# Pump Skid Fabrication for Magnetic Coupling

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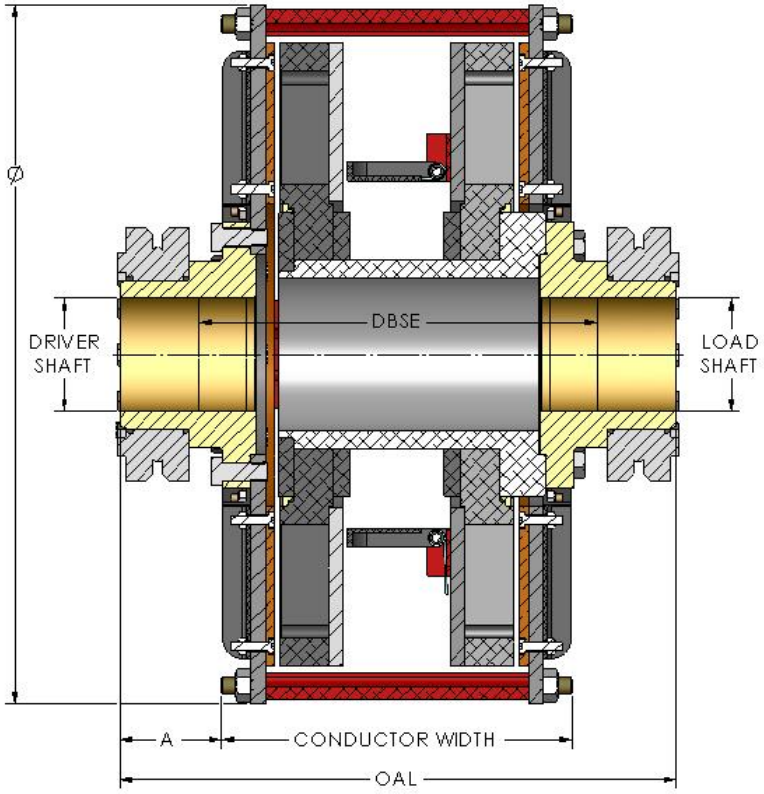
# Contents

- Magnetic Couplings – What They Are, How They Work, Where They're Used
- Fabrication and Manufacturing of Pump Skid Assembly
- Assembling the Unit
- Cautionary Information

# What is a Magnetic Coupling?

- Zero Contact Coupling Device
- Conductor and Magnet
- Conductor Attaches to Motor
- Magnets Attach to Pump or Pedestal Stand

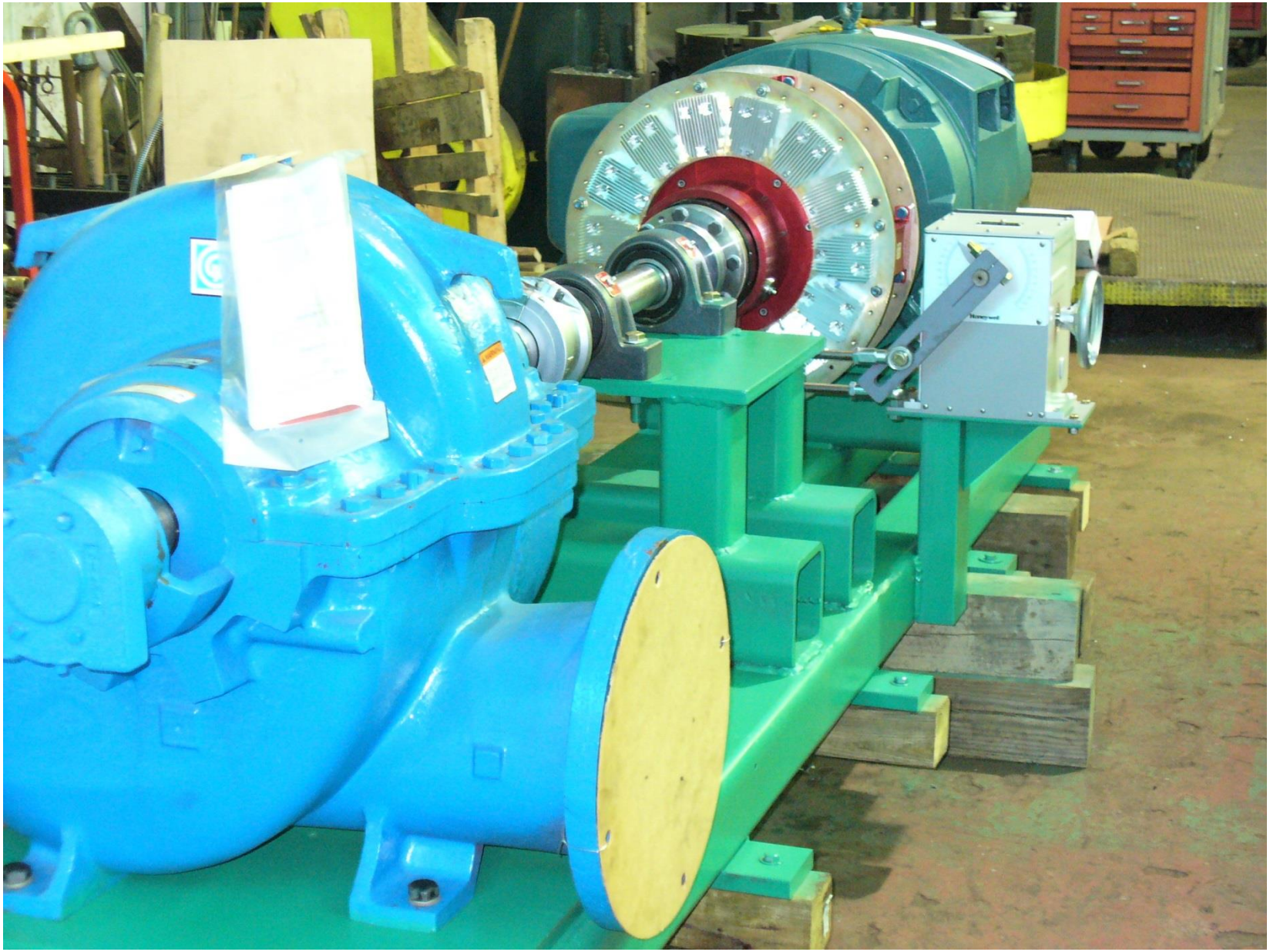


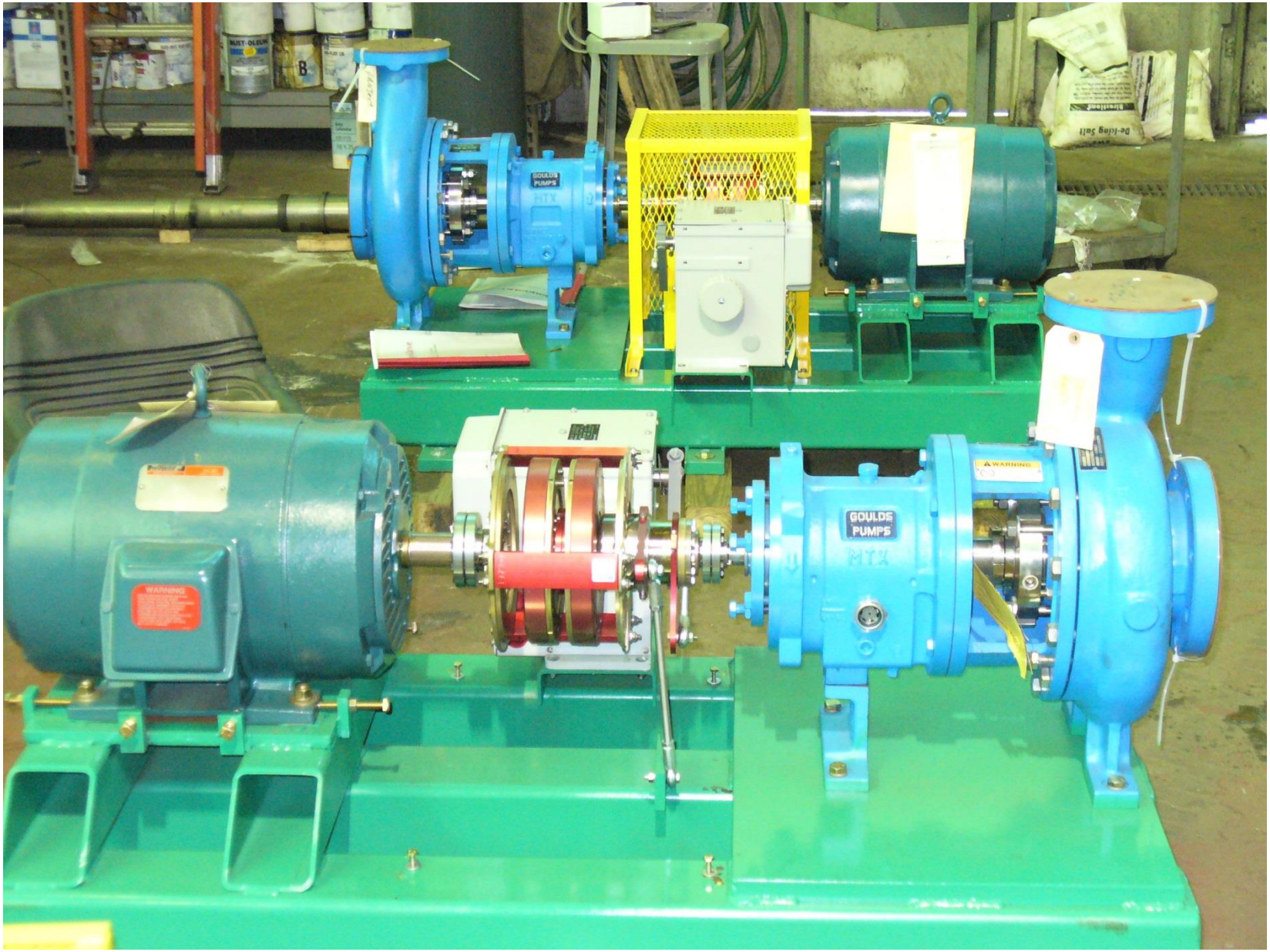
# How Does it Work

- The Motor Begins Rotating with No Load
- As the Motor Ramps Up to Full RPM, the Magnets On the Pump Begin to Rotate Using Magnetic and Centrifugal Forces
- The Motor Will Always Run at Full RPM, While the Pump Can Be Adjusted Using Actuation and Linkage Arms
- This Can Be Calibrated to Coincide With Flow Monitoring to Act as a Variable Drive

# Applicable Pump Types

- Centrifugal
- Split Case
- End Suction
- Vertical Turbine




GOULDS PUMPS
WARNING
GOULDS PUMPS
WARNING

# What Types of Magnetic Couplings are Available

# Vertical Coupling

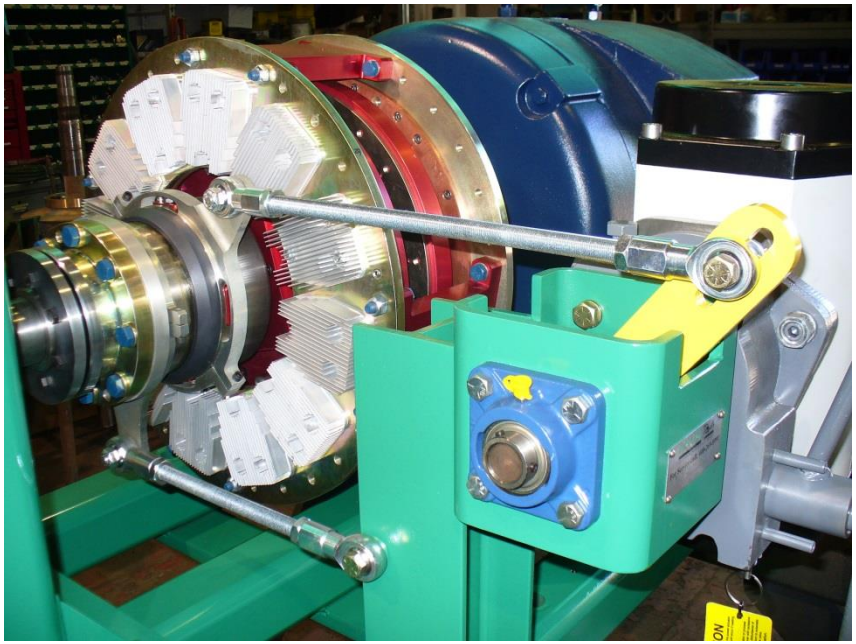

- Vertical ASD
- Adjustable Speed Drive
- Coupling Enclosed in Riser Housing
- 4-20mA Calibration

# Horizontal Fixed Gap

- Soft Start Reduces Start Up Amp Load on Motor
- No Speed Adjustment
- Motor Starts with Zero Load and Pump Begins Spinning After

# Horizontal ASD

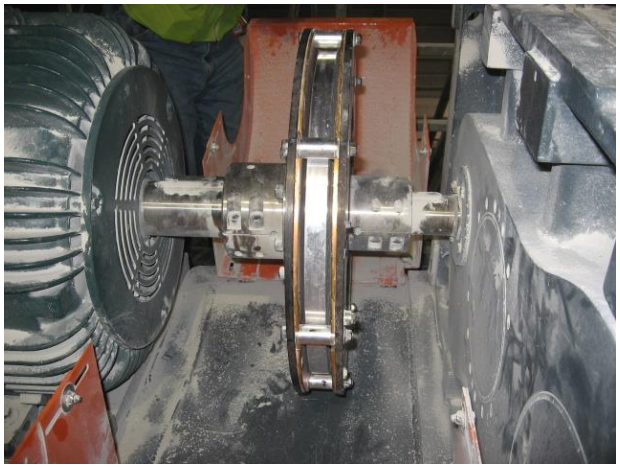
- Adjustable Speed Drive
- Actuator Drives Linkage Arms
- Increasing Gap – Reduces Speed
- Decreasing Gap – Increases Speed



# Applications

- Water
- Wastewater
- Power
- Coal
- Irrigation
- HVAC

# Gypsum Plant



# Wastewater Treatment Plant

# Fresh Water Plant

# Cooling Tower

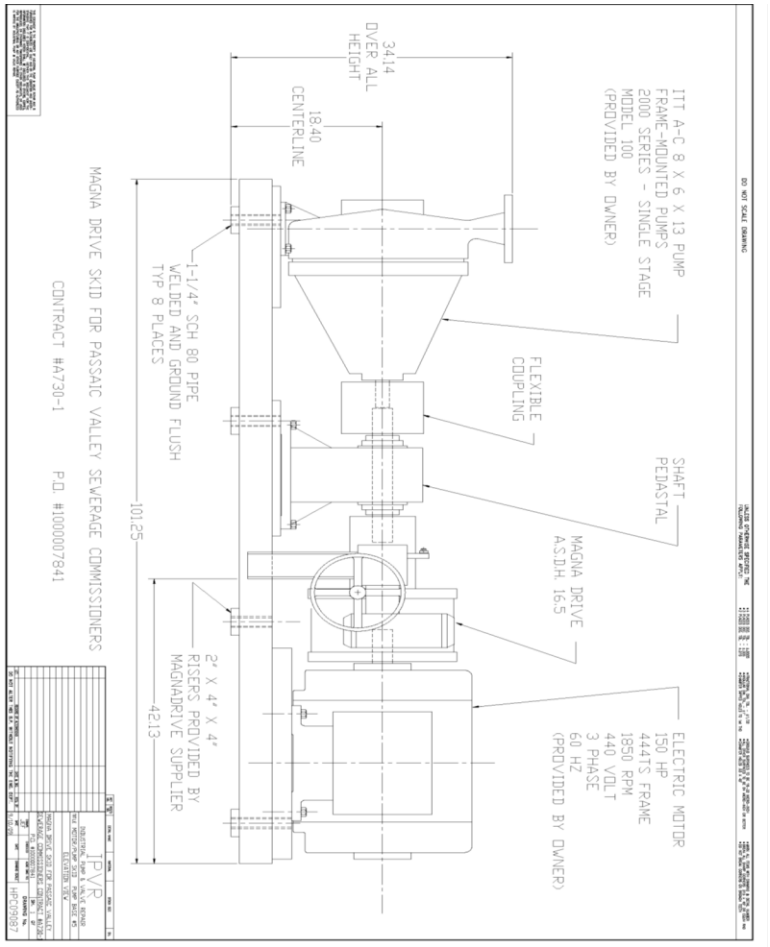
Any Questions??

# Magnetic Coupling Pump Skid

# Magna Drive Pump Skid Parts

- Welded Steel Base Structure
- Welded Steel Actuator Stand
- Welded Steel Bearing Pedestal
- Motor
- Magnetic Coupling
- Pump
- Coupling Guards

# Fabrication of Pump Skid




- AutoCAD Dimensional Design of Finished Product
- Center Line Height is of the Utmost Importance
- Drawings are Based on Customers Needs and Current Specifications
- Goal of Skid is to Provide To Provide Turn-Key Pump Solution

# Gather Parts & Materials

- Square Tube Steel
- Plate Steel
- Schedule 80 Pipe
- Angle Iron
- Expanded Metal
- I Beam
- Shaft Collar
- Flange-Mounted Steel Ball Bearing
- Square Head Jack Bolts
- Grid Style Coupling
- Pedestal Bearings
- Compression Fittings
- Copper Tubing

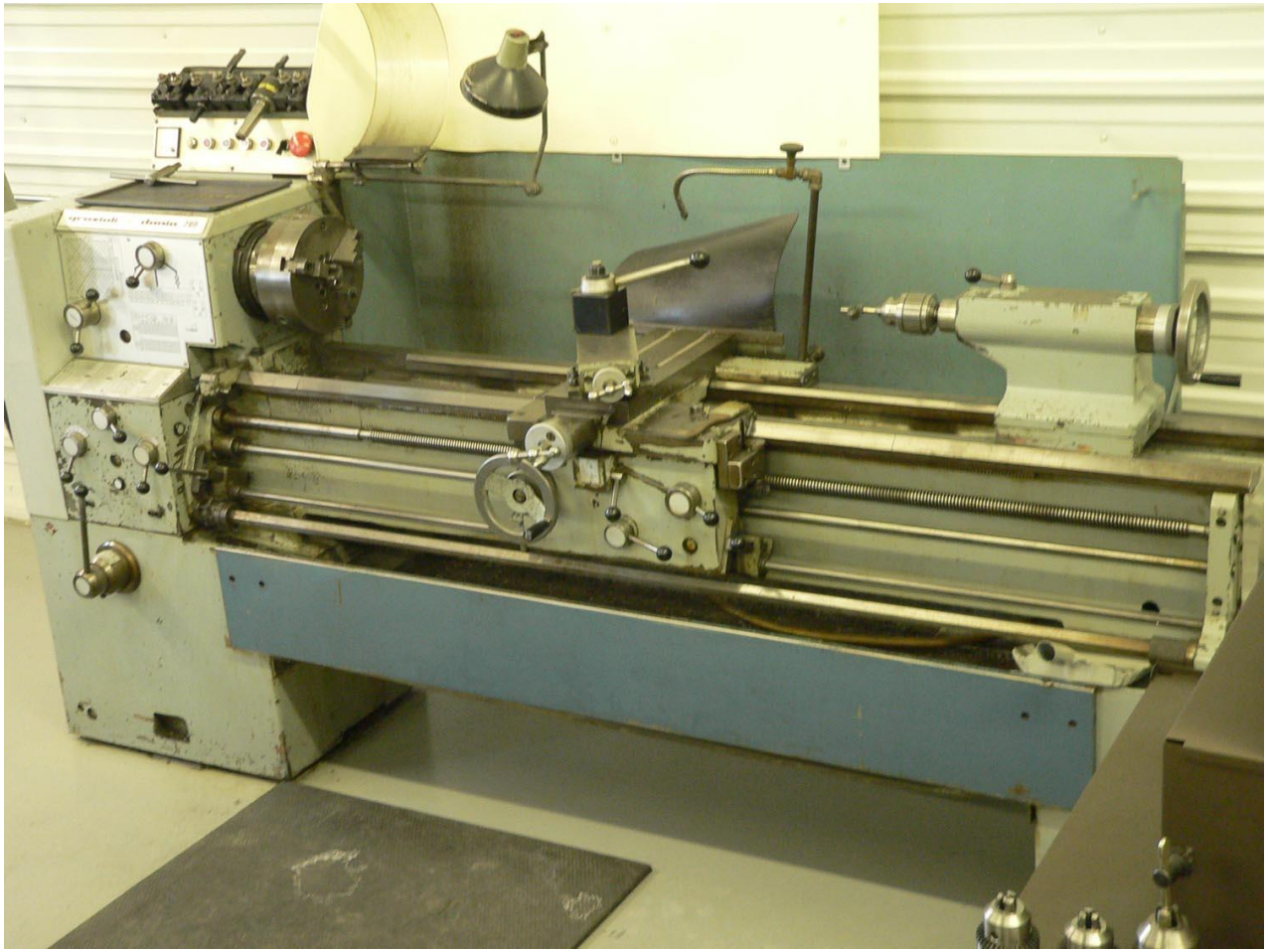
# What Types of Machinery is Used?

# Welder

# Jig Mill

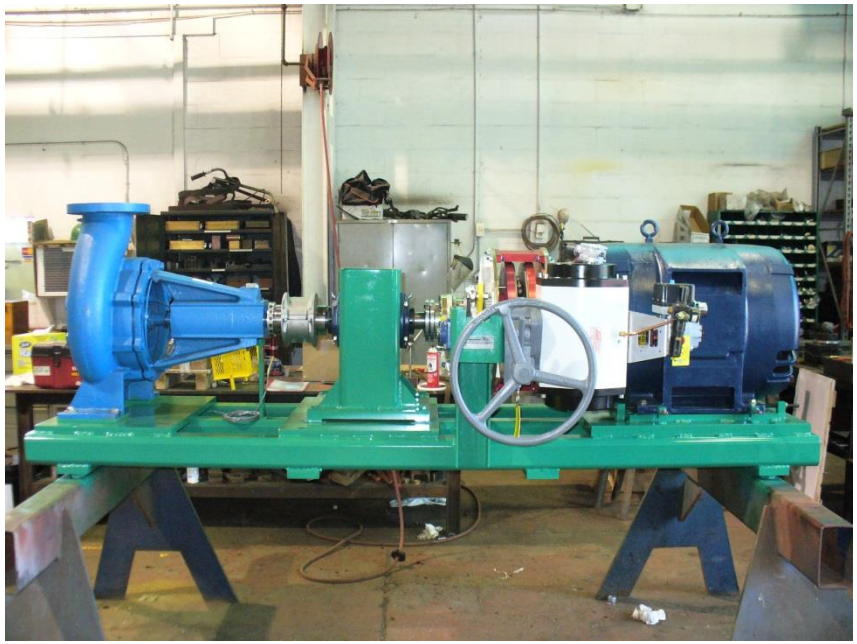
# Knee Mill

# Engine Lathe



# Prepare the Base Structure

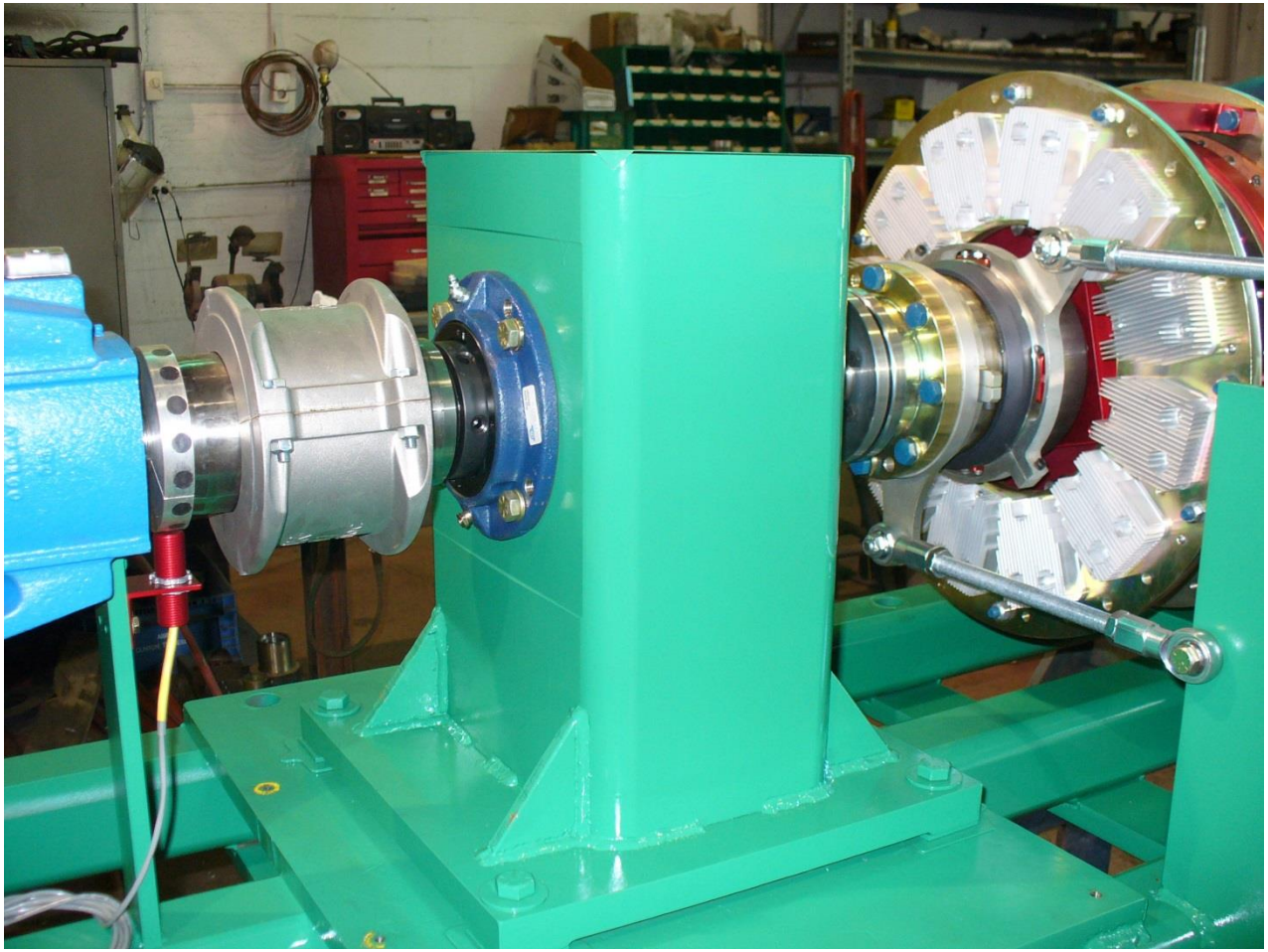
- Lay out Tube Steel to One End of Work Bench
- Weld Foot Plates Across Tube Steel
- Flip Structure
- Weld Motor, Pedestal and Pump Base Plates to Tube Steel



# Machine Base Structure

- Machine Motor Bolt Slots
- Drill and Tap Pedestal Bolt Holes
- Drill and Tap Pump Bolt Holes
- Drill Base Lag Bolt Holes
- Machine Motor, Pedestal and Pump Plate Flat
- Cut Schedule 80 Pipe and Weld into Base Lag Bolt Holes
- Clean Off All Grease and Oil, Cover Machined Surfaces and Paint

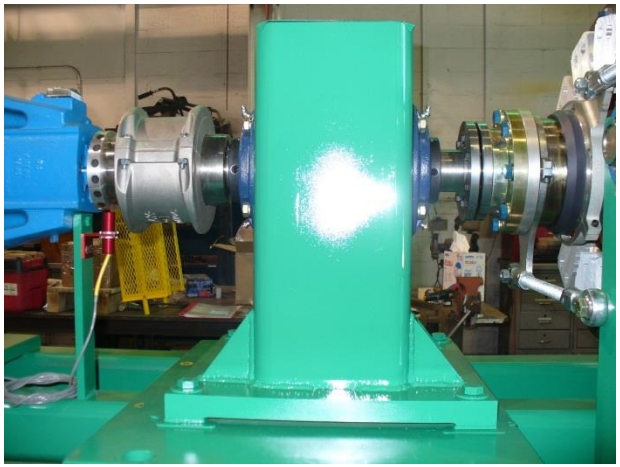
# Manufacturing Bearing Pedestal

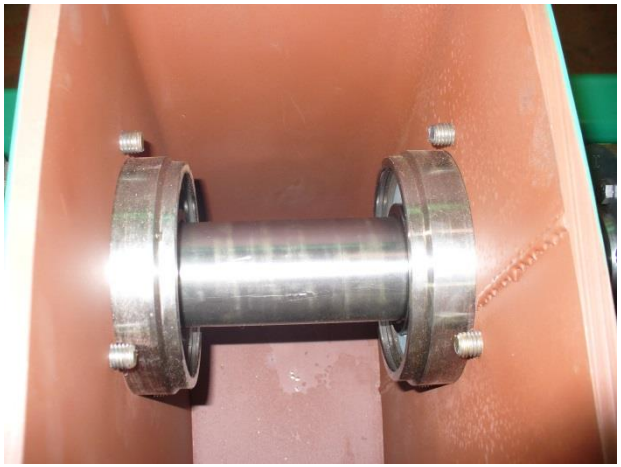


# Purpose of the Pedestal

- Pedestal Bearing Provides the Necessary Load Handling for the Magnetic Coupling
- The Bearing on the Pump is NOT Strong Enough to Handle the Weight of the Magnet
- Thus a More Robust Shaft and Bearing are Necessary

# Pedestal Needs to be Square



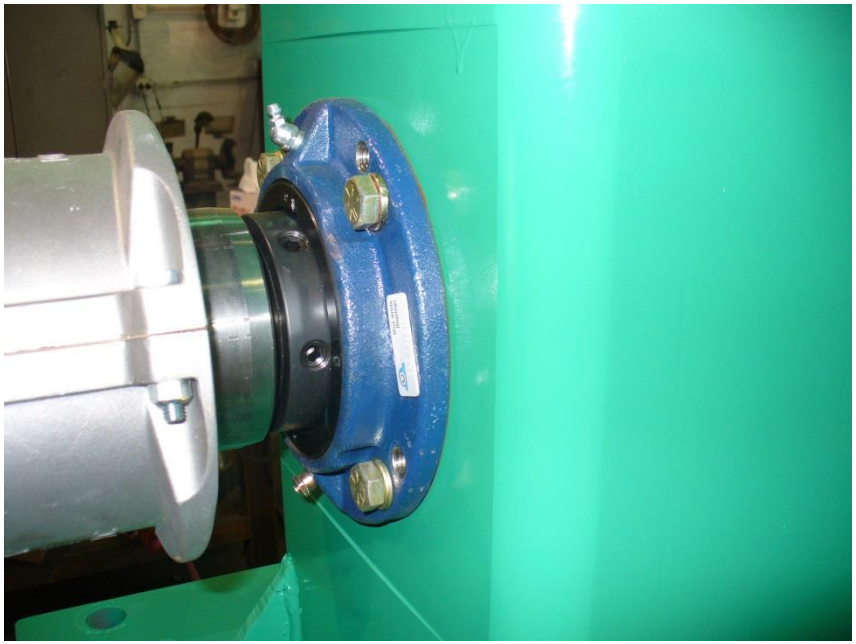


- The Bearing Faces on the Pedestal Must be Square to Prevent Side Loading and Ultimate Bearing Failure
- To Do This….

# Squaring Pedestal

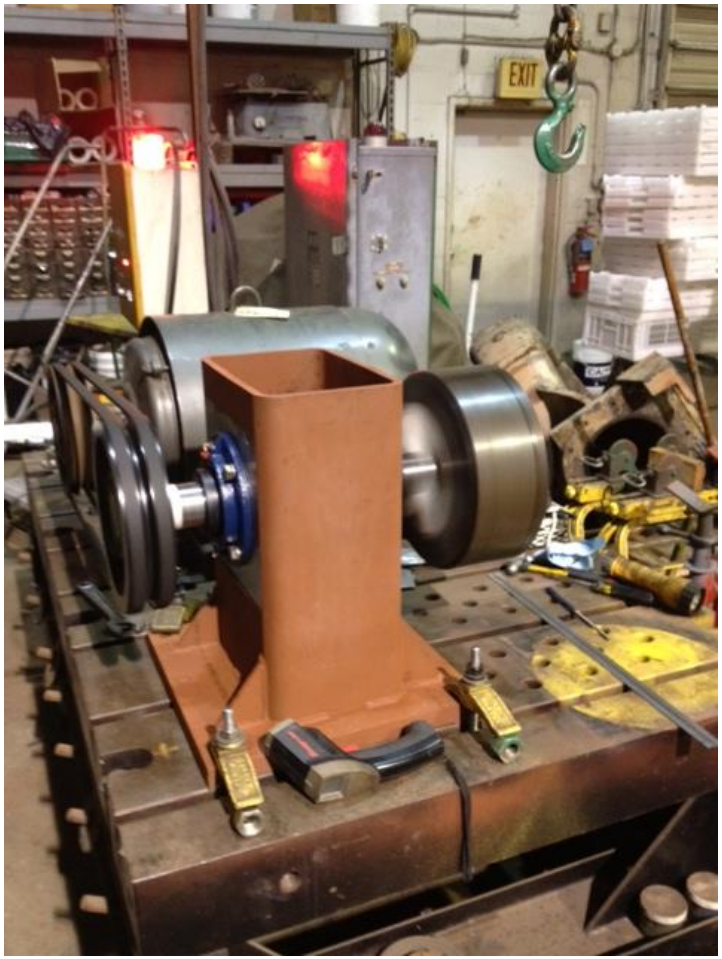
- Machine Both Ends or the Tube Steel and Weld to Pedestal Base Plate
- Mill Bottom of Base Plate Square to Machine Table
- Machine All Sides of the Plate to Obtain Proper Lengths
- Stand Pedestal Upright and Use 2 Planes to Square the Piece
- Mill Nearside of Pedestal Flat for 1 Bearing Face and Cut Bearing Bolt Holes
- Machine Bearing Hole in Center of Bearing Face Allowing only .002” Clearance
- Rotate Pedestal and Square to the Table (Again Using 2 Planes)
- Zero Piece to Table Using Bearing Hole Cut in Previous Step
- Drill and Tap Bearing Bolt Holes
- Mill Far Side Flat to Establish 2 Square Bearing Faces

# Building Pedestal Stand



- Attach Bearings to Stand and Bolt in Place
- Bearings Come With the Ability to Interchange Between Floating and Fixed
- Make the Motor Side the Floating Bearing
- Feed Shaft Through Bearings

# Testing Bearing Pedestal




- Testing the Bearing Pedestal is Important
- A Lathe Chuck is Used on the Load Side to Simulate the Weight of the Magnetic Coupling
- Motor is Run at Operating Speeds to Verify Proper Shaft Alignment

# Actuator Stand

- Holds the Actuator That Controls the Speed of the Unit
- Uses a Fixed Linkage Arm and an Adjustable Linkage Arm to Move Magnet In and Out
- Motor Stays Same Speed, Pump Rotates Slower Based on Gap Between Magnets and Conductors

# Again – Must Be Square

- Machine Top End of Bracket for Reference Point
- Establish Zero
- Machine Near Side Shaft Hole and Drill Nearside Bolt Hole Pattern
- Flip Bracket, Zero Using Reference From Above
- Machine Far Side Shaft Hole and Drill Bolt Hole Pattern
- Weld to I Beam, Noting Position of ½" Hole Location
- Take Shaft Material and Mill 4 Sides To Create Square Ended Shaft to Fit Into Actuator
- Machine to Length and Machine Bearing Fit Into Shaft
- Machine Slot in Drive Arm per Drawing
- Hand Grind Outside End
- Hand Grind Clamp Coupling End to Fit
- Square, Align and Butt Together Clamp Couplings
- Center Drive Arm to Clamp Couplings and Weld Into Place

# Finished Actuator Stand

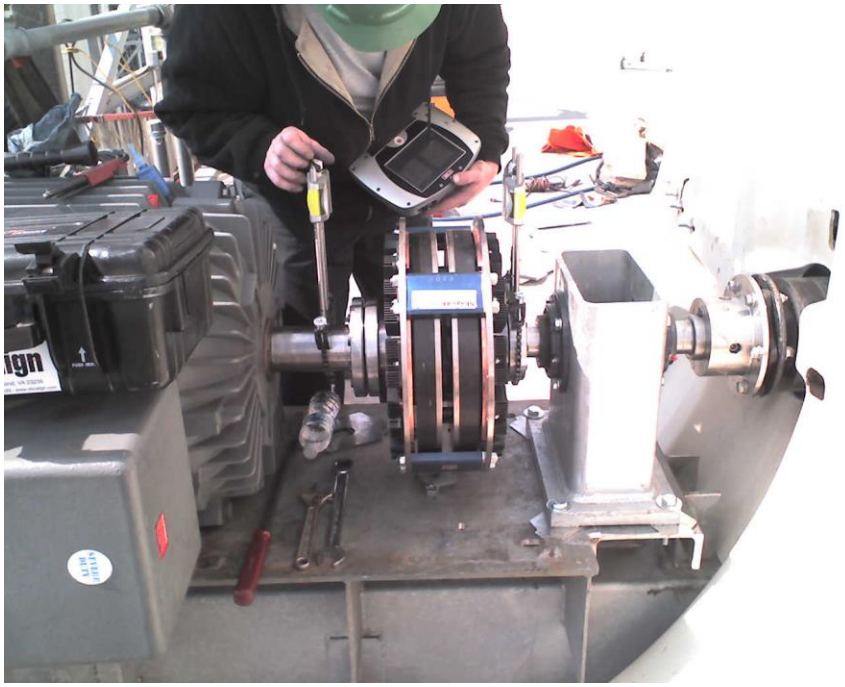
Any Questions??

# Assembling the Pump Skid

# If Everything Is Done Right….

- The Key to Assembling the Pump Skid is Shaft Alignment
- The Pump Needs to be Lower than the Bearing Pedestal and the Bearing Pedestal Needs to be Lower than the Motor
- The Object is to Bolt the Pump Directly to the Skid and Shim the Pedestal to Align the Shafts
- At This Point the Pedestal is Bolted Tight and the Motor is Shimmed and Aligned to the Now Immovable Pedestal

# Importance of Shaft Alignment



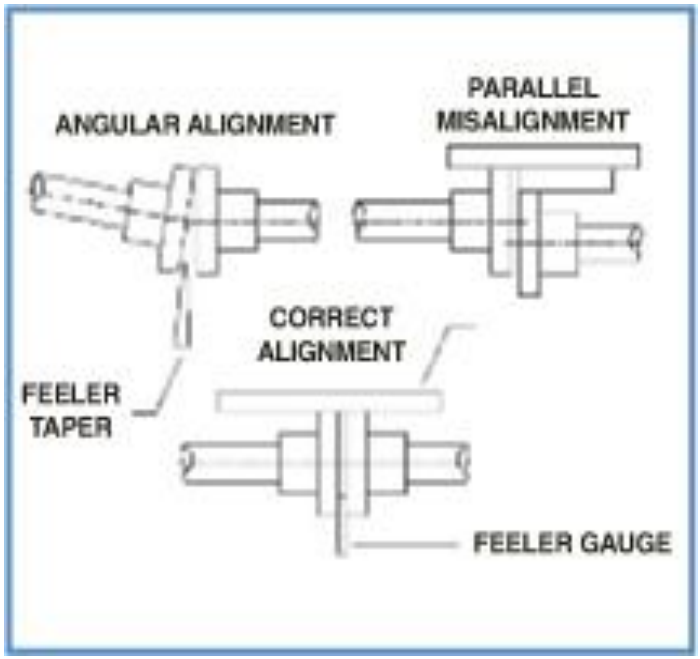
- Over 90% of All Bearing Failure is Due to Shaft Misalignment
- Use Proper Equipment (Laser, Dial Indicators or Feeler Gauges) for Aligning Motors to Equipment
- Using a PEN is NOT Considered an Acceptable Method

# Procedure for Assembling Skid

- Set Pump Onto Pump Base Plate and Start Bolts Into Bolt Holes
- Set Bearing Pedestal Onto Bearing Pedestal Base Plate and Start Bolts Into Bolt Holes
- Set Motor Onto Motor Base Plate and Start Bolts Into Bolt Holes
- Magnetic Couplings Need a Certain Distance Between Shaft Ends to Operate Effectively
- At this Time; Set the Bearing Pedestal Shaft To Allow for an Acceptable Distance

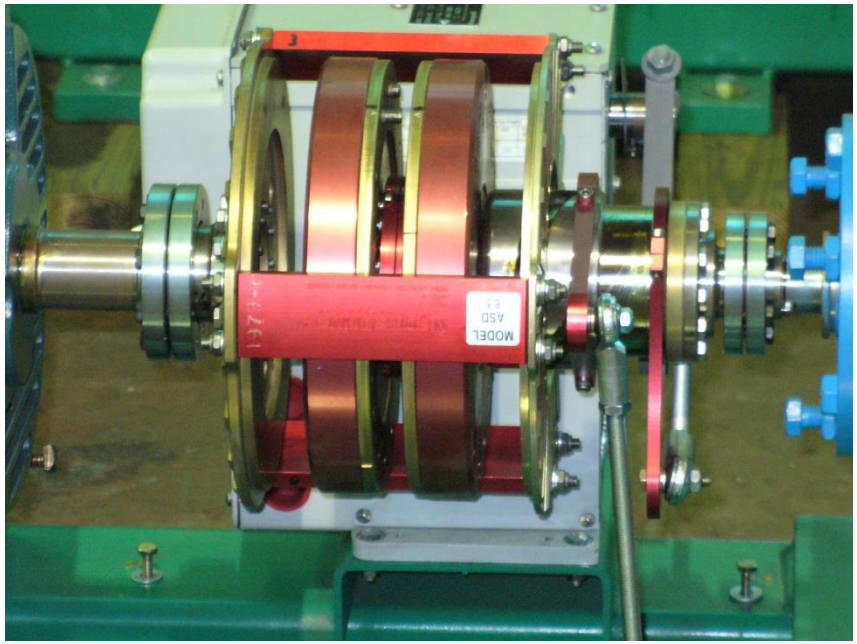
# Procedure for Assembling Skid

- Install the Flexible Coupling to the Pump Shaft and Bearing Pedestal Shaft
- Align Shafts to Within .005” on the Horizontal Axis and the Angular Offset
- Tighten Down Pump and Bearing Pedestal
- Re-Check Alignment

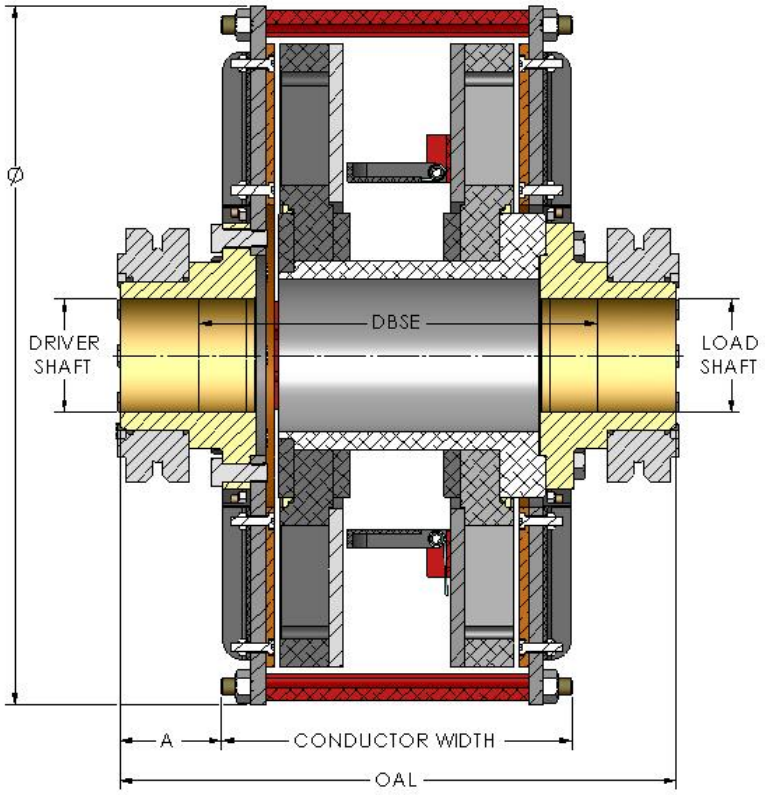


# Installing Magnetic Coupling

- Torque Compression Couplings on Both Pedestal and Motor Shafts
- Take TIR Reading to Verify Run-Out is Within Tolerance
- Install Magnetic Coupling Assembly to Pedestal and Torque Hub Bolts
- Using Motor Jacking Bolts, Bring Motor into Magnetic Coupling Assembly and Torque Hub Bolts



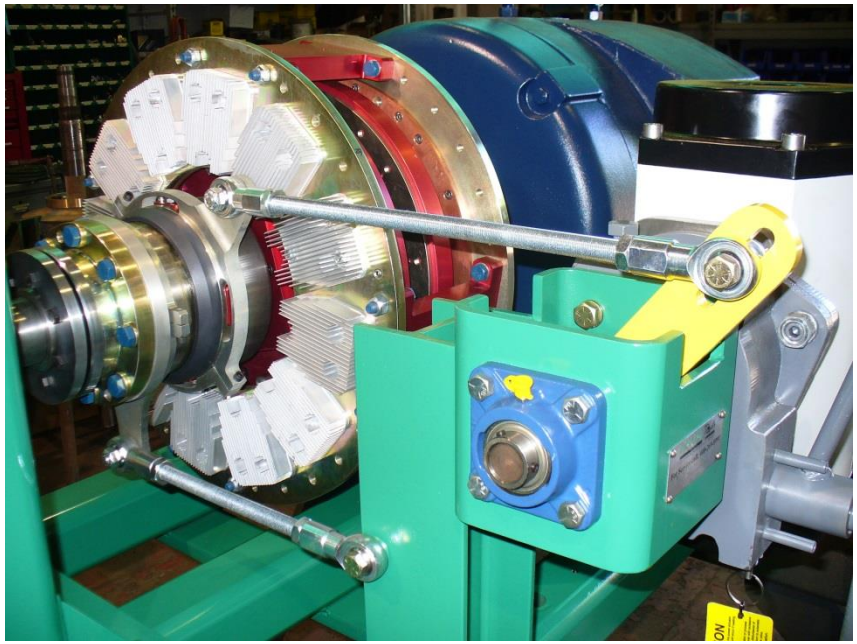
# Aligning Magnetic Coupling




- Shaft Alignment with Magnetic Couplings is Different from Rigid Couplings
- There is Greater Tolerance Due to the Distance Between the Conductor Plates and the Magnets
- Tolerance are .030” Versus .003” With a Rigid Coupling
- In This Instance, Feeler Gauges are Used to Determine the Gap Between The Conductors and the Magnets
- Shim the Motor to the Appropriate Height and Align the Gaps at 90 Degree Intervals

# Actuating The Unit

- Align Actuator Stand with Magnetic Coupling Linkage Arm and Weld Onto Base
- Install Actuator Shaft, Actuator Drive Arm, Actuator Bearing and Gear Operator Onto Actuator Stand
- Install Actuator to Gear Operator
- Install Linkage Arms and Adjust Actuator to Meet Operating Requirements
- Install Copper Tubing Air Lines and Compression Fittings to Actuator
- Calibrate Actuator Using Computer Calibration



# Install Coupling Guards

- Coupling Guards are Needed to Protect Operator from Injury

# Install Pump Skid at Plant

- Pump Skid is to be Lined Up to Piping System and Bolted Into Place
- Lag the Skid Into the Floor Using Lag Bolt Holes in Skid
- Grout Skid Into Place

# Cautionary Tales

# Noise Problems

- Because of the Magnetic Properties of the Coupling, Heat is Produced During Operation
- To Combat This, Cooling Fins are Located on the Exterior of the Conductor Plates
- Magnetic Couplings Therefore are Inherently Loud
- Covering the Couplings with Blankets to Reduce the Noise is a Bad Idea
- Too Much Heat Cracks and Destroys the Conductor Plates

# Bolt Torque

- Bolts are Given Torque Values for a Reason.  Be Sure to Torque All Bolts to the Recommended Specifications
- Compression Couplings Will Slip
- Hub Bolts and Base Bolts Will Vibrate Out
- Both Instances Causes Misalignment and Ultimately; Failure

# Compression Coupling Shaft Clearance

- Coupling Hubs are Sent from the Factory Undersized
- Machining is Needed to Size Hub to Shaft Size
- No More than .002” is Acceptable or Compression Coupling Will Not Compress Hub to Shaft

# Machining Problems

- If During the Machining Process Piece May Move, Causing Loss of Centerline
- Bearing Failure Due to Heat Build Up
- Inability to Align Equipment Due to Lack of Centerline Adjustment
- Bolt Hole Pattern Cut Improperly

# Conclusion

- Magnetic Couplings are Viable Alternatives to VFD Motors
- They Do Not Require as Many Controls and Come Custom Made and Ready to Install
- Also, They Are Less Costly to Repair and Can Tolerate Harsher Conditions

# Conclusion

- Manufacturing a Pump Skid Takes Precision Engineering and Operator Execution
- Whatever You Are Producing, Remember the 3 Biggest Rules
- 1 – Am I Square?
- 2 – Am I Aligned Horizontally and Vertically
- 3 – Measure Twice, and Cut Once!!!

Any Questions??

THANK YOU!!!!