



OGDCL PAKISTAN:
OIL & GAS DEVELOPMENT
COMPANY LIMITED

KPD-TAY Compression Project (Phase-II)

ISSUED FOR TENDER

REV	DATE	DESCRIPTION	ORIG	CHKD	LE	QA	PM	LOCAL REPR.	PROJ. MAN
0	6-1-2022	ISSUED FOR TENDER	HB	MD	KM	MPM	MAS		
A	29-10-2021	ISSUED FOR REVIEW	HB	MD	KM	MPM	MAS		
REVISIONS			APPROVAL					CLIENT APPROVAL	



ENAR Petrotech Services (Pvt.) Limited ,
7-B , Sector 7-A , Korangi Industrial Area ,
Karachi Pakistan

TITLE:

SPECIFICATION FOR GROUTING

PROJECT NO.
14-0258

DOCUMENT NO:

0258 – CA – 7016 – 0



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1.0 GROUTING

1.1 Scope

This section defines the materials and workmanship related to grouting for the following applications:

- i. Bonding of new concrete to existing concrete
- ii. Grouting of base plates and equipment bases

Materials include - regular cement grout, no shrink cement-based grout, epoxy grout and bonding mixtures.

1.2 Reference Codes and Standards

The standards to be taken into consideration in addition to the terms of the present specification are:

ASTM-C33- 79	Standard Specifications for Concrete Aggregates
ASTM -C 109- 77	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (using 2" or 50mm Cube Specimens)
ASTM-C125-79	Standard Definition of Terms Relating to Concrete and Concrete Aggregates
ASTM-C150-78	Standard Specification for Portland Cement
ASTM-C191-79	Standard Test Method for Time of Setting of Hydraulic Cement by Vicat Needle
ASTM-C531-74	Standard Test Method for Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts and Monolithic Surfacing.
ASTM-C579- 75	Standard Test Methods for Compressive Strength Surfacing.
ASThI-C827-78	Standard Test Method for Early Volume Change of Cementations Mixtures
CRD-C588-79	Specification for Nonshrink Grout (Corps of Engineers)



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AASHTO-T26- 78 Quality of water to be used in Concrete

ANSI AIO.9-70 Safety Requirements for Concrete Construction and Masonry-
J Work /1

1.3 Delivery, Storage & Handling

- a. Nonshrink Cement – Based Grout and Epoxy Grout aggregate shall be delivered to the site in sound dry bags and Epoxy Grout liquid components in sealed hardener and resin containers. The Contractor shall be responsible for storing the grout in a dry, weatherproof area and within the temperature range of 4 °C to 32°C.
- b. The total job storage time for non-shrink grout shall be limited to ten months.

2.0 MATERIALS

2.1 The following rules shall govern the selection of grout material to be used:

- Non-shrink grouts shall be used for heavy machinery and shall not be of metallic aggregate type.
- Cement sand grout, compressive strength 4000 psi, shall be used for light machinery. Epoxy grouts + other bending mixture may be used.
- For all other situations, ordinary cement grout shall be utilized.

Sand-cement grouts shall be proportioned at the site. All non-shrink grouts shall consist of premeasured, prepackaged materials, supplied by the Manufacturer, except water.

All grouts shall be non-corrosive, non-staining and resistant to effects of moisture.

2.2 Water, Sand and Cement

Potable Water shall be used for all types of concrete work and should be free from organic and inorganic impurities. Tested cubes shall have a minimum of 90% of the 28 days specified strength.



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Sand shall be as defined by ASTM D2488, grading for fine aggregates (No. 4 to 100).
Sand for bonding mixture shall all pass a No. 16 sieve.

Cement shall be Ordinary Portland Cement, ASTM C150.

2.3 Cement Grouts

Plain Cement Grout shall consist of cement sand ratio of 1:1 by weight; with a minimum 7 days compressive stress of 28 Mpa (4100 psi) in accordance with ASTM C109 and ASTM C172.

2.4 Non-shrink Cement-Based Grout shall meet the following requirements:

PLASTIC VOLUME CHANGE: No shrinkage (0.0%) and a maximum of 4.0% expansion at any time before initial set when tested according to ASTM C827.

HARDENED VOLUME CHANGE: No shrinkage (0.0%) and a minimum of 0.1% expansion in the hardened state when tested according to CRD C588.

COMPRESSIVE STRENGTH: Minimum allowable compressive strength at 28 days to be 65 Mpa (9500 psi) as measured by ASTM C109.

INITIAL SET TIME: Not less than 60 minutes when tested according to ASTM C191.

SOUNDNESS: The grout shall contain no metallic substances (catalyzed or non-catalyzed), aluminum powder, water reducing agents, fluidifiers, accelerators, super plasticizers, or other materials known to increase drying shrinkage Minimum allowable compressive strength at 28 days to be 65 Mpa (9500 psi) as measured by ASTM C109.

2.5 Non-shrink Epoxy Grout shall meet the following requirements:

VOLUME CHANGE: No shrinkage and a maximum of 4.0% expansion when tested according to ASTM C827 (modified).

COMPRESSIVE STRENGTH: Minimum allowable compressive strength at 7 days to be 114 MPa (16,600 psi) as measured by ASTM C579-82.



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HEAT DEVELOPMENT: The peak exotherm of a 50 mm (2 in) diameter by 100 mm (4 in) high cylinder of grout not to exceed 35 °C (95 °F) when tested at 24 °C (75 °F) material and laboratory temperatures.

THERMAL EXPANSION: Not to exceed a coefficient of thermal expansion of 54×10^{-6} mm/mm °C (30×10^{-6} in/in/ °F) when tested according to ASTM C531.

2.6 Bonding Mixtures and Adhesives

The following bonding mixture or adhesive can be used to create cohesion or water tightness between new concrete and existing concrete:

- **Cement Bonding Mixture** – Neat cement and water mixed to the consistency of creamy paint.
- **Epoxy Adhesive** – Mixture consists of a proprietary epoxy adhesive, mixed and applied in accordance with Manufacturer's instructions.

3.0 EXECUTION

3.1 Surface Preparation

Surface of the existing concrete shall be cleaned of oil, paint and other coatings. The surface shall be roughened to expose the aggregate and thoroughly flushed with clean water.

Before grouting, equipment bases and base plates shall be levelled and aligned in accordance with recommendations of equipment manufacturer and drawings.

When any cement-based grout or bonding mixture is used, the concrete surface shall be thoroughly soaked until absorption stops. Excess water shall be removed just before grouting of bonding.

When epoxy grouts or adhesives are used all surfaces shall be kept dry before application.

3.2 Formwork

Forms or back braces used shall be securely anchored to withstand the forces of the placement of grout.



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For non-shrink cement based grout tight forms shall be provided with tape sealed joints. Form oil to be applied for easy form release.

For non-shrink epoxy grout, watertight forms shall be provided with chamfer strips in place where chamfer edge is required. Forms to be lined with polyethylene or heavy wax for easy form release.

3.3 Placement

Grout placement shall be done in a manner that will assure the filling of all surfaces and the intimate contact of grouting materials with surfaces grouted. Grout to be placed rapidly and continuously to avoid cold joints under the base-plate. Grouting to be done from one side to the other in one direction with tamping or rodding to eliminate voids.

Grout shall be placed in a manner that does not interfere with the movement of equipment or piping designed for expansion.

3.4 Finishing

Cement-based grout shall be trimmed back to the level indicated after grout has reached an initial set. Surfaces to be sloped away from edges cut back.

Epoxy grout cannot be trimmed after set. Top surfaces shall be finished to proper slope prior to initial set.

Finish coating shall be applied over grout holes and vent holes after grout has set.

3.5 Curing

Immediately after placement, cement-based grout shall be protected from premature drying, excessively hot or cold temperatures and mechanical injury. Grout to be maintained with minimal moisture loss at relatively constant temperature for the period necessary for hydration of cement and hardening of concrete.

Epoxy grout shall be cured in accordance with manufacturer's instructions.

3.6 Shims and Wedges

Removal of shims and wedges is not required unless specified by equipment manufacturer. All shims or wedges left in place shall be completely encased in grout.



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3.7 Anchor Bolts and Pipe Sleeves

For anchor bolts and pipe sleeves requiring grout, all surfaces shall be cleaned of oil, grease and other foreign substances.

Where anchor bolts or pipe sleeves are to remain isolated, sleeves shall be filled with a pliable material such as Silicone Rubber moulding compound or other material shown on the drawings.

3.8 Bonding New Concrete to Existing Concrete

The bonding mixture shall be applied by working it into the surface with a stiff brush. New concrete to be placed before bonding mixture dries out.

Epoxy adhesive shall be applied in accordance with manufacturer's instructions.

3.9 Testing

Cement-based grout shall be tested under ASTM C109 and epoxy grout under ASTM C579. Cubes shall be prepared for each type of grout and tested for required compressive strength as mentioned for each type of grout.