ANDRITZ

**FOR APPROVAL**

**Drv3mgbt Rev.0**
TK
01/27/00

# DRIVE LIST

## 3.0m GRAVITY BELT TABLE DRIVE LIST

## SPEED RANGE 30 - 125 FPM

**GEAR REDUCER: (BY *ANDRITZ*)**

| | |
|---|---|
| MANUFACTURER: | EURODRIVE |
| MODEL: | Right angle, helical bevel gear reducer<br>KA77LP-184TC |
| RATIO: | 58.34:1 |
| OUTPUT SPEED: | 30.00 RPM @ 60HZ input range 20 TO 85 HZ |
| MOUNTING: | H1A position, terminal box @ 180 deg entry 2, Bore size 2"<br>Torque arm furnished and installed by ANDRITZ |

**HIGH SPEED COUPLING: *(BY ANDRITZ)***

MODEL:

Bore size 7/8" w/ key way for 3/16" SQ. key
1-3/8" w/ key way for 5/16" SQ. key

**MOTOR: *(BY OTHERS)***

5HP, 230/460V, 3 PH., 60HZ., 1750 RPM,
TEFC, NEMA design B, class F insulation,
severe duty, inverter duty, frame size: foot mount 184T

**VARIABLE FREQUENCY DRIVE: *(BY OTHERS)***

| | |
|---|---|
| HP | 5HP |
| VOLTAGE: | 480VAC In and Out |
| PHASE INPUT: | 3Ø |
| FREQUENCY: | 60HZ |
| CONSTANT TORQUE: | Capable of supplying 150% torque for one minute. |
| ENCLOSURE: | Suitable to environment. |

- High performance w/4-20mA outputs proportional to speed and load.

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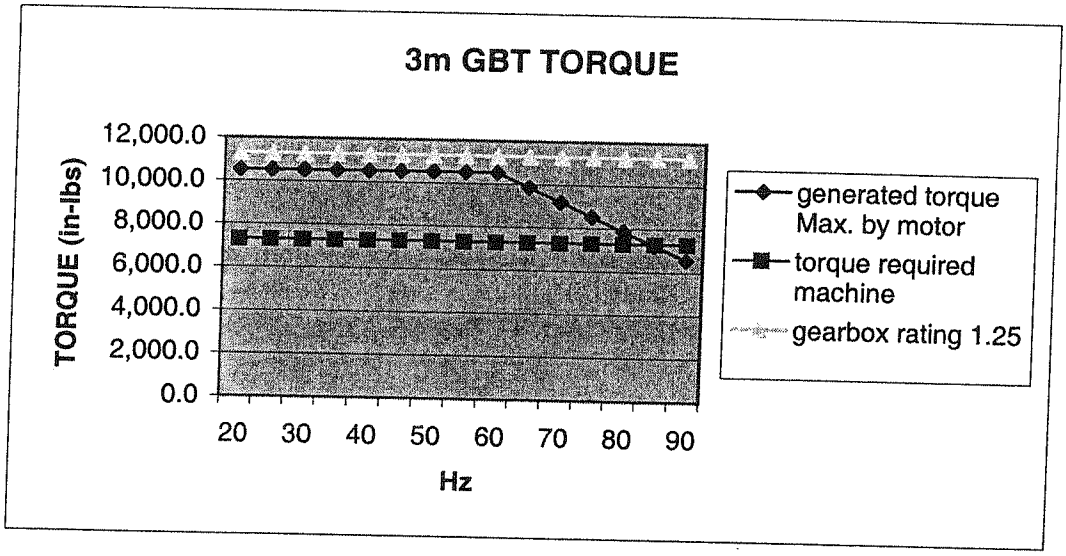
**IMPORTANT: "Client / engineer is responsible to provide controls which protect this machine from continuous overload condition, i.e.: Do not operate continuously in excess of 70% motor load up to 60 Hz and per the attached torque chart for above 60 Hz using motor specified above. Subsequent operation above overload limits voids any mechanical warranties.**

| Hz | generated torque Max. by motor | torque required machine | gearbox rating 1.25 | max. allowable motor load |
|---|---|---|---|---|
| 20 | 10,505.4 | 7,300.0 | 11,280.0 | 69.49% |
| 25 | 10,505.4 | 7,300.0 | 11,280.0 | 69.49% |
| 30 | 10,505.4 | 7,300.0 | 11,280.0 | 69.49% |
| 35 | 10,505.4 | 7,300.0 | 11,280.0 | 69.49% |
| 40 | 10,505.4 | 7,300.0 | 11,280.0 | 69.49% |
| 45 | 10,505.4 | 7,300.0 | 11,280.0 | 69.49% |
| 50 | 10,505.4 | 7,300.0 | 11,280.0 | 69.49% |
| 55 | 10,505.4 | 7,300.0 | 11,280.0 | 69.49% |
| 60 | 10,505.4 | 7,300.0 | 11,280.0 | 69.49% |
| 65 | 9,848.8 | 7,300.0 | 11,280.0 | 74.12% |
| 70 | 9,192.2 | 7,300.0 | 11,280.0 | 79.42% |
| 75 | 8,535.6 | 7,300.0 | 11,280.0 | 85.52% |
| 80 | 7,879.0 | 7,300.0 | 11,280.0 | 92.65% |
| 85 | 7,222.4 | 7,300.0 | 11,280.0 | 100.00% |
| 90 | 6,565.9 | 7,300.0 | 11,280.0 | 100.00% |



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# DRIVE LIST

## 3620C SCREW PRESS

### GEAR REDUCER: (BY *DUPPS)*

| | |
|---|---|
| Type: | Falk parallel shaft reducer |
| Model: | 2177YN4 |
| Motor RPM | 1750 RPM @ 60HZ |
| Sheave Ratio: | 1.398:1 |
| Input RPM @ Reducer: | 1251.8 RPM @ 60HZ |
| Gear Ratio: | 772:1 |
| Output RPM: | 1.62 RPM @ 60HZ |
| TORQUE RATING: | 1,838,000 LB-IN |

### DRIVE SHEAVES: (BY *DUPPS)*

| | |
|---|---|
| Driver: | 8.5" DIA. 14M-435-37V P/N: OE-46228-0A1 Bushing: E 2-1/8" |
| Driven: | 11.8" DIA. 14M-605-37 P/N: OE-46228-0B1 Bushing: E 2" |
| Belt: | 14M-3304-37 P/N: OE-46228-0C1 |

### LOW SPEED COUPLING: (BY *DUPPS)*

Type: Zurn Amerigear 209FA

### MOTOR: *(BY OTHERS)*

HP: 40HP
Voltage: 480VAC
Phase Input: 3Ø
RPM: 1750
Motor Frame: Foot Mount 324T
Service Factor: 1.15
Hertz: 60 Hz

* Ultra High Efficiency
* Mill and Chemical Duty 40ºC Ambient
* Class F Insulation
* Continuous Duty
* TEFC

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## VARIABLE FREQUENCY DRIVE INFORMATION

**VFD:** ***(BY OTHERS)***

HP: 40HP
Voltage: 480VAC In and Out
Phase Input: 3Ø
Frequency: 60 Hz
Constant torque: Capable of supplying 150% torque for one minute.
Enclosure: Suitable to environment.

- High performance w/4-20mA outputs proportional to speed and load.
- Operating Range: 15 to 75 Hz
- Output proportional to speed for remote indication at DCS.
- Output proportional to current for remote indication at DCS.

**IMPORTANT: "Client / engineer is responsible to provide controls which protect this machine from continuous overload conditions, i.e.: Do not operate continuously in excess of 80% motor load using motor specified above, nor in excess of 1,225,000 in-lb torque at screw shaft. Subsequent operation above overload limits void any mechanical warranties.**

ANDRITZ

**REFERENCE ONLY**



# TORQUE CALCULATION FOR 3600 SERIES SCREW PRESS

**Following calculation is an example only. Please check actual motor nameplate data, VFD specifications, sheave ratio and gear reducer ratio. With this data recalculation is required before programming the VFD control to a max. torque.**

**DRIVE SYSTEM: Example**

- **VFD** Constant torque up to 60Hz and constant horse power above 60Hz
- **MOTOR** 40Hp, 1775 rpm @ 60Hz
- **SHEAVE RATIO** 11.8 / 8.5
- **GEAR RATIO** 772 : 1

**Torque of Motor** = $\frac{(\text{Hp of motor}) \times 5250}{\text{rpm of motor}} = \frac{40 \times 5250}{1775} = 118.3 \text{ ft - lbf}$

**Torque of Drive System** = $(\text{Torque of motor}) \times (\text{Reduction of sheaves}) \times (\text{Reduction of reducer})$
= $(118.3 \text{ ft - lbf}) \times (11.8 / 8.5) \times 772$
= $126{,}784 \text{ ft - lbf}$

Drive system efficiency is not included in the calculation for simplicity and allows a small margin of increased safety.
Multiply by 12 from ft-lbf to inch-lbf conversion
**126,784 ft-lbf x 12 = 1,521,408 inch-lbf max. torque at the reducer output shaft.**

**The screw press is rated at a max. torque of 1,800,000 in-lbf.**
**The gear reducer has a rated output torque of 1,838,000 in-lbf. The FALK Co. recommends to limit the max. allowable torque to a 1.5 service factor of the rated torque, the value of 1,225,333 in-lbf output torque on a continuous basis.**

**Allowable motor load** = $\frac{1{,}225{,}333 \text{ in - lbf}}{1{,}521{,}408 \text{ in - lbf}} \times 100\%$ **= 80% of FLA (full load amps).**

**Since max. torque of the drive system is less than max. torque of the press, program the VFD to shutdown the screw press to protect from over-torque conditions in peak or momentary overload situations at 100% of FLA.**

**Now program a choke retracting point to 80% of FLA at a start-up. This set point may be readjusted depending on a type of material to be dewatered; however, a choke retracting set point must not exceed 80% of FLA nor continuous operation above 80% of FLA.**

# GARDEN STATE PAPER II
# 612-998

"FOR REFERENCE ONLY"

SCREW PRESS (SP) AND GRAVITY BELT THICKENER (GBT)
RECOMMENDED SEQUENCE OF OPERATION
AND CONTROL PHILOSOPHY
FOR CLIENT SUPPLIED ELECTRICAL CONTROLS

**IMPORTANT: "Client/Engineer is responsible to design and operate Andritz-Dupps equipment per the following guidelines. Subsequent lack of design features or operation contrary to these guidelines may void the mechanical and performance warrantees."**

## A. START-UP SEQUENCE

1. Make sure emergency stops and alarm conditions are clear.
2. Set the required screw press hopper level at the hopper level indicating controller.
3. Start the discharge conveyor. (If applicable)
4. Start the screw press drive.
5. Load Gravity Belt Thickener pneumatic belt tension and pneumatic belt tracking at Gravity Belt Thickener pneumatic panel.
6. Turn on Gravity Belt Thickener water solenoid for belt cleaning.
7. Start Gravity Belt Thickener drive.
8. Start the tank mixer
9. Start the polymer pump.
10. Start the sludge pump.

**NOTE**: In each case for a particular activity to take place, the previous activity must have occurred. (Polymer and sludge pumps cannot run without the Gravity Belt Thickener running)

11. Load screw press choke.

a. The following actions to control the process is recommended.

I. A set point is compared to the actual hopper level as sensed by the level transmitter and will adjust the sludge pump speed to maintain this level (PID control).

II. Polymer flow rate is varied based upon a programmed ratio with respect to sludge flow rate (PID ratio control).

III. A set point is compared to the actual screw press motor load. The screw press choke air pressure is varied to maintain a constant motor load centered around this set point (PID control).

## B. SHUTDOWN SEQUENCE

1. Stop sludge pump.
2. Stop polymer pump.
3. Stop the tank mixer.
4. Stop Gravity Belt Thickener. Note: Gravity Belt Thickener is to stop automatically after adjustable time (1-2 min.) has elapsed if sludge pump has been stopped to protect dry running of belt to minimize wear.
5. Stop Screw Press after 20-30 minutes of operation to allow it to empty. When Screw Press is stopped, release choke pressure, manually hose down cage areas.
6. Stop discharge conveyor. (If applicable)

## C. ALARMS AND AUTOMATIC SHUTDOWN

1. Screw Press Air Loss - Sensed by **Andritz** supplied pressure switch PS-4 (set at 35 PSI). Alarm only.
2. Screw Press High Load (set point 70% load) - This signal is supplied by customer. Alarm and back off Screw Press choke.
3. Screw Press Hi-Hi Load (set point 100% load) - This signal is supplied by customer. Alarm and shutdown Screw Press when it reaches hi-hi load. When Screw Press shuts down, it will in turn shutdown the Gravity Table, polymer and sludge pumps.
4. Hopper Level High - This signal is supplied by customer. Alarm and shutdown Gravity Table, Tank Mixer, polymer and sludge pumps. Screw Press continues to run.

5. Hopper Level Low - This signal is supplied by customer. Alarm only.

6. Gravity Table Water Pressure Low - This signal comes from customer supplied pressure switch (set at 60 PSI). If this water pressure goes below 60 PSI for more than one minute, control philosophy is to alarm and shutdown Gravity Table, polymer and sludge pumps.

7. Conveyor Fail (If applicable) - This signal is supplied by Customer. This contact to open in case of conveyor failure or if the conveyor is not running. Control philosophy is to alarm and shutdown Screw Press, which in turn will shutdown Gravity Table, polymer and sludge pumps upon receipt of above signal.

8. Screw Press Fail - This signal is supplied by Customer. This contact to close in case VFD Screw Press fails, Control philosophy is to shutdown polymer and sludge pumps and back-off Screw Press choke upon receipt of above signal. Gravity Table continues to run.

9. Gravity Table Air Loss- Senses by **Andritz** supplied pressure switches PS -1 & 2 (set at 35 PSI). Alarm and shutdown Gravity Table, which in turn will shutdown polymer and sludge pumps.

10. Gravity Table Belt Limit Over-Travel - Sensed by **Andritz** supplied limit switches LS-1 & -2. Alarm and shutdown Gravity Table, which in turn will shutdown polymer and sludge pumps.

11. Gravity Table Emergency Stops - **Andritz** supplied pull cord emergency stop switches will shutdown Gravity Table, which in turn will shutdown polymer and sludge pumps. Screw Press continues to run.

12. Sludge Feed System Fail - Signal supplied by customer. Alarm and shutdown polymer and sludge pumps. Gravity Belt Thickener and Screw Press continue to run.

13. Polymer System Fail - Signal supplied by customer. Alarm and shutdown polymer and sludge pumps. Gravity Belt Thickener and Screw Press continue to run.

## SPECIFICATION FOR SCREW PRESS AUTOMATIC CHOKE CONTROL

* Automatic choke control maintains a constant screw press load measured in percent motor load by adjusting air pressure on choke cylinders.

* Components and signals required:

* 4-20 mA DC signal from screw press variable frequency drive controller proportional to 0-100% motor load. VFD is supplied by customer.

* Load indicating controller (customer supplied PID loop @ DCS) accepts 4-20 mA DC input and provides 4-20 mA DC output to the I/P converter.

* Current to pneumatic converter (I/P converter) accepts 4-20 mA DC input and provides proportional 0-100 PSI output to the screw press choke pressure regulator. I/P converter is supplied by **Andritz**

* Pilot air operated regulator with 1:1 ratio supplied by **Andritz**

## D. OPERATION:

1. Operator sets the percent screw press motor load he wants to maintain at the PID loop controller. Load indicating controller receives input from drive controller and compares this signal to operator entered setpoint. Loop indicating controller sends 4-20 mA DC output accordingly to the I/P converter to maintain the % load setpoint.