

 NISOC	نگهداشت و افزایش تولید میدان نفتی بینک سطح الارض و ابنیه تحت الارض خرید مخازن ذخیره ایستگاه تقویت فشار گاز بینک (قرارداد BK-HD-GCS-CO-0026_00)							
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طرح نگهداشت و افزایش تولید ۲۷ مخزن

BLASTING, PAINTING AND LINING PROCEDURE

نگهداشت و افزایش تولید میدان نفتی بینک

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1.0 INTRODUCTION

Binak oilfield in Bushehr province is a part of the southern oilfields of Iran, is located 20 km northwest of Genaveh city.

With the aim of increasing production of oil from Binak oilfield, an EPC/EPD Project has been defined by NIOC/NISOC and awarded to Petro Iran Development Company (PEDCO). Also, PEDCO (as General Contractor) has assigned the EPC-packages of the Project to "Hirgan Energy - Design and Inspection" JV.

GENERAL DEFINITION

The following terms shall be used in this document.

CLIENT:	National Iranian South Oilfields Company (NISOC)
PROJECT:	Binak Oilfield Development – Manufacturing (w/Engineering & Material Supply) of Gas Dehydration Package.
EPD/EPC CONTRACTOR (GC):	Petro Iran Development Company (PEDCO)
EPC CONTRACTOR/PURCAHSER:	Joint Venture of: Hirgan Energy – Design & Inspection Companies (HE/DI)
VENDOR:	iDrill Middle East (iDrill M.E)
EXECUTOR:	Executor is the party which carries out all or part of construction and/or commissioning for the project.
TPI:	Third-Party Inspector
SHALL:	Is used where a provision is mandatory.
SHOULD:	Is used where a provision is advisory only.
MAY:	Is used where a provision is completely discretionary.

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2.0 SCOPE

This procedure describes surface preparation, Painting and Lining for the Binak Oilfield Development – ELEVATED POTABLE WATER TANK (TK-2209), LEAN GLYCOL STORAGE TANK (TK-2102), FIRE WATER TANK (TK-2301 A/B) that fabricated by iDrill Middle East company.

3.0 REFERENCES CODE AND STANDARD

3.1 IRANIAN PETROLEUM STANDARDS (IPS)

- IPS-E-TP-100: Engineering Standard for Paint.
- IPS-C-TP-101: Construction Standard for Surface Preparation.
- IPS-M-TP-205: Material & Equipment Standard for Zinc Rich Epoxy as Primer, Intermediate & Top Coat.
- IPS-M-TP-220: Material & Equipment Standard for Epoxy Polyamide Intermediate Paint.
- IPS-M-TP-235: Material & Equipment Standard for Two Pack Aliphatic Poly Urethane Paint as Top Coat.
- IPS-M-TP-210: Material & Equipment Standard for Zinc Silicate Paint
- IPS-M-TP-190: Material & Equipment Standard for Coal Tar Epoxy Polyamide Paint
- IPS-M-TP-202: Material & Equipment Standard for Two-Pack Amine-Adduct Paint

3.2 STEEL STRUCTURE PAINTING COUNCIL (SSPC)

- -SSPC volume 1 - Good painting practice
- -SSPC volume 2 - Good painting practice

3.3 American Society of Testing Materials (ASTM)

- ASTM A123: Specification for zinc (hot galvanized) coatings on products fabricated from rolled, pressed and forged steel shapes, plates bats and strip.
- ASTM D1014: Standard test method for conducting exterior exposure tests of paints on steel.
- ASTM A1640: Standard test method for drying, curing or film formation of organic coating at room temperature.
- ASTM D3359: Standard test methods for measuring adhesion by tape test.
- ASTM D3951: Practice for commercial packaging.
- ASTM D4285: Standard test method for indicating oil or water in compressed air.
- ASTM D4366: Standard test method for hardness of organic coating.
- ASTM D4940: Standard test method for conduct metric analysis of water-soluble ionic contamination of blasting abrasives.

3.4 International Organization for Standardization (ISO)

- ISO 8501: Preparation of steel substrates before application of paints and related products. Visual assessment of surface cleanliness
- ISO 8502-3: Preparation of steel substrates before application of paints and related products. Tests for the assessment of surface cleanliness.
- ISO 8504-2: Preparation of steel substrates before application of paints and related products. Surface

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preparation methods-Abrasive Blast-Cleaning.

- ISO 19840: Paints and varnishes. Corrosion protection of steel structures by protective paint systems. Measurement of and acceptance criteria for the thickness of dry films on rough surfaces.

3.6 Project Specification

- BK-GNRL-PEDCO-000-PI-SP-0006-D04
- BK-GNRL-PEDCO-000-PI-SP-0007-D03

Surface preparation type & grade, type & number of coats shall be in accordance with client Painting specification. In case of requirements missing or difference with specification shall govern. Quality control report for surface preparation, coating & final inspection will be issued on client's request. All operations concerning painting as stated in the following pages, shall be recorder in a daily log.

4.0 TECHNICAL DEFINITIONS

DFT: dry film thickness

WFT: wet film thickness

5.0 SAFETY

- Special attention shall be paid to the potential fire, explosion and health hazards due to the presence of solvent vapors, air borne dust and to the dangers to personnel in the vicinity of equipment operating at a very high pressures using material switch may be toxic, irritant to the skin, eyes, lungs - - - etc.
- Paint manufacturer's safety data sheets shall be made available at the workplace. Manufacturer's instruction for handling and storage shall be followed.
- Paints and thinners shall be stored in an air-conditioned store room away from combustible materials with all precautions taken to avoid creating a fire or explosion hazards.
- Fire extinguishers shall be place in accessible areas close to the storage, application and mixing areas.
- Applicable Personal Protection Equipment to suit the type of material and operation in progress shall be used i.e. air fed blasting helmets, filtered breathing masks and normal safety wear as stipulated in the iDrill Middle East Safety Manual. Manufacturer's safety data sheets shall be consulted and any recommendations be followed.

5.1 SAFE OPERATING PRACTICES

If safe operating practices are followed, reasonable care exercised by the operator, and equipment maintained in good order, the airless spray-painting method is as safe as conventional methods. The

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following precautions should be part of every operator's training and should be strictly observed and rigidly enforced:

- Check all hoses connections and fittings to ensure that they are tight and not leaking. The fluid hose should be designed to withstand the high pressure to which it is subjected. The hose, gun, and pressure vessel should be equipped with special fittings not interchangeable with low pressure fittings.
- Check the fluid hose to be sure that there are no weak or worn spots. Make certain the hose does not contact moving parts of machinery, or lie over and around sharp edges and corners, or come near objects that would damage it. Check for deterioration due to the exposure to chemicals or ordinary wear and tear. High pressure leaks from the hose or from the connections can cause hypodermic injections just as the gun tip can.
- Do not disconnect the gun from the fluid hose or the hose from the pump until the pressure has been released from the hose. This is accomplished by first closing off the main line air pressure to the pump and then bleeding off the pressure in the fluid hose by triggering the gun.
- When handling the gun but not actually spraying - for example, while changing piece parts or work position - hold the gun by the grip and remove the fingers from the trigger.

Never Point an Airless Gun at Any Part of The Human Body - Your Own Or Anyone Else's!

- Airless spray guns cannot be cleaned with the same methods used for conventional air-operated guns. It is hard to force waste material out of the gun except through its head, and material released at such high pressures can be driven into the fingers or hand if they are held over the spray cap or head of the gun.
- The gun should have a guard which completely protects the trigger. When the gun is under pressure but not being used, the safety latch should be kept in the non-operating position.
- If production rates or paint usage rates are to be increased, or solvent changes made, existing controls should be reviewed to maintain safe conditions.

5.2 RULES FOR SAFETY WITH PRESSURIZED EQUIPMENT

conventional and airless spray equipment, sandblasting equipment, and water blasting equipment that operate under pressure.

- Use only pressure equipment that has been constructed as specified by the National Board Code and the ASME Code for Unfired Pressure Vessels.
- Test safety relief valves used on pressure equipment daily.
- Use remote control dead man valves with pressure equipment. Be sure that the dead man valves are a pneumatic type that use the same air for activation that is used for blasting or spraying.

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5.3 RULES FOR SAFETY WITH PRESSURIZED EQUIPMENT

- Identify and seal all toxic and dermatitis material when not in use.
- Adequately ventilate all painting areas. Air used to fulfill the requirements of coating will require monitoring
- prior to, during, and following use to assure proper quality. Effluent treatment is required for the removal of fumes, vapors, and particulates where monitoring analyses indicate that levels exceed the acceptable discharge limits.
- Wear goggles and the proper respirator when spraying or performing any operation where an abnormal vapor or dust is formed.
- Eye protection shall be worn during paint spraying or when painting over head with other applicators.
- Cleaning the hands with paint solvents or "thinners" may cause serious chronic skin complaints.
- Wear appropriate gloves and clothing when handling dermatitis material, change and clean work clothing daily.
- Avoid touching any part of the body when handling dermatitis materials. Wash hands face and arms thoroughly before eating and at the end of the day. Try to take shower at or near the job site.
- All alkaline cleaners shall be handled with care. Rubber gloves and face or eye shields shall be worn when these materials are added to cleaning tanks. Should these materials contact the skin, it shall be flushed with water as soon as possible. These precautions apply also to the handling of acids used in phosphating and chromating.
- Liquid acid shall never be drawn from a carboy by using air pressure to force it out, even when using the so-called air pressure reducers. Danger is always present that the carboy will break and spray or splash acid on the operator. This also holds true for drums.

6.0 AMBIENT LIMITATION

No surface preparation or application of material shall be performed under the following conditions (as per project specification):

- when the temperature of the surfaces is less than 3°C above the dew point of the surrounding air, and/or the relative humidity is higher than 80%;
- when the temperature is below 5°C

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- when there is the likelihood of an unfavorable change in weather conditions within two hours after coating;
- when there is a deposition of moisture in the form of rain, condensation, frost, etc., on the surface;
- When the ambient temperature above 35°C, surface preparation will be performed if such is allowed as per paint manufacturer's recommendations
- Stop anticorrosive construction in the open air under the weather conditions of rain, snow, fog, sand storm, noticeable wind, etc.

7.0 COATING PERFORMANCE REQUIREMENT

Paint performance and characteristics may be subjected to change based on Vendors' data sheet and Company approval.

7.1 The performance, storage and packaging, etc. requirements of epoxy zinc rich primer should accord to IPS-M-TP-205 or follow table:

No.	CHARACTERISTICS	PERFORMANCE	STANDARDS
1	Tack-free (h)	≤4	ASTM D5895
2	Actual dry (h)	≤24	ASTM D5895
3	Pliability (grade)	1	ASTM D522
4	Impact strength(kg.cm)	≥50	ASTM D2794
5	Volume resistivity(Ω.m)	≥1×10 ¹³	IEC 60093
6	Electrical strength (MV/m)	≥25	IEC 60243-1
7	Adhesive force (Mpa)	≥8	ASTM D 1308
8	5%H ₂ SO ₄ , (room temperature,30d)	Paint film has no change.	ASTM D 1308
9	5%NaOH, (room temperature,30d)	Paint film has no change.	ASTM D 1308
10	3%NaCl, (60°C,30d)	Paint film has no change.	ASTM D 1308
11	Dry film zinc content	≥80%	ISO12944
12	Solid content % (m/m)	≥80	ISO 3251

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7.2 The performance, storage and packaging, etc. requirements of epoxy polyamide intermediate coat should accord to IPS-M-TP-220 material and equipment standard for epoxy polyamide paint as intermediate paint:

No.	CHARACTERISTICS	MIN.	MAX.	STANDARDS
1	Paint consistency			ASTM D562
2	Viscosity shear rate 200 rpm grams	95	190	
3	KREB units	60	89	
4	Density Kg/Lit	1.3	1.4	ASTM D1475
5	Fineness of Grind, Microns	65		ASTM D1210
6	Drying time (24°C 45 % R. H.)			ASTM D1640
7	Tack - free, hours dry hard, hours	-	2	
8	Dry Head, Hours	-	5	
9	Dry through, hours	-	8	
10	Flash Point, °C	27.2	-	D1310

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7.3 The performance, storage and packaging, etc. requirements of two-pack aliphatic polyurethane top coat should accord to IPS-M-TP-235 material and equipment standard for two pack aliphatic polyurethane paint as top-coat (finish):

No.	CHARACTERISTICS	MIN.	MAX.	STANDARDS
1	Paint consistency			ASTM D562
2	KREB units	85	95	
3	Density Kg/Lit	By vendor	By vendor	ASTM D1475
4	Fineness of Grind, (HEGMAN UNITS)	3	5	ASTM D1210
5	Drying time (24°C 45 % R. H.)			ASTM D5895
6	Tack - free, hours dry hard, hours	-	2	
7	Dry through, hours	-	24	
8	Flash point °C	¾	8	ASTM D1310
9	Impact strength(kg.cm)	≥50		ASTM D2794
10	Adhesive force (MPa)	≥8		ISO 4624
11	Anti-10%NaCl(72h)	Paint film has no change.		ASTM D 1308
12	Anti-3%NaOH(72h)	Paint film has no change.		ASTM D 1308
13	Anti-10%H ₂ SO ₄ (72h)	Paint film has no change.		ASTM D 1308
14	Neutral salt spray test (720h, Grade)	1		ASTM G85
15	Accelerated weathering test (800 h)	No blistering, no cracking. It allows minor change in color and glaze, and chalking degree is not much.		ASTM C1308
16	Solid content (%)	≥55		ISO3251

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7.4 The performance, storage and packaging requirements of coal tar epoxy paint should accord to below tables:

No.	CHARACTERISTICS	PERFORMANCE		STANDARDS
		PRIMER	TOP COAT	
1	Fineness (μm)	≤100	≤100	ASTM D1210
2	Solids Content (%)	≥95	≥95	ISO 3251
3	Tack-free(h)	≤1	≤4	ASTM D5895
4	Actual dry(h)	≤6	≤24	ASTM D5895
5	Fineness, grade	1	1	ISO 2409
6	Impact strength(cm)	50	50	ASTM D2794
7	Pliability (mm)	1	1	ASTM D522

No.	CHARACTERISTICS		PERFORMANCE	STANDARDS
1	Electric strength (MV/m)		≥20	IEC 60243-1
2	Volume resistivity (Ω·m)		≥1×10 ¹¹	IEC 60093
3	Salt spray test (500h)		Paint film has no change.	ASTM G85
4	Water resistance (100°C, 72h)		Paint film has no change.	ASTM D870
5	Anti-chemical agent	10%H ₂ SO ₄ (72h) room temperature	Complete paint film and no falling off.	ASTM D 1308
		10%NaOH (72h) room temperature	Paint film has no change.	ASTM D 1308
		3%NaCl (72h) room temperature	Paint film has no change.	ASTM D 1308

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7.5 The Composition and Analysis requirements of Zinc Ethyle Silicate paint should accord to below tables:

No.	INGREDIENTS	COMPOSITION WT. %	INGREDIENT STANDARDS
1	Pigment	66	ASTM D520
2	Vehicle	12	-
3	Solvent	22	-
4	Selected Additives	As Required	-

No.	CHARACTERISTICS	PERFORMANCE	STANDARDS
1	Total Solid by Weight of Paint	78	D2369
2	Pigment, % by Weight of Total Solids	85	D2371
3	Total Zinc Dust, % by Weight of Pigment	87	D521
4	Total Zinc Dust, % by Weight of Total Solids	Paint film has no change.	ASTM D870

7.6 The Composition and Analysis requirements of Amine Adduct Epoxy paint shall have approval from health ministry of IRAN.

8.0 SURFACE NOT TO BE PAINTED

The following are not to be painted and must be protected from painting:

- Porcelain
- Gauge Glasses
- Meter Faces
- Valve Stem and Threads
- Working Surfaces of Equipment
- Name Plates
- Aluminum, Plastic and Stainless Steel, cast iron and non-metallic surfaces such as glass, PVC, GRP coated, etc.

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- Insulation or Fireproofing
- Galvanized Steel
- Concrete, Transite , Masonry. Stucco, Etc.
- Factory Finished Control Panels
- Factory Finished Instrument Cases and Meters
- Factory Finished Equipment, Including Compressors, Pumps, Control Valves, Etc.
- Factory Finished Buildings
- Masking or compounds used to protect non-painted surface must be removed prior to completion of the job.
- Stainless Steel and non-ferrous surfaces shall be protected from blasting, over spray and painting, especially those containing Zinc.

9.0 DEGREE OF ROUGHNESS (SURFACE PROFILE)

Blast-cleaning produces a roughened surface and the profile size is important. The surface roughness (average peak-to valley height) achieved for each quality of surface finish, depends mainly upon the type and grade of abrasive used. The blast profile shall be that recommended by the paint manufacturer. Table 3 gives the range of maximum and average maximum profile heights of some abrasive to be expected under normal good operation conditions (wheel and nozzle). If excessively high air pressure or wheel speed is used, the profile may be significantly higher. Surface roughness acceptance criteria shall be 50-85 micron.

9.1 Methods of measurement

The methods described herein are some of the suitable methods for measuring surface roughness. The Company shall decide for the method(s) of measurement to be used.

9.2 Grinding

The thickness of the blast-cleaned specimen is measured with a flat-ended micrometer. The surface is then ground until the bottoms of only the deepest pits are just visible. A further thickness measurement is then taken.

9.3 Direct measurement by microscope

The blast-cleaned specimen, or a replica, is viewed through a suitable microscope, first focusing on the peak and then focusing on the lowest adjacent through, noting the necessary adjustment of focus.

9.4 Profile tracing

A blast-cleaned specimen is traversed with a diamond or sapphire stylus and the displacement of the stylus as it passes over peaks and roughs is recorded. For instruments and the procedures for the measurement see ISO 3274 and ISO 4288.

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9.5 Comparator disc

The comparator disc (kean-tator) is a field instrument to determine anchor pattern profile depth of blasted surface. Comparator disc is composed of five sections, each with a different anchor pattern depth (0.0125 to 0.1 min.). To use this instrument, place the disc on the blasted surface and visually select the reference section most closely approaching the roughness. Comparator with four anchor patterns could be used also.

TABLE 3 - TYPICAL MAXIMUM PROFILES PRODUCED BY SOME COMMERCIAL ABRASIVE MEDIA
(ACCORDING TO IPS-C-TP-101)

ABRASIVE	TYPICAL PROFILE MAXIMUM (mm)	HEIGHT (mm) Av. MAXIMUM
GRIT G 50	0.056	0.04
GRIT G 40	0.086	0.061
GRIT G 25	0.117	0.078
GRIT G 14	0.165	0.13
MINERAL ABRASIVES:		
FLINT SHOT (MEDIUM. FINE)	0.089	0.068
SILICA SAND (MEDIUM)	0.10	0.074
BOILER SLAG (MEDIUM)	0.117	0.078
BOILER SLAG (COARSE)	0.152	0.094
HEAVY MINERAL SAND (MEDIUM. FINE)	0.086	0.066

10.0 SURFACE PREPARATION

For surface preparation reference is made to IPS-C-TP-101;

Before blast cleaning any oil, grease and dirt shall be removed either by means of a suitable solvent. Excessive layers of rust shall be removed by chipping. Weld spatter and sharp edges shall be removed. Surface preparation shall be at the grade requested for each coating system. All contamination occurring after abrasive blasting shall be properly eliminated and the area shall be re blasted. All crevices, cover sharp edges, etc. shall be grinded to obtain a smooth and round appearance, with special care for bolt heads, weld beads, etc. As a guide, blast cleaning shall not be carried out when the temperature of the surfaces to be blasted is less than 3° C above dew point and when the relative humidity of the air is greater than 85% or when the ambient temperature is below 3°C. Prepared surfaces should be primed generally within 4 to 6 hours after blasting (depends on site conditions) or before visible re-rusting occurs. Cleaned surface shall never be left overnight prior to coating, in such case re-blasting or re-cleaning is necessary. Blasting equipment shall be good quality, well maintained, and compressed air shall be free of oil and moisture.

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11.0 ABRASIVE

the grade of non-metallic abrasive has been selected with the target of a surface roughness (see also 4.4 in IPS-C-TP-101) defined by a maximum amplitude of 0.18 mm. For size grades of abrasives see Appendix B.1. in IPS-C-TP-101. It is essential to avoid the use of contaminated abrasives, as the following three types of contamination may occur.

- Dry dust and detritus from the surface and the smaller fines from the breakdown of abrasives. They can be removed by automatic and re circulatory plants. Without such a cleaning process, abrasives shall not be re-used.
- Water, either on the surface, in the compressed air, or from conditions of very high humidity, forms agglomerates of dust and abrasive particles, which will inhibit cleaning processes. In this case the abrasive shall be dry before cleaning.
- Oil and grease on the surface or from the equipment preclude the re-use of abrasives. Such oil and grease shall be removed before blast-cleaning.
- The choice of abrasive will be determined mainly by economic considerations, but cast-iron grit is recommended, particularly for surfaces to be metal-coated.

12.0 BLAST CLEANING EQUIPMENT

- The compressed air supply used for blast cleaning shall be free from water and oil.
- No acid washes or other cleaning solutions or solvents shall be used on metal surfaces after they have been blasted. This includes inhibitive washes intended to prevent rusting.
- Adequate separators and traps shall be provided, installed in the coolest part of the system. They shall be emptied regularly to prevent carry-over of water and oil. Accumulations of oil and moisture shall be removed from the air receiver by regular purging.
- Air compressors shall not be allowed to deliver air at a temperature above 110 °C.
- Abrasive blast cleaning equipment shall be an intrinsically safe construction and equipped with a remote shut-off valve triggered by the release of a dead man's handle at the blasting nozzle (as IPS-C-TP-101 table B6).
- Where air-operated equipment is used, the operator's hood or head gear shall be ventilated by clean, cool air served through a regulator filter, to prevent blast cleaning residues from being inhaled.
- Surface preparation operations shall be terminated early enough during the day to permit application of the primer on the prepared surface before the sunsets.

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13.0 PAINT APPLICATION

Paint application shall be in accordance with IPS-C-TP-102.

- Prepared surfaces should be primed generally within 4 to 6 hours after blasting (depends on site conditions) or before visible re-rusting occurs. Cleaned surface shall never be left overnight prior to coating, in such case re-blasting or re-cleaning is necessary.
- The paint shall be applied in accordance with the paint Manufacturer's product data sheet, which shall include the mix ratio, the method of application, and the use of thinners and over coating times.
- The dry film thicknesses shall be as specified, which are subjected to change based on vendor's data sheet and Company approval. Areas with inadequate coating thickness shall be thoroughly cleaned and, if necessary, abraded, and additional compatible coats shall be applied until they meet the required film thickness.
- Painting shall not be performed when the temperature of the surface is less than 3°C above the dew point of the surrounding air or when the relative humidity of the air is greater than 85%, or outside the daylight hours or due to wind speed according based on inspector's instruction unless local conditions dictate otherwise and the principal is in agreement. Guidance on the estimation of the probability of condensation can be found in ISO 8502-4. The measurement of these conditions is the responsibility of the painting contractor.
- If condensation, rain, dust or other foreign materials contaminate the surface of a paint coating which is not dry to the touch, the paint shall be removed, the surface re-cleaned and fresh paint applied in accordance with this specification.
- Paints shall not be applied within 100 mm of edges which will later have to be welded. Such weld areas shall be taped for a distance of 100 mm either side of the weld line.
- All sharp edges shall be coated to the same film thickness as the adjacent steelwork to prevent premature breakdown from this area. Corners, services, bolt heads and rivet heads require similar attention. When spray method has been applied, supplemental repeated brushing may be required to obtain adequate thickness on such areas. Where there is any doubt that these areas have received adequate film thickness the paint Manufacturer may direct that an additional strip coat of paint, be applied to ensure the full film thickness, without any additional cost.
- When welding metal coated or zinc-dust painted steel, it is necessary to remove the coating near the weld area, or mask-off the weld area before coating. After welding, scale and heat-damaged coating shall be removed by local blast-cleaning and the area, renovated by repainting the original coating.
- Transport and construction of painted structures shall be carried out only after the drying time specified by the paint Manufacturer has elapsed. Damage to the paint system shall be avoided by taking appropriate measures, such as the use of non-metallic slings, etc. for handling and by minimizing as far as possible handling after painting.

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- All steel equipment shall be provided with priming or coating system to protect the steel surfaces during transport, storage, installation and construction.
- Subsequent coats shall be of a distinctly different shade. In case of using light colors for finish coat, the intermediate coat shall be selected with a proper color, in order to avoid any darkness in finish coat.

13.1 Spray application

Airless or pneumatic spray applications are the preferred methods of application, the requirement shall be as the IPS-C-TP-102 clause 14.3.

- Spray painting may cause interference with other works. If spray painting is to be carried out, the following shall be taken into account:
- The correct spray tips, air pressures etc., as recommended by the equipment supplier, shall be used.
- Each coat shall be applied uniformly and completely over the entire surface. All runs and sags shall be brushed out immediately or the paint shall be removed and the surface re-sprayed.
- Very complex structures should be painted by brush instead of spray gun to avoid overspray, dry spray and unacceptable paint losses.

13.2 Brush application

Brush application requirement shall be as the IPS-C-TP-102 clause 14.2. The application may be used under the following circumstances:

- When area cannot be properly coated by spray application for any reason.
- For repair to localized damaged paint.
- Where manufacturer considers the coating material suitable for brush application.
- For applying the initial coat of paint (primer) to corners, crevices or other irregular surfaces prior to spray application.
- The brush shall not be dipped more than one-third of bristle length into the paint to avoid overloading the bristles and filling the "heel" with paint. The brush shall be held at an angle of about 75° to the work.
- The paint shall be spread to hide the surface and provide a uniform coating. Work from dry to wet surface.
- Excessive pressure shall not be applied to the brush. When the surface has been completely covered with paint, the wet area shall be brushed cross-wise to ensure uniformity, and finally brushed lightly to smooth out brush marks and laps. On large areas this final light brushing shall be in vertical direction.
- The film produced by brushing shall be free from brush marks, consistent with good practice for the type of paint used.

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- Brushes shall be made from a good quality hog bristle for solvent based paints and synthetic filament (Nylons and polyester) for water-thinned paints and caustic material such as cement paint.
- Avoid brushes with filament that are not flagged. Round or oval brushes are suitable for irregular surfaces and wide, flat brushes are suitable for large flat areas.
- Roller coating shall not be used.
- Additionally, approved procedure tests shall be confirmed at intervals of not more than 1 year for each type of paint used by the Contractor and for each size of component as requested by the company
- All painting shall be carried out in full conformity with this Standard. Particular attention shall be paid to instructions on storage, mixing, thinning, pot life, application conditions, application technique and recommended time intervals between coats. Coatings shall not be applied to wet or damp surfaces.
- Paint which does not have a limited pot life (time interval) or does not deteriorate on standing may be mixed at any time before using, but if settling has occurred it must be remixed immediately before using.

14.0 STRIPE COATING

A stripe coat shall be applied before each full coat to ensure the DFT on areas which is difficult to obtain accurate DFT readings i.e. welds, edges, interstices, comers and etc. Multiple brush coats of this type may be required to attain the required DFT in areas inaccessible to spray gun.

15.0 REPAIR AND REINSTATEMENT OF COATING

After all the coats of paint have been applied, the inspector shall verify that the appropriate clean-up is done, and that any abrasions, nicks, or scrapes are repaired as required.

Holiday, pinhole, or spark testing is to be used to find the nicks, scrapes, and pinholes in the coating film, particularly if the coating is intended for immersion service. Holiday testing shall be required after application of either the next to last or last coat of paint. Usually when such testing is done before final cure of the coating has occurred so that any repair material applied will successfully bond to the underlying coat.

Repairs of all defective places such as holiday sand damaged areas due to destructive tests shall be made in accordance with procedures specified in each coating system, individual, accordance with IPS-E-TP-100 and 270.

All repairs shall be retested for holidays in accordance with project specification BK-GNRAL-PEDCO-000-PI-SP-0007-D03

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16.0 INSPECTION AND TESTING

Before painting activities commence the contractor shall submit an inspection procedure report indicating inspections and tests to be conducted during preparation and application of the paint system.

The following coating inspections and tests shall be applied:

16.1 Surface Contamination

Tests indicating the extent of substrate contamination as a result of iron, chlorides and dust are specified in IPS-C-TP-101. Drying and application time between coats shall adhere to the coating manufacturer's recommendations with temperature and humidity conditions taken into account, and shall generally be kept to the minimum in order to prevent contamination between coats. Where contamination occurs between coats, this must be completely removed, generally be washed per manufacturers recommendation or otherwise with suitable detergent solution and rinsed with clean water. The paint surface shall be dry before over-coated application.

16.2 WET Film Thickness, WFT

Spot checks shall be carried out during the course of the painting operation to ensure that film thickness is being maintained. These shall be performed according to the procedure described in ISO 2808, Method No. 7B.

16.3 DRY Film Thickness, DFT

ISO 2808, Method No.6, describes the test techniques suitable for measurement of the dry film coating thickness.

Dry film thickness shall be measured with a magnetic probe, such as Micro test or Elcometer or equivalent. it is imperative that the magnetic probe be calibrated for each thickness of coating steel support with a non-magnetic block whose thickness is as close as possible to the coating being checked. Each coat's thickness and total thickness shall be checked. Make five (5) separate spot measurements spaced evenly over each section of the structure 10 square meter in area (divide the entire surface in 10 square meter areas). On each spot, make 3 readings by moving the probe a short distance for each new gage reading. Discard any unusually high or low gage reading that cannot be repeated consistently. Take the average of the three (3) gage readings as the spot measurements.

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For each successive coat, the minimal allowable thickness shall be at least 80% of the specified thickness; the maximum thickness shall not exceed 150% of the specified thickness.

For the total system, the minimal allowable thickness shall be at least 80% of the specified thickness, the maximum thickness shall not exceed 200% of the specified.

16.4 Holiday Testing

Holiday testing shall be conducted in accordance with IPS-C-TP-101 on equipment where the continuity of the coating is important, for example internal tank linings which are subjected to corrosive conditions. The principal shall specify the maximum number of holidays permissible.

16.5 Adhesion

The adhesion of the primer to the steel substrate and the inter-coat adhesion of the subsequent coat(s) after curing shall be determined by the application of either a cross-cut test in accordance with ISO 2409.

Adhesion test shall be carried out on a test panel prepared and coated parallel to the material. Test shall be determined by X-cut in accordance with ASTM D3359 Method A, with an acceptable rating of "4A".

16.6 MEK TEST

For inorganic Zinc Silicate: Record of spraying with fresh water to enhance hydrolysis (if relevant) and result of MEK Test: Level 5 according to ASTM D4752.

17.0 TEST METHOD A-X-CUT TAPE TEST

17.1 APPARATUS AND MATERIALS

17.1.1 Cutting Tool—Sharp razor blade, scalpel, knife or other cutting devices. It is of particular importance that the cutting edges be in good condition.

17.1.2 Cutting Guide—Steel or other hard metal straightedge to ensure straight cuts.

17.1.3 Tape—One-inch (25-mm) wide semitransparent pressure-sensitive tape with an Adhesion strength agreed upon by the supplier and the user is needed. Because of the variability in adhesion strength from batch-to-batch and with time, it is essential that tape from the same batch be used when tests are to be run in different laboratories. If this is not possible the test method should be used only for ranking a series of test coatings.

17.1.4 Rubber Eraser, on the end of a pencil.

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17.1.5 Illumination—A light source is helpful in determining whether the cuts have been made through the film to the substrate.

17.2 PROCEDURE

- 17.2.1** Select an area free of blemishes and minor surface imperfections. For tests in the field, ensure that the surface is clean and dry. Extremes in temperature or relative humidity may affect the adhesion of the tape or the coating.
- 17.2.2** Make two cuts in the film each about 1.5 in. (40 mm) long that intersect near their middle with a smaller angle of between 30 and 45°. When making the incisions, use the straightedge and cut through the coating to the substrate in one steady motion.
- 17.2.3** Inspect the incisions for reflection of light from the metal substrate to establish that the coating film has been penetrated. If the substrate has not been reached make another X in a different location. Do not attempt to deepen a previous cut as this may affect adhesion along the incision.
- 17.2.4** Remove two complete laps of the pressure-sensitive tape from the roll and discard. Remove an additional length at a steady (that is, not jerked) rate and cut a piece about 3 in. (75mm) long.
- 17.2.5** Place the center of the tape at the intersection of the cuts with the tape running in the same direction as the smaller angles. Smooth the tape into place by finger in the area of the incisions and then rub firmly with the eraser on the end of a pencil. The color under the transparent tape is a useful indication of when good contact has been made.
- 17.2.6** Within 90 6 30 s of application, remove the tape by seizing the free end and pulling it off rapidly (not jerked) back upon itself at as close to an angle of 180° as possible.
- 17.2.7** Inspect the X-cut area for removal of coating from the substrate or previous coating and rate the adhesion in accordance with the following scale:
- 5A No peeling or removal,
 - 4A Trace peeling or removal along incisions or at their intersection,
 - 3A Jagged removal along incisions up to 1/16 in. (1.6 mm) on either side,
 - 2A Jagged removal along most of incisions up to 1/8 in. (3.2 mm) on either side,
 - 1A Removal from most of the area of the X under the tape, and
 - 0A Removal beyond the area of the X.

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17.2.8 Repeat the test in two other locations on each test panel. For large structures make sufficient tests to ensure that the adhesion evaluation is representative of the whole surface.

17.2.9 After making several cuts examine the cutting edge and, if necessary, remove any flat spots or wire-edge by abrading lightly on a fine oil stone before using again. Discard cutting tools that develop nicks or other defects that tear the film. discard. Remove an additional length at a steady (that is, not jerked) rate and cut a piece about 3 in. (75mm) long.

18.0 FIELD AND TOUCH UP PAINTING OF STEEL

- 18.1** Previously applied shop coatings must be dry and free of dirt, oil, or other contaminates. The manufacturer's instructions shall be followed if special surface preparation procedures are required before application of the field coats (see also IPS-E-TP-101 Sub-Section 10.5).
- 18.2** All shop primed items which have deteriorated as a result of transshipment to the extent that either crumbling or white staining of the coating is evident shall receive. A superficial sweep blast cleaning sufficient to remove the degradation and to re prepare exposed degraded metal substrate and dust.
- 18.3** Shop coated steel members shall preferably be field painted after erection of such members is completed. Steel members may be field painted on the ground before erection, provided such painting is touched-up where damaged with the same number of coats and kinds of paints after erection. However, the last complete coat of paint shall be applied after erection.
- 18.4** The first field coat of paint shall be applied within a reasonable period after the shop coat(s), and in any event before the weathering (and required touch-up) of the shop coat becomes excessive.
- 18.5** When the type of paint for field coats is not specified, it shall be determined that the paint to be used is compatible with the shop applied coats(s). Paint used in the first field coat over shop painted surfaces shall not cause wrinkling, lifting, or other damage to the underlying paint.
- 18.6** Contact surfaces shall be painted or left unpainted as specified in the the procurement documents or required by the job (see also 16.6 in IPS-C-TP-102).
- 18.7** Surfaces (other than contact surfaces) of fabricated assemblies that are accessible before erection but which will not be accessible after erection shall receive all field coats of paint before erection.
- 18.8** All cracks and crevices shall be filled with paint if practical.
- 18.9** The final coat of steel structures paint shall not be applied until all concrete work is finished. In addition to the cleaning specified in IPS-C-TP-101, all cement or concrete spatter and drippings shall be removed before any application of paint. If any paint is damaged, the damaged surface shall be cleaned and repainted before the final coat is applied.
- 18.10** Wet paint shall be protected against damage from dust or other detrimental foreign matter as much as is practical.

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18.11 Steel stored pending erection shall be kept free from contact with the ground and so positioned as to minimize water-holding pockets, soiling, contamination, and deterioration of the paint film. Such steel shall be cleaned and repainted or touched-up with the specified paint whenever it becomes necessary to maintain the integrity of the film.

18.12 All field welds and all areas within 100 mm of welds shall be cleaned before painting, using surface preparation methods at least as effective as those specified for the structure itself; all welds shall either be blast cleaned, thoroughly power wire brushed, chemically scrubbed, or water scrubbed of all detrimental welding deposits as required (see IPS-C-TP-101 surface preparation).

19.0 PINHOLE AND HOLIDAY DETECTIONS

19.1 After all the coats of paint have been applied, the inspector shall verify that the appropriate clean-up is done, and that any abrasions, nicks, or scrapes are repaired as required.

19.2 Holiday, pinhole, or spark testing is to be used to find the nicks, scrapes, and pinholes in the coating film, particularly if the coating is intended for immersion service. Holiday testing shall be required after application of either the next to last, or last coat of paint. Usually when such testing is done before final cure of the coating has occurred so that any repair material applied will successfully bond to the underlying coat.

19.3 Pinhole and holiday detectors are in three general types: low voltage wet sponge, DC high voltage and AC electrostatic types. When testing conductive lining applied over steel substrate (i.e. conductive rubber lining), the AC electro-static type shall be used.

19.4 If the continuity of the coating, e.g. for tank linings, is checked with a high-voltage spark test, the pinhole detection device shall be set as high as is practicable with a minimum of 5 watts per ζ m of average coating thickness. The test apparatus shall be a low-pulse direct-current detector of a type approved by the company.

19.6 For detect holidays such as pinholes and voids in thin film paints and coatings from 0.0254 to 0.254 mm (1 to 10 mils) in thickness, low voltage holiday detector shall be used.

19.7 This Method may be considered to be a non-destructive test because of an applied voltage of less than 100 V DC. It is effective on films up to 0.508 mm (20 mils) and is not satisfactory for the thickness over 0.508 mm (see ASTM G62-87). The voltage between the electrode (sponge) and the metal surface upon which the coating lies shall not exceed 100 V DC and is according to the manufacturer's instructions.

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	پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه		
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20.0 MAINTENANCE PAINTING OF STEEL

- 20.1** Surface preparation for maintenance work shall be as specified in IPS-C-TP-101 Section 13.
- 20.2** Paint that curls or lifts after application of the spot or priming paint shall be removed and the area shall be repainted.
- 20.3** On structures that are known to have been originally pre-treated with basic zinc chromate wash primer, or other methods, the cleaned areas shall, unless otherwise specified, be similarly pre-treated (see Section 12) before applying the prime coat of paint.
- 20.4** All prepared surfaces shall be primed (see 16.2) before any deterioration of the preparation occurs or within 4 hours whichever is the sooner. Where patch priming is being carried out this shall extend 50 mm on to the adjacent sound paintwork.
- 20.5** The minimum dry film thickness of individual coatings and the total dry film thickness of complete paint system and also wet film thickness, (specially where existing paint surfaces are over coated) shall be determined at the discretion of the company with reference to IPS-E-TP-100.
- 20.6** On repair work, epoxy coatings and inorganic zinc coating shall only be applied on newly blasted surfaces.
- 20.7** If pinholes are present, they shall, depending on the extent, be treated as follows:
- If pinholes are few and local: the areas shall be rubbed down and (an) additional coat(s) shall be applied by brush.
 - If the areas are extensive: the area shall be made paint-free and be repainted at the contractor's expense.

The word "pinhole" is synonymous with "holiday" and "pore" (see pinhole and holiday detection in 22.2.3).

21.0 INSPECTION RECORDS AND REPORTS

The principal shall have the right to inspect the paint work at all stages of preparation and to reject any tools, instruments, materials, equipment or work which do not conform to this specification.

Prior to final acceptance of the paint work an inspection shall be made. The Contractor and the Principal shall both be represented and they shall sign an agreed inspection report.

These reports shall include:

➤ General

- Names of the Contractor and the responsible personnel.

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- Dates when work was carried out. Substrate
- Type
- Normal operating temperature
- Maximum operating temperature

➤ Materials preparation

- Equipment and techniques used.
- Materials receipt condition.
- Type and calibration of instruments used. Environmental conditions
- Weather and ambient conditions.
- Painting periods

➤ Surface preparation

- Condition of surface before preparation.
- Tools and methods used to prepare surface.
- Condition after preparation.

➤ Paints and painting

- Information on systems being applied.
- Mixing and testing prior to application.
- Paint application techniques.

➤ Testing

- Type of quality control checks carried out, and results.
- Compliance or otherwise with specification

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شماره پیمان: ۰۵۳ - ۰۷۳ - ۹۱۸۴	BLASTING, PAINTING AND LINING PROCEDURE							شماره صفحه : 27 از 29	
	پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال		نسخه
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22.0 QUALITY INSPECTION

REQUIREMENTS	REFERENCE STANDARD
Check cleanliness of components immediately prior to cleaning	IPS-C-TP-101
Monitor size, shape and cleanliness of the blast cleaning material and process	IPS-C-TP-102
check visually in good light, the surface of the components for metal defects, dust and entrapped grit	IPS-C-TP-101
Check for residual contamination of component surfaces	IPS-C-TP-101
Check temperature control of the component surface by an agreed method	IPS-C-TP-101
Check the weather condition	IPS-C-TP-102, section 22
Check the paint thickness	IPS-C-TP-102, section 22
Check the cure of paint	IPS-C-TP-102, section 22
Check the paint adhesion	IPS-C-TP-102, section 22
Supervision to ensure the adequate and proper repair of all defects	IPS-C-TP-102, section 22
Check on paint color and appearance, e.g. uniformity and flow	IPS-C-TP-102, section 22

23.0 CALIBRATION

All test gages shall be calibrated against a standard calibrated master gage method at least every 6 months and at any time is reason to believe they are in error.

24.0 GUARANTEE

The supplier shall guarantee painting against poor workmanship and improper application. This guarantee shall remain in effect for one year from the time the equipment is placed in regular operation. The Purchaser shall repair at his own expense any defects noted during the guarantee period.

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25.0 SURFACE PAINT SCHEDULE OF TANK

Item Name	Tag No.	Max. Operating Temperature (°C) (in/out)	Insulation	Material	Surface Preparation	Primer Coat	Intermediate Coat	Final Coat	DFT (μ)
Fire Water Storage Tank	TK-2301 A/B	AMB.	-	A283 Gr.C/ ST37	Sa 2 ½	Zinc rich EPOXY (75 μ)	Epoxy Polyamide (80)	Polyurethane top Coat (50μ) Ral code 7047	205 μ
Elevated Potable Water Tank	TK-2209	AMB.	-	A283 Gr.C/ ST37	Sa 2 ½	Zinc rich EPOXY (75 μ)	Epoxy Polyamide (80)	Polyurethane top Coat (50μ) Ral code 7047	205 μ
Lean Glycol Storage Tank	TK-2102	AMB.	-	A283 Gr.C/ ST37	Sa 2 ½	Zinc rich EPOXY (75 μ)	Epoxy Polyamide (80)	Polyurethane top Coat (50μ) Ral code 7047	205 μ

26.0 LINING PAINT SCHEDULE OF TANK

Item Name	Tag No.	Max. Operating Temperature (°C) (in/out)	Insulation	Material	Surface Preparation	Roughness	Primer Coat	Intermediate Coat	Final Coat	DFT (μ)
Fire Water Storage Tank	TK-2301 A/B	AMB.	-	A283 Gr.C/ ST37	Sa 3	Grit-Coarse (C)	COAL TAR EPOXY (150 μ)	COAL TAR EPOXY (150 μ)	COAL TAR EPOXY (150 μ)	450 μ
Elevated Potable Water Tank	TK-2209	AMB.	-	A283 Gr.C/ ST37	Sa 3	Grit-Coarse (G)	AMINE ADDUCT EPOXY (food grade) (125 μ)	AMINE ADDUCT EPOXY (food grade) (125 μ)	AMINE ADDUCT EPOXY (food grade) (125 μ)	375 μ
Lean Glycol Storage Tank	TK-2102	AMB.	-	A283 Gr.C/ ST37	Sa 3	Grit-Coarse (G)	Zinc Ethyl Silicate (60 μ)	-	-	60 μ

27.0 SURFACE PAINT SCHEDULE OF STRUCTURAL PART

Item Number	Tag No.	Max. Operating Temperature (°C) (in/out)	Insulation	Material	Surface Preparation	Primer Coat	Intermediate Coat	Final Coat	DFT (μ)
Elevated Potable Water Tank	TK-2209	AMB.	-	A283 Gr.C/ ST37	Sa 2 ½	Zinc rich EPOXY (75 μ)	Epoxy Polyamide (80)	Polyurethane top Coat (50μ) Ral code 7047	205 μ

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	BLASTING, PAINTING AND LINING PROCEDURE								
	پروژه	بسته کاری	صادر کننده	تسهیلات	رشته	نوع مدرک	سریال	نسخه	
	BK	GCS	IDR	120	QC	PR	0008	V00	

28.0 ATTACHMENT

- Format of Report

		SURFACE PREPARATION & PAINTING REPORT of INTERNAL/EXTERNAL																									
Project:						ITEM / TAG NO.:																					
OWNER:						STANDARD:																					
P.O. No.:						Material:																					
DWG No.:						Report No.:																					
PROCEDURE NO.:						Report Date:																					
SURFACE PREPARATION		PRIMER COAT		INTERMEDIATE COAT		FINAL COAT																					
DATE:		DATE:		DATE:		DATE:																					
Method:		Paint Manufacture.:		Paint Manufacture.:		Paint Manufacture.:																					
Standard (Cleaness):		Exp. Date:		Exp. Date:		Exp. Date:																					
Abrasive used:		Production No.:		Production No.:		Production No.:																					
Weather condition:		paint Product code:		paint Product code:		paint Product code:																					
Surface Profile:		Paint Product Name:		Paint Product Name:		Paint Product Name:																					
		Weather Condition:		Weather Condition:		Weather Condition:																					
		Surface Temp.:		Surface Temp.:		Surface Temp.:																					
		Dew point		Dew point		Dew point																					
		DFT (procedure):		DFT (procedure):		DFT (procedure):																					
		DFT (Actual):		DFT Min/Max.:		DFT Min/Max.:																					
Remark / Action																											
<table border="1"> <tr> <td>IDRILL M. E</td> <td>HIRGAN / DI</td> <td>PEDCO</td> <td>TPI</td> <td>NISOC</td> </tr> <tr> <td>Name:</td> <td>Name:</td> <td>Name:</td> <td>Name:</td> <td>Name:</td> </tr> <tr> <td>Date:</td> <td>Date:</td> <td>Date:</td> <td>Date:</td> <td>Date:</td> </tr> <tr> <td>Signature:</td> <td>Signature:</td> <td>Signature:</td> <td>Signature:</td> <td>Signature:</td> </tr> </table>								IDRILL M. E	HIRGAN / DI	PEDCO	TPI	NISOC	Name:	Name:	Name:	Name:	Name:	Date:	Date:	Date:	Date:	Date:	Signature:	Signature:	Signature:	Signature:	Signature:
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