

EFRC Training Workshop

Foundation design for reciprocating compressors

Grouting & Chocking

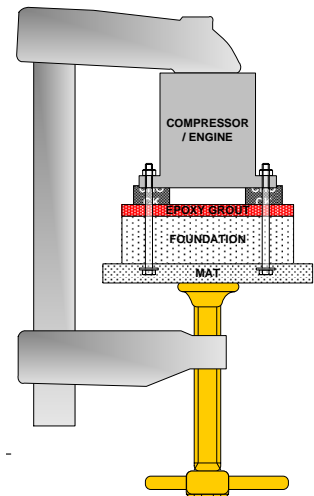
Mr. Theo de Kok – EMHA BV



Grouting and Chocking

Goals

- **Accurately support** compressor for its life;
- **Firmly secure** the compressor to the foundation so that all vibration created in the compressor travel downward into the soil;
- **Protect** the foundation against intrusion of water, oil and chemicals



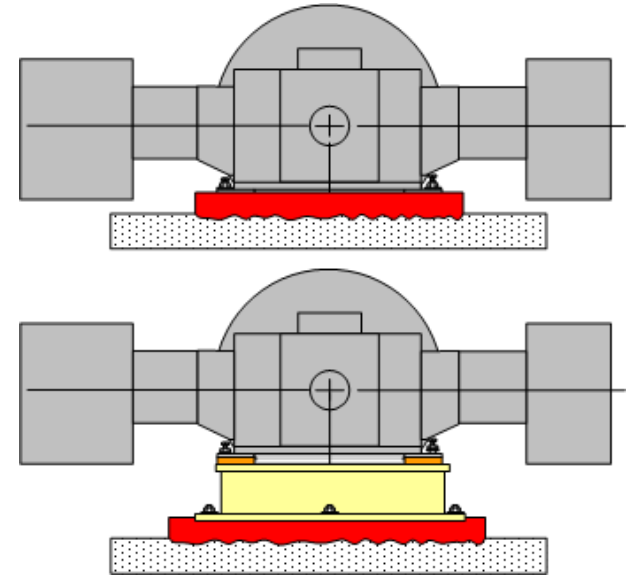
Epoxy versus Cement

- Fast curing (start the machine after 48 hours);
- No intrusion of water, oil or other fluids;
- Imperative for weather conditions;
- Resistant to almost all chemicals;
- Superior compressive and tensile strength;
- No shrinkage;

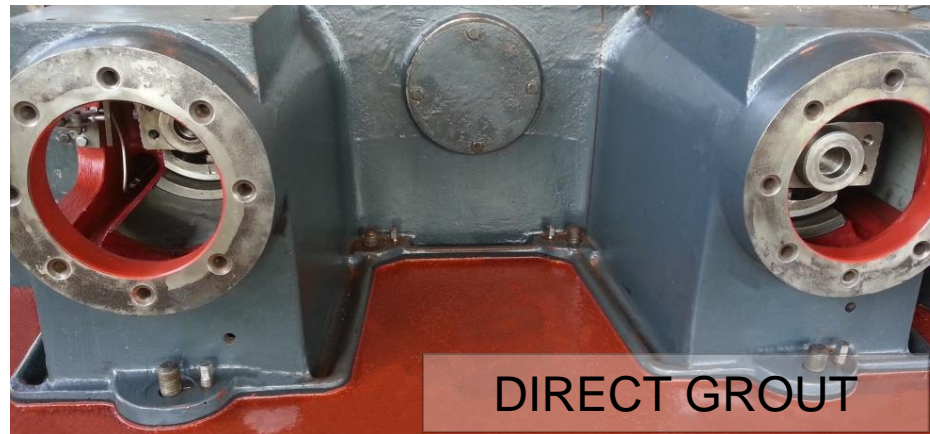
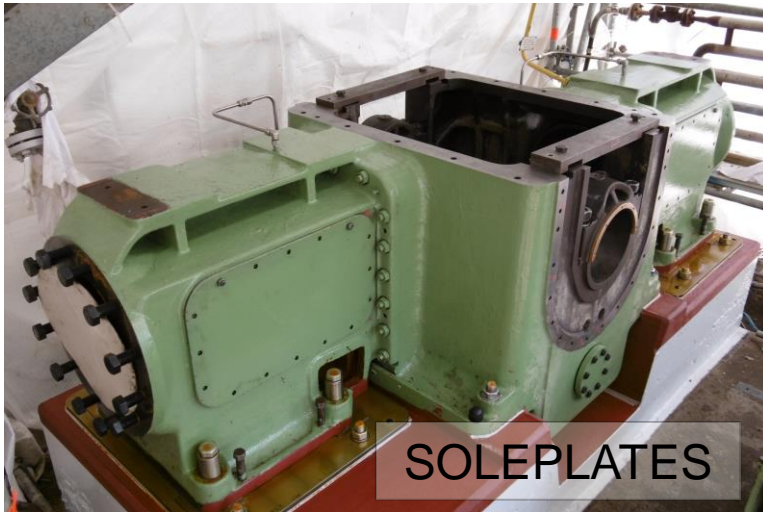


Types of Compressor Installs

- Skid
 - Full Bed Grout
 - Grout the Beam / Rail Only
- Sole Plates
 - Sole Plates & Skids
 - Sole Plates & Compressors
- Direct Mount
 - Engine / Compressor direct into the grout

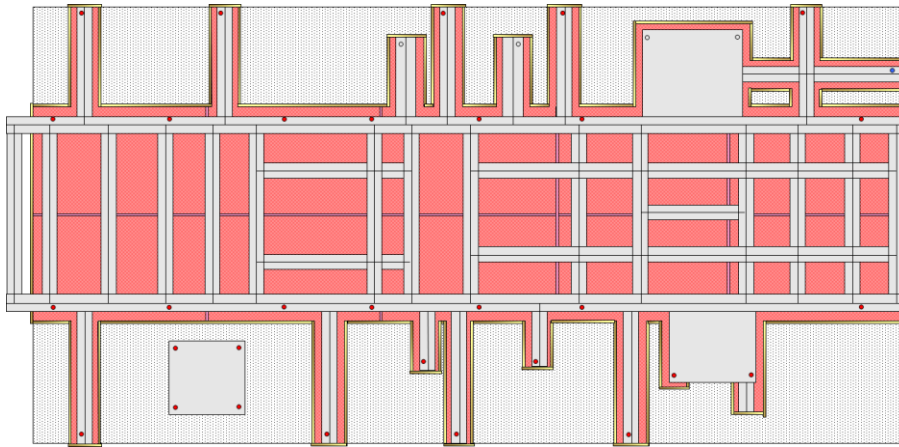


Examples of Compressor Installs

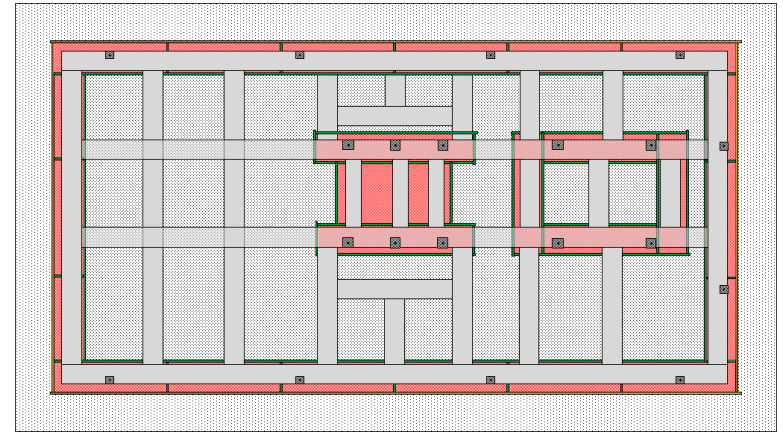


Examples of skid grouting methods

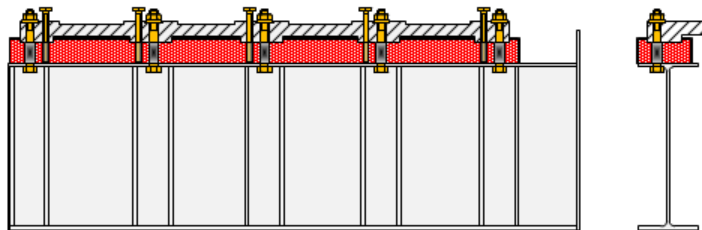
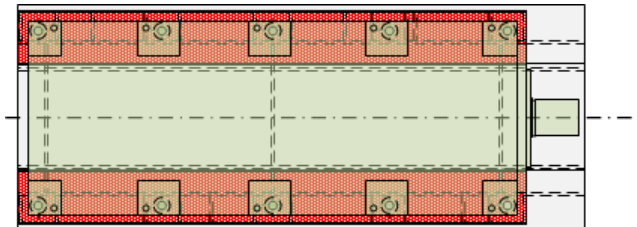
FULL BED GROUT



BEAM GROUTING

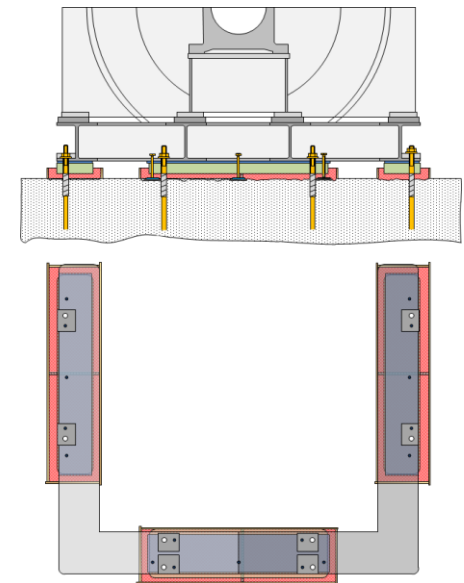


RAIL GROUT



Expert session foundation design

SOLE PLATE GROUT



September 13/14 2017

Chocking

Epoxy Grout vs Chocks

Material Characteristics

CHARACTERISTICS	EPOXY GROUT	EPOXY CHOCKS
Material Consists of...	Resin, hardener and 4 to 5 large bags of aggregate	Resin and hardener
Pour Restrictions	Up to 2 M x 2 M x 45 cm	Up to 75 cm x 45 cm x 7 cm
Exothermic Temp.	50°C	90°C
Consistency	Lumpy Oatmeal	Thick, heavy oil
Flowability	Fair to Poor	Fair to Good
Working Time	1 to 4 hours	15 to 40 minutes
Cure	Cool and slow – 24 to 48 hours	Hot and fast – 24 hours
Damming Material	Wood with 100 to 150 mm overpours on all 4 sides	Metal with 18 mm wide overpours on 2 sides only



Chocking

Epoxy Grout vs Chocks

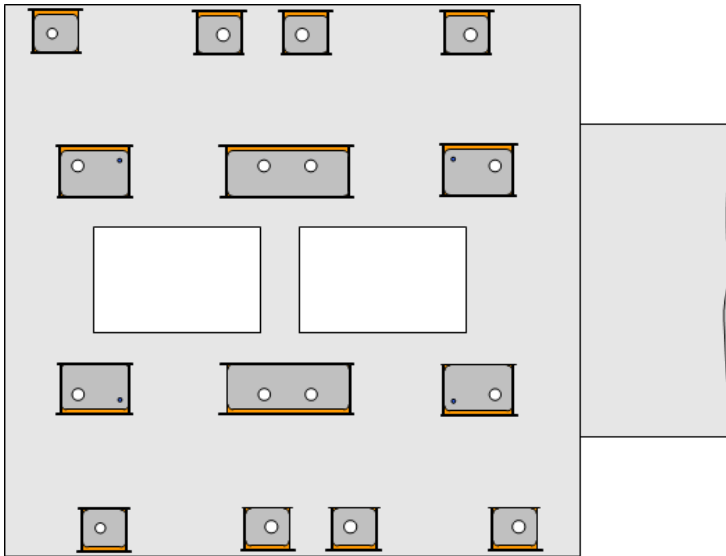
Physical Properties

CHARACTERISTICS	EPOXY GROUT	EPOXY CHOCKS
Compressive Strength	79 to 125 MPa	130 to 170 MPa
Modulus of Elasticity	12 to 20 GPa	2.5 to 6 GPa
Tensile Strength	11 to 20 MPa	34 to 46 MPa
Creep	0.004%	0.02%
Coefficient of Thermal Expansion	$19.34 \times 10^{-6} \text{ cm/cm/}^{\circ}\text{C}$	$30 \text{ to } 48 \times 10^{-6} \text{ cm/cm/}^{\circ}\text{C}$
Shrinkage	0.0005%	0.0002%
Coefficient of Friction	0.125 to 0.5	0.5 to 0.7
Adhesion to Substrate Desirable	Yes to concrete & steel	No to steel, Yes to concrete & grout

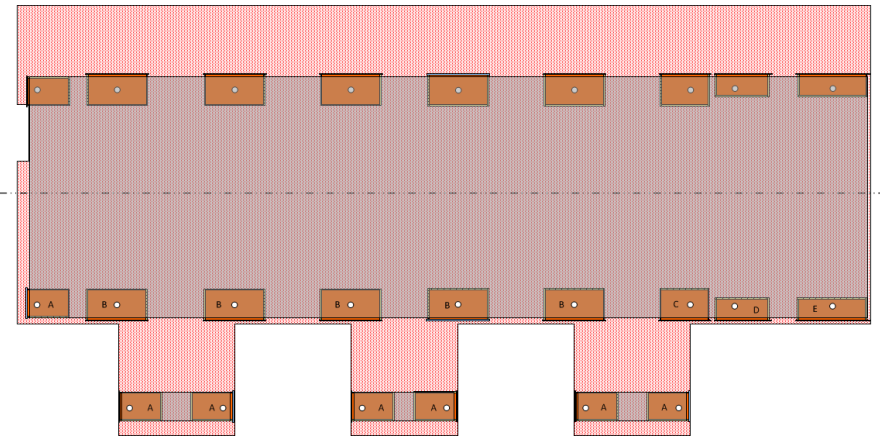


Examples of Chocking methods

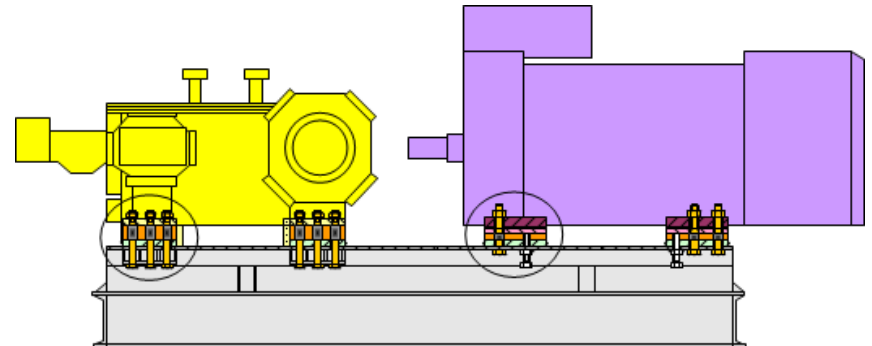
SOLE PLATES - CHOCKS



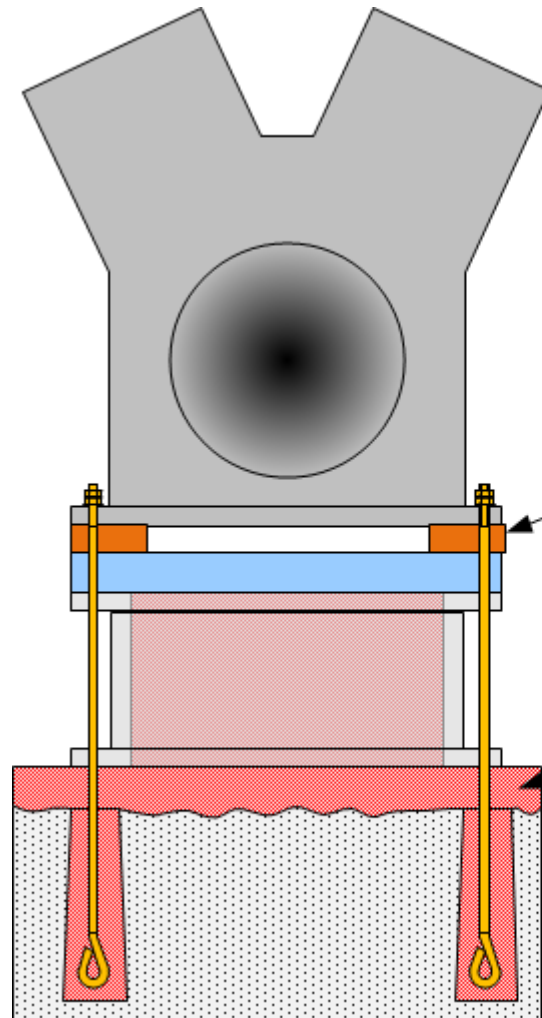
COMPRESSOR ENGINE - CHOCKS



DIRECT MOUNT - CHOCKS



Different Materials & Installation



Two Different
Materials Used And
Installed In Two
Completely
Different Ways

EPOXY CHOCKS

- Small, thin pour
- Around anchor bolt
- Metal dam

EPOXY GROUT

- Large, thick pour
- Over entire foundation
- Fill anchor bolt pockets
- Fill skid
- Wood dams



Prior to Installation

- Fully Cured Concrete – shrunk, strong & dry
- Foundation Preparation
 - Chip laitance & expose broken aggregate
 - Round edges of the foundation
 - Clean off all dust and loose stone
 - Must be oil & water free
 - Heat / Cool as required – 20 to 25°C is Best
 - Bolt pockets rough & dry



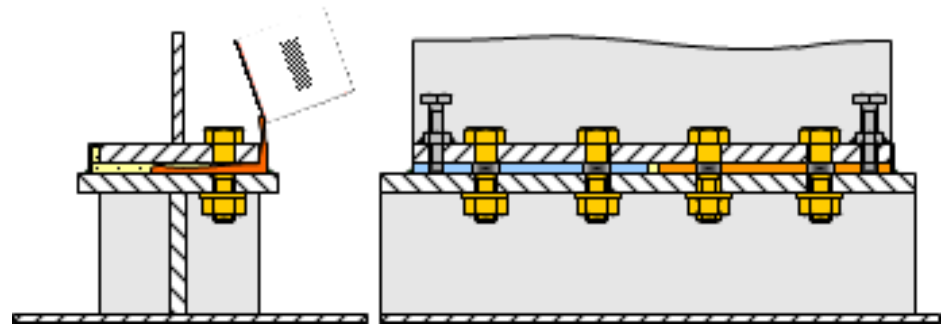
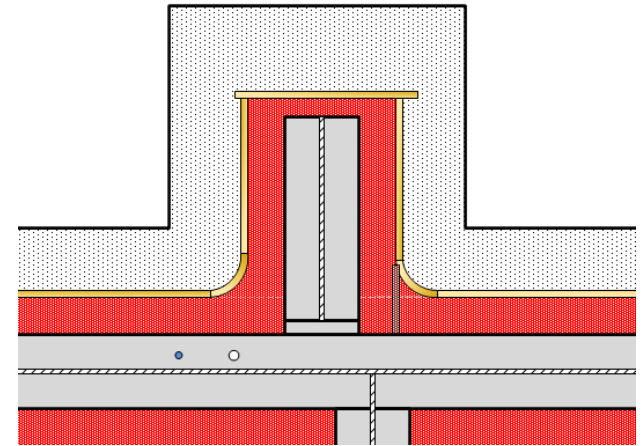
Prior to Installation

- Bolt Preparation
 - Wrap or cover bolt shank (free stretch)
- Alignment Devices
 - Install landing pads for jack screws
 - Grease well
- Expansion Joints
 - 1.5 m to 2m apart
 - Under I-beam and away from anchors
- Install Pins – if needed, 30 cm apart



Prior to Installation

- Forming for Grout
 - Wood forms well braced
 - Round internal corners
 - Waxed on inside
- Forming for Chocks
 - Metal and foam
 - Narrow overpour
 - Air can escape
 - Release Agent



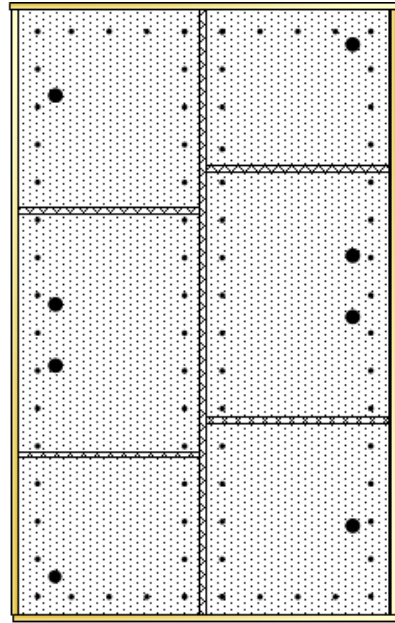
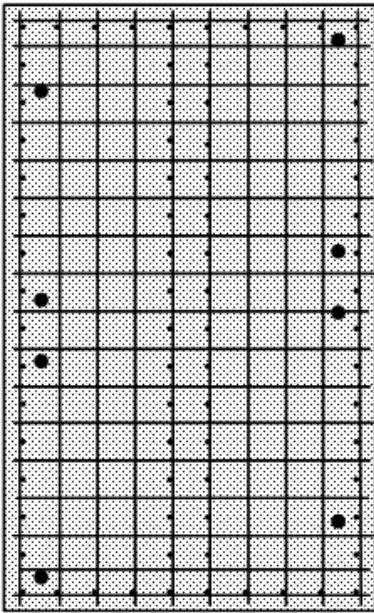
Steel Preparation

- Skid Preparation
 - Preferred – white metal blast
 - Second Choice – thin coat epoxy primer (NO ZINC)
 - Solvent wash
- Engine/Compressor/Sole Plate Preparation
 - No paint, oil, grease, slag, rust, etc.
 - Solvent wash
 - Release Agent on steel only



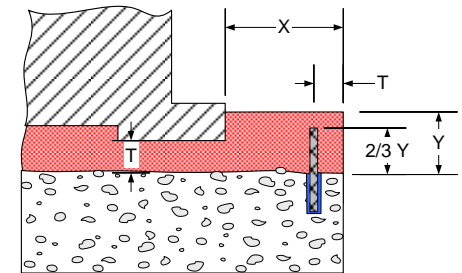
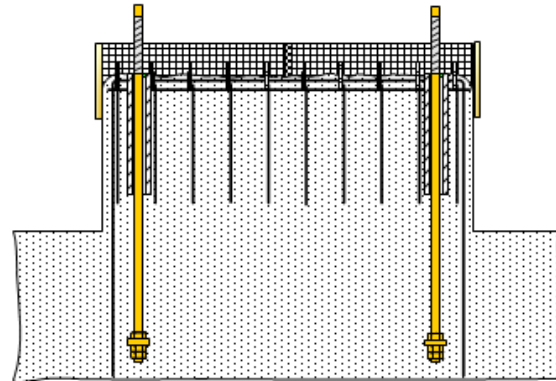
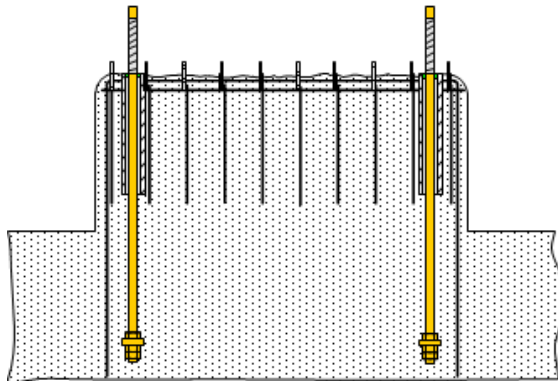
The Grouting / Chocking Process



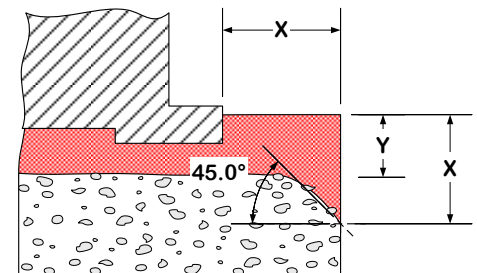


Study foundation drawings

- Dowel pins required?
- Rebar clashes
- Anchor bolt positions
- Grouting volumes

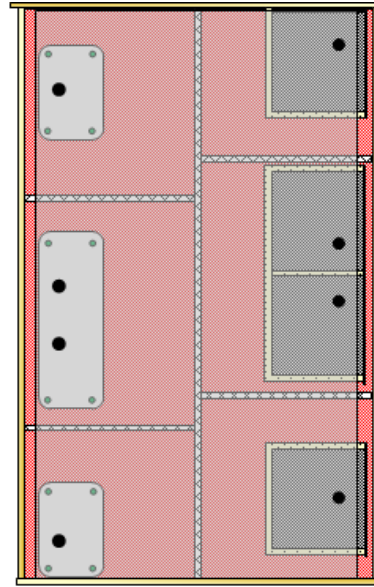
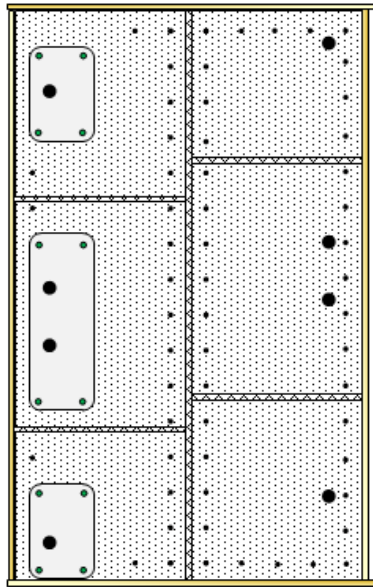


When $Y < X$
Install Pins Along Edge of
Concrete



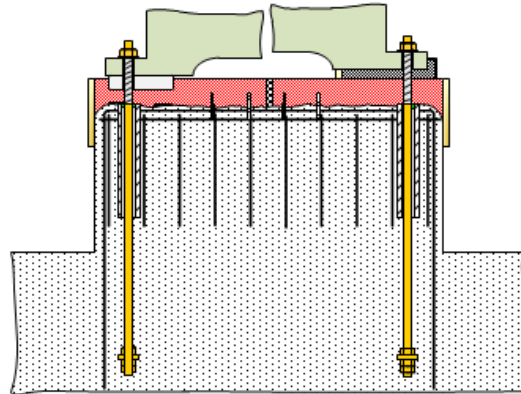
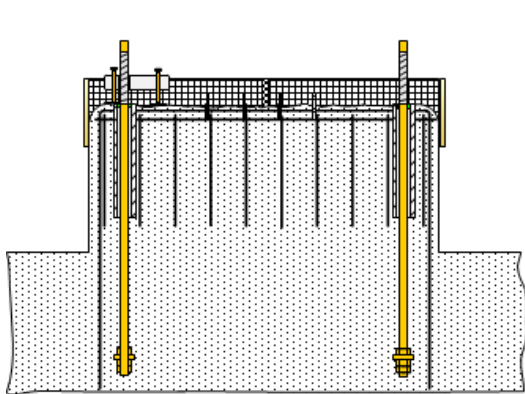
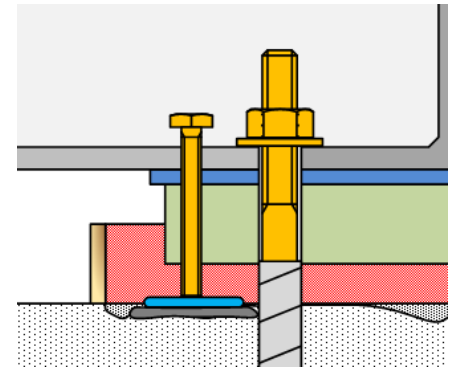
When $Y < X$
Option 2 - Round Edge of Concrete





Study general arrangement

- Where to place expansion joints
- When to place expansion joints
- Soleplate design
- Jack bolt positions



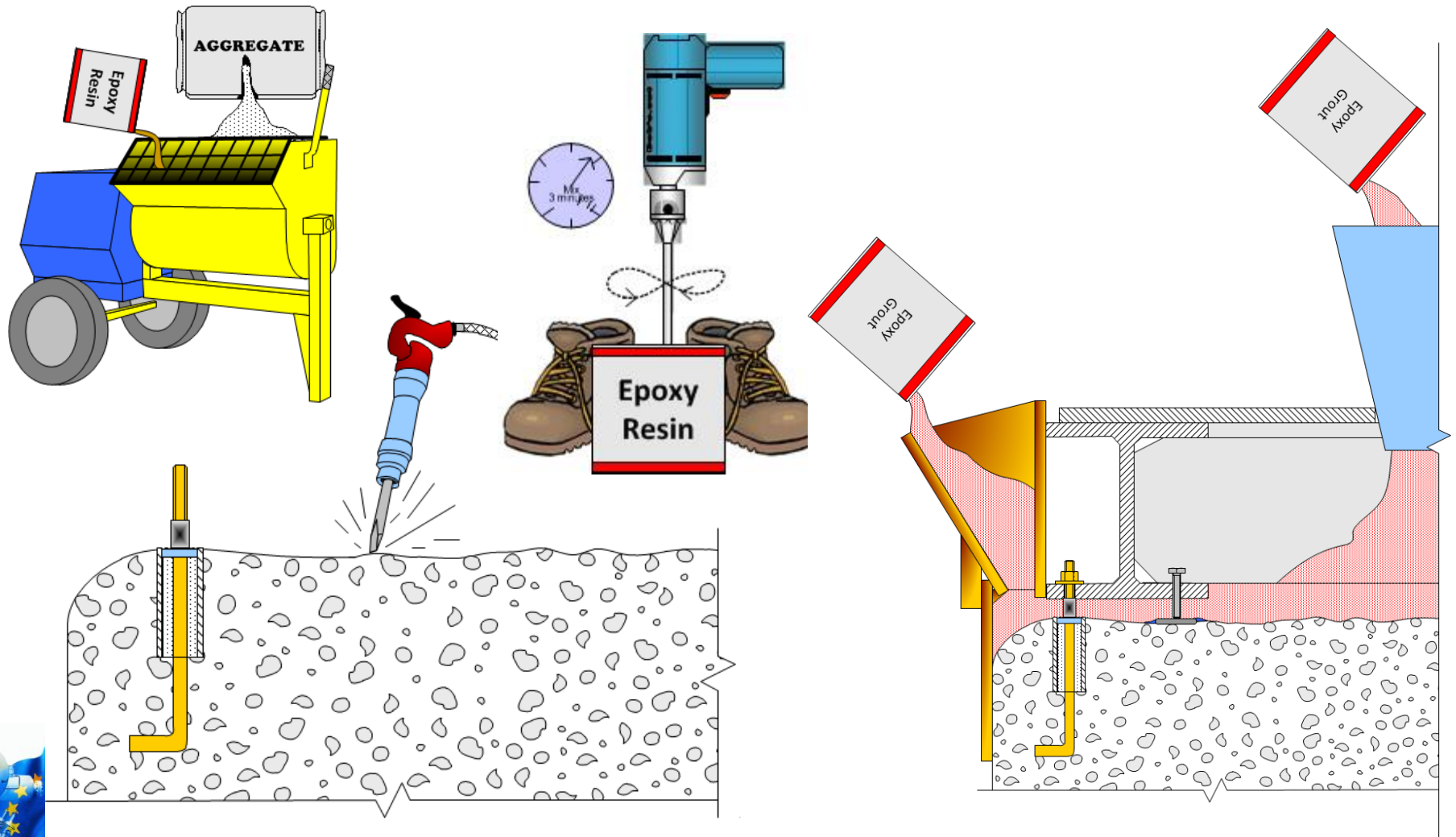
Plan all required preparations before setting the machine

Grout / Chock Installation

- Grout Installation
 - Mix resin & hardener first then add aggregate
 - Use mortar mixer
 - Pour through grout holes or from side
- Chock Installation
 - Mix well using Jiffy mixing blade
 - Pour in thin stream from a height into one end of the chock
- Both – Fill to 24mm above bottom of steel

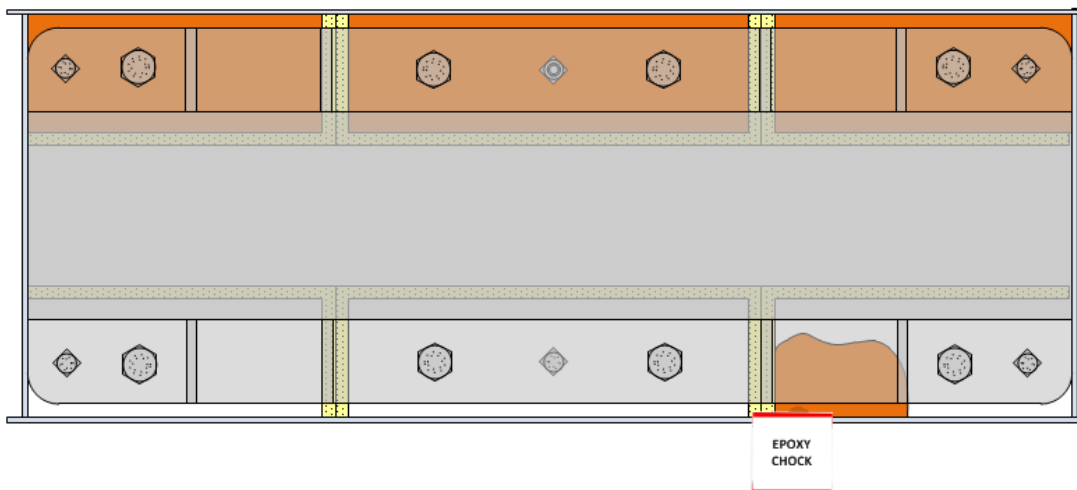
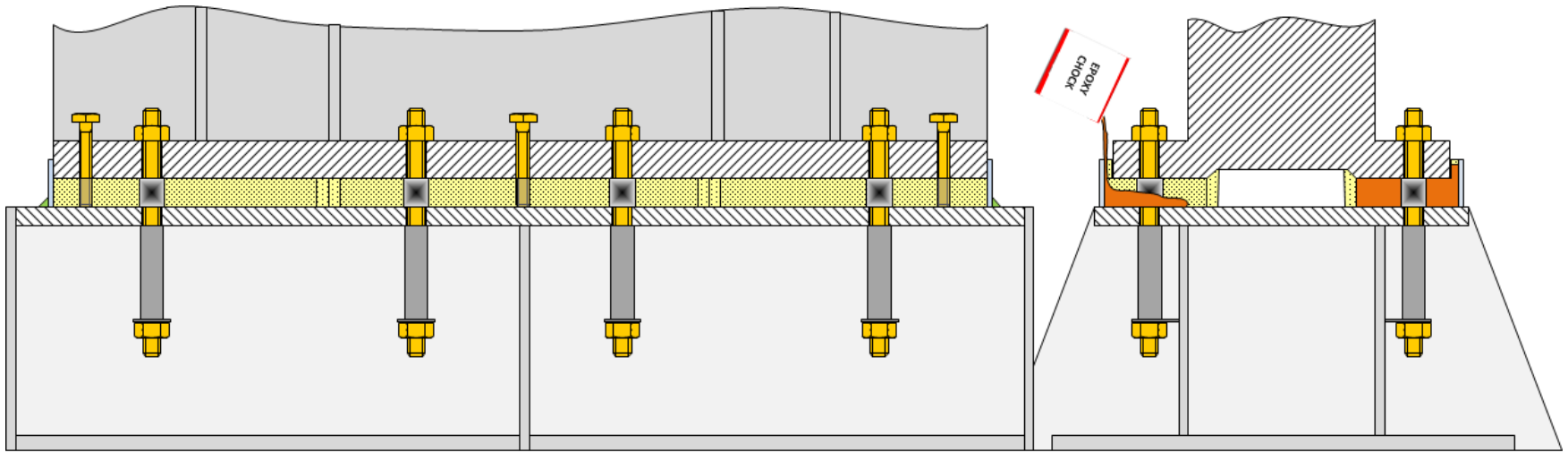


Grout Installation





Chock Installation



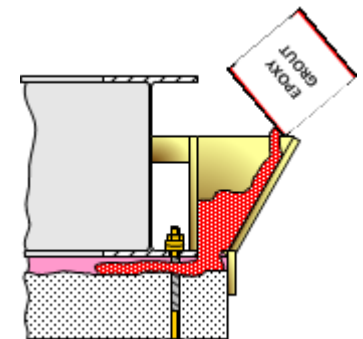
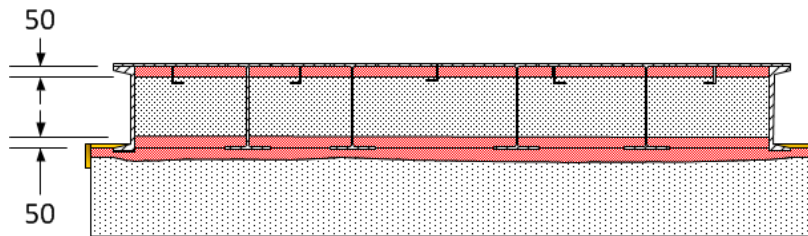
Wrap-Up

- Finishing – Grout & Chocks
 - Remove alignment devices & tension bolts
 - Remove forms
 - Grind off sharp edges
 - Coat exposed foundation
 - Seal expansion joints with flexible compound
 - Gradual temperature change to ambient (0.5°C per hour)
- Clean up mixers and tools quickly



Grouting Issues

- Creep – Greater Area = Less Load = Less Creep
- Shrinkage – Pour grout in layers. Manage heat.
- Cracks – No stress risers. Manage heat.
- Flow - Use headbox, grout holes, wider gap
- Vibration in baseframe - Add Mass



- Grout Samples

Conclusions

- Choose the correct material
 - Grout and Epoxy Chocks are not the same.
 - Determine the correct size of pour & damming material required.
 - Manage the temperature.
- Plan well ahead of time
 - Do not put the machine in place until you are completely prepared.
- Choose an experienced applicator



Thank You

Please feel free to contact me if
there are any questions

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