Considerations regarding………

Foundations & Grouting of Reciprocating & Rotating Equipment
Diversity of Grouting Applications
Diversity of Grouting Applications
The Equipment “System”
Components of an Equipment “System”

- Equipment
- Mounting System (Optional)
- Grouting System
- Anchoring System
- Foundation System
- Sub-surface condition

“Consider the whole of the components as a monolithic unit when designing for optimum equipment performance”
Goals when designing an Efficient Equipment “System”

• **Proper selection of components** - To meet the client’s requirements

• **Optimum Equipment Performance** - Based on system components selected, designed & their installation

• **Costs** - Initial installation; long-term operating costs
Advantages of Epoxy Grout

What Part Does Epoxy Grout Play in the Equipment “System”? 

- Maintains Precise Equipment Alignment
  - Positioning critical to efficient performance
  - Resistance to downward and some lateral acting loads on the foundation
Advantages of Epoxy Grout

What Part Does Epoxy Grout Play in the Equipment “System”? 

• Provides a superior interface to the foundation
  – Proper damping of equipment vibration
    • 10 times greater than cement grout
    • 30 times greater than steel
  – Other dynamic load transference to the foundation for proper absorption & dissipation
Advantages of Epoxy Grout

What Part Does Epoxy Grout Play in the Equipment “System”? 

- **Chemical Resistance**
  - Service longevity of the grout & foundations
    - Life of the Equipment?
  - Protects porous concrete to maintain integrity of the foundation mass
Advantages of Epoxy Grout

What Part Does Epoxy Grout Play in the Equipment “System”? 

• Cost!………More economical than cement grout
  – Material Cost vs. Cost Efficiency………Which is most important to the client?
    • Material Cost - One time cost
    Or……
    • Cost Efficiency – Continual enhanced equipment performance due to use of epoxy grout over cement grout.

“Enhanced performance creates decreased maintenance costs which provides ongoing $ savings for the client”
Characteristics of Epoxy Grouts

What is an Epoxy Grout?

- Thermosetting Epoxy Resin System
- Amide Resin
- Catalyst
- Blended Aggregate of Silica or Quartz
Characteristics of Epoxy Grouts

- High Physical Strengths
- Faster Curing & Higher Strength Gain than Cement Grout
- Shrinkage Nil (< than cement grout)
- Pre – Measured Packaging ( No Water! )
- Approximately 2 to 3 times stronger than Concrete
- Resistance to Chemical Attack
- High Vibration Damping Efficiency
Exothermic Cure

“Cross Linking”

Before

After
Timeline of the Initial Cure
Coefficient of Thermal Expansion

“Rate of expansion or contraction a material is subject to, according to temperature”

Values

<table>
<thead>
<tr>
<th>Material</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
<td>$6.1 \times 10^{-6}$ in/in/°F</td>
</tr>
<tr>
<td>Concrete</td>
<td>$5.9 \times 10^{-6}$ in/in/°F</td>
</tr>
<tr>
<td>Epoxy Grout</td>
<td>$11.2 \times 10^{-6}$ to $27.0 \times 10^{-6}$ in/in/°F</td>
</tr>
</tbody>
</table>
Epoxy in Tension

Concrete in Compression

Epoxy Grout Contracts Faster than Concrete

Concrete Restricts Epoxy Contraction

Foundation Temp. Below Peak Exotherm Temp.
Preparation & Installation Considerations

(From the Engineer’s Point of View)

Pre-Planning

• Project Requirements
  • Drawings & Specifications including:
    • Equipment Selection / Foundation Design
    • Grout Selection
    • Project Timing
• Budget Estimates
Pre-Planning (cont.)

• Contract Bids & Project Awards
  • Construction Schedule

• Pre-Construction Meeting
  • Contractor, Engineer, Manufacturer’s Representative, Client’s Representative
  • Contactor’s Preparation and Installation Plan

• Engineering Supervision of the Installation
Site Preparation

Initial job staging by the contractor allows for all tools, equipment, materials and manpower to be set up for the equipment installation and grouting. The work area is isolated to protect surrounding areas and observe safety regulations. When these tasks are complete, advanced preparations will begin at the surface of new concrete foundation.
Installation of the Equipment

Ensure Proper Guidelines are Followed pertaining to:

• Foundation Preparation
• Setting & Alignment Equipment or Base plate
• Forming Preparation
  – Expansion Joints (if necessary)
• Grout Mixing & Installation
• Grout Curing
• Anchoring System
  – Installation & Tensioning
Anchor Bolts
Their Effect on Proper Equipment Performance

Definition

While Epoxy Grout resists downward forces produced by equipment deadweight and anchor bolt tension and provides dynamic load transference to the foundation for proper absorption & dissipation, the anchor bolts serve to resist the upward and lateral forces imposed by the dynamics of the equipment.
• Improper Design & Installation

• Free Stretch

• Anchor Bolt Maintenance

Anchor Bolt Factors Affecting Equipment Performance
Goals Associated with Proper Epoxy Grouting:

“Create an analogous operating system from multiple components (Equipment/Support System/Anchor Bolts/Grout Cap/Foundation) capable of performing its function with the greatest cost efficiency and longevity. Each project situation differs, but the goals remain relatively constant.

While the information on the subject of grouting and related subjects can become involved, the basic criteria and considerations presented here provide the basis for successful grouting operations and proper performance of equipment”
Grouting Guidelines & Techniques:

Pumps
The Two Most Common Causes of Pump Failures in the Petrochemical Industry:

Mechanical Seals
34.5%

Bearing Distress
20.2%
SINGLE POUR GROUT FORM
FOR PUMP BASEPLATE
Head Box Details

Chute To Handle Concrete
# Vibration Levels Before and After Proper Epoxy Grouting

<table>
<thead>
<tr>
<th></th>
<th>Vertical Plane</th>
<th></th>
<th>Horizontal Plane</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before</td>
<td>After</td>
<td>(Red.)</td>
<td>Before</td>
</tr>
<tr>
<td>Pump #1</td>
<td>1.40</td>
<td>0.07</td>
<td>(20 x)</td>
<td>0.21</td>
</tr>
<tr>
<td>Pump #2</td>
<td>0.19</td>
<td>0.01</td>
<td>(19 x)</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Vibration Readings are in IN. / SEC.

(1 inch = 25.4 mm)

By using Epoxy Grout, expect a reduction in pump vibration of about ten (10) times that experienced using Cementitious grouts.
HS Modular Compressor Package
For additional information on this and other concepts pertaining to foundations and equipment grouting, contact us at:

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For local assistance and material requirements, contact your nearest ITW Philadelphia Resins Chockfast® Product Distributor: