlip
6 customer shaft
7 locknut
8 removal washer

03367AXX

***SEW installation/ removal kit***

The SEW installation/removal kit is available with the indicated part number.




03394CXX

*Fig. 11: SEW installation/removal kit*

1 retaining screw
7 locknut for removal
8 removal washer

| Type | $D^{H7}$ [mm] | $M^{1)}$ | C4 [mm] | C5 [mm] | C6 [mm] | $U^{-0.5}$ [mm] | $T^{-0.5}$ [mm] | $D3^{-0.5}$ [mm] | L4 [mm] | Part number installation/ removal kit |
|---|---|---|---|---|---|---|---|---|---|---|
| **WA..10** | 16 | M5 | 5 | 5 | 12 | 4.5 | 18 | 15.7 | 50 | 643 712 5 |
| **WA..20** | 18 | M6 | 5 | 6 | 13.5 | 5.5 | 20.5 | 17.7 | 25 | 643 682 X |
| **WA..20, WA..30, SA..37** | 20 | M6 | 5 | 6 | 15.5 | 5.5 | 22.5 | 19.7 | 25 | 643 683 8 |
| **FA..27, SA..47** | 25 | M10 | 5 | 10 | 20 | 7.5 | 28 | 24.7 | 35 | 643 684 6 |
| **FA..37, KA..37, SA..47, SA..57** | 30 | M10 | 5 | 10 | 25 | 7.5 | 33 | 29.7 | 35 | 643 685 4 |
| **FA..47, KA..47, SA..57** | 35 | M12 | 5 | 12 | 29 | 9.5 | 38 | 34.7 | 45 | 643 686 2 |
| **FA..57, KA..57, FA..67, KA..67, SA..67** | 40 | M16 | 5 | 12 | 34 | 11.5 | 41.9 | 39.7 | 50 | 643 687 0 |
| **SA..67** | 45 | M16 | 5 | 12 | 38.5 | 13.5 | 48.5 | 44.7 | 50 | 643 688 9 |
| **FA..77, KA..77, SA..77** | 50 | M16 | 5 | 12 | 43.5 | 13.5 | 53.5 | 49.7 | 50 | 643 689 7 |
| **FA..87, KA..87, SA..77, SA..87** | 60 | M20 | 5 | 16 | 56 | 17.5 | 64 | 59.7 | 60 | 643 690 0 |
| **FA..97, KA..97, SA..87, SA..97** | 70 | M20 | 5 | 16 | 65.5 | 19.5 | 74.5 | 69.7 | 60 | 643 691 9 |
| **FA..107, KA..107, SA..97** | 90 | M24 | 5 | 20 | 80 | 24.5 | 95 | 89.7 | 70 | 643 692 7 |
| **FA..127, KA..127** | 100 | M24 | 5 | 20 | 89 | 27.5 | 106 | 99.7 | 70 | 643 693 5 |
| **FA..157, KA..157** | 120 | M24 | 5 | 20 | 107 | 31 | 127 | 119.7 | 70 | 643 694 3 |

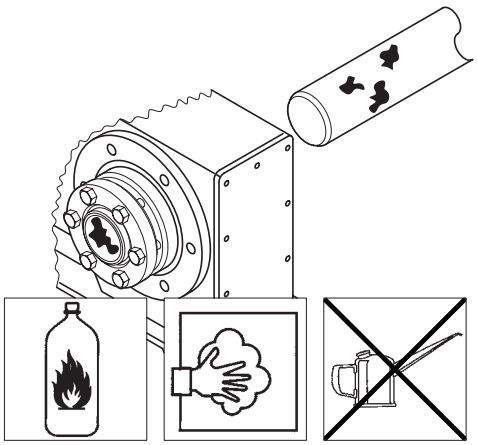
1) retaining screw

## 4.8 Installation/removal of shaft-mounted gear units with shrink disc

***Installation notes***

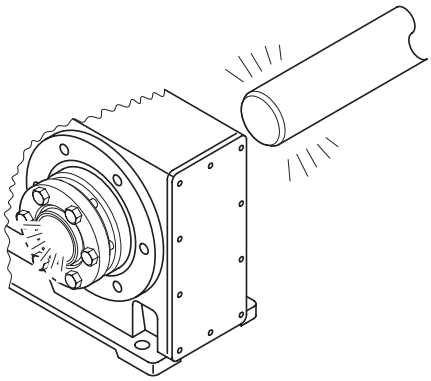
- Do not tighten locking screws unless shaft is installed - hollow shaft could be deformed!

1. Thoroughly remove grease from hollow shaft bore and drive shaft.



01815AXX

2. Degreased hollow shaft/drive shaft



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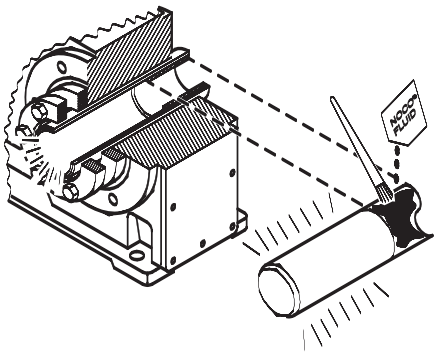
3. Apply NOCO® fluid in the bushing area onto the input shaft[1)].

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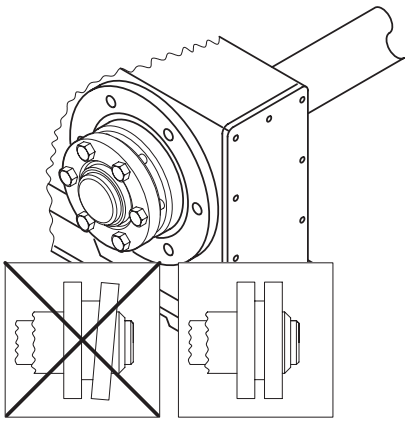
4. Install shaft, making sure that the locking collars of the shrink disc are evenly spaced[2)].



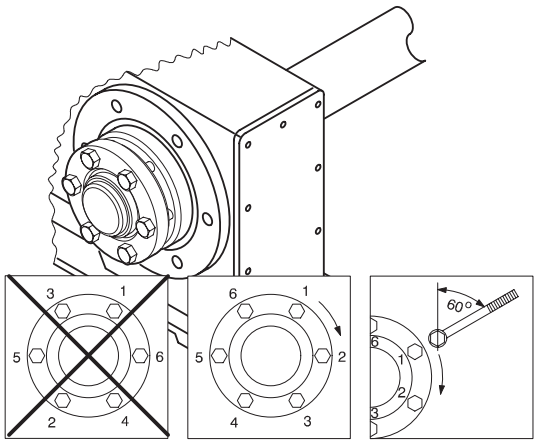
01818AXX

STOP

1) **The clamping area of the shrink disc must always be kept free from grease! Therefore, never apply NOCO® fluid directly onto the bushing, since the paste can enter the clamping area of the shrink disc when installing the input shaft.**

2) **After installation,** grease the outer surface of the hollow shaft in the shrink disc area to protect the shaft against corrision.

5. Tighten the locking screws by working round several times from one crew to the next (not diagonally). See table for tightening torques.

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| Gear unit type | | | Screw | Nm | ◁ max.[1)] |
|---|---|---|---|---|---|
| | FH27 | SH37 | M5 | 5 | |
| KH37...77 | FH37...77 | SH47...77 | M6 | 12 | |
| KH87/97 | FH87/97 | SH87/97 | M8 | 30 | 60° |
| KH107 | FH107 | | M10 | 59 | |
| KH127/157 | FH127 | | M12 | 100 | |

1) maximum tightening angle per cycle

***Notes on removal of shrink disc***

1. Unscrew the locking screws evenly one after the other. To avoid tilting and jamming of the locking collars, each locking screw may only be unscrewed by about one quarter turn in the initial cycle. Do not fully unscrew the locking screws!
2. Remove the shaft or pull the hub off the shaft (it is necessary to remove any rust which may have formed between the hub and the end of the shaft).
3. Pull the shrink disc off the hub..

**Caution!**

There is a risk of injuries if the shrink disc is not removed correctly!

***Cleaning and lubricating the shrink disc***

There is no need to take apart and re-grease disassembled shrink discs before they are screwed back on.

The shrink disc only needs to be cleaned and re-greased if it is contaminated.

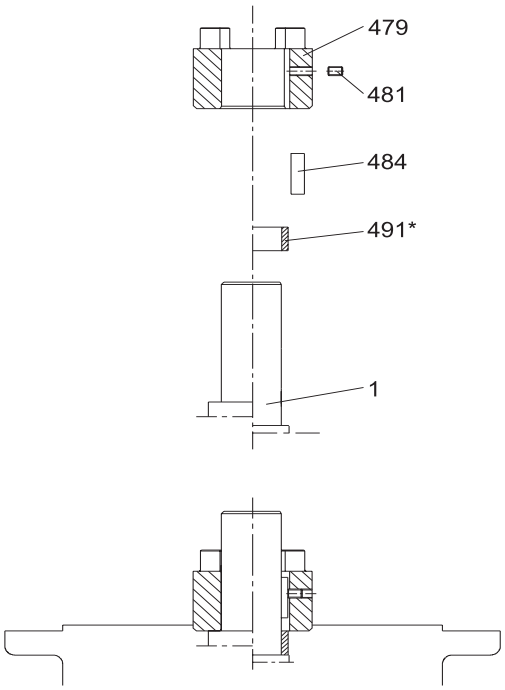
Use one of the following solid lubricants for the tapered surfaces.

| Lubricant (Mo S2) | Available as |
|---|---|
| Molykote 321 (lube coat) | spray |
| Molykote Spray (powder spray) | spray |
| Molykote G Rapid | spray or paste |
| Aemasol MO 19P | spray or paste |
| AemasolDIO-sétral 57 N (lube coat) | spray |

Grease the locking screws with a multipurpose grease such as Molykote BR 2 or similar.

## 4.9 Installation of the AM adapter coupling

***IEC adapters***
***AM63 - 225 /***
***NEMA adapters***
***AM56 - 365***




* = NEMA adapters only
1 = motor shaft

04469AXX

1. Clean motor shaft and flange surfaces of motor and adapter.
2. **IEC adapters:** Remove motor shaft key and replace with supplied key (484).

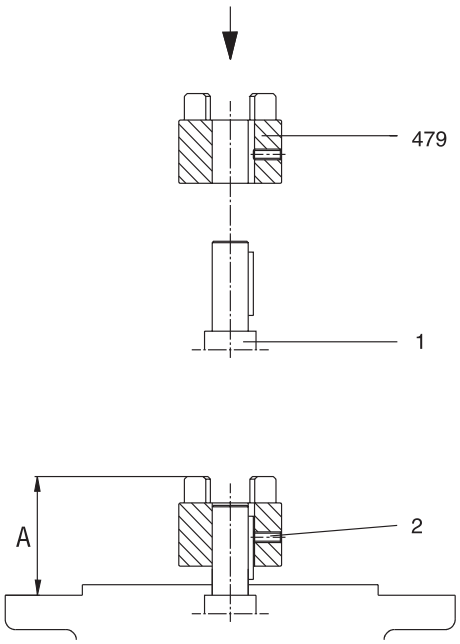
   **NEMA adapters:** Remove motor shaft key, slide spacer tube (491) on motor shaft and install supplied key (484).
3. Heat coupling half (479) to approx. 80 - 100°C; slide coupling half on motor shaft.

   **IEC adapters:** until rest on motor shaft shoulder.

   **NEMA adapters:** until rest on spacer tube.
4. Secure key and coupling half with setscrew (481) on motor shaft .
5. Mount motor to adapter; the gearing of the coupling half and the geared adapter shaft must enmesh.


Note: We recommend applying Noco® fluid on the motor shaft prior to installation of the coupling half to prevent contact corrosion.

***IEC adapters AM250/AM280***



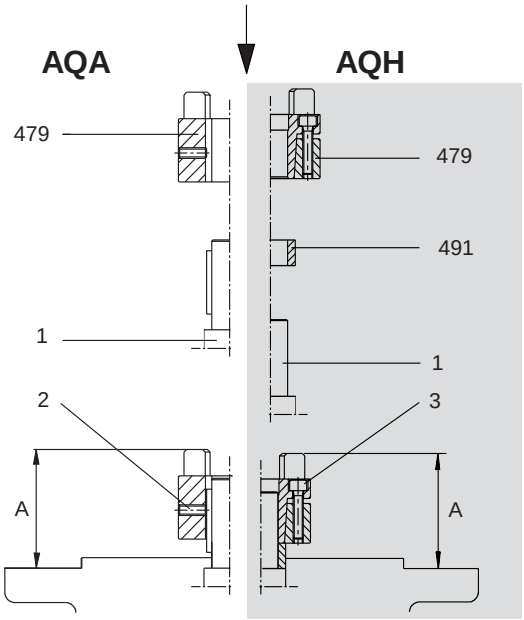

1 = Motor shaft
2 = Setscrew

02047CXX

1. Clean motor shaft and flange surfaces of motor and adapter.
2. Remove motor shaft key and replace with supplied key **(size AM280 only)**.
3. Heat coupling half (479) (to 80 °C - 100 °C) and slide on motor shaft (A = 139 mm).
4. Fasten coupling half with setscrew and check position (distance "A").
5. Mount motor on adapter; the gearing of the coupling half and the geared adapter shaft must enmesh.


Note: We recommend applying Noco® fluid on the motor shaft prior to installation of the coupling half to prevent contact corrosion.

## 4.10 Installation of the AQ adapter coupling




1 Motor shaft
2 Setscrew
3 Screw

**AQA** = with keyway
**AQH** = w/o keyway

02702CXX

1. Clean motor shaft and flange surfaces of motor and adapter.
2. **AQH design:** Slide spacer tube (491) on motor shaft.
3. **AQH design:** Loosen screws of coupling half (479) and conical connection.
4. Heat coupling half (80° C - 100° C) and slide on motor shaft.

   **AQH design:** until rest on spacer tube (491).

   **AQA design:** until distance "A" (see table)
5. **AQH design:** Fasten screws of coupling half evenly by working round several times in sequence until all screws have been tightened to the TT tightening torque.

   **AQA design:** Secure coupling half with setscrew.
6. Check position of coupling half (distance "A" see table).

   Mount motor to adapter; the jaws of both coupling halves must enmesh. The insertion force required to join the coupling halves. The insertion force required to join the coupling halves is suspended after final assembly thereby causing danger of axial load on the adjacent bearing.

***Setting dimensions, tightening torques***

| Type | Coupling size | Distance "A" [mm] | Bolts DIN 912[1)] | Tightening torque TT[1)] [Nm] |
|---|---|---|---|---|
| **AQA /AQH 80 /1/2/3** | 19/24 | 44.5 | M4 | 3 |
| **AQA /AQH 100 /1/2** | | 39 | | |
| **AQA /AQH 100 /3/4** | | 53 | | |
| **AQA /AQH 115 /1/2** | | 62 | | |
| **AQA /AQH 115 /3** | 24/28 | 62 | M5 | 6 |
| **AQA /AQH 140 /1/2** | | 62 | | |
| **AQA /AQH 140 /3** | 28/38 | 74.5 | M5 | 6 |
| **AQA /AQH 190 /1/2** | | 76.5 | | |
| **AQA /AQH 190 /3** | 38/45 | 100 | M6 | 10 |

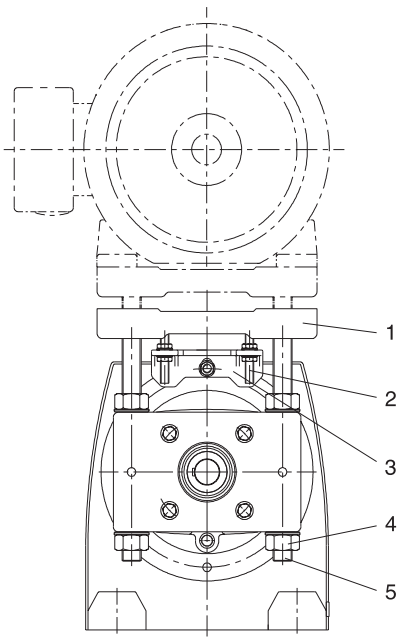
1) in versions without keyway only (AQH)

## 4.11 Installation on the AD input shaft assembly

See section "Installation of input and output shafts" for installation of input elements.

***Version with motor mounting platform AD../P***

Installation of motor and adjustment of motor mounting platform

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1 Motor mounting platform
2 Setscrew (AD6/P / AD7/P only)
3 Support (AD6/P / AD7/P only)
4 Nut
5 Threaded column

1. Adjust motor mounting platform to required mounting position by evenly tightening the adjusting nuts. For the lowest possible adjustment position of helical gear units, remove eyebolts/transport lugs if there are any; touch up any damage to protective coating.
2. Align motor on motor mounting plate (shaft extensions must be aligned) and secure it.
3. Mount drive elements onto input shaft extension and install motor shaft, align these to each other; correct motor position where necessary.
4. Install traction mechanisms (V-belts, chains, ...) and tighten by evenly adjusting the motor mounting plate. The motor mounting plate and columns must not be tightened against each other.
5. Secure threaded columns with the nuts not used for adjustment purposes.

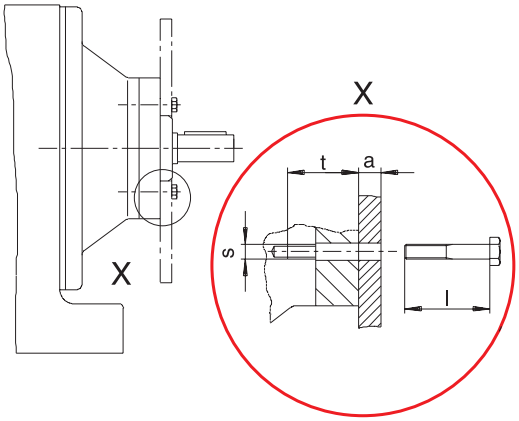
***AD6/P and AD7/P only:***

Loosen nuts and stud bolts before readjustment so that the stud bolts can be moved freely in the support axially. Tighten nuts after the final position has been accomplished. Do not adjust the motor mounting platform by using the support.

***AD../ZR design with centering shoulder***

Installing components on the input shaft assembly with centering shoulder

1. The bolts must be available in the correct length to fasten the installed components. The length of the new bolts results from:




l = t + a
t srew depth (see table)
a thickness of application
s retaining thread (see table)

02725CXX

**The calculated screw length must be rounded down to the next smallest standard length.**

2. Remove retaining screw from centering shoulder.
3. Clean contact surface and centering shoulder.
4. Clean the threads of the new screws and apply an adhesive agent (e.g. Loctite 243) to the first turns on the screw.
5. Set component onto centering shoulder and fasten retaining screws with indicated tightening torque $T_t$ (see table).

| Type | Depth of screw t | Retaining thread s | Tightening torque $T_A$ [Nm] |
|---|---|---|---|
| **AD2/ZR** | 25.5 | M8 | 25 |
| **AD3/ZR** | 31.5 | M10 | 48 |
| **AD4/ZR** | 36 | M12 | 86 |
| **AD5/ZR** | 44 | M12 | 86 |
| **AD6/ZR** | 48.5 | M16 | 210 |
| **AD7/ZR** | 49 | M20 | 410 |
| **AD8/ZR** | 42 | M12 | 86 |

***AD../RS version with backstop***

Check the direction of rotation prior to installation or startup. In case of the wrong direction of rotation, please consult our technical department.

The backstop is maintenance-free and does not require any additional maintenance work.

# 5 Startup

## 5.1 Startup of helical-worm and Spiroplan® W gear units


Note: The direction of rotation for the output shaft has been changed from CW to CCW for helical-worm gear units S..7 series compared to the S..2 series. Switch two motor feeder cables to change the direction of rotation.

***Running-in period***

Spiroplan® and helical-worm gear units require a running-in period of at least 24 hours before reaching their maximum efficiency. A separate running-in period is required for each direction of rotation if the gear unit is operated in both directions of rotation. The table displays the average power reduction during the running-in period.

| No. of starts | Helical-worm | | Spiroplan® | |
|---|---|---|---|---|
| | power reduction | i range | power reduction | i range |
| **1 start** | approx. 12% | app. 50...280 | approx. 15% | approx. 40...75 |
| **2 starts** | approx. 6% | app. 20...75 | approx. 10% | approx. 20...30 |
| **3 starts** | approx. 3% | app. 20...90 | approx. 8% | approx. 15 |
| **4 starts** | - | - | approx. 8% | approx. 10 |
| **5 starts** | approx. 3% | app. 6...25 | approx. 5% | approx. 8 |
| **6 starts** | approx. 2% | app. 7...25 | - | - |

## 5.2 Startup of helical, parallel shaft helical and helical-bevel gear units

There are no special startup notes that have to be observed for helical gear units, parallel shaft helical gear units and helical-bevel gear units, if the gear units have been mounted according to the section "Mechanical Installation."

# 6 Troubleshooting

## 6.1 Gear unit problems

| Problem | Possible cause | Remedy |
|---|---|---|
| Unusual, regular running noise | A Meshing/grinding noise: bearing damage<br>B Knocking noise: irregularity in the gearing | A Check oil (see Inspection and Maintenance), replace bearing<br>B Call customer service |
| Unusual, irregular running noise | Foreign bodies in the oil | • Check oil (see Inspection and Maintenance)<br>• Stop the drive, call customer service |
| Oil leaking [1)]<br>• from the gear unit cover<br>• from the motor flange<br>• from motor oil seal<br>• from gear unit flange<br>• from the output end oil seal | A Defective rubber gasket on gear unit cover<br>B Defective gasket<br>C Gear unit not vented | A Retighten screws on gear unit cover and observe gear unit. Oil still leaking: Call customer service<br>B Call customer service<br>C Vent the gear unit (see Mounting Positions) |
| Oil leaking<br>from the breather valve | A Too much oil<br>B Drive installed in incorrect mounting position<br>C Frequent cold starts (oil foaming) and / or high oil level | A Correct oil level (see Inspection and Maintenance)<br>B Fit the breather valve correctly (see Mounting Positions) and adjust oil level (see Lubricants) |
| Output shaft is not rotating although the motor is running or the input shaft is rotating | Shaft hub connection interrupted in the gear unit | Send in gear unit/geared motor for repair |

1) It is normal for small amounts of oil/grease to leak out of the oil seal during the running-in period (24 hour running time) (also see DIN 3761).

**Please have the following information available if you require assistance of our customer service:**
- Nameplate data (complete)
- Type and extent of problem
- Time and circumstances of problem
- Possible cause

# 7 Inspection and Maintenance

## 7.1 Inspection and maintenance periods

| Time period | What to do? |
|---|---|
| • every 3000 operating hours, at least every six months | • Check oil |
| • depending on operating conditions (see following illustration), at least every three years | • Replace mineral oil |
| | • Replace bearing grease |
| • depending on operating conditions (see following illustration), at least every five years | • Replace synthetic oil |
| | • Replace bearing grease |
| • R17, R27, F27 and Spiroplan® gear units are lubricated for life and do not require maintenance | |
| • different (depending on external influences) | • Touch up or replace surface/corrosion protection coat |

## 7.2 Lubricant replacement schedule

Change oil more often in special version and under more demanding/aggressive ambient conditions!

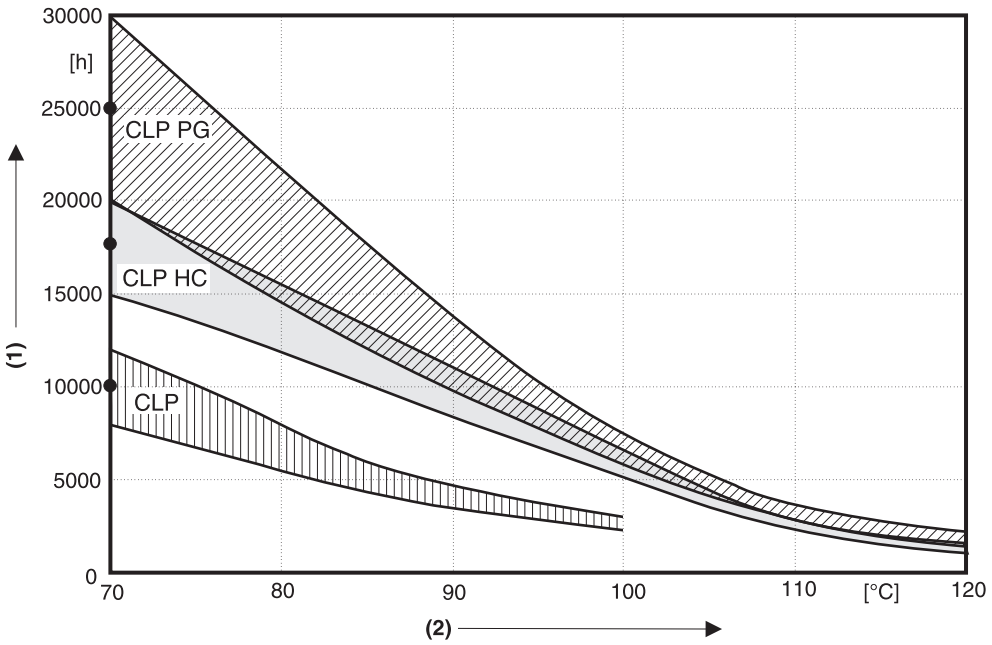



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*Fig. 12: Replacement schedule for standard gear units operating under normal ambient conditions.*

(1) Operating hours
(2) Oil bath steady-state temperature
• Average value depending on oil type at 70° C

## 7.3 Inspection/maintenance of gear units

Do not mix synthetic lubricants with each other nor with mineral lubricants!

Mineral oil is the standard lubricant.

**The position of the oil level plug, oil drain plug and the breather valve is dependent on the mounting position.**

### *Checking the oil level*

1. **De-energize the drive and secure against unintentional switch-on!**

   **Wait until the gear unit has cooled down – Danger of burns!**
2. See section "Setup of gear unit" for change in mounting position!
3. For gear units with oil level plug: remove oil level plug, check fill level and correct if necessary, install oil level plug

### *Check oil*

1. **De-energize the drive and secure against unintentional switch-on!**

   **Wait until gear unit has cooled down - Danger of burns!**
2. Remove some oil from the oil drain plug
3. Check oil consistency
   - viscosity
   - if the oil is visibly contaminated, it is recommended to change it sooner than recommended by the maintenance intervals listed under the heading "Inspection and maintenance periods" on page 32
4. For gear units with an oil level plug: remove oil level plug, check oil fill level and correct if necessary, install oil level plug

### *Changing the oil*

Only change the oil when the gear unit is at operating temperature.

1. **De-energize the drive and secure against unintentional switch-on!**
   **Wait until the gear unit has cooled down – Danger of burns!**
   **Note**: **Gear unit must still be warm, otherwise the high viscosity of excessively cold oil will make it harder to drain the oil correctly.**
2. Place a container underneath the oil drain plug
3. Remove oil level plug, breather plug/valve and oil drain plug
4. Drain oil completely
5. Install oil drain plug
6. Fill new oil of the same type through the breather hole, otherwise consult our service department
   – amount in accordance with the mounting position (see section "Lubricant fill levels") on the nameplate
   – check at the oil level plug
7. Install oil level plug
8. Install breather plug/valve

# 8 Mounting Positions

## 8.1 General comments on mounting positions

### Mounting position designation

*SEW has six mounting positions M1 ... M6 for gear units (see illustration).*

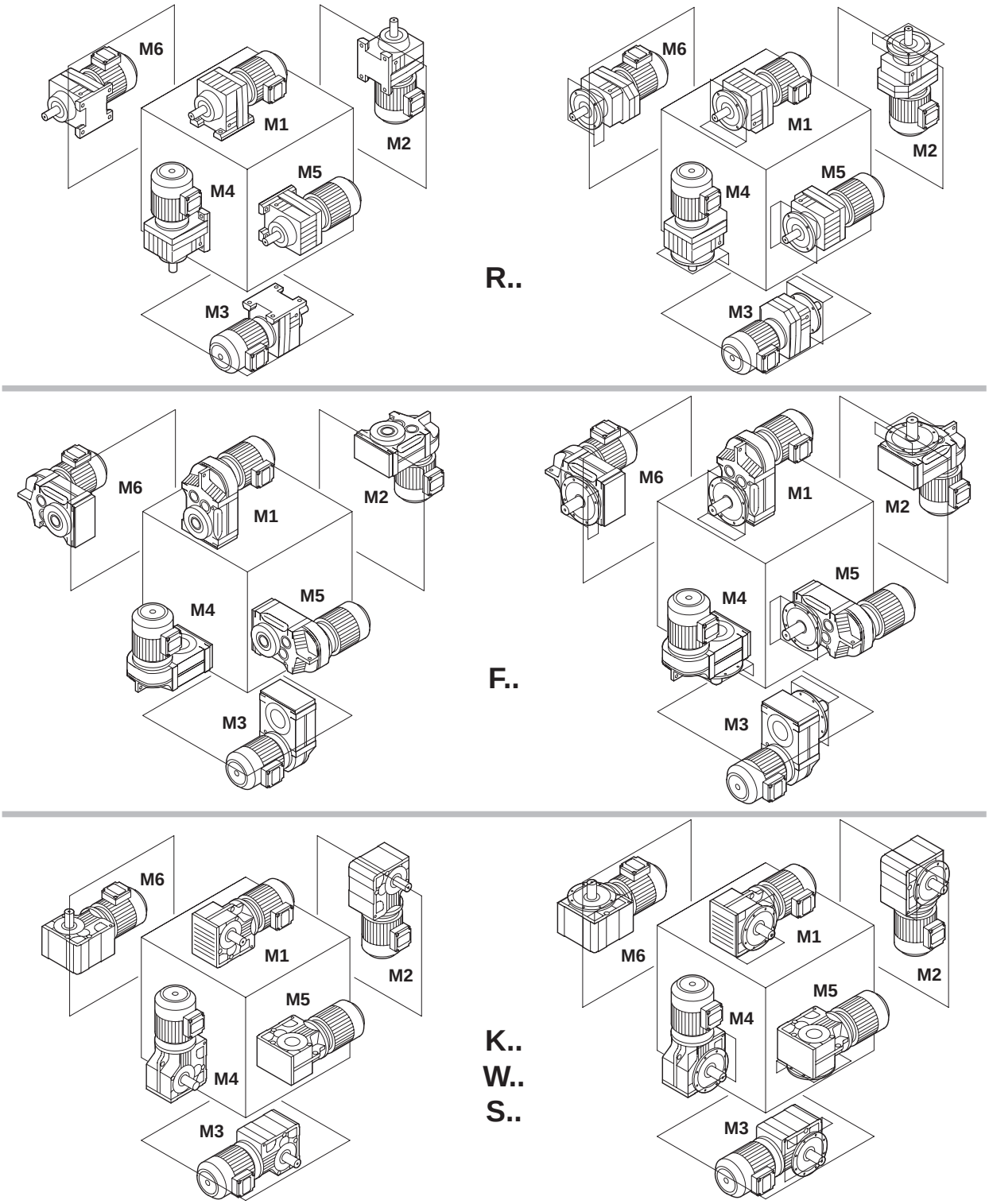


*Fig. 13: Mounting positions M1 ... M6*

***Comparison old/new***

The following table indicates in which way the old SEW mounting position designations are integrated into the new system:

| | M1 | M2 | M3 | M4 | M5 | M6 |
|---|---|---|---|---|---|---|
| **R, RX** | B3 | V6 | B8 | V5 | B6 | B7 |
| **R..F** | B35 | V36 | B85 | V15 | B65 | B75 |
| **RF, RXF** | B5 | V3 | B5II | V1 | B5I | B5III |
| **F** FA..B FH..B FV..B | B6 | V6 | B6II | V5 | B3<br>B8 | B3I<br>B8I |
| **FF** | B5 | V3 | B5II | V1 | B5I | B5III |
| **FA** FHF FVF<br>FH FAZ<br>FV FHZ<br>FAF FVZ | H1 | H6 | H2 | H5 | H4 | H3 |
| **K** KA..B KH..B KV..B | B3<br>B6I | B6<br>B8I | B8 | B3I<br>B6II | V5<br>V5I | V6<br>V6I |
| **K/KH**<br>166/167<br>186/187 | B3<br>B5/I | | | B3I<br>B5/II | V1/ | V1/I |
| **KF** | B5I<br>B3/B5I | B5<br>B65 | B5III<br>B8/B5III | B5II<br>B6/B5II | V1<br>V15 | V1I<br>V6/V1I |
| **KA** KHF KVF<br>KH KAZ<br>KV KHZ<br>KAF KVZ | H1 | H4 | H2 | H3 | H5 | H6 |
| **S** | B3<br>B6I<br>B8II (S37) | B6<br>B8I | B8<br>B3II | B3I<br>B6II | V5<br>V5I | V6<br>V6I<br>V5II (S37) |
| **SF** | B5I | B5 | B5III | B5II | V1 | V1I |
| **SA** SH SAF<br>SHF<br>SAZ<br>SHZ | H1 | H4 | H2 | H3 | H5 | H6 |

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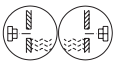
*Example*

A KA77B helical-bevel gear unit with the old mounting position B3I or B6II, is now referred to with mounting position designation M4.

## 8.2 Legend for mounting position pages

***Used symbols***

The following table contains all symbols used in the mounting position pages as well as their meaning:

| Symbol | Meaning |
|---|---|
|  | Breather valve |
|  | Oil level check plug |
|  | Oil drain plug |

***Churning losses***

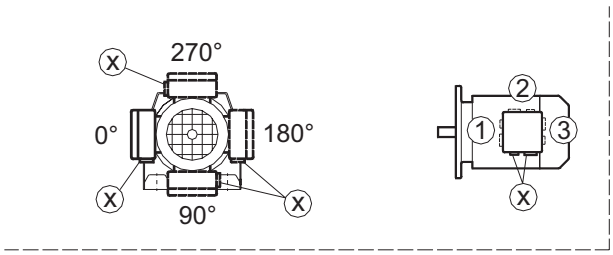

There is a possibility of increased churning losses with some mounting positions. Please contact SEW when dealing with the following combinations:

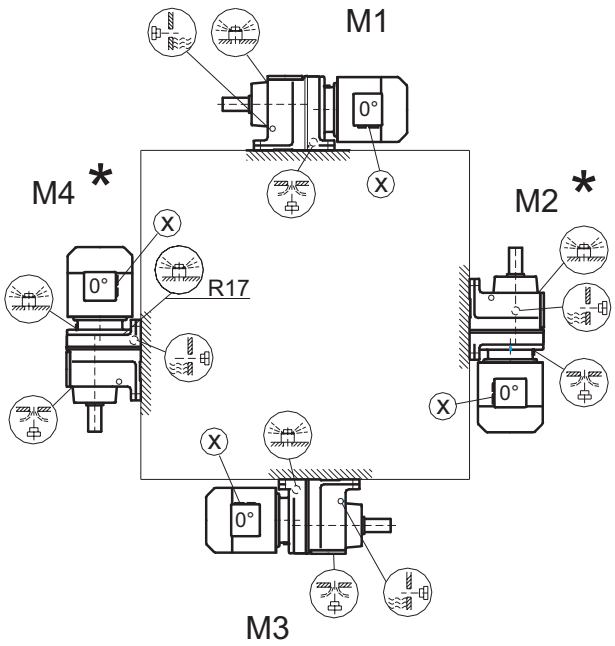
| Mounting position | Gear unit type | Gear unit size | Input speed [1/min] |
|---|---|---|---|
| **M2, M4** | R | 97 ... 107 | > 2500 |
| | | > 107 | >1500 |
| **M2, M3, M4, M5, M6** | F | 97 ... 107 | > 2500 |
| | | > 107 | > 1500 |
| | K | 77 ... 107 | > 2500 |
| | | > 107 | > 1500 |
| | S | 77 ... 97 | > 2500 |

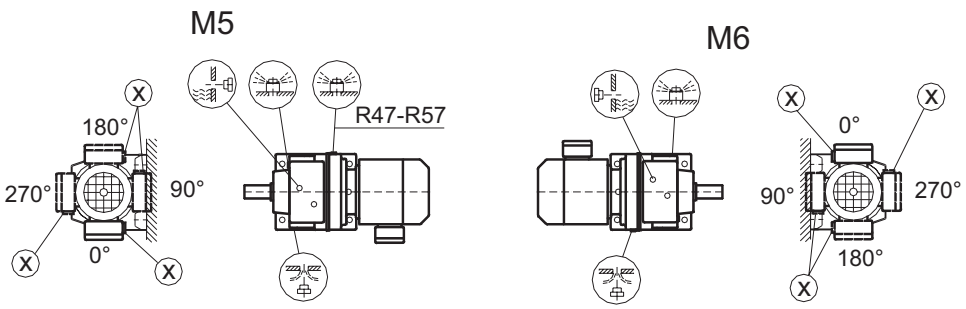
## 8.3 Mounting positions, helical gear units

***R17-R167***

**04 040 100**



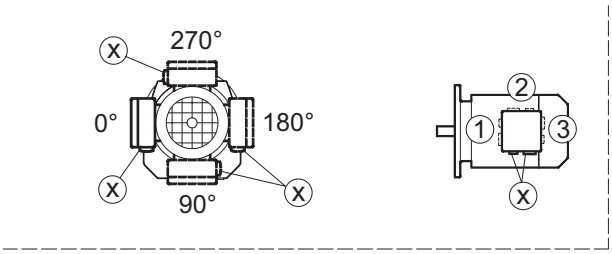



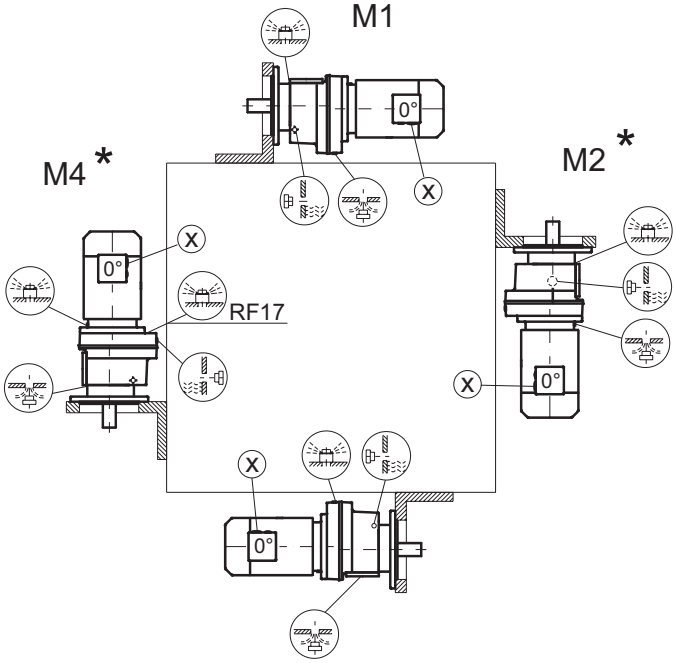

| | | |
|---|---|---|
| R17, R27 |  | M1, M3 , M5 , M6 |
| R47, R57 |  | M5 |
| R17, R27 |  | |

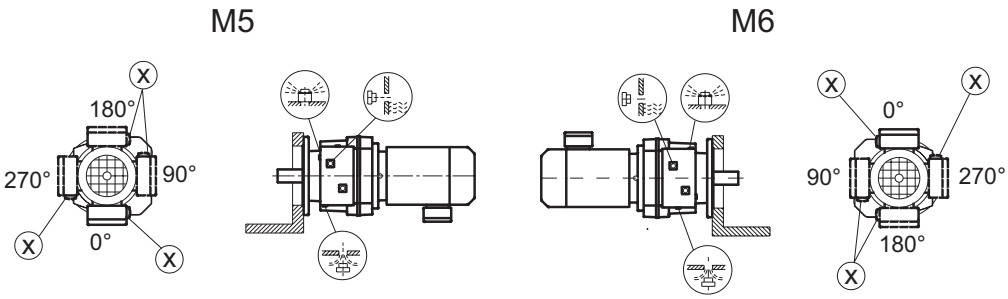
* → page 36

***RF17-RF167***

**04 041 100**



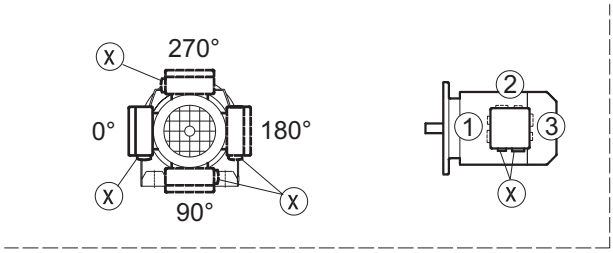



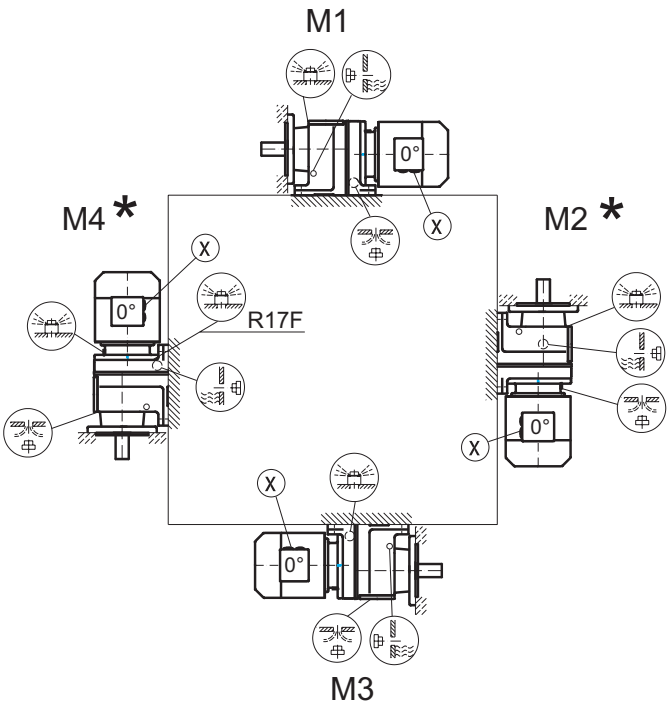

| | | |
|---|---|---|
| RF17, RF27 |  | M1, M3 , M5 , M6 |
| RF47, RF57 |  | M5 |
| RF17, RF27 |  | |

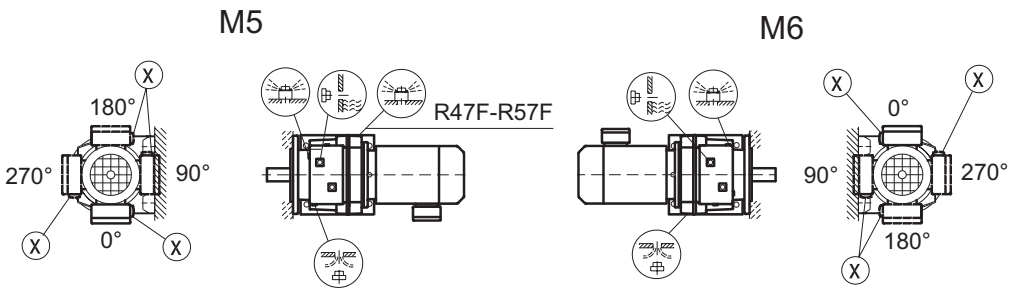
* → page 36

***R17F-R87F***

**04 042 100**




R17F, R27F M1, M3 , M5 , M6

R47F, R57F M5

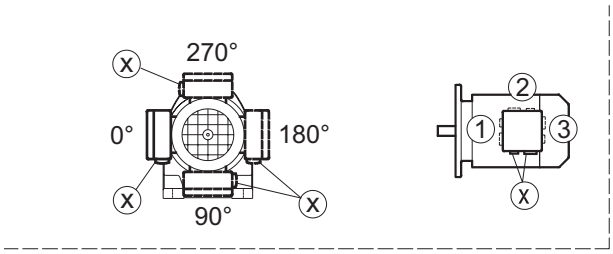
R17F, R27F

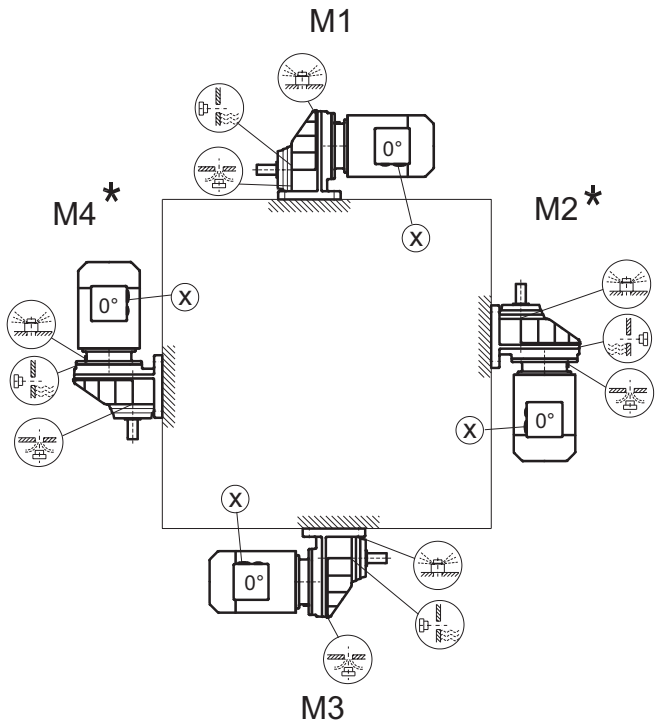
* → page 36

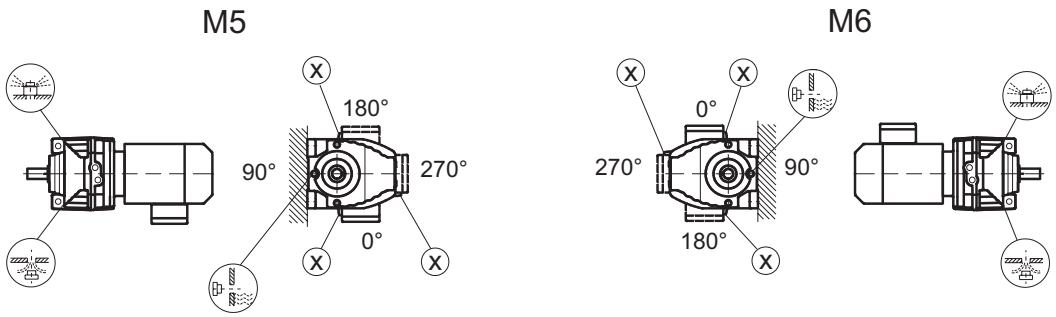
**Caution:** Note the notes in the "Geared Motors" catalog, section "Project Planning Gear Units/Overhung and axial loads."

***RX57-RX107***

**04 043 100**



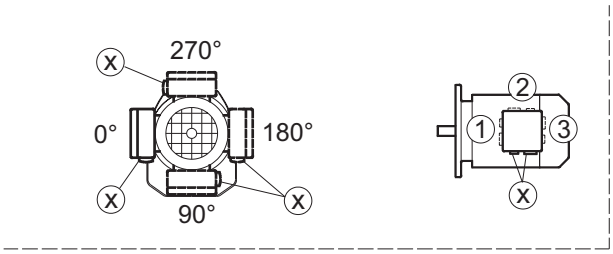



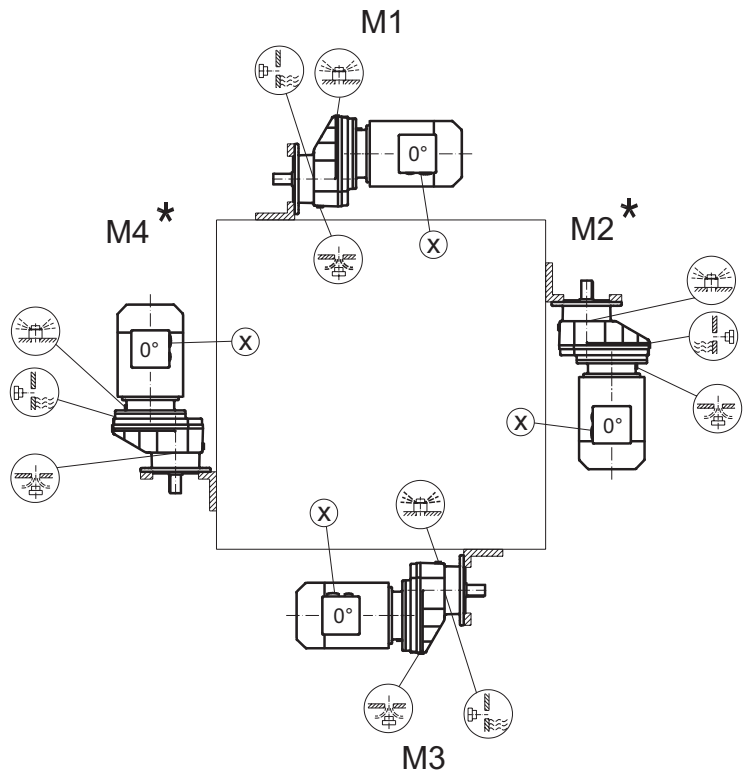



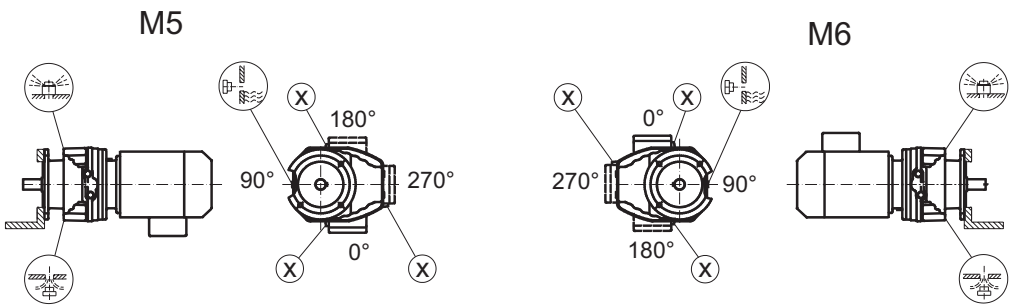

* → page 36

***RXF57-RXF107***

**04 044 100**



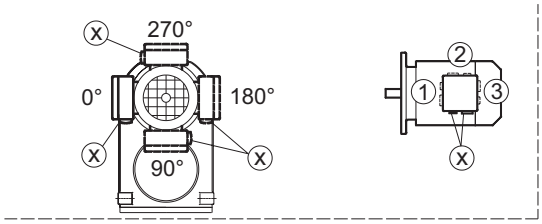



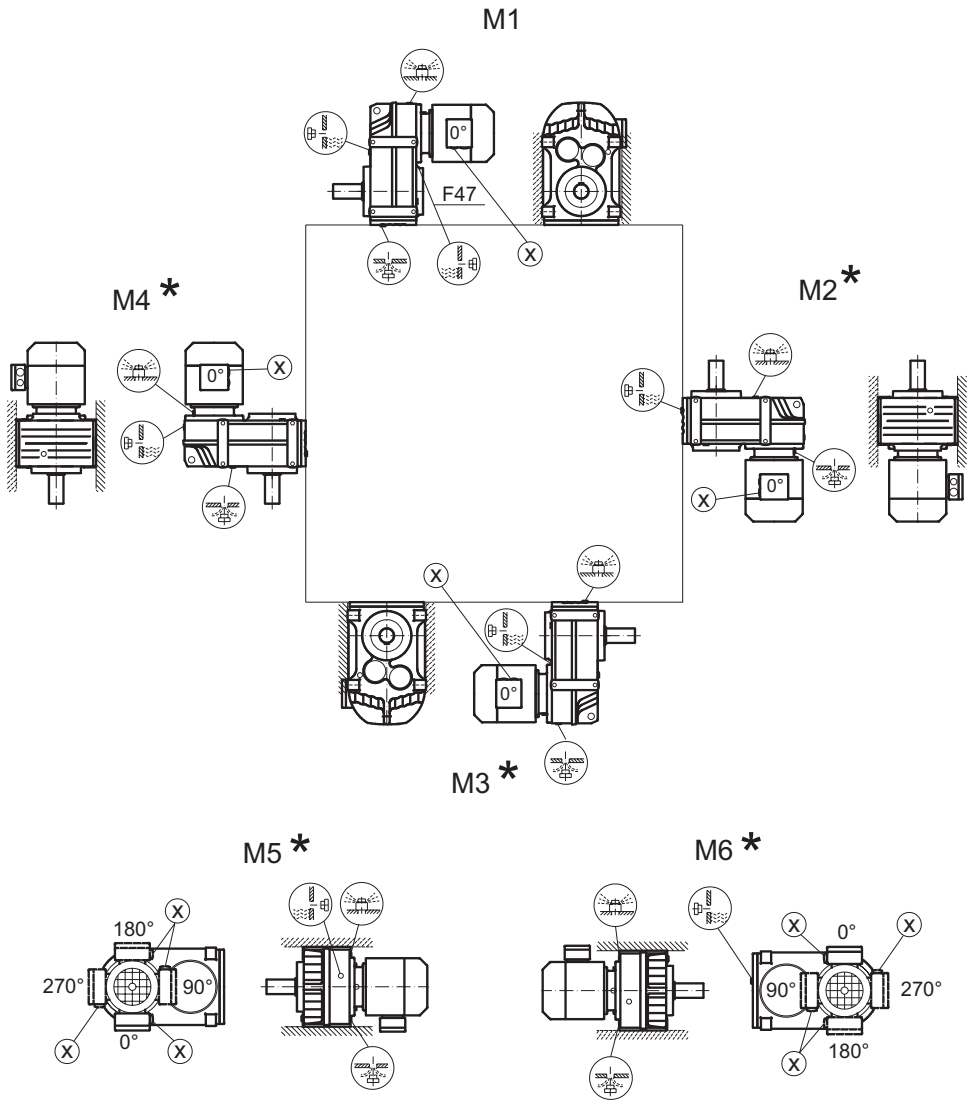

* → page 36

## 8.4 Mounting positions, parallel shaft helical gear units

### F/FA..B/FH27B-157B, FV27B-107B

**42 042 100**




F..27 M1, M3, M5, M6

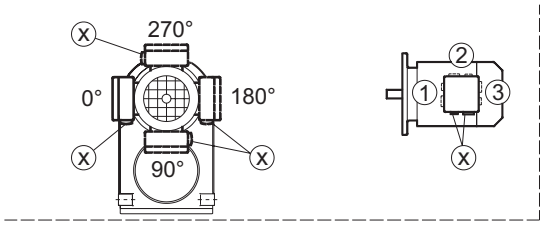
F..27 M1 - M6

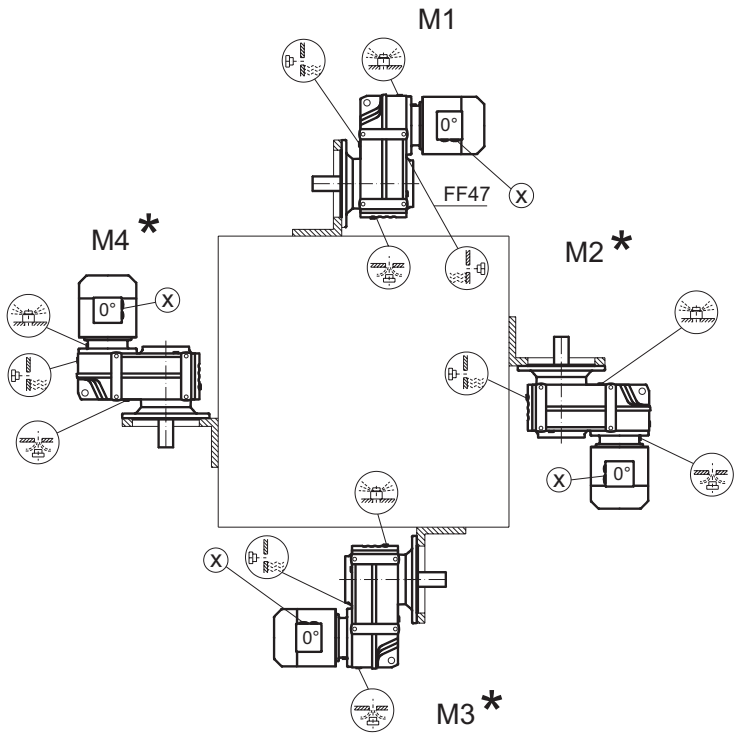
F..27 M1, M3, M5, M6

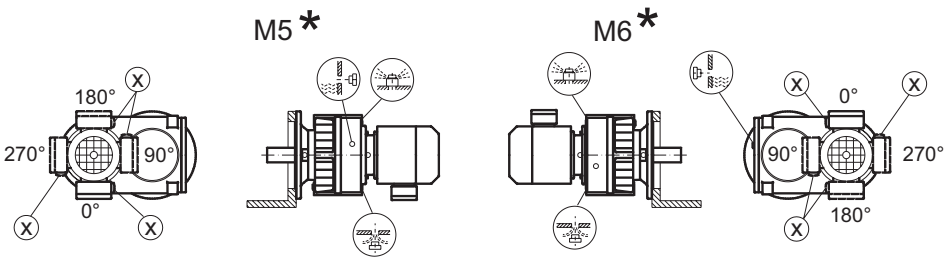
* → page 36

***FF/FAF/FHF/FAZ/FHZ27-157, FVF/FVZ27-107***

**42 043 100**




F..27  M1, M3, M5, M6

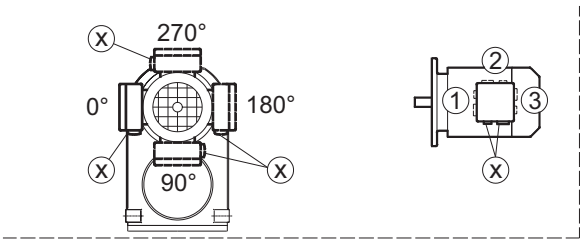
F..27  M1 - M6

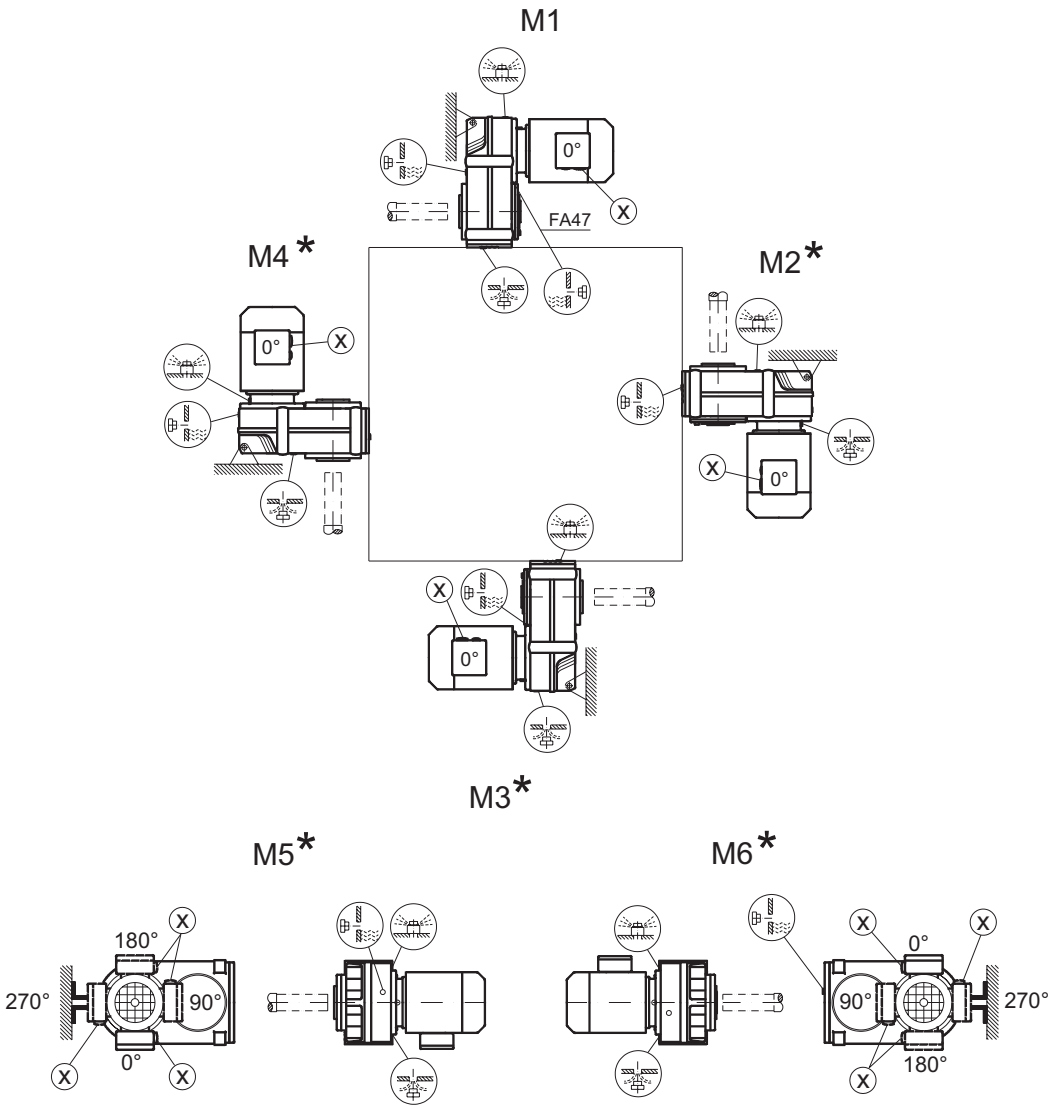
F..27  M1, M3, M5, M6

* → page 36

***FA/FH27-157, FV27-107***

**42 044 100**




F..27 M1, M3, M5, M6

F..27 M1 - M6

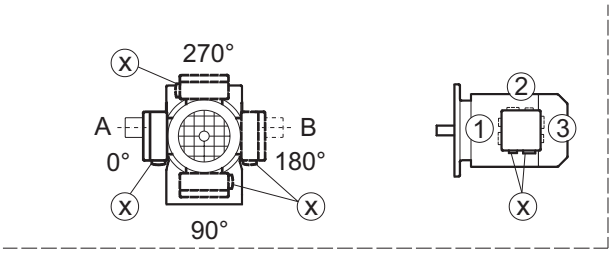
F..27 M1, M3, M5, M6

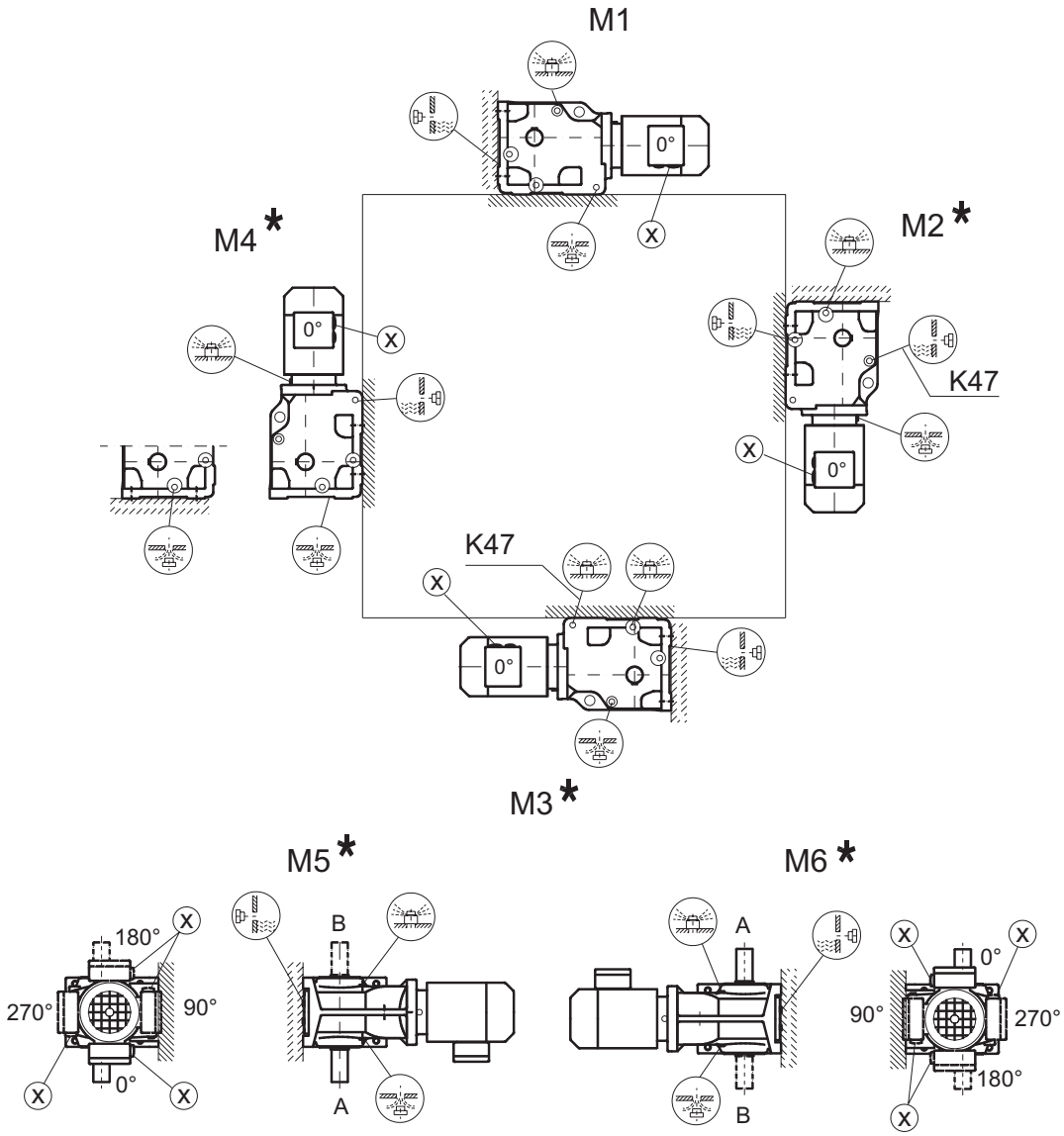
* → page 36

## 8.5 Mounting positions, helical-bevel gear units

***K/KA..B/KH37B-157B, KV37B-107B***

**34 025 100**



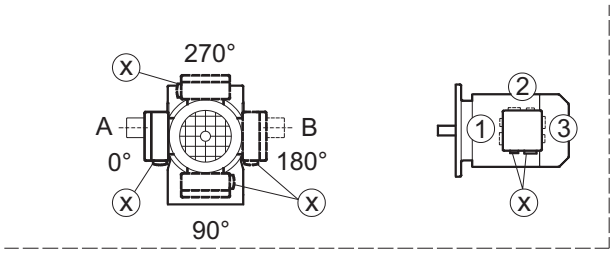



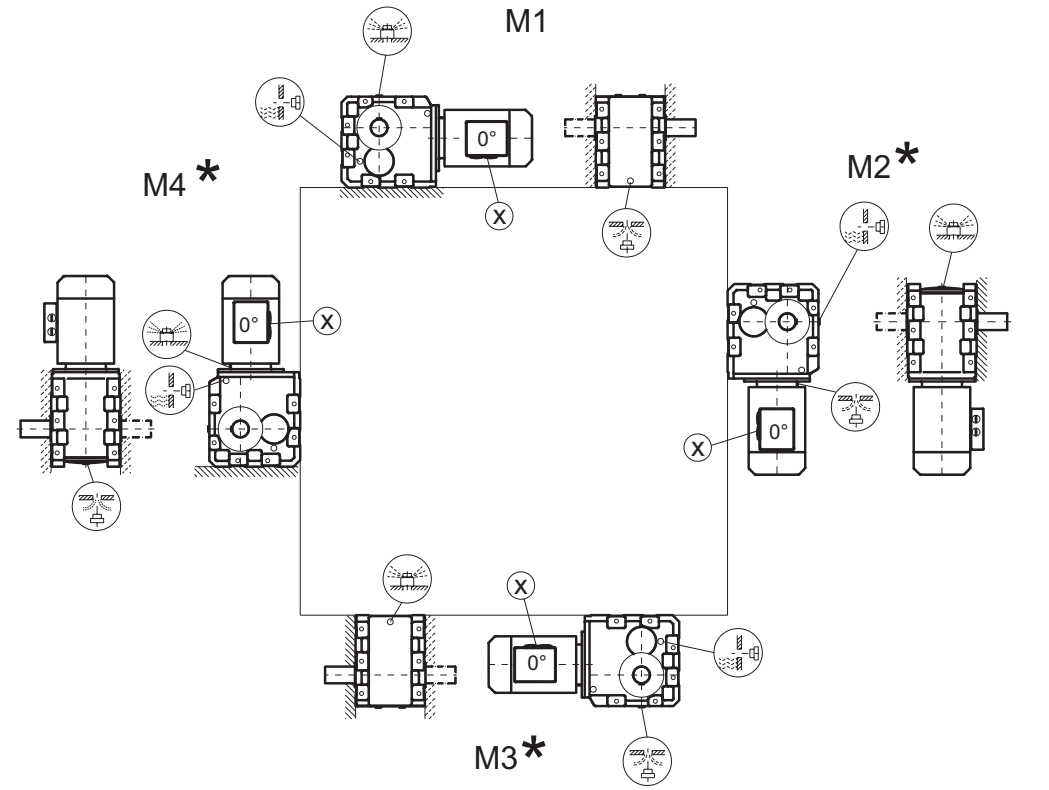

* → page 36

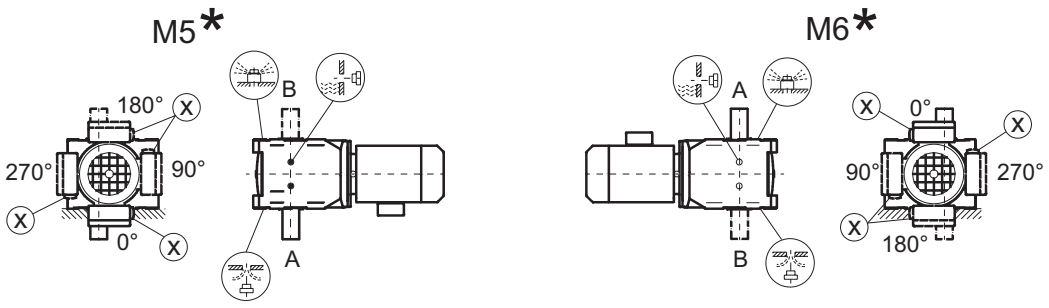
**Caution:** Note the ⓘ notes in the "Geared Motors" catalog, section "Project Planning Gear Units/Overhung and axial loads."

***K167-187, KH167B-187B***

**34 026 100**



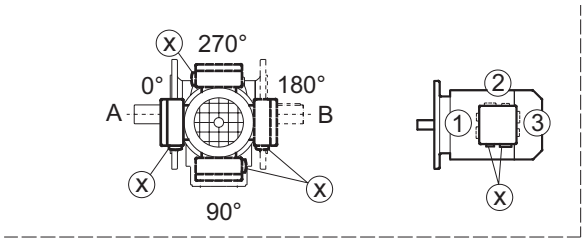



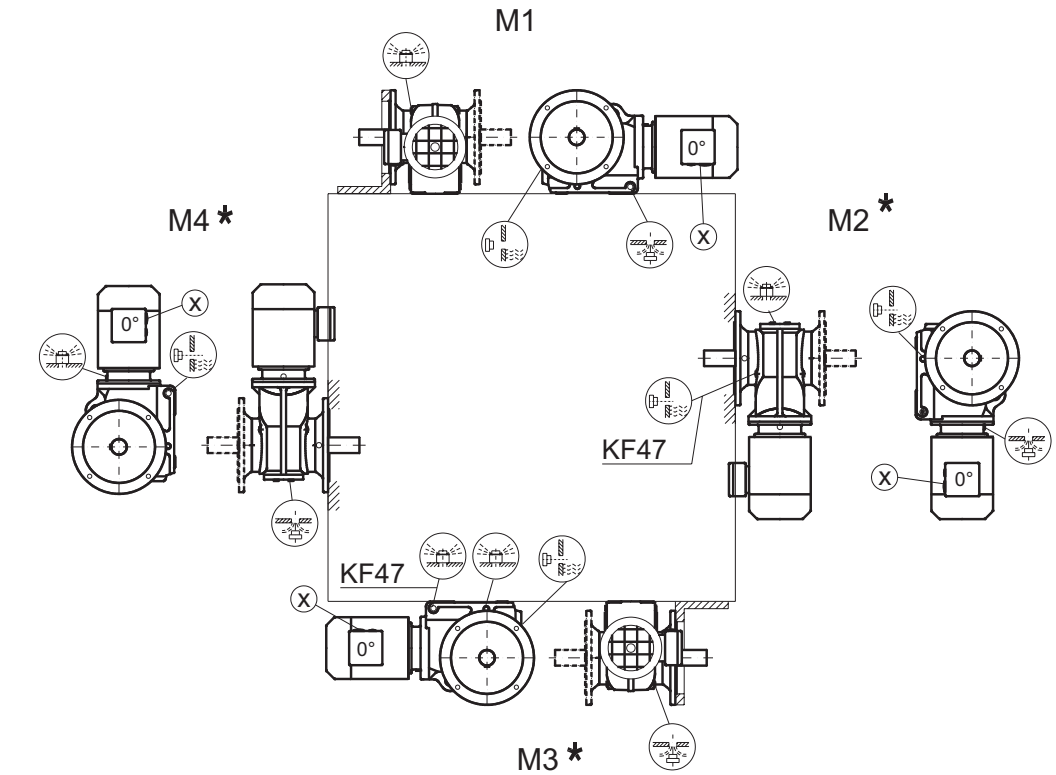

* → page 36

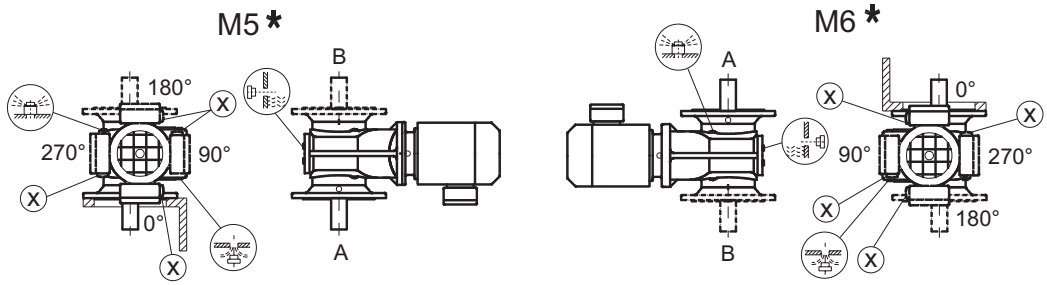
**Caution:** Note the (i) notes in the "Geared Motors" catalog, section "Project Planning Gear Units/Overhung and axial loads."

***KF/KAF/KHF/KAZ/KHZ37-157, KVF/KVZ37-107***

**34 027 100**



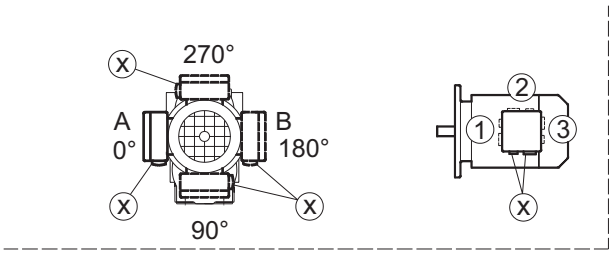



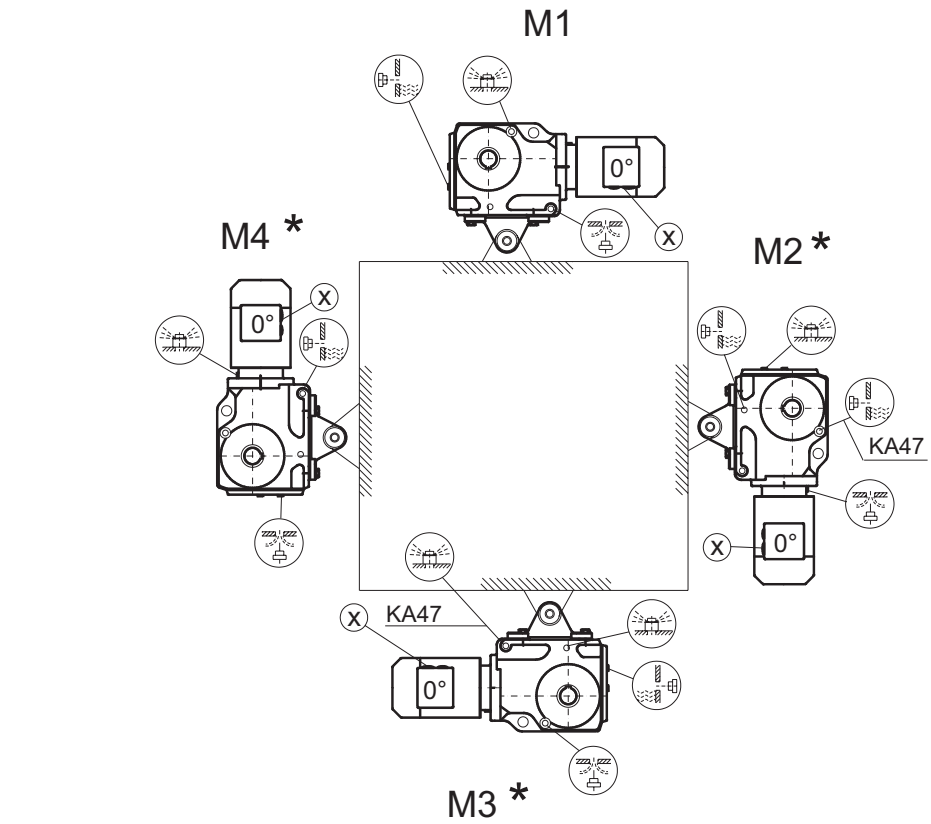



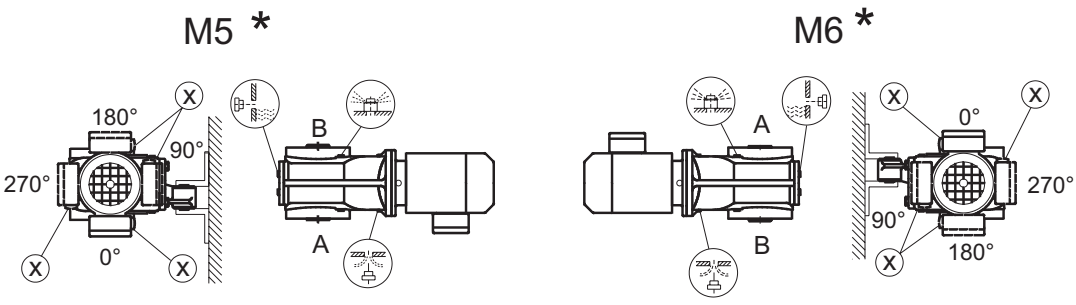

* → page 36

***KA/KH37-157, KV37-107***

**39 025 100**

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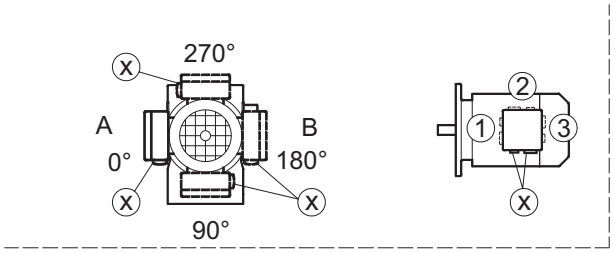
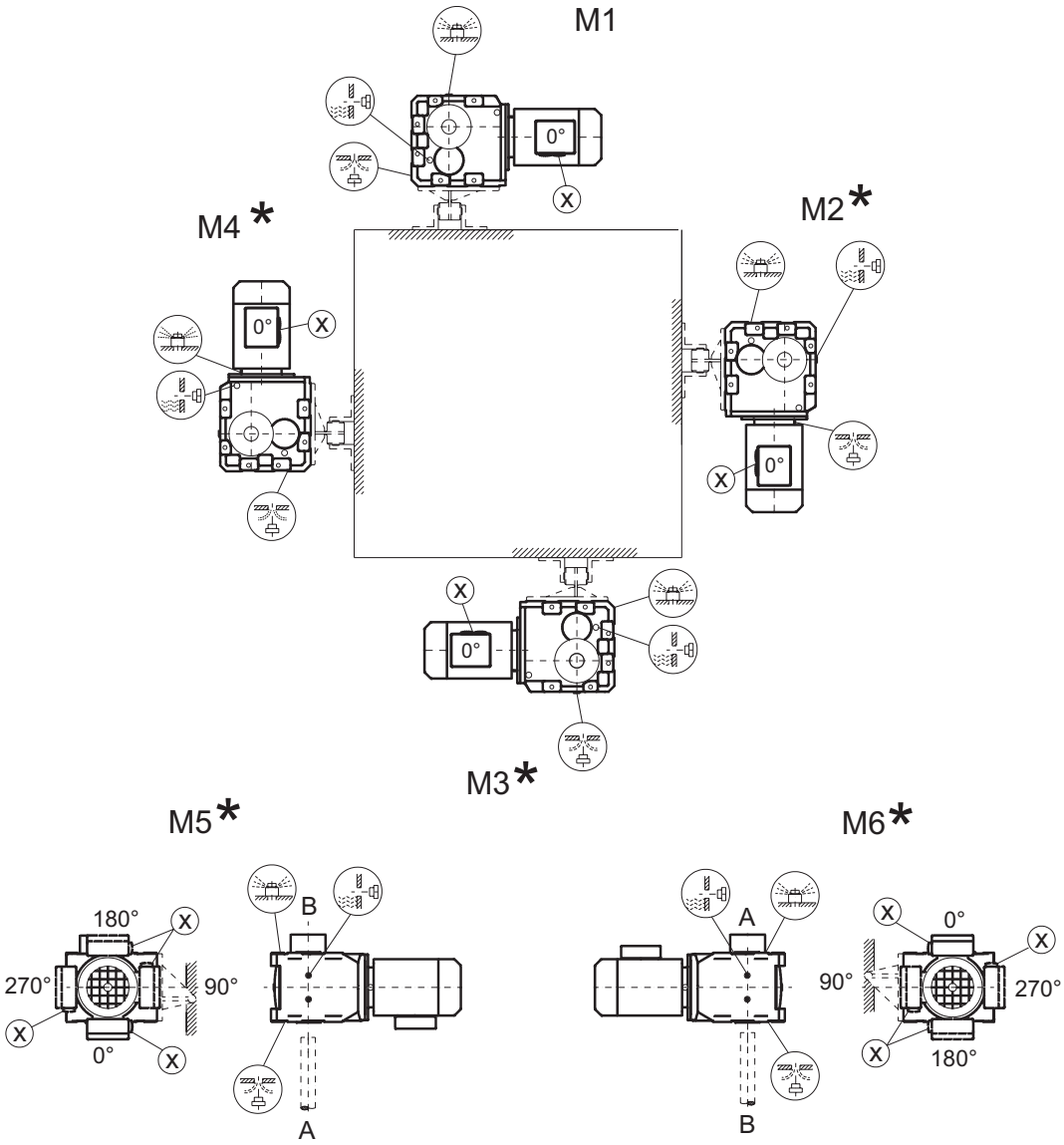
***KH167-187***

**39 026 100**

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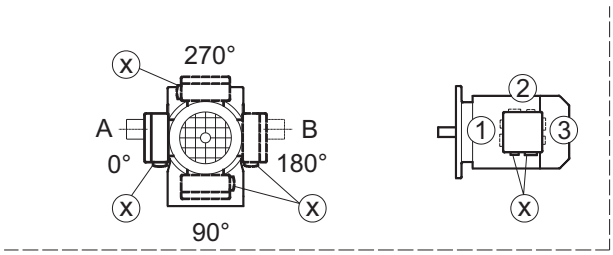
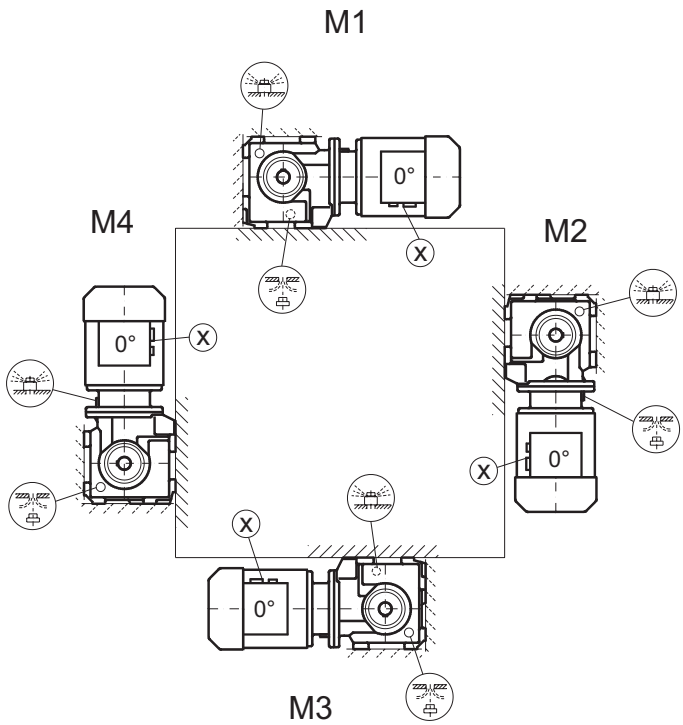
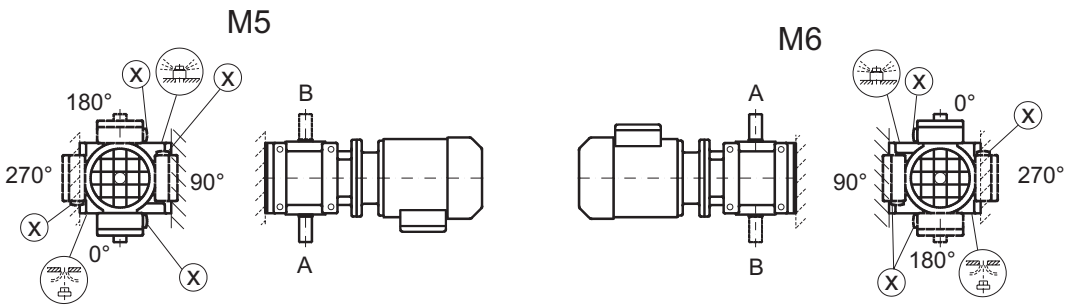
## 8.6 Mounting positions, helical-worm gear units

***S37***

**05 025 100**



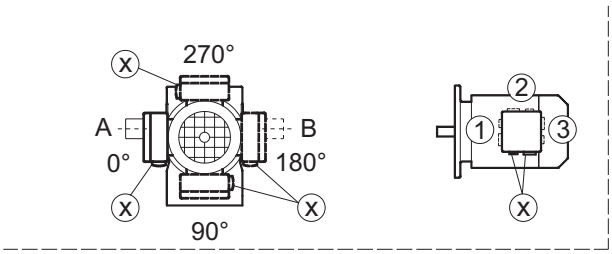



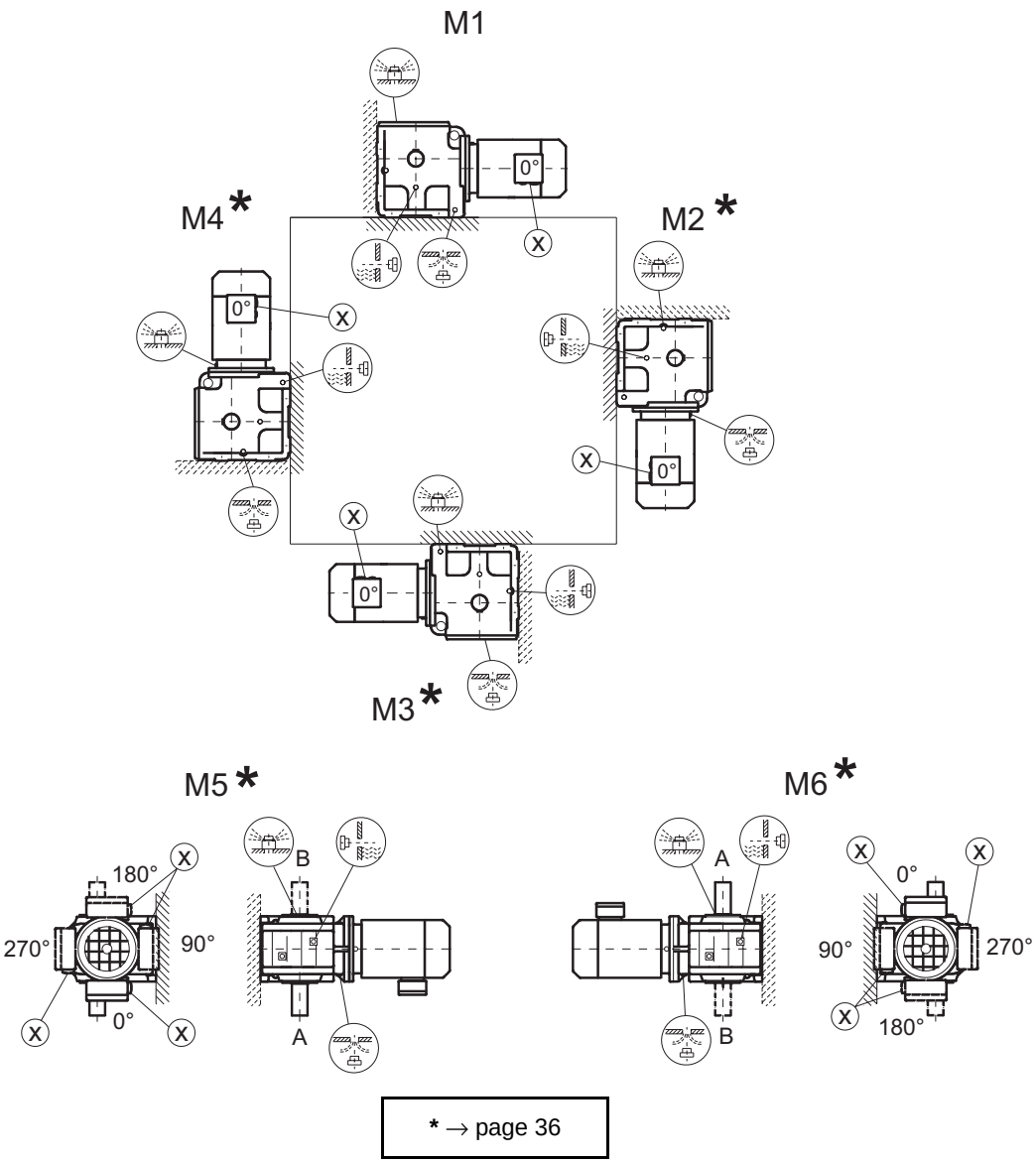




**Caution:** Note the notes in the "Geared Motors" catalog, section "Project Planning Gear Units/Overhung and axial loads."

***S47-S97***

**05 026 100**

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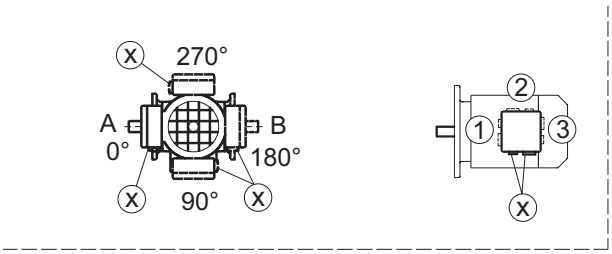
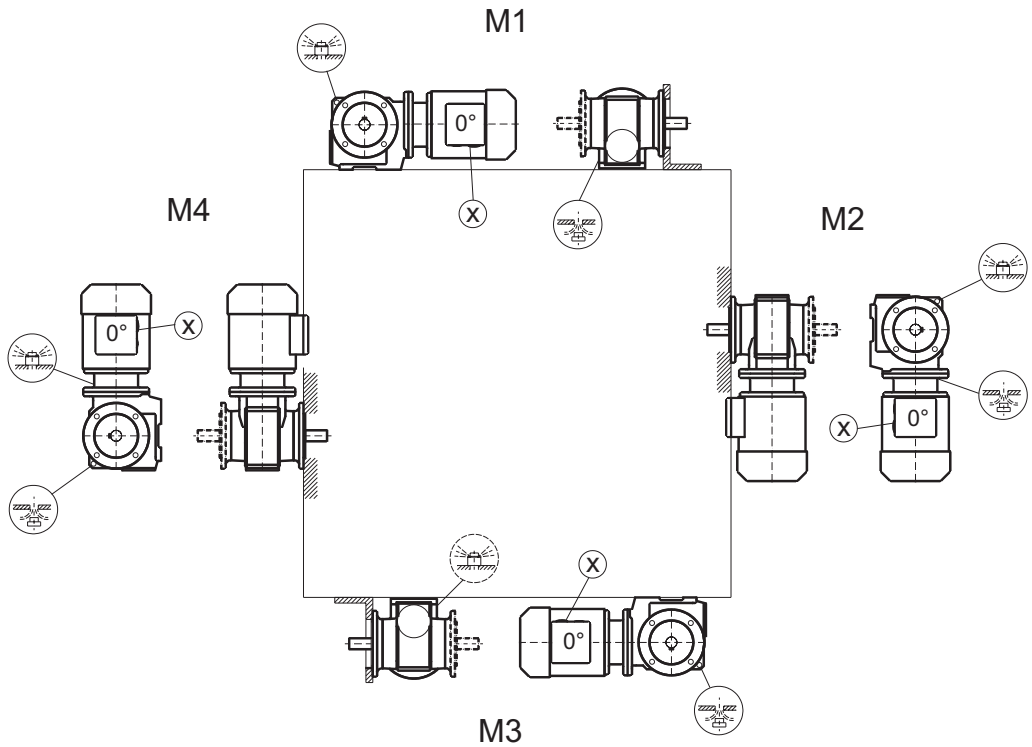
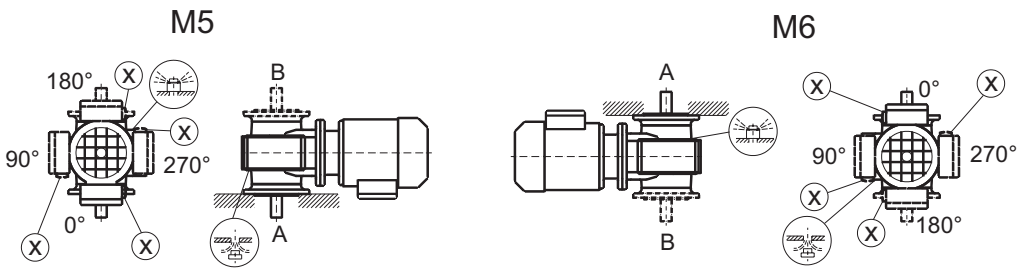
**Caution:** Note the ⓘ notes in the "Geared Motors" catalog, section "Project Planning Gear Units/Overhung and axial loads."

***SF/SAF/SHF37***

**05 027 100**

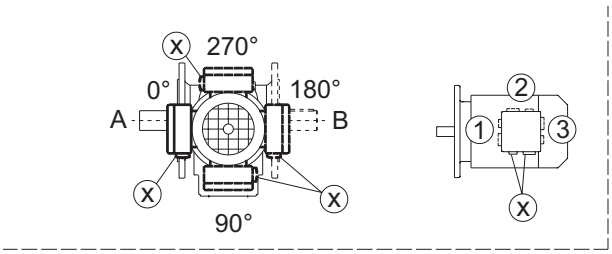


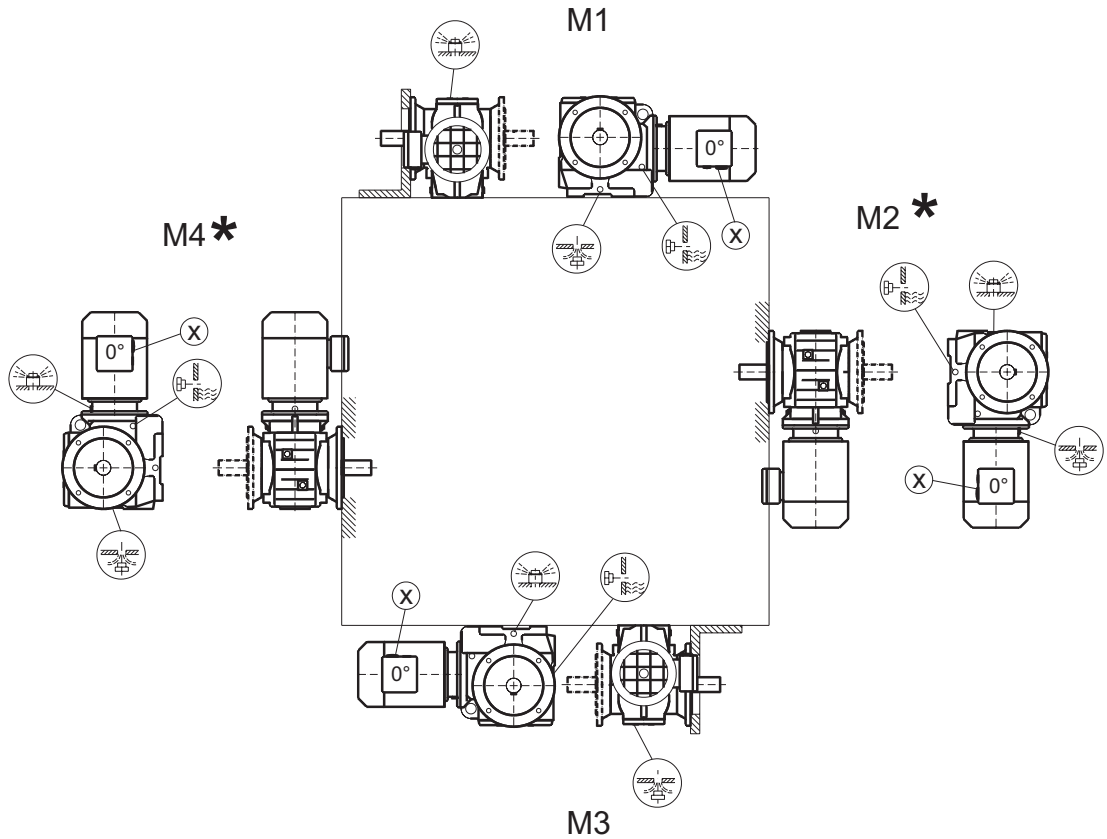



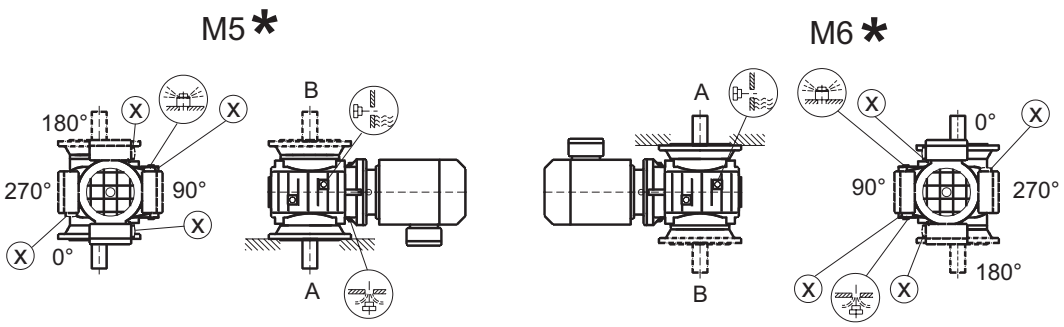



***SF/SAF/SHF/SAZ/SHZ47-97***

**05 028 100**

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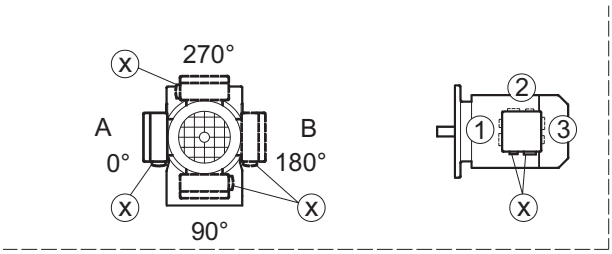
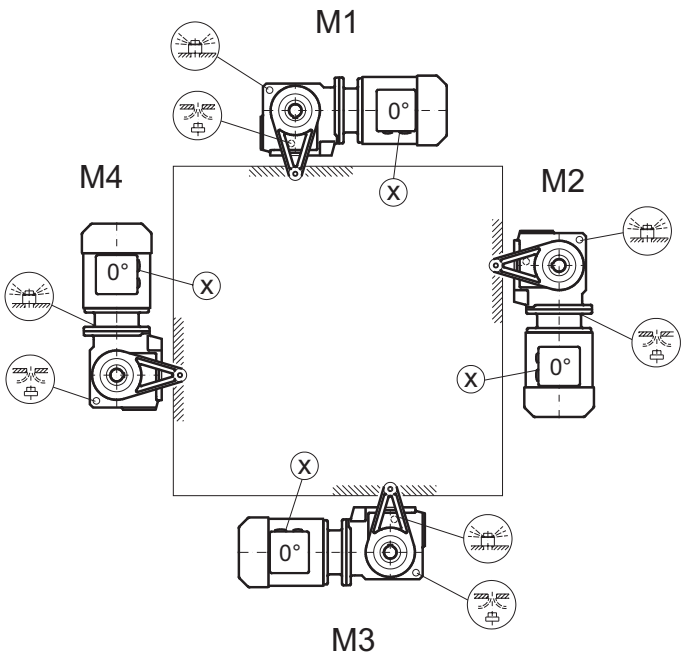
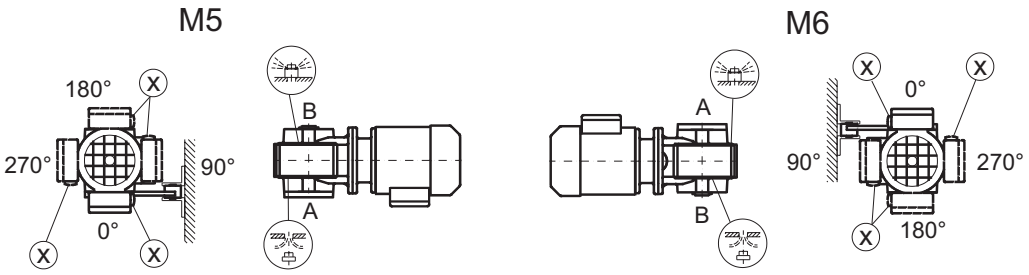
***SA/SH37***

**28 020 100**

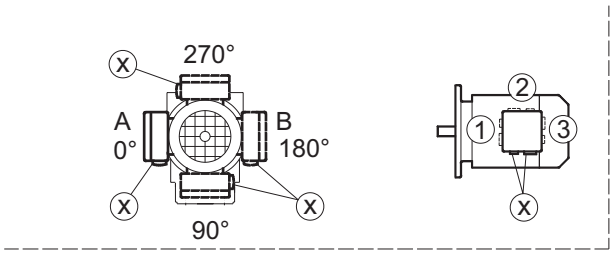


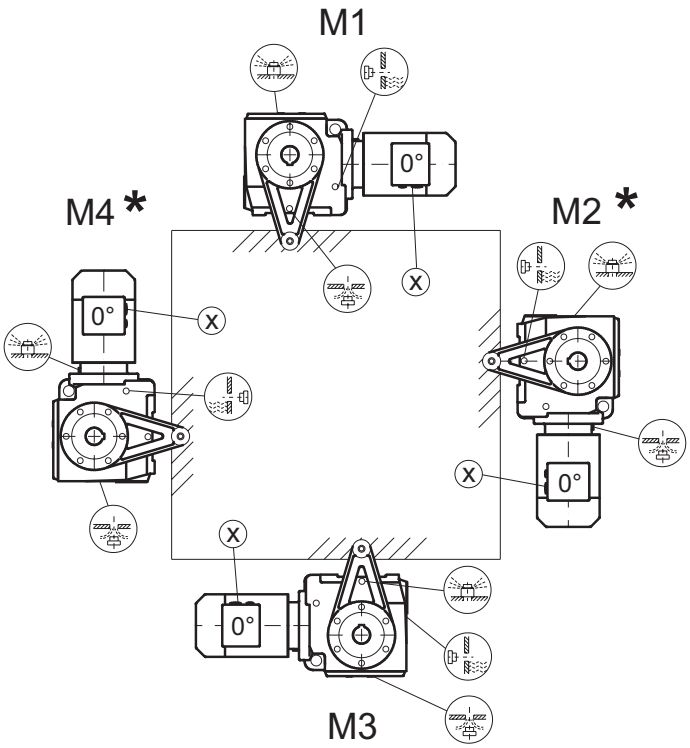



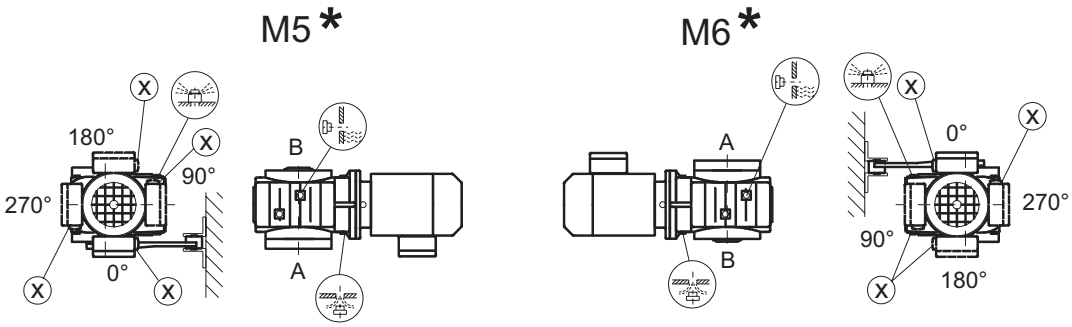



***SA/SH47-97***

**28 021 100**

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# 9 Lubricants

***General***

SEW supplies the drives filled with a lubricant appropriate for the specific gear unit and mounting position. The decisive factor is the indicated mounting position (M1...M6, → section "Mounting positions and important order information") when ordering the drive. The lubricant fill amounts for subsequent changes in the mounting position will have to be adjusted for the specific mounting position (→ Lubricant fill quantities).

***Lubricant table***

The lubricant table for SEW drives on the following page is a list of all approved lubricants for SEW drives. Please note the following legend for the lubricant table.

*Legend for lubricant table*

Abbreviations, meaning of shading and notes:

| | |
|---|---|
| CLP | = Mineral oil |
| CLP PG | = Polyglykol (W gear unit, meeting USDA-H1standard) |
| CLP HC | = Synthetic hydrocarbons |
| E | = Diester oil (water pollution class WGK 1) |
| HCE | = Synthetic hydrocarbons + diester oil (USDA - H1 approval) |
| HLP | = Hydraulic oil |
| | = Synthetic lubricant (= anti-friction bearing grease on synthetic base) |
| | = Mineral lubricant (= anti-friction bearing grease on mineral base) |
| 1) | Helical-worm gear unit with PG oil: Please consult SEW |
| 2) | Special lubricant for Spiroplan® gear units only |
| 3) | Recommendation: Select SEW $f_B \geq 1.2$ |
| 4) | Note critical starting performance at low temperatures! |
| 5) | Low-viscosity grease |
| 6) | Ambient temperature |
| | Lubricant for the food industry |
| | Biological oil (lubricant for agricultural, forestry and water industry) |

***Anti-friction bearing greases***

The anti-friction bearings in SEW gear units and motors will be filled with the following greases at the factory. SEW recommends to change the grease when replacing the oil in anti-friction bearings with grease filling.

| | Ambient temperature | Manufacturer | Type |
|---|---|---|---|
| **Gear unit anti-friction bearing** | -30°C ... +60°C | Mobil | Mobilux EP 2 |
| | -40°C ... +80°C | Mobil | Mobiltemp SHC 100 |
| **Motor anti-friction bearing** | -25°C ... +80°C | Esso | Unirex N3 |
| | -25°C ... +60°C | Shell | Alvania R3 |
| | +80°C ... +100°C | Klüber | Barrierta L55/2 |
| | -45°C ... -25°C | Shell | Aero Shell Grease 16 |
| **Special greases for gear unit anti-friction bearings:** | | | |
| | -30°C ... +40°C | Aral | Aral Eural Grease EP 2 |
| | -20°C ... +40°C | Aral<br>Klüber | Aral Aralub BAB EP 2<br>Klüberbio M32-82 |

**You need the following grease amounts:**

- For fast-running bearings (motor and gear unit input side): Fill one third of the hollow spaces between the actual roller bodies with grease.
- For slow-running bearings (in gear unit and gear unit output side): Fill two thirds of the spaces between the actual roller bodies with grease.

| | 6) °C | DIN (ISO) | ISO,NLGI | Mobil® | Shell | Klüber Lubrication | Aral | BP | Tribol | Texaco | Optimol | Fuchs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R... K...(HK...) F... | Standard -10 +40 | CLP(CC) | VG 220 | Mobilgear 630 | Shell Omala 220 | Klüberoil GEM 1-220 | Aral Degol BG 220 | BP Energol GR-XP 220 | Tribol 1100/220 | Meropa 220 | Optigear BM 220 | Renolin CLP 220 |
| | -25 +80 | CLP PG | VG 220 | Mobil Glygolyle 30 | Shell Tivela WB | Klübersynth GH 6-220 | Aral Degol GS 220 | BP Enersyn SG-XP 220 | Tribol 800/220 | Synlube CLP 220 | Optiflex A 220 | |
| | 4) -40 +80 | CLP HC | VG 220 | Mobilgear SHC 630 | Shell Omala 220 HD | Klübersynth EG 4-220 | Aral Degol PAS 220 | | Tribol 1510/220 | Pinnacle EP 220 | Optigear Synthetic A 220 | Renolin Unisyn CLP 220 |
| | 4) -40 +40 | | VG 150 | Mobil SHC 629 | | Klübersynth EG 4-150 | | | | Pinnacle EP 150 | | |
| | -20 +25 | CLP (CC) | VG 150 VG 100 | Mobilgear 629 | Shell Omala 100 | Klüberoil GEM 1-150 | Aral Degol BG 100 | BP Energol GR-XP 100 | Tribol 1100/100 | Meropa 150 | Optigear BM 100 | Renolin CLP 150 |
| | -30 +10 | HLP (HM) | VG 68-46 VG 32 | Mobil D.T.E. 15M | Shell Tellus T 32 | Klüberoil GEM 1-68 | Aral Degol BG 46 | | Tribol 1100/68 | Rando EP Ashless 46 | Optigear 32 | Renolin B 46 HVI |
| | 4) -40 +10 | CLP HC | VG 32 | Mobil SHC 624 | | Klüber-Summit HySyn FG-32 | | | | Cetus PAO 46 | | |
| | 4) -40 -20 | HLP (HM) | VG 22 VG 15 | Mobil D.T.E. 11M | Shell Tellus T 15 | Isoflex MT 30 ROT | | BP Energol HLP-HM 10 | | Rando HDZ 15 | | |
| S...(HS...) | Standard 0 +40 | CLP (CC) | VG 680 | Mobilgear 636 | Shell Omala 680 | Klüberoil GEM 1-680 | Aral Degol BG 680 | BP Energol GR-XP 680 | Tribol 1100/680 | Meropa 680 | Optigear BM 680 | Renolin CLP 680 |
| | -20 +60 | CLP PG | VG 680 1) | Mobil Glygoyle HE 680 | | Klübersynth GH 6-680 | | BP Enersyn SG-XP 680 | Tribol 800/680 | Synlube CLP 680 | | |
| | 4) -30 +80 | CLP HC | VG 460 | Mobil SHC 634 | Shell Omala 460 HD | Klübersynth EG 4-460 | | | | Pinnacle EP 460 | | |
| | 4) -40 +10 | | VG 150 | Mobil SHC 629 | | Klübersynth EG 4-150 | | | | Pinnacle EP 150 | | |
| | -20 +10 | CLP (CC) HLP (HM) | VG 150 VG 100 | Mobil D.T.E. 18M | Shell Omala 100 | Klüberoil GEM 1-150 | Aral Degol BG 100 | BP Energol GR-XP 100 | Tribol 1100/100 | Meropa 100 | Optigear BM 100 | Renolin CLP 150 |
| | -25 +20 | CLP PG | VG 220 1) | Mobil Glygoyle 30 | | Klübersynth GH 6-220 | | | Tribol 800/220 | Synlube CLP 220 | Optiflex A 220 | |
| | 4) -40 0 | CLP HC | VG 32 | Mobil SHC 624 | | Klüber-Summit HySyn FG-32 | | | | Cetus PAO 46 | | |
| R...,K...(HK...), F...,S...(HS...) | 4) -30 +40 | HCE | VG 460 | | Shell Cassida Fluid GL 460 | Klüberoil 4UH1-460 | Aral Eural Gear 460 | | | | Optileb GT 460 | |
| | -20 +40 | E | VG 460 | | | Klüberbio CA2-460 | Aral Degol BAB 460 | | | | Optisynt BS 460 | |
| W...(HW...) | Standard -20 +40 | SEW PG | VG 460 2) | | | Klüber SEW HT-460-5 | | | | | | |
| | 4) -40 +10 | API GL5 | SAE 75W90 (~VG 100) | Mobilube SHC 75 W90-LS | | | | | | | | |
| | -20 +40 | CLP PG | VG 460 3) | | | Klübersynth UH1 6-460 | | | | | | |
| R32 R302 | -25 +60 | DIN 51 818 5) | 00 | Glygoyle Grease 00 | Shell Tivela Compound A | Klübersynth GE 46-1200 | | | | Multifak 6833 EP 00 | | |
| | Standard -15 +40 | | 000 - 0 | Mobilux EP 004 | Shell Alvania GL 00 | | Aralub MFL 00 | BP Energrease LS-EP 00 | | Multifak EP 000 | Longtime PD 00 | Renolin SF 7 - 041 |

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### *Lubricant fill quantities*

The indicated fill quantities are **recommended values**. The specific values vary depending on number of stages and ratio. Pay close attention to the **oil level plug to serve as indicator for the correct amount of oil**.

The following tables list the recommended values for the lubricant fill quantities in reference to mounting positions M1...M6.

*Helical (R-) gear units*

| Gear units R.., R..F | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1[1)] | M2[1)] | M3 | M4 | M5 | M6 |
| **R17/R17F** | 0.25 | 0.6 | 0.35 | 0.6 | 0.35 | 0.35 |
| **R27/R27F** | 0.25/0.4 | 0.7 | 0.4 | 0.7 | 0.4 | 0.4 |
| **R37/R37F** | 0.3/1 | 0.9 | 1 | 1.1 | 0.8 | 1 |
| **R47/R47F** | 0.7/1.5 | 1.6 | 1.5 | 1.7 | 1.5 | 1.5 |
| **R57/R57F** | 0.8/1.7 | 1.9 | 1.7 | 2.1 | 1.7 | 1.7 |
| **R67/R67F** | 1.1/2.3 | 2.6/3.5 | 2.8 | 3.2 | 1.8 | 2 |
| **R77/R77F** | 1.2 / 3 | 3.8 / 4.3 | 3.6 | 4.3 | 2.5 | 3.4 |
| **R87/R87F** | 2.3 / 6 | 6.7 / 8.4 | 7.2 | 7.7 | 6.3 | 6.5 |
| **R97** | 4.6/9.8 | 11.7/14 | 11.7 | 13.4 | 11.3 | 11.7 |
| **R107** | 6/13.7 | 16.3 | 16.9 | 19.2 | 13.2 | 15.9 |
| **R137** | 10/25 | 28 | 29.5 | 31.5 | 25 | 25 |
| **R147** | 15.4/40 | 46.5 | 48 | 52 | 39.5 | 41 |
| **R167** | 27/70 | 82 | 78 | 88 | 66 | 69 |
| **Gear units RF..** | **Fill quantity in liters** | | | | | |
| | **M1[1)]** | **M2[1)]** | **M3** | **M4** | **M5** | **M6** |
| **RF17** | 0.25 | 0.6 | 0.35 | 0.6 | 0.35 | 0.35 |
| **RF27** | 0.25/0.4 | 0.7 | 0.4 | 0.7 | 0.4 | 0.4 |
| **RF37** | 0.4/1 | 0.9 | 1 | 1.1 | 0.8 | 1 |
| **RF47** | 0.7/1.5 | 1.6 | 1.5 | 1.7 | 1.5 | 1.5 |
| **RF/RM57** | 0.8/1.7 | 1.8 | 1.7 | 2 | 1.7 | 1.7 |
| **RF/RM67** | 1.2/2.5 | 2.7/3.6 | 2.7 | 3.1 | 1.9 | 2.1 |
| **RF/RM77** | 1.2 / 2.6 | 3.8/4.1 | 3.3 | 4.1 | 2.4 | 3 |
| **RF/RM87** | 2.4 / 6 | 6.8/7.9 | 7.1 | 7.7 | 6.3 | 6.4 |
| **RF/RM97** | 5.1/10.2 | 11.9/14 | 11.2 | 14 | 11.2 | 11.8 |
| **RF/RM107** | 6.3/14.9 | 15.9 | 17 | 19.2 | 13.1 | 15.9 |
| **RF/RM137** | 9.5/25 | 27 | 29 | 32.5 | 25 | 25 |
| **RF/RM147** | 16.4/42 | 47 | 48 | 52 | 42 | 42 |
| **RF/RM167** | 26/70 | 82 | 78 | 88 | 65 | 71 |

1) The larger gear unit in multi-stage gear units must be filled with the larger oil quantity.

| Gear units RX.. | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1 | M2 | M3 | M4 | M5 | M6 |
| **RX57** | 0.6 | 0.8 | 1.3 | 1.3 | 0.9 | 0.9 |
| **RX67** | 0.8 | 0.8 | 1.7 | 1.9 | 1.1 | 1.1 |
| **RX77** | 1.1 | 1.5 | 2.6 | 2.7 | 1.6 | 1.6 |
| **RX87** | 1.7 | 2.5 | 4.8 | 4.8 | 2.9 | 2.9 |
| **RX97** | 2.1 | 3.4 | 7.4 | 7 | 4.8 | 4.8 |
| **RX107** | 3.9 | 5.6 | 11.6 | 11.9 | 7.7 | 7.7 |
| **Gear units RXF..** | **Fill quantity in liters** | | | | | |
| | **M1** | **M2** | **M3** | **M4** | **M5** | **M6** |
| **RXF57** | 0.5 | 0.8 | 1.1 | 1.1 | 0.7 | 0.7 |
| **RXF67** | 0.7 | 0.8 | 1.5 | 1.7 | 1 | 1 |
| **RXF77** | 0.9 | 1.5 | 2.4 | 2.5 | 1.6 | 1.6 |
| **RXF87** | 1.6 | 2.5 | 4.9 | 4.7 | 2.9 | 2.9 |
| **RXF97** | 2.1 | 3.6 | 7.1 | 7 | 4.8 | 4.8 |
| **RXF107** | 3.1 | 5.9 | 11.2 | 10.5 | 7.2 | 7.2 |

*Parallel shaft helical (F-) gear units*

F.., FA..B, FH..B, FV..B:

| Gear units | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1 | M2 | M3 | M4 | M5 | M6 |
| **F..27** | 0.6 | 0.8 | 0.7 | 0.7 | 0.6 | 0.6 |
| **F..37** | 1 | 1.2 | 0.7 | 1.2 | 1 | 1.1 |
| **F..47** | 1.5 | 1.8 | 1.1 | 1.9 | 1.5 | 1.7 |
| **F..57** | 2.6 | 3.7 | 2.1 | 3.5 | 2.8 | 2.9 |
| **F..67** | 2.7 | 3.8 | 1.9 | 3.8 | 2.9 | 3.2 |
| **F..77** | 5 | 7.3 | 4.3 | 8 | 6 | 6.3 |
| **F..87** | 10 | 13.0 | 7.7 | 13.8 | 10.8 | 11 |
| **F..97** | 18.5 | 22.5 | 12.6 | 25.2 | 18.5 | 20 |
| **F..107** | 24.5 | 32 | 19.5 | 37.5 | 27 | 27 |
| **F..127** | 40.5 | 55 | 34 | 61 | 46.5 | 47 |
| **F..157** | 69 | 104 | 63 | 105 | 86 | 78 |

FF..:

| Gear units | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1 | M2 | M3 | M4 | M5 | M6 |
| **FF27** | 0.6 | 0.8 | 0.7 | 0.7 | 0.6 | 0.6 |
| **FF37** | 1 | 1.2 | 0.7 | 1.3 | 1 | 1.1 |
| **FF47** | 1.6 | 1.9 | 1.1 | 1.9 | 1.5 | 1.7 |
| **FF57** | 2.8 | 3.8 | 2.1 | 3.7 | 2.9 | 3 |
| **FF67** | 2.7 | 3.8 | 1.9 | 3.8 | 2.9 | 3.2 |
| **FF77** | 5.1 | 7.3 | 4.3 | 8.1 | 6 | 6.3 |
| **FF87** | 10.3 | 13.2 | 7.8 | 14.1 | 11 | 11.2 |
| **FF97** | 19 | 22.5 | 12.6 | 25.5 | 18.9 | 20.5 |
| **FF107** | 25.5 | 32 | 19.5 | 38.5 | 27.5 | 28 |
| **FF127** | 41.5 | 56 | 34 | 63 | 46.5 | 49 |
| **FF157** | 72 | 105 | 64 | 106 | 87 | 79 |

FA.., FH.., FV.., FAF.., FHF.., FVF.., FAZ.., FHZ.., FVZ..:

| Gear units | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1 | M2 | M3 | M4 | M5 | M6 |
| **F..27** | 0.6 | 0.8 | 0.7 | 0.7 | 0.6 | 0.6 |
| **F..37** | 1 | 1.2 | 0.7 | 1.2 | 1 | 1.1 |
| **F..47** | 1.5 | 1.8 | 1.1 | 1.9 | 1.5 | 1.7 |
| **F..57** | 2.7 | 3.8 | 2.1 | 3.6 | 2.9 | 3 |
| **F..67** | 2.7 | 3.8 | 1.9 | 3.8 | 2.9 | 3.2 |
| **F..77** | 5 | 7.3 | 4.3 | 8 | 6 | 6.3 |
| **F..87** | 10 | 13.0 | 7.7 | 13.8 | 10.8 | 11 |
| **F..97** | 18.5 | 22.5 | 12.6 | 25.0 | 18.5 | 20 |
| **F..107** | 24.5 | 32 | 19.5 | 37.5 | 27 | 27 |
| **F..127** | 39 | 55 | 34 | 61 | 45 | 46.5 |
| **F..157** | 68 | 103 | 62 | 104 | 85 | 77 |

*Helical-bevel (K-) gear units*

K.., KA..B, KH..B, KV..B:

| Gear units | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1 | M2 | M3 | M4 | M5 | M6 |
| **K..37** | 0.5 | 1 | 1 | 1.3 | 1 | 1 |
| **K..47** | 0.8 | 1.3 | 1.5 | 2 | 1.6 | 1.6 |
| **K..57** | 1.2 | 2.3 | 2.5 | 3 | 2.6 | 2.4 |
| **K..67** | 1.1 | 2.4 | 2.6 | 3.4 | 2.6 | 2.6 |
| **K..77** | 2.2 | 4.1 | 4.4 | 5.9 | 4.2 | 4.4 |
| **K..87** | 3.7 | 8 | 8.7 | 10.9 | 7.8 | 8 |
| **K..97** | 7 | 14 | 15.7 | 20 | 15.7 | 15.5 |
| **K..107** | 10 | 21 | 25.5 | 33.5 | 24 | 24 |
| **K..127** | 21 | 41.5 | 44 | 54 | 40 | 41 |
| **K..157** | 31 | 62 | 65 | 90 | 58 | 62 |
| **K..167** | 35 | 100 | 100 | 125 | 85 | 85 |
| **K..187** | 60 | 170 | 170 | 205 | 130 | 130 |

KF..:

| Gear units | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1 | M2 | M3 | M4 | M5 | M6 |
| **KF37** | 0.5 | 1.1 | 1.1 | 1.5 | 1 | 1 |
| **KF47** | 0.8 | 1.3 | 1.7 | 2.2 | 1.6 | 1.6 |
| **KF57** | 1.3 | 2.3 | 2.7 | 3 | 2.9 | 2.7 |
| **KF67** | 1.1 | 2.4 | 2.8 | 3.6 | 2.7 | 2.7 |
| **KF77** | 2.1 | 4.1 | 4.4 | 6 | 4.5 | 4.5 |
| **KF87** | 3.7 | 8.2 | 9 | 11.9 | 8.4 | 8.4 |
| **KF97** | 7 | 14.7 | 17.3 | 21.5 | 15.7 | 16.5 |
| **KF107** | 10 | 22 | 26 | 35 | 25 | 25 |
| **KF127** | 21 | 41.5 | 46 | 55 | 41 | 41 |
| **KF157** | 31 | 66 | 69 | 92 | 62 | 62 |

KA.., KH.., KV.., KAF.., KHF.., KVF.., KAZ.., KHZ.., KVZ..:

| Gear units | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1 | M2 | M3 | M4 | M5 | M6 |
| **K..37** | 0.5 | 1 | 1 | 1.4 | 1 | 1 |
| **K..47** | 0.8 | 1.3 | 1.6 | 2.1 | 1.6 | 1.6 |
| **K..57** | 1.3 | 2.3 | 2.7 | 3 | 2.9 | 2.7 |
| **K..67** | 1.1 | 2.4 | 2.7 | 3.6 | 2.6 | 2.6 |
| **K..77** | 2.1 | 4.1 | 4.6 | 6 | 4.4 | 4.4 |
| **K..87** | 3.7 | 8.2 | 8.8 | 11.1 | 8 | 8 |
| **K..97** | 7 | 14.7 | 15.7 | 20 | 15.7 | 15.7 |
| **K..107** | 10 | 20.5 | 24 | 32 | 24 | 24 |
| **K..127** | 21 | 41.5 | 43 | 52 | 40 | 40 |
| **K..157** | 31 | 66 | 67 | 87 | 62 | 62 |
| **KH167** | 35 | 100 | 100 | 125 | 85 | 85 |
| **KH187** | 60 | 170 | 170 | 205 | 130 | 130 |

*Spiroplan® (W-) gear units*

The Spiroplan® gear units always have the same fill quantity, independent of the mounting position:

| Gear units | Mounting position independent fill quantity in liters |
|---|---|
| **W..10** | 0.16 |
| **W..20** | 0.26 |
| **W..30** | 0.5 |

*Helical-worm (S-) gear units*

S..:

| Gear units | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1 | M2 | M3[1)] | M4 | M5 | M6 |
| **S37** | 0.25 | 0.4 | 0.5 | 0.6 | 0.4 | 0.4 |
| **S47** | 0.35 | 0.8 | 0.7/0.9 | 1.1 | 0.8 | 0.8 |
| **S57** | 0.5 | 1.2 | 1/1.2 | 1.5 | 1.3 | 1.3 |
| **S67** | 1 | 2.0 | 2.2/3.1 | 3.2 | 2.6 | 2.6 |
| **S77** | 1.9 | 4.2 | 3.7/5.4 | 6 | 4.4 | 4.4 |
| **S87** | 3.3 | 8.1 | 6.9/10.4 | 12 | 8.4 | 8.4 |
| **S97** | 6.8 | 15 | 13.4/18 | 22.5 | 17 | 17 |

1) The larger gear unit in multi-stage gear units must be filled with the larger oil quantity.

SF..:

| Gear units | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1 | M2 | M3[1)] | M4 | M5 | M6 |
| **SF37** | 0.25 | 0.4 | 0.5 | 0.6 | 0.4 | 0.4 |
| **SF47** | 0.4 | 0.9 | 0.9/1.1 | 1.2 | 1.0 | 1 |
| **SF57** | 0.5 | 1.2 | 1/1.5 | 1.6 | 1.4 | 1.4 |
| **SF67** | 1 | 2.2 | 2.3/3 | 3.2 | 2.7 | 2.7 |
| **SF77** | 1.9 | 4.1 | 3.9/5.8 | 6.5 | 4.9 | 4.9 |
| **SF87** | 3.8 | 8 | 7.1/10.1 | 12 | 9.1 | 9.1 |
| **SF97** | 7.4 | 15 | 13.8/18.8 | 23.6 | 18 | 18 |

1) The larger gear unit in multi-stage gear units must be filled with the larger oil quantity.

SA.., SH.., SAF.., SHF.., SAZ.., SHZ..:

| Gear units | Fill quantity in liters | | | | | |
|---|---|---|---|---|---|---|
| | M1 | M2 | M3[1)] | M4 | M5 | M6 |
| **S..37** | 0.25 | 0.4 | 0.5 | 0.6 | 0.4 | 0.4 |
| **S..47** | 0.4 | 0.8 | 0.7/0.9 | 1.1 | 0.8 | 0.8 |
| **S..57** | 0.5 | 1.1 | 1/1.5 | 1.6 | 1.2 | 1.2 |
| **S..67** | 1 | 2 | 1.8/2.6 | 2.9 | 2.5 | 2.5 |
| **S..77** | 1.8 | 3.9 | 3.6/5 | 5.9 | 4.5 | 4.5 |
| **S..87** | 3.8 | 7.4 | 6/8.7 | 11.2 | 8 | 8 |
| **S..97** | 7 | 14 | 11.4/16 | 21 | 15.7 | 15.7 |

1) The larger gear unit in multi-stage gear units must be filled with the larger oil quantity.

# Addresses

| | | | |
|---|---|---|---|
| **Germany** | | | |
| **Headquarters**<br>**Production**<br>**Sales**<br>**Service** | **Bruchsal** | SEW-EURODRIVE GmbH & Co<br>Ernst-Blickle-Straße 42<br>D-76646 Bruchsal<br>P.O. Box<br>Postfach 3023 · D-76642 Bruchsal | Tel. (0 72 51) 75-0<br>Fax (0 72 51) 75-19 70<br>http://www.SEW-EURODRIVE.de<br>sew@sew-eurodrive.de |
| **Production** | **Graben** | SEW-EURODRIVE GmbH & Co<br>Ernst-Blickle-Straße 1<br>D-76676 Graben-Neudorf<br>P.O. Box<br>Postfach 1220 · D-76671 Graben-Neudorf | Tel. (0 72 51) 75-0<br>Fax (0 72 51) 75-29 70<br>Telex 7 822 276 |
| **Assembly**<br>**Service** | **Garbsen**<br>(near Hannover) | SEW-EURODRIVE GmbH & Co<br>Alte Ricklinger Straße 40-42<br>D-30823 Garbsen<br>P.O. Box<br>Postfach 110453 · D-30804 Garbsen | Tel. (0 51 37) 87 98-30<br>Fax (0 51 37) 87 98-55 |
| | **Kirchheim**<br>(near München) | SEW-EURODRIVE GmbH & Co<br>Domagkstraße 5<br>D-85551 Kirchheim | Tel. (0 89) 90 95 52-10<br>Fax (0 89) 90 95 52-50 |
| | **Langenfeld**<br>(near Düsseldorf) | SEW-EURODRIVE GmbH & Co<br>Siemensstraße 1<br>D-40764 Langenfeld | Tel. (0 21 73) 85 07-30<br>Fax (0 21 73) 85 07-55 |
| | **Meerane**<br>(near Zwickau) | SEW-EURODRIVE GmbH & Co<br>Dänkritzer Weg 1<br>D-08393 Meerane | Tel. (0 37 64) 76 06-0<br>Fax (0 37 64) 76 06-30 |
| | Additional addresses for service in Germany provided on request! | | |
| **France** | | | |
| **Production**<br>**Sales**<br>**Service** | **Haguenau** | SEW-USOCOME SAS<br>48-54, route de Soufflenheim<br>B. P. 185<br>F-67506 Haguenau Cedex | Tel. 03 88 73 67 00<br>Fax 03 88 73 66 00<br>http://www.usocome.com<br>sew@usocome.com |
| **Assembly**<br>**Sales**<br>**Service** | **Bordeaux** | SEW-USOCOME SAS<br>Parc d'activités de Magellan<br>62, avenue de Magellan - B. P. 182<br>F-33607 Pessac Cedex | Tel. 05 57 26 39 00<br>Fax 05 57 26 39 09 |
| | **Lyon** | SEW-USOCOME SAS<br>Parc d'Affaires Roosevelt<br>Rue Jacques Tati<br>F-69120 Vaulx en Velin | Tel. 04 72 15 37 00<br>Fax 04 72 15 37 15 |
| | **Paris** | SEW-USOCOME SAS<br>Zone industrielle<br>2, rue Denis Papin<br>F-77390 Verneuil l'Etang | Tel. 01 64 42 40 80<br>Fax 01 64 42 40 88 |
| | Additional addresses for service in France provided on request! | | |
| **Argentina** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Buenos Aires** | SEW EURODRIVE ARGENTINA S.A.<br>Centro Industrial Garin, Lote 35<br>Ruta Panamericana Km 37,5<br>1619 Garin | Tel. (3327) 45 72 84<br>Fax (3327) 45 72 21<br>sewar@sew-eurodrive.com.ar |
| **Australia** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Melbourne** | SEW-EURODRIVE PTY. LTD.<br>27 Beverage Drive<br>Tullamarine, Victoria 3043 | Tel. (03) 99 33 10 00<br>Fax (03) 99 33 10 03 |
| | **Sydney** | SEW-EURODRIVE PTY. LTD.<br>9, Sleigh Place, Wetherill Park<br>New South Wales, 2164 | Tel. (02) 97 25 99 00<br>Fax (02) 97 25 99 05 |
| **Austria** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Wien** | SEW-EURODRIVE Ges.m.b.H.<br>Richard-Strauss-Strasse 24<br>A-1230 Wien | Tel. (01) 6 17 55 00-0<br>Fax (01) 6 17 55 00-30<br>sew@sew-eurodrive.at |

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|---|---|---|---|
| **Belgium** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Brüssel** | CARON-VECTOR S.A.<br>Avenue Eiffel 5<br>B-1300 Wavre | Tel. (010) 23 13 11<br>Fax (010) 2313 36<br>http://www.caron-vector.be<br>info@caron-vector.be |
| **Brazil** | | | |
| **Production**<br>**Sales**<br>**Service** | **Sao Paulo** | SEW DO BRASIL<br>Motores-Redutores Ltda.<br>Rodovia Presidente Dutra, km 208<br>CEP 07210-000 - Guarulhos - SP | Tel. (011) 64 60-64 33<br>Fax (011) 64 80 33 28<br>sew@sew.com.br |
| | Additional addresses for service in Brazil provided on request! | | |
| **Bulgaria** | | | |
| **Sales** | **Sofia** | BEVER-DRIVE GMBH<br>Bogdanovetz Str.1<br>BG-1606 Sofia | Tel. (92) 9 53 25 65<br>Fax (92) 9 54 93 45<br>bever@mbox.infotel.bg |
| **Canada** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Toronto** | SEW-EURODRIVE CO. OF CANADA LTD.<br>210 Walker Drive<br>Bramalea, Ontario L6T3W1 | Tel. (905) 7 91-15 53<br>Fax (905) 7 91-29 99 |
| | **Vancouver** | SEW-EURODRIVE CO. OF CANADA LTD.<br>7188 Honeyman Street<br>Delta. B.C. V4G 1 E2 | Tel. (604) 9 46-55 35<br>Fax (604) 946-2513 |
| | **Montreal** | SEW-EURODRIVE CO. OF CANADA LTD.<br>2555 Rue Leger Street<br>LaSalle, Quebec H8N 2V9 | Tel. (514) 3 67-11 24<br>Fax (514) 3 67-36 77 |
| | Additional addresses for service in Canada provided on request! | | |
| **Chile** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Santiago de Chile** | SEW-EURODRIVE CHILE<br>Motores-Reductores LTDA.<br>Panamericana Norte No 9261<br>Casilla 23 - Correo Quilicura<br>RCH-Santiago de Chile | Tel. (02) 6 23 82 03+6 23 81 63<br>Fax (02) 6 23 81 79 |
| **China** | | | |
| **Production**<br>**Assembly**<br>**Sales**<br>**Service** | **Tianjin** | SEW-EURODRIVE (Tianjin) Co., Ltd.<br>No. 46, 7th Avenue, TEDA<br>Tianjin 300457 | Tel. (022) 25 32 26 12<br>Fax (022) 25 32 26 11 |
| **Colombia** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Bogotá** | SEW-EURODRIVE COLOMBIA LTDA.<br>Calle 22 No. 132-60<br>Bodega 6, Manzana B<br>Santafé de Bogotá | Tel. (0571) 5 47 50 50<br>Fax (0571) 5 47 50 44<br>sewcol@andinet.com |
| **Croatia** | | | |
| **Sales**<br>**Service** | **Zagreb** | KOMPEKS d. o. o.<br>PIT Erdödy 4 II<br>HR 10 000 Zagreb | Tel. +385 14 61 31 58<br>Fax +385 14 61 31 58 |
| **Czech Republic** | | | |
| **Sales** | **Praha** | SEW-EURODRIVE S.R.O.<br>Business Centrum Praha<br>Luná 591<br>16000 Praha 6 | Tel. 02/20 12 12 34 + 20 12 12 36<br>Fax 02/20 12 12 37<br>sew@sew-eurodrive.cz |
| **Denmark** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Kopenhagen** | SEW-EURODRIVEA/S<br>Geminivej 28-30, P.O. Box 100<br>DK-2670 Greve | Tel. 4395 8500<br>Fax 4395 8509<br>http://www.sew-eurodrive.dk<br>sew@sew-eurodrive.dk |
| **Estonia** | | | |
| **Sales** | **Tallin** | ALAS-KUUL AS<br>Paldiski mnt.125<br>EE 0006 Tallin | Tel. 6 59 32 30<br>Fax 6 59 32 31 |

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| **Finland** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Lahti** | SEW-EURODRIVE OY<br>Vesimäentie 4<br>FIN-15860 Hollola 2 | Tel. (3) 589 300<br>Fax (3) 780 6211 |
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| **Assembly**<br>**Sales**<br>**Service** | **Normanton** | SEW-EURODRIVE Ltd.<br>Beckbridge Industrial Estate<br>P.O. Box No.1<br>GB-Normanton, West- Yorkshire WF6 1QR | Tel. 19 24 89 38 55<br>Fax 19 24 89 37 02 |
| **Greece** | | | |
| **Sales**<br>**Service** | **Athen** | Christ. Boznos & Son S.A.<br>12, Mavromichali Street<br>P.O. Box 80136, GR-18545 Piraeus | Tel. 14 22 51 34<br>Fax 14 22 51 59<br>Boznos@otenet.gr |
| **Hong Kong** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Hong Kong** | SEW-EURODRIVE LTD.<br>Unit No. 801-806, 8th Floor<br>Hong Leong Industrial Complex<br>No. 4, Wang Kwong Road<br>Kowloon, Hong Kong | Tel. 2-7 96 04 77 + 79 60 46 54Fax 2-7<br>95-91 29sew@sewhk.com |
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| **Sales**<br>**Service** | **Budapest** | SEW-EURODRIVE Kft.<br>H-1037 Budapest<br>Kunigunda u. 18 | Tel. +36 1 437 06 58<br>Fax +36 1 437 06 50 |
| **India** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Baroda** | SEW-EURODRIVE India Pvt. Ltd.<br>Plot No. 4, Gidc<br>Por Ramangamdi · Baroda - 391 243<br>Gujarat | Tel. 0 265-83 10 86<br>Fax 0 265-83 10 87<br>sew.baroda@gecsl.com |
| **Ireland** | | | |
| **Sales**<br>**Service** | **Dublin** | Alperton Engineering Ltd.<br>48 Moyle Road<br>Dublin Industrial Estate<br>Glasnevin, Dublin 11 | Tel. (01) 8 30 62 77<br>Fax (01) 8 30 64 58 |
| **Italy** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Milano** | SEW-EURODRIVE di R. Blickle & Co.s.a.s.<br>Via Bernini,14<br>I-20020 Solaro (Milano) | Tel. (02) 96 98 01<br>Fax (02) 96 79 97 81 |
| **Japan** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Toyoda-cho** | SEW-EURODRIVE JAPAN CO., LTD<br>250-1, Shimoman-no,<br>Toyoda-cho, Iwata gun<br>Shizuoka prefecture, P.O. Box 438-0818 | Tel. (0 53 83) 7 3811-13<br>Fax (0 53 83) 7 3814 |
| **Korea** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Ansan-City** | SEW-EURODRIVE KOREA CO., LTD.<br>B 601-4, Banweol Industrial Estate<br>Unit 1048-4, Shingil-Dong<br>Ansan 425-120 | Tel. (031) 4 92-80 51<br>Fax (031) 4 92-80 56 |
| **Luxembourg** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Brüssel** | CARON-VECTOR S.A.<br>Avenue Eiffel 5<br>B-1300 Wavre | Tel. (010) 23 13 11<br>Fax (010) 2313 36<br>http://www.caron-vector.be<br>info@caron-vector.be |
| **Macedonia** | | | |
| **Sales** | **Skopje** | SGS-Skopje / Macedonia<br>"Teodosij Sinactaski"<br>6691000 Skopje / Macedonia | Tel. (0991) 38 43 90<br>Fax (0991) 38 43 90 |
| **Malaysia** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Johore** | SEW-EURODRIVE SDN BHD<br>No. 95, Jalan Seroja 39, Taman Johor Jaya<br>81000 Johor Bahru, Johor<br>West Malaysia | Tel. (07) 3 54 57 07 + 3 54 94 09<br>Fax (07) 3 5414 04 |

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| **Netherlands** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Rotterdam** | VECTOR Aandrijftechniek B.V.<br>Industrieweg 175<br>NL-3044 AS Rotterdam<br>Postbus 10085<br>NL-3004 AB Rotterdam | Tel. +31 10 44 63 700<br>Fax +31 10 41 55 552<br>http://www.vector.nu<br>info@vector.nu |
| **New Zealand** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Auckland** | SEW-EURODRIVE NEW ZEALAND LTD.<br>P.O. Box 58-428<br>82 Greenmount drive<br>East Tamaki Auckland | Tel. 0064-9-2 74 56 27<br>Fax 0064-9-2 74 01 65<br>sales@sew-eurodrive.co.nz |
| | **Christchurch** | SEW-EURODRIVE NEW ZEALAND LTD.<br>10 Settlers Crescent, Ferrymead<br>Christchurch | Tel. (09) 3 84 62 51<br>Fax (09) 3 84 64 55<br>sales@sew-eurodrive.co.nz |
| **Norway** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Moss** | SEW-EURODRIVE A/S<br>Solgaard skog 71<br>N-1599 Moss | Tel. (69) 2410 20<br>Fax (69) 2410 40<br>sew@sew-eurodrive.no |
| **Peru** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Lima** | SEW DEL PERU MOTORES REDUCTORES S.A.C.<br>Los Calderos # 120-124<br>Urbanizacion Industrial Vulcano, ATE, Lima | Tel. (511) 349-52 80<br>Fax (511) 349-30 02<br>sewperu@terra.com.pe |
| **Poland** | | | |
| **Sales** | **Lodz** | SEW-EURODRIVE Polska Sp.z.o.o.<br>ul. Pojezierska 63<br>91-338 Lodz | Tel. (042) 6 16 22 00<br>Fax (042) 6 16 22 10<br>sew@sew-eurodrive.pl |
| **Portugal** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Coimbra** | SEW-EURODRIVE, LDA.<br>Apartado 15<br>P-3050-901 Mealhada | Tel. (0231) 20 96 70<br>Fax (0231) 20 36 85<br>infosew@sew-eurodrive.pt |
| **Romania** | | | |
| **Sales**<br>**Service** | **Bucuresti** | Sialco Trading SRL<br>str. Madrid nr.4<br>71222 Bucuresti | Tel. (01) 2 30 13 28<br>Fax (01) 2 30 71 70<br>sialco@mediasat.ro |
| **Russia** | | | |
| **Sales** | **St. Petersburg** | ZAO SEW-EURODRIVE<br>P.O. Box 193<br>193015 St. Petersburg | Tel. (812) 3 26 09 41 + 5 35 04 30<br>Fax (812) 5 35 22 87<br>sewrus@post.spbnit.ru |
| **Singapore** | | | |
| **Assembly**<br>**Sales**<br>**Service** | | SEW-EURODRIVE PTE. LTD.<br>No 9, Tuas Drive 2<br>Jurong Industrial Estate<br>Singapore 638644 | Tel. 8 62 17 01-705<br>Fax 8 61 28 27<br>Telex 38 659 |
| **Slovenia** | | | |
| **Sales**<br>**Service** | **Celje** | Pakman - Pogonska Tehnika d.o.o.<br>UI. XIV. divizije 14<br>SLO – 3000 Celje | Tel. 00386 3 490 83 20<br>Fax 00386 3 490 83 21<br>pakman@siol.net |

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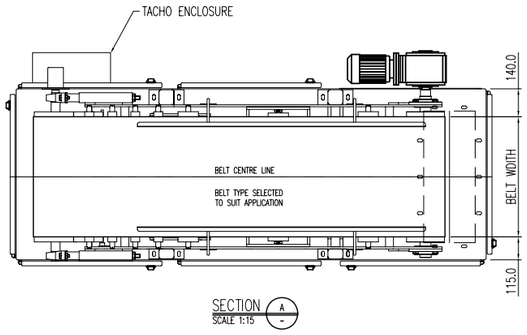
|---|---|---|---|
| **South Africa** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Johannesburg** | SEW-EURODRIVE (PROPRIETARY) LIMITED<br>Eurodrive House<br>Cnr. Adcock Ingram and Aerodrome Roads<br>Aeroton Ext. 2<br>Johannesburg 2013<br>P.O.Box 90004<br>Bertsham 2013 | Tel. + 27 11 248 70 00<br>Fax +27 11 494 23 11 |
| | **Capetown** | SEW-EURODRIVE (PROPRIETARY) LIMITED<br>Rainbow Park<br>Cnr. Racecourse & Omuramba Road<br>Montague Gardens<br>Cape Town<br>P.O.Box 36556<br>Chempet 7442<br>Cape Town | Tel. +27 21 552 98 20<br>Fax +27 21 552 98 30<br>Telex 576 062 |
| | **Durban** | SEW-EURODRIVE (PROPRIETARY) LIMITED<br>2 Monaceo Place<br>Pinetown<br>Durban<br>P.O. Box 10433, Ashwood 3605 | Tel. +27 31 700 34 51<br>Fax +27 31 700 38 47 |
| **Spain** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Bilbao** | SEW-EURODRIVE ESPAÑA, S.L.<br>Parque Tecnológico, Edificio, 302<br>E-48170 Zamudio (Vizcaya) | Tel. 9 44 31 84 70<br>Fax 9 44 31 84 71<br>sew.spain@sew-eurodrive.es |
| **Sweden** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Jönköping** | SEW-EURODRIVE AB<br>Gnejsvägen 6-8<br>S-55303 Jönköping<br>Box 3100 S-55003 Jönköping | Tel. (036) 34 42 00<br>Fax (036) 34 42 80<br>www.sew-eurodrive.se |
| **Switzerland** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Basel** | Alfred Imhof A.G.<br>Jurastrasse 10<br>CH-4142 Münchenstein bei Basel | Tel. (061) 4 17 17 17<br>Fax (061) 4 17 17 00<br>http://www.imhof-sew.ch<br>info@imhof-sew.ch |
| **Thailand** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Chon Buri** | SEW-EURODRIVE (Thailand) Ltd.<br>Bangpakong Industrial Park 2<br>700/456, Moo.7, Tambol Donhuaroh<br>Muang District<br>Chon Buri 20000 | Tel. 0066-38 21 40 22<br>Fax 0066-38 21 45 31 |
| **Turkey** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Istanbul** | SEW-EURODRIVE<br>Hareket Sistemleri San. ve Tic. Ltd. Sti<br>Bagdat Cad. Koruma Cikmazi No. 3<br>TR-81540 Maltepe ISTANBUL | Tel. (0216) 4 41 91 63 + 4 41 91 64 + 3 83 80 14 + 3 83 80 15<br>Fax (0216) 3 05 58 67<br>seweurodrive@superonline.com.tr |
| **USA** | | | |
| **Production**<br>**Assembly**<br>**Sales**<br>**Service** | **Greenville** | SEW-EURODRIVE INC.<br>1295 Old Spartanburg Highway<br>P.O. Box 518<br>Lyman, S.C. 29365 | Tel. (864) 4 39 75 37<br>Fax Sales (864) 439-78 30<br>Fax Manuf. (864) 4 39-99 48<br>Fax Ass. (864) 4 39-05 66<br>Telex 805 550 |
| **Assembly**<br>**Sales**<br>**Service** | **San Francisco** | SEW-EURODRIVE INC.<br>30599 San Antonio St.<br>Hayward, California 94544-7101 | Tel. (510) 4 87-35 60<br>Fax (510) 4 87-63 81 |
| | **Philadelphia/PA** | SEW-EURODRIVE INC.<br>Pureland Ind. Complex<br>200 High Hill Road, P.O. Box 481<br>Bridgeport, New Jersey 08014 | Tel. (856) 4 67-22 77<br>Fax (856) 8 45-31 79 |
| | **Dayton** | SEW-EURODRIVE INC.<br>2001 West Main Street<br>Troy, Ohio 45373 | Tel. (9 37) 3 35-00 36<br>Fax (9 37) 4 40-37 99 |
| | **Dallas** | SEW-EURODRIVE INC.<br>3950 Platinum Way<br>Dallas, Texas 75237 | Tel. (214) 3 30-48 24<br>Fax (214) 3 30-47 24 |

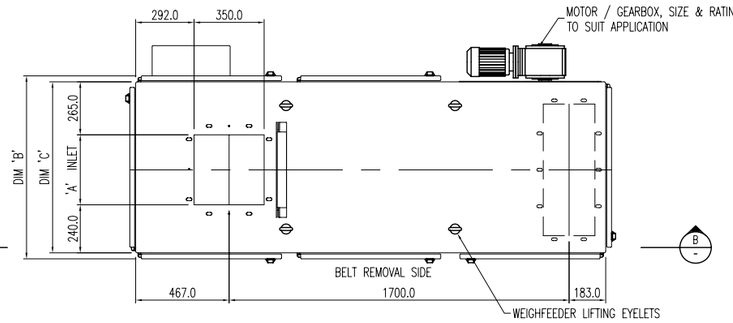
| | | | |
|---|---|---|---|
| **USA** | | | |
| | Additional addresses for service in the USA provided on request! | | |
| **Venezuela** | | | |
| **Assembly**<br>**Sales**<br>**Service** | **Valencia** | SEW-EURODRIVE Venezuela S.A.<br>Av. Norte Sur No. 3, Galpon 84-319<br>Zona Industrial Municipal Norte<br>Valencia | Tel. +58 (241) 8 32 98 04<br>Fax +58 (241) 8 38 62 75<br>sewventas@cantr.net<br>sewfinanzas@cantr.net |

SEW-EURODRIVE GmbH & Co · P.O. Box 3023 · D-76642 Bruchsal/Germany · Phone +49-7251-75-0
Fax +49-7251-75-1970 · http://www.sew-eurodrive.com · sew@sew-eurodrive.com

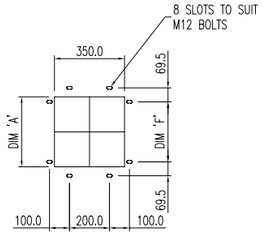
SEW
EURODRIVE



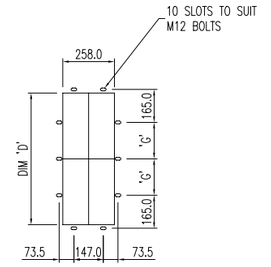

SECTION A
SCALE 1:15



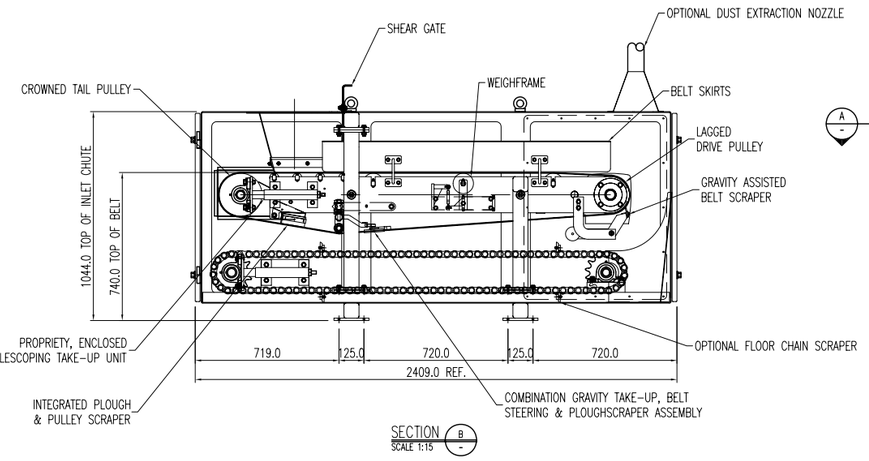

PLAN VIEW



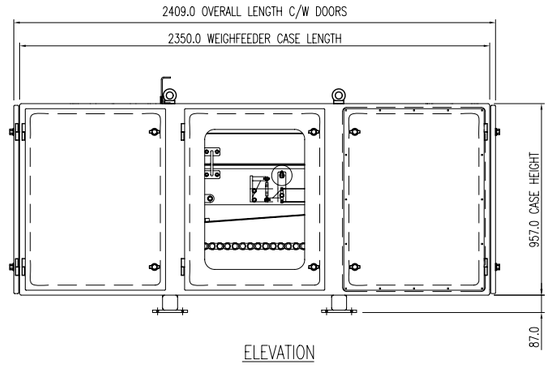

DISCHARGE CHUTE HOPPER
MOUNTING DETAILS



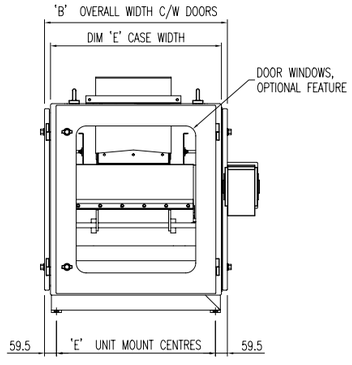

INLET CHUTE HOPPER
MOUNTING DETAILS



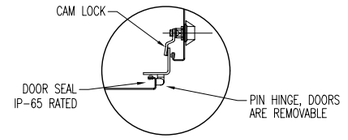

SECTION B
SCALE 1:15



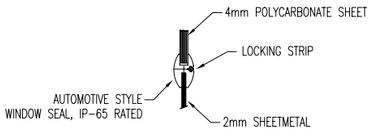

ELEVATION



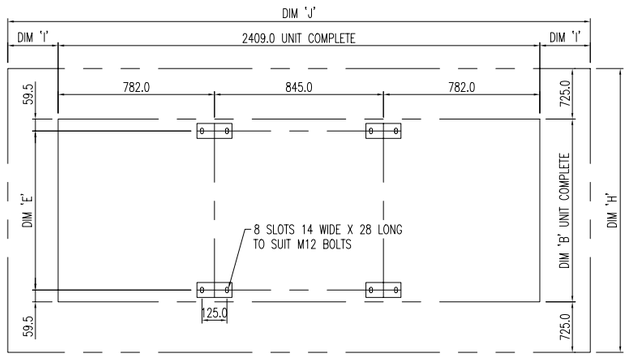

VIEW FROM DISCHARGE END




TYPICAL HINGE AND LATCH DETAIL




WINDOW SEAL CROSS-SECTION
DOOR WINDOWS ARE AN OPTIONAL FEATURE




MAINTENANCE ENVELOPE

WEIGHFEEDER FOOTPRINT LAYOUT

| BELT WIDTH | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| 300mm | 150.0 | 614.0 | 555.0 | 358.0 | 495.0 | 100.0 | 107.0 | 2064.0 | 795.0 | 3999.0 |
| 450mm | 200.0 | 764.0 | 705.0 | 508.0 | 645.0 | 150.0 | 144.5 | 2214.0 | 945.0 | 4299.0 |
| 600mm | 350.0 | 914.0 | 855.0 | 658.0 | 795.0 | 300.0 | 182.0 | 2364.0 | 1095.0 | 4599.0 |
| 750mm | 500.0 | 1064.0 | 1005.0 | 808.0 | 945.0 | 450.0 | 219.5 | 2514.0 | 1245.0 | 4899.0 |
| 900mm | 650.0 | 1214.0 | 1155.0 | 958.0 | 1095.0 | 600.0 | 257.0 | 2664.0 | 1395.0 | 5199.0 |
| 1050mm | 800.0 | 1364.0 | 1305.0 | 1108.0 | 1245.0 | 750.0 | 294.5 | 2814.0 | 1545.0 | 5499.0 |
| 1200mm | 950.0 | 1514.0 | 1455.0 | 1258.0 | 1395.0 | 900.0 | 332.0 | 2964.0 | 1695.0 | 5799.0 |

REVISIONS
A: 29/07/99 ORIGINAL ISSUE 0000

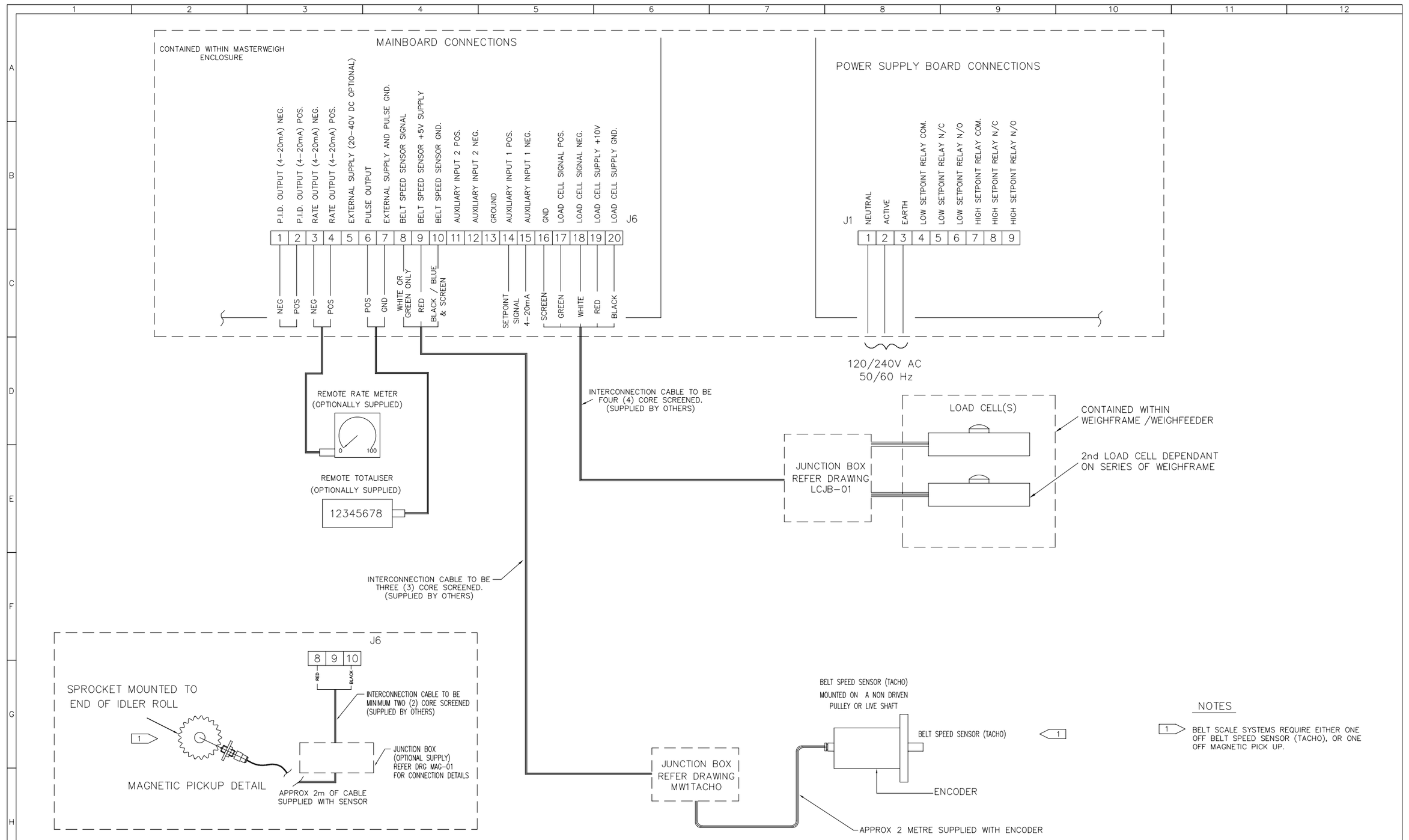
| | |
|---|---|
| DRAWN | TONY BERNARDI |
| CHECKED | – |
| APPROVED | – |
| DATE APP'D | – |
| SCALE | 1:10 |
| | DO NOT SCALE IF IN DOUBT ASK |


**WEB-TECH AUSTRALIA PTY. LTD.**
A.C.N. 010 764 431
11 ELECTRONICS STREET EIGHT MILE PLAINS, QUEENSLAND, 4113, AUSTRALIA
P.O. BOX 4006 EIGHT MILE PLAINS, QUEENSLAND, 4113, AUSTRALIA
Phone +61-7-3841 2844 Fax +61-7-3841 0005


| | |
|---|---|
| SIZE | A1 |
| DRAWING No. NUMBER | 17000008 |
| REV. | A |
| CUSTOMER | – |
| PROJECT | – |
| CAD FILE | 17000008 |

TITLE: WT1700 ENCLOSED WEIGHFEEDER C/W OPTIONAL CHAIN SCRAPER GENERAL ARRANGEMENT

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE SPECIFIED




REVISIONS

| | | |
|---|---|---|
| A: ORIGINAL ISSUE | 09/01/97 | |
| B: WIRING COLOURS ALTERED ECN: 0000 | 10/03/97 | T.BERNARDI |
| C: TACHO DRAWING No. ALTERED ECN: 0000 | 11/07/97 | T.BERNARDI |

CERTIFICATION

WEB–TECH AUSTRALIA PTY. LTD. CUSTOMER No.:
CUSTOMER CUSTOMER ORDER No.:
- ☐ RETURN OF APPROVAL NOT REQUIRED
- ☐ RETURN APPROVAL FOR RECORD
- ☐ BEFORE MANUFACTURING PROCEEDS

WEB–TECH AUSTRALIA PTY. LTD.
CERTIFIED BY: DATE / /
CUSTOMER APPROVAL DATE / /
- ☐ APPROVED FOR CONSTRUCTION
- ☐ APPROVED AS NOTED
- ☐ APPROVED AS NOTED – RESUBMIT

UNLESS OTHERWISE STATED UNTOLERANCED DIMENSIONS TO BE WITHIN THE LIMITS SHOWN

| NOMINAL SIZE | UP TO 50 | ABOVE 50 UP TO 150 | ABOVE 150 UP TO 300 | ABOVE 300 UP TO 1000 | ABOVE 1000 |
|---|---|---|---|---|---|
| MACHINING | ± 0.1 | ± 0.2 | ± 0.3 | ± 0.5 | ± 1.0 |
| FABRICATION | ± 0.5 | ± 0.5 | ± 0.5 | ± 1.0 | ± 2.0 |
| ASSEMBLIES | ± 0.5 | ± 0.5 | ± 0.5 | ± 1.0 | ± 2.0 |

| | |
|---|---|
| DRAWN | T.BERNARDI |
| CHECKED | |
| APPROVED | |
| DATE APP'D | |
| SCALE | N.T.S. |
| | DO NOT SCALE IF IN DOUBT ASK |

**WEB–TECH AUSTRALIA PTY. LTD.**
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Phone +61–7–3841 2844 Fax +61–7–3841 0005

TITLE: ELECTRICAL CONNECTION DIAGRAM FOR BELT SCALE SYSTEMS INCORP MASTERWEIGH 1

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE SPECIFIED



| SIZE | DRAWING No. | | |
|---|---|---|---|
| | NUMBER | SHT. | REV. |
| A1 | WTMW1 | 01 | C |

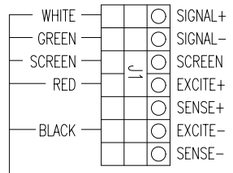
CONTRACT

PROJECT

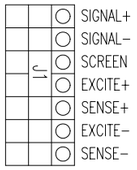
CAD FILE
WT05001C

LOADCELL JUNCTION BOX

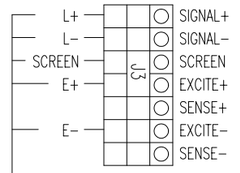
LOADCELL J-BOX TERMINATION BOARD



LOADCELL 1

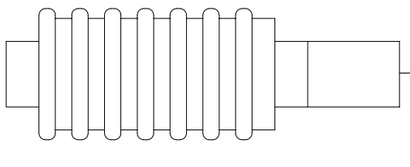


LOADCELL 2



INDICATOR

LOAD CELL
(Capacity selected to suit application)



SIGNAL +
SIGNAL -
EXCITATION +
EXCITATION -
SCREEN

TO ELECTRONICS

NOTES

REVISIONS
A: 21/11/05
ORIGINAL ISSUE

| UNLESS OTHERWISE STATED UNTOLERANCED DIMENSIONS TO BE WITHIN THE LIMITS SHOWN | | | | | | DRAWN | L.H. |
|---|---|---|---|---|---|---|---|
| | | | | | | CHECKED | L.H. |
| NOMINAL SIZE | UP TO 50 | ABOVE 50 UP TO 150 | ABOVE 150 UP TO 300 | ABOVE 300 UP TO 1000 | ABOVE 1000 | APPROVED | L.H. |
| | | | | | | DATE APP'D | 21/11/05 |
| MACHINING | ± 0.1 | ± 0.2 | ± 0.3 | ± 0.5 | ± 1.0 | SCALE | N.T.S. |
| FABRICATION | ± 0.5 | ± 0.5 | ± 0.5 | ± 1.0 | ± 2.0 | | DO NOT SCALE IF IN DOUBT ASK |
| ASSEMBLIES | ± 0.5 | ± 0.5 | ± 0.5 | ± 1.0 | ± 2.0 | | |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Phone +61-7-3841 2844 Fax +61-7-3841 0005


TITLE
MODEL WT735/1200/1700 WEIGHFEEDER
LOAD CELL JUNCTION BOX CONNECTION DIAGRAM.

ALL DIMENSIONS IN MILLIMETRES
UNLESS OTHERWISE SPECIFIED

| SIZE | DRAWING No. | | |
|---|---|---|---|
| | NUMBER | SHT. | REV. |
| A1 | LCJBOX | 1 | A |
| CONTRACT | | | |
| PROJECT | | | |
| CAD FILE | | | |

SPEED SENSOR (TACHO) JUNCTION BOX

(COMPONENTS REMOVED FOR CLARITY)

SHIELD — 4
0V (GND) — 3
+5V SUPPLY — 2
SIGNAL — 1

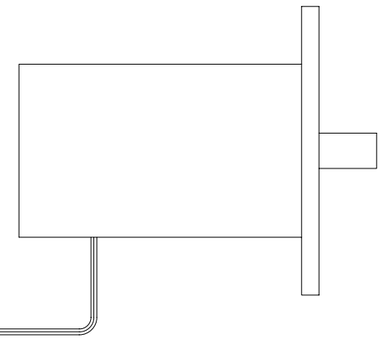
5 — RED
4 — BLACK OR BLUE
3 — WHITE
2 — GREEN
1 — SHIELD

1 — 8 7 6 5 4 3 2 1 — X4 X2 X1 /2 /4 /8 /16 /32

CABLE SUPPLIED BY CUSTOMER. CABLE TO BE BELDEN 3 CORE PART No. 8770 OR EQUIVALENT

CABLE INTEGRAL TO TACHO

SPEED SENSOR (TACHO)



1 THE POSITION OF THE SLIDER SWITCH HAS BEEN FACTORY ADJUSTED AND DETERMINES THE OUTPUT OF THE TACHO. THIS SETTING SHOULD BE CHECKED AGAINST THE DATA SHEET PRIOR TO COMMISSIONING.

TO MASTERWEIGH 1 ELECTRONICS

J6 TERM. 10 — SCREEN
J6 TERM. 10 — 0V (GND)
J6 TERM. 9 — +5V SUPPLY
J6 TERM. 8 — SIGNAL

REVISIONS

A: 20/10/98 ORIGINAL ISSUE

| | |
|---|---|
| DRAWN | L.HARTLEY |
| CHECKED | L.HARTLEY |
| APPROVED | L.HARTLEY |
| DATE APP'D | 20/10/98 |
| SCALE | N.T.S |
| | DO NOT SCALE IF IN DOUBT ASK |


WEB-TECH AUSTRALIA PTY. LTD.
A.C.N. 010 764 431
11 ELECTRONICS STREET EIGHT MILE PLAINS, QUEENSLAND, 4113, AUSTRALIA
P.O. BOX 4006 EIGHT MILE PLAINS, QUEENSLAND, 4113, AUSTRALIA
Phone +61-7-3841 2844 Fax +61-7-3841 0005


TITLE: TACHO (S/S) JUNCTION BOX WIRING (WITH MULTIPLICATION), & CONNECTIONS TO MASTERWEIGH 1 INTEGRATOR

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE SPECIFIED



| SIZE | DRAWING No. | REV. |
|---|---|---|
| A1 | JB010011 | A |

CUSTOMER

PROJECT

CAD FILE JB010011

# WEB-TECH AUSTRALIA PTY LTD

Customer : _____ Conveyor Designation : _____

Material : _____ Model : _____ Date : _____

Load Cell Type : _____ Tacho : _____ Data By : _____

MW S/No : _____ Software Version : _____ Contract No : _____

Order No.

| MENU | FUNCTION | MASTERWEIGH 1 SETTINGS |
|---|---|---|
| 1 | **Parameter Setup** | Capacity : _____ Increments Size: _____<br>Zero Reference : _____ mV Precision Reference : _____ mV<br>Pulse Width: _____ ms |
| 2 | **Pulses per Belt Revolution** | Programmed Pulses per Belt Revolution : _____ No. of Belt Revs : _____ |
| 3 | **Zero Calibration** | Zero Calibration : _____ mV AutoZero Tracking : _____ mV |
| 4 | **Fixed Weight Calibrate** | Span : _____ Target Weight : **#REF!** kgs |
| 5 | **Emperical Span** | Emperical Span : _____ |
| 6 | **Null Level** | Null Level : _____ |
| 7 | **Auto Zero Tracking** | Auto Zero Level : _____ Auto Zero Period : _____ Delay Time : _____ sec |
| 8 | **Loadcell Input** | Dynamic (No Load) : _____ mV Dynamic (with weights) : _____ mV |
| 9 | **Tacho Frequency** | Tacho Frequency : _____ Hz @ _____ Hz on VF Drive (if appl.) |
| 10 | **High Alarm Setpoint** | High Alarm Level : _____ Alarm Delay : _____ sec |
| 11 | **Low Alarm Setpoint** | Low Alarm Level : _____ Alarm Delay : _____ sec |
| 12 | **Parameter Print** | NOT USED |
| 13 | **Auto/Manual Control of PID** | Auto / Manual |
| 14 | **PID Parameters** | Current Setpoint : _____ Proportional Term : _____ Integral Term : _____<br>Integral Lower Limit : _____ Integral Upper Limit : _____ Differential Term :<br>O/P Offset Term : _____ Feed Forw. Term: _____ |
| 15 | **Remote Setpoint Mode** | _____ |
| 16 | **Remote Setpoint** | _____ |
| 17 | **Filter Constants** | Display Time Constant : _____ secs Rate O/P Time Constant : _____ secs<br>Cascade Time Constant : _____ secs PID I/P Time Constant : _____ secs<br>PID O/P Time Constant : _____ secs |
| 18 | **Displayed Units** | _____ |
| 19 | **Belt Speed Indication** | Indicated Belt Speed : _____ m/sec @ _____ Hz on VF Drive (if appl.)<br>Current Belt Length : _____ metres |

# WEB-TECH WEIGHFEEDER DESIGN DATA SHEET

**CLIENT :** **DATE :** _____

**DESIGNATION :** **MODEL** _____

**CALIBRATION METHOD : BAR(S) / CHAIN**

## CALIBRATION BAR(S)

1. CALIBRATION BAR QTY AND TOTAL WEIGHT _____ = _____
2. IDLER PITCH _____
3. TOTAL WEIGH AREA _____ **metres**
4. EQUIVALENT LOADING/M WITH CAL BAR(S) (Item 1 x 1/Item 3) = _____
5. BELT SPEED _____ **m/s**
6. SIMULATED MASS RATE (Item 4 x Item 5 x 3600 ) = _____ **kg/hr**
7. BELT LENGTH _____ **metres**
8. No. OF BELT REVOLUTIONS FOR TEST _____
9. **TARGET WEIGHT ( Item 4 x Item 7 x Item 8 ) =** _____ **kgs**

## CALIBRATION CHAIN

1. WEIGHT OF CALIBRATION CHAIN PER STRAND _____ **kg/m**
2. No. OF STRANDS _____
3. TOTAL WEIGHT OF CALIBRATION CHAIN (Item 1 x Item 2 ) _____ **kg/m**
4. BELT LENGTH _____ **m**
5. No. OF BELT REVOLUTIONS FOR TEST _____
4. **TARGET WEIGHT ( Item 3 x Item 4 x Item 5 ) =** _____ **kgs**

# ADDENDUM

The following addenda are applicable to the equipment supplied for this contract.