points for consideration when shaft mounting direct drive gear units.

Modern hollow bore output hub gear units lend themselves to direct shaft mounting on to the driven application shaft.

If installed correctly this reduces the need for relatively expensive transmissions or shaft couplings at the low speed / high torque gear unit output and a foundation or platform for mounting is normally not required, guarding is also minimised. The following points however must be considered to reduce the possibility of application problems and increase the maintenance intervals on the application:

**Shaft bearing selection;**

The shaft bearings must cater for both the radial loads induced from the application loading and also any overhung loads generated by the gear unit and motor mass. The gear unit hollow bore is normally sized to suit the torque being transmitted which will be proportional to the bearing load, typically the bearing I.D. should be approx. 10 - 15% greater in Ø than the gear hub for roller and spherical roller bearing types. The bearing selection should however be verified by the relevant bearing supplier!

**Anti-rotation device, (torque arm, reaction bracket or bolt etc.);**

When shaft mounting is adopted the gear hub and application shaft become in effect one piece. This means that the 2 application shaft bearings and 2 gear unit hub bearings must be concentric to ensure excessive radial loads are not generated. The most effective way to achieve this is by use of a device such as a torque arm or reaction bracket / bolt kit which has a flexible element to allow simple installation. This will normally also cater for shaft oscillation that occurs in many applications. The anchor point for the reaction device must be robust enough to cope with the relatively large reactive forces that can be generated, especially during D.O.L. starting where the gear unit torque can be up to 3 times it's nominal torque rating. The reaction device should not have axial load exerted on it during installation - typically this can occur by incorrect alignment. Ideally the anchor point for the reaction device should prevent axial movement.

**Shaft, key & keyways;**

It is imperative that shaft keyways / fitted keys are as per gear unit manufacturers instructions to ensure that correct installation and in particular top fitting keys do not occur. Attached is a sheet showing standard key and keyway sizes - refer to manufactures data for shaft tolerances.
axial location of the gear unit on to the application shaft;
as virtually no axial loading is generated when a shaft mounting procedure is adopted it is not common for the gear unit to move axially. normally the reaction device / anchor point will prevent axial gear movement.
if axial location is required then the shaft Ø reduction from bearings to gear unit can be used as locating point for the inside of the gear unit hub to prevent inward movement.
some gear units have an internal hub circlip arrangement which can then be used to fix axial location. if that is not present then a simple washer located against the hub at the outside as shown in the following drawings is acceptable.

guarding / safety hub covers;
as no transmission is required for direct shaft mounting then guarding is reduced.
the rotating keyway in the output hub however is an issue and must be covered.
some gear unit manufacturers supply a plastic plug in cover - this rotates with the output hub but the keyway is covered. Health & Safety Inspectors may not approve the plastic covers as the method of fixing is not positive and depends on friction. if this is the case a larger stationary hub cover can normally be supplied.

lubrication;
one of the advantages of shaft mounting is the ability to rotationally locate the drive unit to the most suitable position. the lubricant should be installed as per manufacturers instructions.
the appropriate positions for any sight glass, breather or drain point will also be shown.
if the actual position is not one of the normal positions shown in the instructions then a "pro-rata" fill should be used based on quantity - in these positions the sight glass can not be used for level checking.

motor sealing and terminal block position;
most motors now are either IP54 or IP55 rated as standard making them suitable for normal outside use.
this rating however is only active when correct glands and cables are fitted so it is imperative that care is taken if storing a drive unit outside prior to electrical connection that moisture ingress can not occur.
the motor terminal box position can normally be adjusted to facilitate cable entry and in our experience when the glands are located at the bottom of the terminal box, (as shown on attached drawing), then moisture ingress on the application is least likely to occur.

method of starting;
shaft mounting creates a very positive drive on to the application shaft with no flexible coupling elements or rubber type transmissions present to cushion shock loads on start up. when motor size is 7.5kw or below, D.O.L. (Direct On Line) starting is not normally an issue but above that assisted starting is recommended. - consult with technidrive during gear unit selection for advice on this subject.

gear unit removal;
fretted corrosion can occur between the gear unit output hub and application shaft after a period of time.
one method of minimising this is to apply a liberal coating of high quality anti-seize compound during installation of the gear unit on to the application shaft and gear unit output hub.
if and when a gear unit is to be removed and proves difficult then in our experience it is advisable to try and remove the shaft key first - this can be achieved by drilling and tapping the key in an axial direction and using a threaded impact hammer or similar to drift the key out. this will make subsequent removal of the gear unit much easier than with the key installed.
schematic to show gear unit shaft mounting

direct shaft mounting via hollow bore is now a very common method used to mount gear units on to driven shafts.

it reduces the need for relatively expensive couplings or transmissions at the low speed / high torque output side of the reducer, a foundation for the drive is not normally required and guarding is minimised.

when this method is adopted the gear unit hub and driven shaft in effect become one component and as most gear units have 2 bearings supporting the output hub and most driven shafts have 2 locating bearings then commonly 4 bearings are to be located on the same axis.

if the gear unit is incorrectly fixed to a rigid plane or structure which is not exactly at the correct dimension to ensure axis of shaft and axis of bearing rotation are the same then excessive radial loading can be generated on either the gear unit or shaft bearings.

most gear unit manufacturers who offer hollow bore gear units for shaft mounting also offer devices that prevent rotation of the gear without causing additional bearing loading due to misalignment. Typically these are in the form of:-

torque arm
reaction bracket
reactor bolt kit

most of these have some form of flexible element which allows connection to a rigid plane but still allowing contained movement of the gear unit with regard to axial, angular and parallel movement of the gear unit relative to the shaft axis.

it is difficult to see small amounts of angular misalignment or oscillation at the shaft but when a gear unit is fitted with a reaction device it is common to see quite a lot of movement of the gear unit at parts furthest away from the hub centre.

again it is not uncommon to see 2 identical application with shaft mounted gear units having reaction devices and for 1 to show no signs of movement and the other to have considerable apparent "oscillation" of the gear unit.
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detail for shaft mounting arrangement with axial location bolt and hub cover
(Bonfiglioli “A” series)

robust anchor point for reaction device - also provides axial location

shoulder on shaft used for axial location of gear unit hub

B = effective shaft length through hub.

A1

A2
lubrication recommendations

(Bonfiglioli “A” series)

position “B3 / B8”

lubricate as per manufacturers instructions, sight glass for level can be used.

position “VA”

lubricate as per manufacturers instructions, sight glass for level can be used.

position “VB”

lubricate as per manufacturers instructions, sight glass for level can be used.

no catalogue reference

lubricate “pro-rata” between positions, DO NOT use sight glass for level checking.
Terminal box orientation “A”
Terminal box located at side, terminal cover for side access, cable gland location at bottom.

Terminal box orientation “B”

Notes:

1) Most electric motors are IP 54 / IP 55 rated making them suitable for outside applications. This rating is only when correct IP rated cables / glands are fitted - if the motor is to be left in outside environment and exposed to the elements prior to correct electrical connection, the motor must be protected against moisture ingress.

2) On outside applications or areas where moisture is present it is recommended that the terminal box cover and cable glands have additional sealing via a coat of silicone sealant or similar.

3) On very wet applications it is advisable to fill the terminal box after correct electrical connection with a sealer such as “Ray-tech Magic Gel” or similar to provide enhanced protection against moisture ingress.