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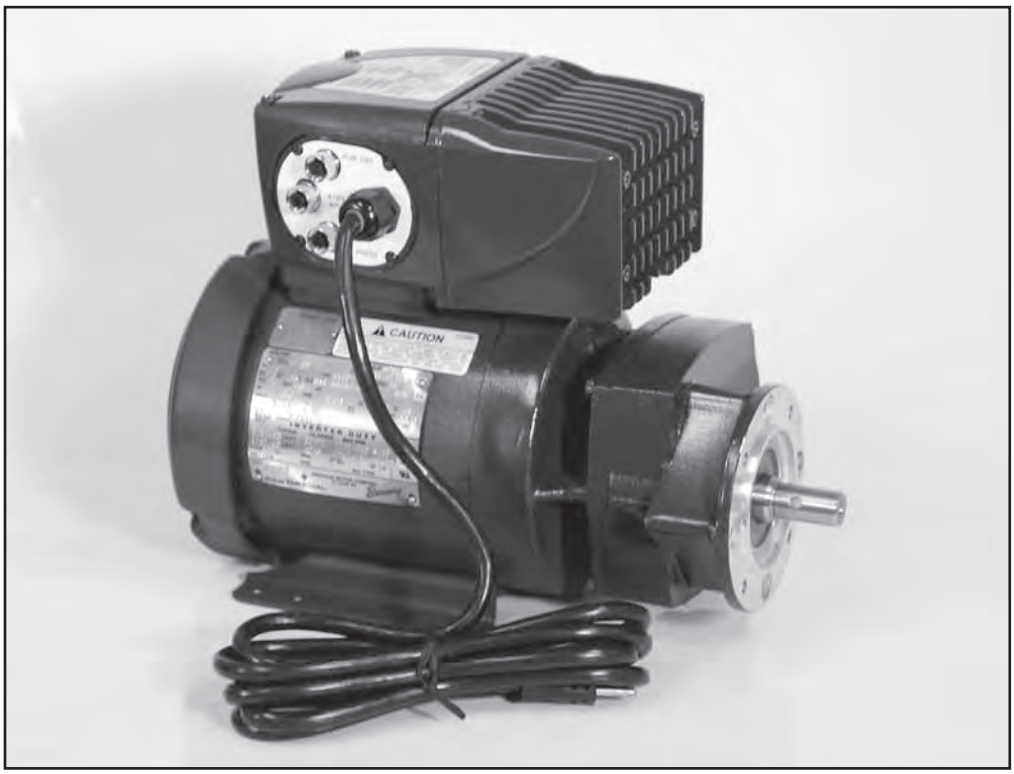
**F O R M**
**9178E**
**Revised**
**April 2012**

# Installation and Maintenance Manual For IntelliGear Plus™ MD and BW1/BW2 Variable Speed Drives

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Thank you for choosing an IntelliGear Plus Gearmotor.

## General Safety Instructions

**⚠ WARNING**

- Read and follow all instructions carefully.
- Disconnect and lock-out power before installation and maintenance. Working on or near energized equipment can result in severe injury or death.
- Disconnect power at least 2 minutes prior to servicing to allow capacitors to discharge. Handling wires sooner than this could result in electric shock, severe injury, or death.
- Do not operate equipment without guards in place. Exposed equipment can result in severe injury or death.
- Any eyebolts that have been supplied with the breakmotor or gearmotor are designed for lifting only these components. Lifting additional weight attached to theses components may break the eyebolt and result in personal injury or death, and product damage.

**⚠ CAUTION**

- All electrical work should be performed by qualified personnel and compliant with local and national electrical codes.
- Periodic inspections should be performed. Failure to perform proper maintenance can result in premature product failure and personal injury.

***NOTICE***

- IntelliGear Plus contains parts sensitive to static electricity. Care should be taken to discharge static prior to handling these components to avoid damage to them.
- Contact Emerson Power Transmission for recommendations for units running at slow speeds or unusual conditions.

# IntelliGear Plus™ Variable Speed MD Gearmotors

**Contents**

# IntelliGear Plus™ Variable Speed MD Gearmotors

## General Information

### 1 - General Information

### 1.1 - General operating principle

The IntelliGear Plus is a combination of a 3-phase induction motor and an integrated open loop vector variable speed drive. The motor can be combined with many gear types from Emerson Power Transmission's range.

In the standard product version, the integrated drive does not require any connection other than the power supply. The options may be used to broaden the application range of the IntelliGear Plus.

IntelliGear Plus motors meet the requirements of the Low Voltage Directive 73/23/EEC, modified by 93/68/EEC. The harmonized standards of the DIN VDE 0160 series in connection with standard VDE 0660, part 500 and EN 60146/VDE 0558 are also applicable.

### 1.2 - Product name

| **115V Single Phase Power Supply** | | **230V Single Phase Power Supply** | |
|---|---|---|---|
| Rating | Power (HP) | Rating | Power (HP) |
| 310 M 050 | 0.50 | 31 M 050 | 0.50 |
| 32 M 075 | 0.75 | 31 M 075 | 0.75 |

| **IntelliGear PLUS Controlling Options** | |
|---|---|
| Designation | Description |
| RP1 | 4-20 mA follow or local Start/Stop/10 Turn Potentiometer |

| **IntelliGear PLUS Accessories** | |
|---|---|
| Designation | Description |
| KEYPAD LCD | Parameter setting console w/cable to locally reprogram to customize parameters |
| VMA30SOFT | CD w/cable and USB to locally reprogram to customize parameters |

### 1.3 - Environmental Characteristics

| Characteristics | Level - IntelliGear PLUS | |
|---|---|---|
| Degree of protection | TEFC Version | TEFC motor and NEMA 4/12 Controller |
| Storage temperature | -40 °C to +70 °C | |
| Transport temperature | -40 °C to +70 °C | |
| Ambient operating temperature | -20 °C to +40 °C (above 40 °C requires derating 1% per °C | |
| Altitude | Up to 3000 feet above sea level without derating | |
| Ambient humidity | 95% non-condensing | |
| Humidity during storage | 93%, 40 °C, 4 days | |
| Vibration | | |
| | | |
| | | |
| Shocks | | |
| | | |
| Immunity | Conforming to EN61000-6-2 | |
| Radiated and conducted emissions | Conforming to EN500081-2 with internal filters | |
| UL (USA) | Conforming to UL 508 C (E211799) | |
| CUL (CANADA) | | |

**1.4 - Radio-frequency interference:**

**1.4.1 - General**

Variable speed drives use high-speed switches (transistors, semi-conductors) which switch high voltages (around 660V for 3-phase drives) at high frequencies (several kHz). This provides better efficiency and a low level of motor noise. As a result, they generate radio-frequency signals which may disturb operation of other equipment or distort measurements taken by sensors:

- due to high frequency leakage currents which escape to ground via the stray capacity of the drive/motor cable and that of the motor via the metal structures which support the motor
- by conduction or feedback of R.F. signals on the power supply cable; conducted emissions
- by direct radiation near to the main supply power cable or the drive/motor cable: radiated emissions

These phenomena are of direct interest to the user. The frequency range concerned (radio-frequency) does not affect the energy distribution company.

**1.4.2 - Standards (Emission)**

The maximum emission level is set by (EN 50081-2) and (EN 50081-1). IntelliGear Plus conforms to:

- EN 50081-2 as standard
- EN 50081-1 with filter option

**1.4.3 - Standards (Immunity)**

The maximum immunity level is set by (EN 50082-2) and (EN 50082-1). IntelliGear Plus conforms to:

- EN 50082-2 and EN 50082-1 as standard

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**1.5 - Description of cables and protection devices (Customer Supplied)**

**NOTICE:** When using a circuit-breaker, it must be a motor circuit-breaker (D curve).

- Comply with the size of protection fuses.
- The cable size may vary according to legislation applicable in the country, which will take precedence over the values given in the table below without exception.

| Motor HP Rating | 115V Single Phase Power Supply | | | | 230V Single Phase Power Supply | | | |
|---|---|---|---|---|---|---|---|---|
| | IntelliGear Plus Number | Input Amps | Wire Gauge | Fuse Size | IntelliGear Plus Number | Input Amps | Wire Gauge | Fuse Size |
| 0.50 | I 310M 050 | 5 | 14AWG | 10 A | I 31M 050 | 2.5 | 14AWG | 8A |
| 0.75 | I 32M 075 | 8.5 | 14AWG | 14A | I 31M 075 | 4 | 14AWG | 8A |

**1.6 - UL conformity**

**1.6.1 Special mains supply**

The drive can be incorporated in an installation with short circuit capacity of 5000 A rms maximum at voltage 264 VAC rms maximum for 230 V (TL) drives or 528 VAC rms maximum for 400 V (T) drives.

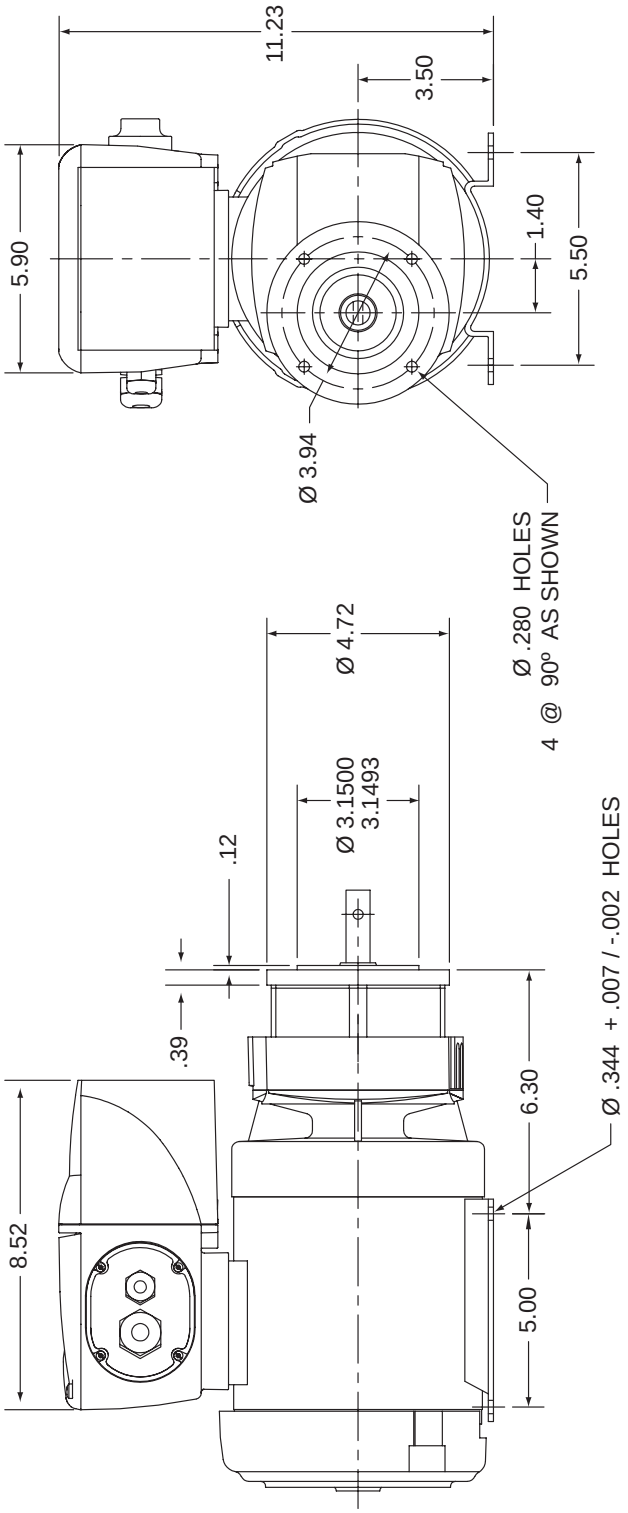
**1.6.2 Cables**

Only class 1 copper cables 60/70° C (140/167° F) should be used.

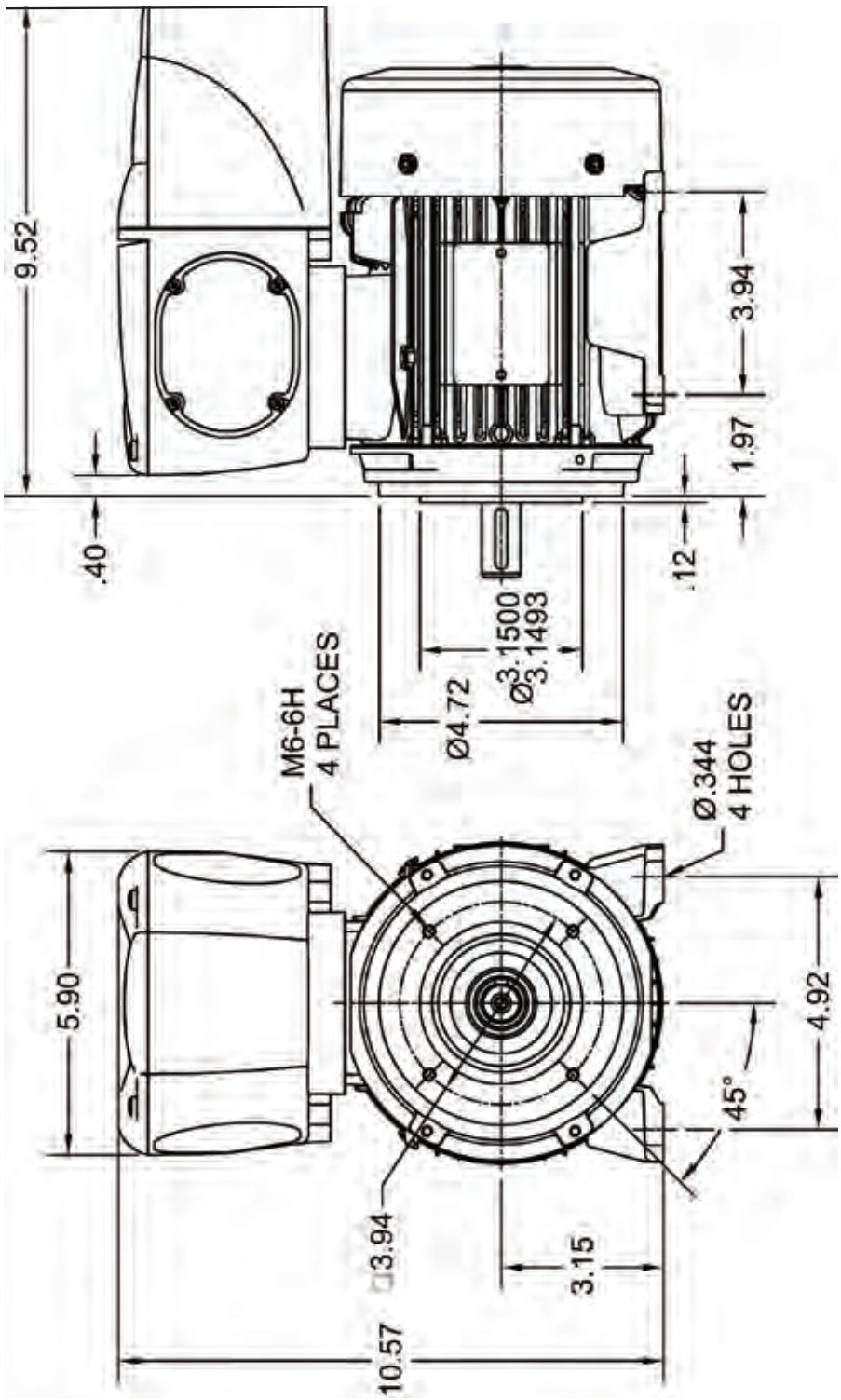
**1.6.3 Fuses**

UL conformity is adhered to if the fuses are UL-listed, fast-blow fuses (class CC up to 30 A) with a rating as indicated in the above table and if the short-circuit symmetrical current does not exceed 5 kA.

## 1.8 - Dimensions




| CATALOG NUMBER | CCI NUMBER |
|---|---|
| CBN3001BSCB524.556 CCI 109 | CCI 109-G |




| CATALOG NUMBER | CCI NUMBER |
|---|---|
| SEEPEXBW2+TS1LS80B14 | CCI0109G |

## 2 - Installation

After connection, ensure that the seals are firmly in place, and that the screws and cable glands are watertight to ensure drive protection. Clear any condensation from the drain holes at the bottom of the motor.

### 2.1 - General

The IntelliGear Plus is usually fitted to the gear and mounted to the machine with flange or foot mounting. The motor fan cools the whole assembly. Make sure that the ventilation air inlet is free of obstruction. The positions of the potentiometer/cable gland supports are specified at the time of ordering. However they may be reversed if necessary.

## 3 - Connections

Connection with copper conductor only.

### 3.1 - Control Terminal Blocks

- Remove the terminal block from it's fixed holder (unplugged) before making any connections, to avoid putting pressure on the card.

**CAUTION:** The IntelliGear Plus has a positive logic configuration. Using a drive with a control system which has a different control logic may cause unwanted starting of the motor.

- The control circuits in the drive are isolated from the power circuits by single insulation (IEC 664-1).
- The installer must ensure that the external control circuits are isolated against any human contact.
- If the control circuits need to be connected to circuits conforming to SELV safety requirements, additional insulation must be inserted to maintain the SELV classification.

Removable screws in terminal block:

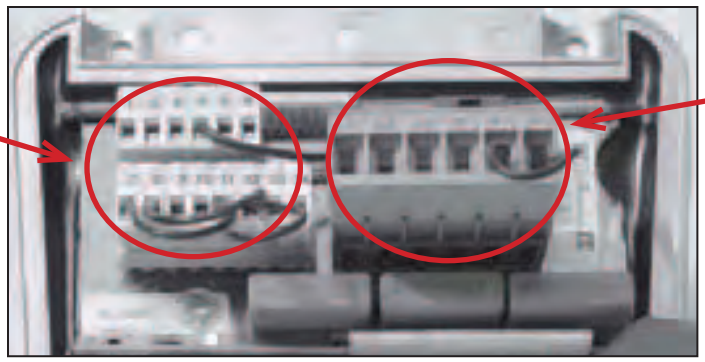
- Tightening torque = 2.62 in. lbs.
- Maximum cross section = 17 AWG

### 3.2 Power terminal blocks

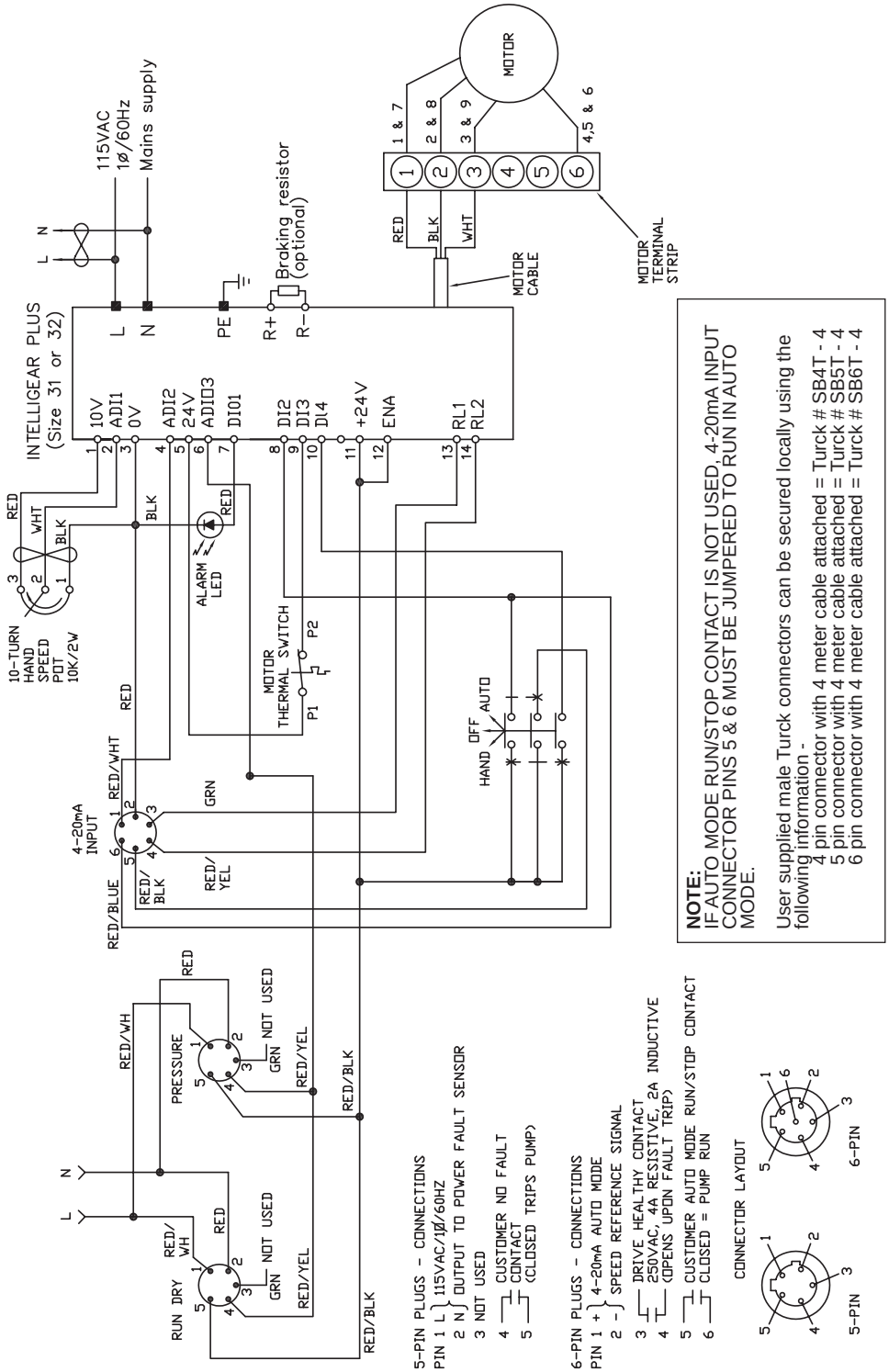
#### 3.2.1 Terminal block for power supply PB1 (marked L&N)

This terminal block is used to connect the 3 phase power supply when the RFI filter is not used in an IntelliGear Plus. Otherwise, the RFI filter output is screwed onto this connector and the power supply should be attached to the terminals located on top of the filter. (See table below)

| Screw terminal blocks | Frame 310M |
|---|---|
| Tightening Torque | 7.1 in. lbs. |
| Max. cross-section | AWG 14 |



### 3.3 Wiring diagram based on standard configuration



### 3.4 Terminal block assignments and MD functionality

| Controller Terminal Number | Designation | Function | Characteristics | |
|---|---|---|---|---|
| 1 | 10V | +10V analog internal source | Accuracy | ± 2% |
| | | | Maximum output current | 30 mA |
| 2 | ADI1 | Hand Mode Speed Reference ** | Voltage input | |
| | | | Full scale voltage | 10 V ± 2% |
| | | | Input Impedance | 95 kΩ |
| 3 | 0V | Logic circuit common 0V | | |
| 4 | ADI2 | Auto Mode Speed Reference | Current input | |
| | | | Current range | 0 to 20 mA ± 5% |
| | | | Input impedance | 500 Ω |
| | | | Resolution | 10 bits |
| | | | Sampling | 6 ms |
| 6 | ADIO3 | Fault Signal Input From Pump Operation Run Dry and/or High Pressure | Logic input (if connected to the +24 V | |
| | | | Threshholds | "0":<5V-"1"; >10V |
| | | | Voltage range | 0 to +24V |
| | | | Load | 95 kΩ |
| | | | Input threshold | 7.5V |
| 7 | DIO1 | Alarm LED | Characteristics | Digital output 1 |
| | | | Threshholds | "0":<5V-"1"; >10V |
| | | | Voltage range | 0 to +24V |
| | | | Sampling/refreshment | 2 ms |
| 5 | 24V | +24V internal source | Output current | 10 mA in total |
| | | | Overload current | 33 = 150mA, 31/32 = 50mA |
| 11 | | | Accuracy | ± 5% |
| | | | Protection | Current limiting and overload fault trip |
| 8 | DI2 | Logic input 2 Run/Stop | Characteristics | Logic input (positive logic) |
| | | | Threshold | "0":<5V-"1"; >10V |
| | | | Voltage range | 0 to +24V |
| 9 | DI3 | Logic input 3 Motor Thermal Input | Sampling/refreshment | 2 ms |
| | | | Absolute maximum voltage range | 0 to +35V |
| 10 | DI4 | Logic input 4 Hand Mode Selectior | Load | 15 kΩ |
| | | | Input threshold | 7.5V |
| 12 | ENA | Enable | Voltage range | 9 to + 35V |
| | | | Impedance | 820 Ω |
| 13 | RL1 | Drive Healthy Contact N/C after start-up if OK | Characteristics | NO single pole contact |
| 14 | RL2 | | 250VAC maximum contact current | 4 A, resistive load |
| | | | | 2 A inductive load |

** Performs scaling function when drive is programmed for full PI mode of operation

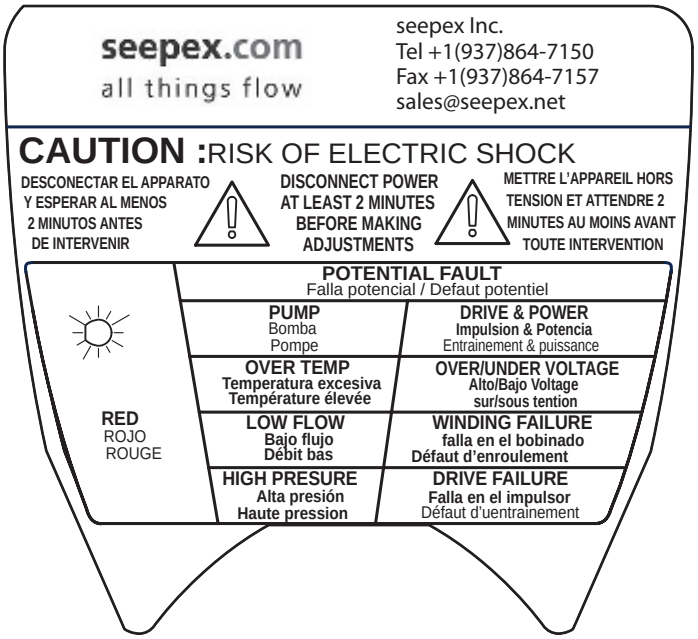
### 4. Commissioning

**WARNING!** Before switching on the IntelliGear Plus unit, check that the electrical connections are correct, and that any moving parts are mechanically guarded.

**WARNING!** For the safety of personnel, the IntelliGear Plus must not be switched on with any protective covering removed.

**5. Faults - Diagnostics**

Information relating to the status of the IntelliGear Plus is provided by an indicator lamp (see photo bottom right) on the control and by the internal LED in 310M.





**5. 1 MD Gearmotor Troubleshooting Guide**

| Symptom | Probable Cause(s) | Actions Required |
|---|---|---|
| Not running in AUTO or HAND mode- Alarm Light not lit | Power to drive is not on | Check power supply and cord |
| | HOA switch is in "OFF" position | Move switch to HAND or AUTO |
| Not running in AUTO mode - | HOA switch not in "AUTO" position | Put HOA switch in "AUTO" position |
| Alarm light not lit | Pins "5" and "6" of the six pin Turck connector are not "connected" | • Connect Auto Mode Run/Stop contact to pins "5"and "6" of six pin Turck connector.<br>• Make sure Auto Mode Run/Stop contact is closed.<br>• Jumper pins "5" and "6" if Auto Mode Run/ Stop contact is not being utilized |
| Unit runs at only Low Speed in AUTO mode | 4-20 mA signal is not present at drive | Check incoming 4-20 mA signal |
| | 4-20 mA to drive installed in reverse into pins "1" and "2" of six pin Turck connector | Reverse 4-20 mA connection polarity |
| Unit in AUTO mode will not achieve high RPM output at 20 mA | 4-20 mA signal does not achieve full scale | Check incoming 4-20 mA signal |
| | Signal to drive is not reaching full 20 mA | Repair signal |
| | Potentiometer is not in "10" position | Turn potentiometer to "10" position |
| Red LED "Alarm" light is on - Unit has stopped | Refer to "badge" below and on top of unit for mechanical/pump and electrical/ motor causes | Check these causes to determine the root cause for fault. Once cleared, un-plug and re-install main power plug with power source |

## 6 - Gear Lubrication

Series 3000 CbN gearing is shipped with one of the following synthetic lubricants per the table below. The gear reducer has been filled to accommodate any mounting position. In the case of synthetic oil, the lubricant does not require changing, but it is recommended that proper oil level be checked periodically.

**Synthetic**

**No Backstop**

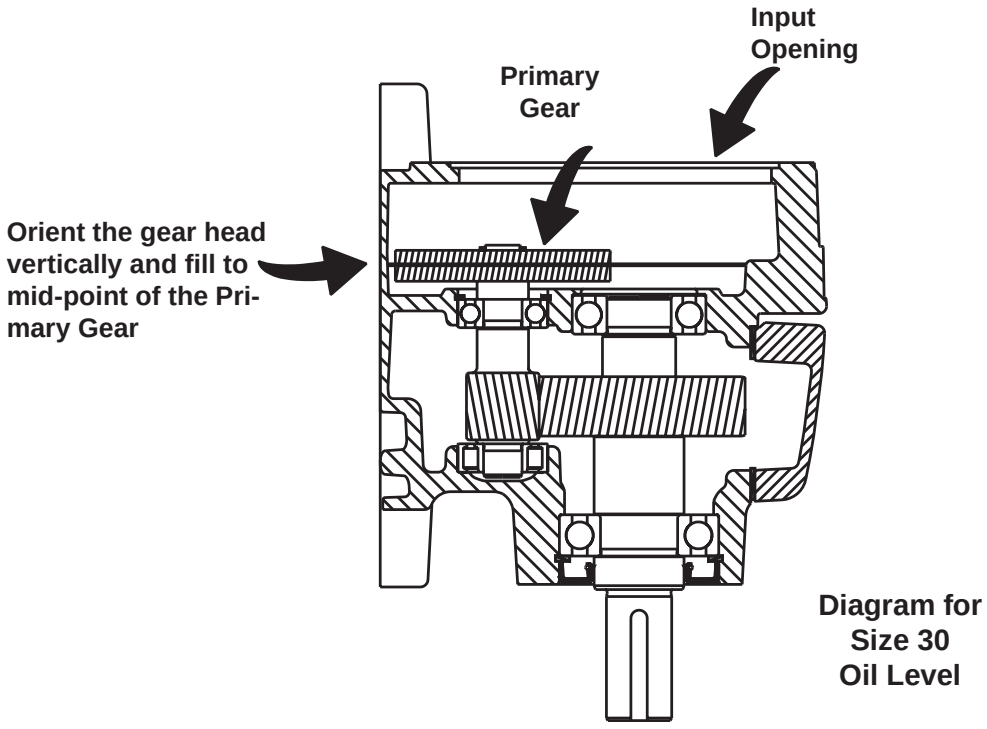
| Manufacturer | -25˚ F to 125˚ F (-30˚ C to 50˚ C) |
|---|---|
| Fuchs® | Sintogear® 125 |
| Mobil® | SHC 629 |
| Shell® | Omala® Fluids HD 150 |

**With Backstop**

| Manufacturer | -25˚ F to 125˚ F (-30˚ C to 50˚ C) |
|---|---|
| Shell | Omala RL 100 |

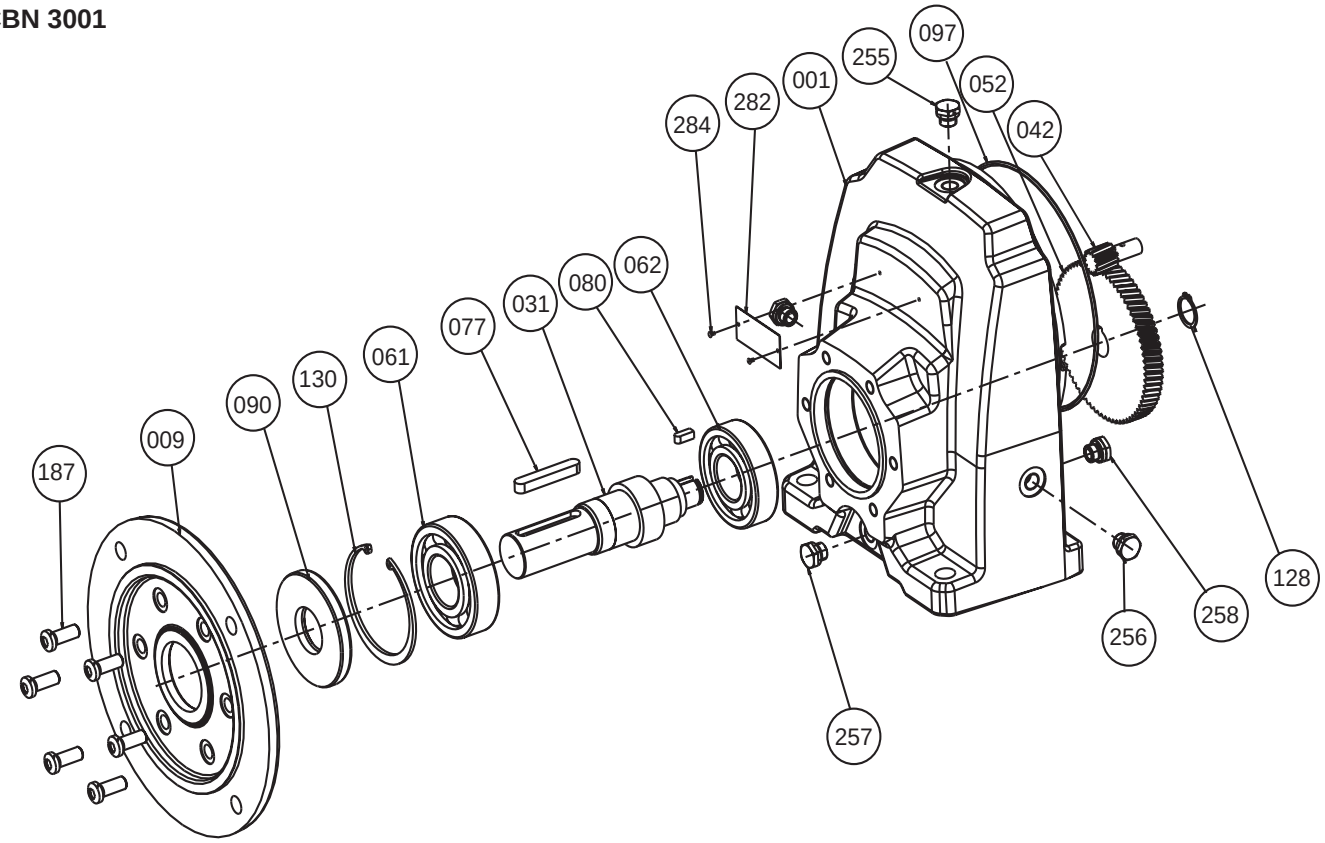
**Acceptable Mineral Oil Lubricants**

| Ambient Range of Installation | | | | | |
|---|---|---|---|---|---|
| -4˚ F to 14˚ F (-20˚C to 10˚C) | 14˚F to 122˚F (-10˚C to 50˚C) | | | | 122˚F and Above (50 ˚C+) |
| | No Backstop | | | With Backstop | |
| ISO VG 68 | ISO VG 100 | ISO VG 150 | ISO VG 220 | ISO VG 150 | ISO VG 320 |




Fuchs is a registered trademark of Fuchs Petrolub; Shell is a registered trademark of Shell Petroleum Incorporated. Omala is a registered trademark of Shell Trademark Management.

## 7.0 - Gear Parts List
**CBN 3001**




| Rep | Description | Quantity |
|---|---|---|
| 001 | Housing | 1 |
| 009 | Output flang ring | 1 |
| 031 | Output shaft | 1 |
| 042 | Pinion | 1 |
| 052 | Gear | 1 |
| 061 | Bearing front | 1 |
| 062 | Bearing back | 1 |
| 077 | Output shaft key | 1 |
| 080 | Gear Key | 1 |

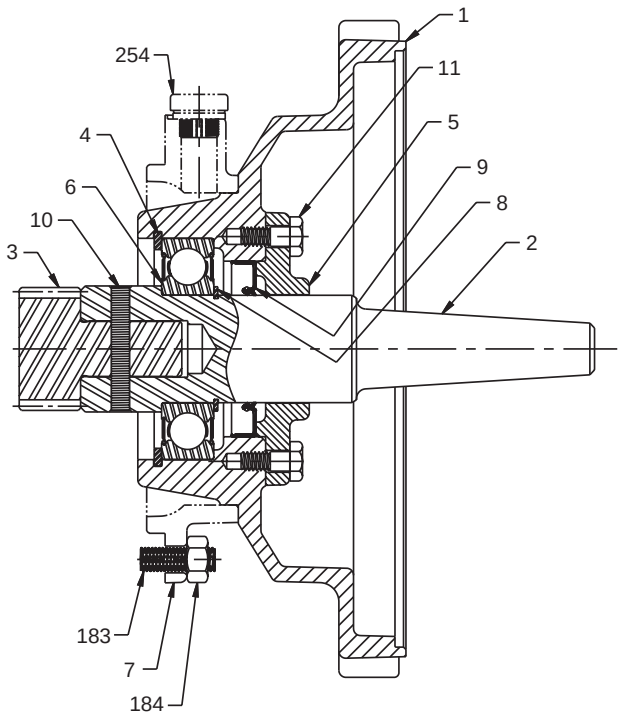
| Rep | Description | Quantity |
|---|---|---|
| 090 | Oil seal | 1 |
| 097 | Input o-ring | 1 |
| 127 | Gearing snap ring* | 1 |
| 130 | Gearing snap ring | 1 |
| 175 | Input bracket screw | 4 |
| 185 | Washer for gear* | 1 |
| 186 | Screw washer* | 1 |
| 187 | Bolt | 4 |
| 282 | Nameplate | 1 |

* Not illustrated on diagram

**Typical Maintenance Items - Bearings and Seals**

| Gear Frame | Item Description By Location | | |
|---|---|---|---|
| | Bearings | | Seal (mm) |
| | 61 | 62 | 90 |
| 30 | 6205 ZZ | 6005 | 25 x 52 x 7 DL nitrile |

## CbN 30 (Quantity Per Unit)

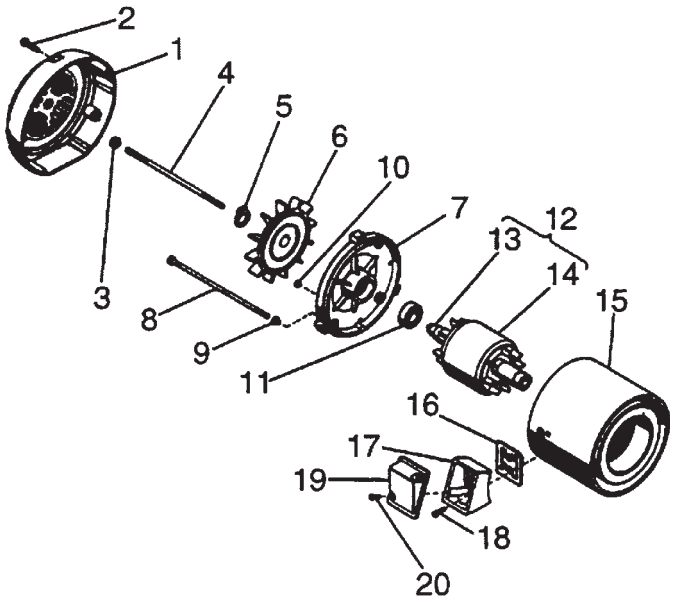



| Rep | Description | Quantity |
|---|---|---|
| 1 | Motor adapter | 1 |
| 2 | Input shaft | 1 |
| 3 | Pinion | 1 |
| 4 | Internal snap ring | 1 |
| 6 | Bearing | 1 |
| 8 | External snap ring | 1 |
| 9 | Seal | 1 |
| 10 | Pinion pin | 1 |
| 183 | Stud | 4 |
| 184 | Nut | 4 |

| Gear Frame | Bearing | Seal (mm) |
|---|---|---|
| | 6 | 9 |
| 30 | 6005 2RS | 47 x 25 x 7 |

| Part # | Description | Qty. |
|---|---|---|
| 1 | Fan Cover | 1 |
| 2 | Self Tapping Screw | 3 |
| 3 | Hex Nut | 1 |
| 5 | Retaining Snap Ring | 1 |
| 6 | Fan | 1 |
| 7 | Bracket | 1 |
| 8 | Screw | 4 |
| 9 | Bushing | 4 |
| 10 | Plastic Plug | 4 |
| 11 | Ball Bearing | 1 |
| 12 | Rotor Assembly (includes items 13 & 14) | 1 |
| 13 | Shaft | 1 |
| 14 | Rotor Core | 1 |
| 15 | Wound Stator Assembly | 1 |
| 16 | Gasket | 1 |
| 17 | Outlet Box Base | 1 |
| 18 | Self Tapping Screw | 2 |
| 19 | Outlet Box Cover | 1 |
| 20 | Self Tapping Screw | 2 |

**FRAME 56**



## Notes

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