

"Village with a Past, City with a Future"



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ADDENDUM NO. 2

This addendum consists of 52 pages with attachments.

TO: All Bid Packet Holder

FROM: City of Kenai Public Works Department

DATE: August 22, 2019

SUBJECT: Invitation to Bid – Alaska Regional Fire Training Center Training Equipment Rehabilitation

DUE DATE: *August 29, 2019, by no later than 2:00 PM*

Bidders must acknowledge receipt of this Addendum in the appropriate place on the Bid Form. Failure to do so may result in the disqualification or rejection of the bid.

Note: Information in this addendum takes precedence over original information. All other provisions of the document remain unchanged.

01 - General:

01-01 Plan Holder Question:

"What is the engineer's estimate?"

Response: Not available

01-02 Plan Holder Question:

"Do you require union to all of your projects or contracts?"

Response: DOL Title 36 Pamphlet 600 was provided with Addendum #1.

01-03 Plan Holder Question:

“Is the bid date still August 29 at 02:00 PM?”

Response: Bid date is August 29th at 2:00 PM

01-04 Plan Holder Question:

“Would there be a plan holders/bidders list available? Could you also send me a copy if you have one?”

Response: See attached Plan holders List.

01-05 Plan Holder Question:

“I noticed that project updates (cost estimate, attendance sheets, plan holders list, addendum, bid tabs, awards) were posted on the city website <https://www.kenai.city/rfps>, to help trim down number of inquiries from us is it a policy to post all project updates through this website?”

Response: Yes.

01-06 Plan Holder Question:

- 1) The RFP asks the fire training system bidders to refurbish the ARFF burn pit to provide the same features and performance as the existing trainer. To fulfill the qualification of being a responsible bidder what level of technical information and detail must be provided to demonstrate that the bidder will provide new like-for-like or better systems, components, component quantities, and structural details per the provided specification. For example Schedule 2B-2.1f, number of burn zones, should the bidder confirm the number of zones to be provided? Other examples are specifying the quantity of thermocouples for agent detection either by zone or in total? Please clarify the level of detail and appropriate format to fulfill this requirement.

Response: There are no requirements to provide technical information with the bid. The successful bidder will provide the all equipment, materials, labor, etc. as identified in the plans and specification and shall meet or exceed all of the performance requirements found in the specifications, specifically the original design Performance Specification for Aircraft Fires Trainer and the original design System Specification for the Fuel Spill Fire Trainer.

01-07 Plan Holder Question:

Schedule 2B-2.1f states that all pneumatic valves must be replaced with electrically-operated valves, yet the following sentence requires all pneumatic valve enclosures (8) be replaced. If all pneumatic valves are removed and replaced with electric valves the pneumatic valve enclosures will no longer be required. Please clarify.

Response: The pneumatic valve enclosures will no longer be required.

02 - Project Plans

02-01 Replace the following project plans with the following drawings

- 2-4 Spill Fire Control Bunkers
- SC-1 Spill Fire Burn Pit Plan
- SC-2 Spill Fire Burn Pit Section
- SG-1 Spill Fire Burn Pit Grating Support Plan
- SG-2 Spill Fire Burn Pit Grating Support Details
- SG-7 Spill Fire Burn Pit Grating Plan
- M-1 Spill Fire Burn Pit Propane Circuiting
- M-3 Spill Fire Burn Pit Drainage Piping Plan
- E-1 Spill Fire Burn Pit Conduit Routing and Fire Zone Plans and Details

03- Project Specifications

- 02-01 Remove Specification No. 053100 Steel Decking
- 02-02 Insert attached Specification No. 05530 Fabricated Grating
- 02-03 Remove Specification No – 03300, Replace with attached Specification No. 03300B

04 – Clarifications

04-01 Section 1.6 – Method of Measurements

04-011 Schedule 2B – Bunker Equipment Rehabilitation: Note changes in bold.

Schedule 2B Bunker Equipment Rehabilitation

2B – 2.1 - Description: Remove and dispose of all existing equipment, piping, electrical components, enclosures and all associated items. The bunkers shall be stripped except for equipment and enclosure supports, **and electrical conduits**, unless unusable by corrosion. Install new in-kind or of higher quality equipment. Must meet original design performance standards or better. This shall include, but not limited to the following:

- a. Fuel spill pilot components and enclosures
- b. Fuel spill liquid manifold assemblies
- c. Thermocouple junction boxes
- d. All control and power systems
- e. Replace black iron gas pipes in bunker walls with stainless steel pipe.
- f. Rehabilitate Three Dimensional Fuel Leak Fire to original or better.
- g. **All removed components shall be stored on site at a location at the Owner's direction and shall not be damaged upon removal. No components shall be re-used on new installation.**

2.1.1 List of items to replace:

Fuel Spill Pilot Control - Replace the following:

- 4 pilot heads
- 4 pilot air blowers
- 4 pilot air blower switches

- 4 pilot air blower pressure switches
- 4 pilot control valves
- Replace 2 enclosures.

Manifold Assemblies – Replace the following:

- 8 manifold assemblies

Pneumatic Valves – Replace the following

- All pneumatic valves shall be replaced with electric operated valves

Pneumatic Valve Enclosures – Replace the following:

- 8 valve enclosures

Bunker Manual Shutoff Valves – Replace the following:

- Bunker shut off valves

Bunker Distribution Piping – Replace the following:

- Replace all piping

Thermocouple Junction Boxes – Replace the following:

- Replace all junction boxes

Fuel Spill Burner Elements – Replace the following:

- All burner elements

Agent Thermocouples – Replace the following:

- All thermocouples and cables.

3F Replace 7 Fireplace Control Assemblies: Revise as follows:

- h. **3F – 3.1** Description: Remove and **salvage all components of** existing 7 Fireplace Control Assemblies equipment. **All removed components shall be salvaged and stored on site at a location at the Owner's direction and shall not be damaged upon removal. No components shall be re-used on the new installation.** Install new in-kind 7 Fireplace Control Assemblies.

**CITY OF KENAI
PRE-BID CONFERENCE
ALASKA REGIONAL EMERGENCY SERVICES TRAINING CENTER
AUGUST 14, 2019 1:00 PM**

1. INTRODUCTIONS:

Identification of those present at pre-bid conference. Please sign in.

2. SCOPE OF THE PROJECT.

ALASKA REGIONAL EMERGENCY SERVICES TRAINING CENTER

PROJECT 1 - TRAINING EQUIPMENT REHABILITATION

<u>Schedule</u>	<u>Description</u>
1A	Propane Tank Farm General Rehabilitation
1B	Replace Tank Farm Propane Pumps
A1-A	Additive Alternative A - Replace Pump Motors
A1-B	Additive Alternative B - Replace Starters and Cut off Switches
A1-C	Additive Alternative C- Vaporizer Equipment Rehabilitation
2A	Fuel Spill Trainer Control System Rehabilitation
2B	Bunker Equipment Rehabilitation
2C	Burn Pit Rehabilitation
2D	Install New Water Deck Burn Pit System
A2- A	Additive Alternative A - Replace Air Blower Motor/Fan/Heater
A2-B	Additive Alternative B - Spill Fire Slab Hydronic Heating System Rehabilitation
3A	Control System Rehabilitation
3B	Replace mockup exhaust system fan and motor
3C	Replace combustion air system fan, motor and ducting
3D	Replace Smoke Generation System
3E	Replace Agent Detection System
3F	Replace 7 Fireplace Control Assemblies
DA3 - A	Deductive Alternative A - Replace 4 Fireplace Control Assemblies, Rehabilitate 3

PROJECT 2 – TRAINING BUILDING REHABILITATION

<u>Schedule</u>	<u>Description</u>
1A	Replace SCBA Cylinder Filling Station
1B	Booster Pump and Controls Rehabilitation
1C	Pneumatic Valve System Compressor Replacement
1D	Effluent Building Submersible Sump Pumps Replacement
A1-A	Hydronic Heating System Boiler Rehabilitation
2A	Office area Ventilation and AC Systems Rehabilitation
2B	Install Ventilation in Apparatus Bay
2C	Heating System Rehabilitation
2D	Mechanical Control System Rehabilitation
3A	Roof System Rehabilitation
4A	High Traffic Flooring Rehabilitation
5A	Building and Site Lighting Rehabilitation
6A	Maneuver Area Surface Rehabilitation

3. BID OPENING.

Pre-Bid Meeting: August 14th, 2019 at 1:00 pm at City Hall Council Chambers
Site Visit / Tour of Site

Last Day for written questions: August 21th, 2019 4:00 pm, local time.

Bid Due Date and Time: August 29th, 2019 by 2:00 pm local time. City Hall, Kenai, AK

4. INSTRUCTIONS TO BIDDERS.

Use the “Project Bid Form” only for submitting a bid.

One (1) complete bid package shall be completely sealed in an envelope clearly marked with the Bidder’s company name, and the “Project Name” and “Bid Due Date” specified in Section 1 of these Instructions to Bidders. A complete bid package shall include the following documents:

1. Bid Form
2. Tax Compliance Certificate
3. Applicable Licenses
4. Non-Collusion Affidavit
5. Bid Bond with Power-of-Attorney (If Bid exceeds \$100,000.00)
6. DBE Attachment 1 Disadvantaged Business Enterprise Declaration
7. DBE Attachment 2 Bidder’s Registration Form (for Prime contractor only)
8. DBE Attachment 3 List of Potential Subcontractors

5. AWARD OF AGREEMENT

The Owner reserves the right to award the contract to the low, responsive, responsible Bidder meeting the requirements stated on the Bid Form, based on the Base Bid or for the combination of Base Bid and any Alternatives or Schedules selected by the Owner, in the best interest of the Owner. The Owner shall award one (1) contract for Project. (Meeting DBE requirements)

6. FUNDING:

This project is to be built with the Owner's local funds and a grant from the FAA. Therefore, award of the Contract by the City will be made subject to concurrence of FAA. The Owner has received tentative allocation of a grant from the FAA for the proposed construction project. The Owner has local funds on hand to match the FAA Grant. The Owner reserves the right to reject all bids due to lack of funding or budgeting.

7. BUY AMERICAN COMPLIANCE CERTIFICATION/COMPLIANCE

The bidder or offeror must indicate how they intend to comply with 49 USC § 50101 certification.

8. CITY OF KENAI DISADVANTAGED ENTERPRISE PROGRAM

- **DBE Participation Goal – 2.0%**
- **Compliance – All Bidders who fail to meet the DBE Goal and fail to demonstrate good faith efforts shall not be eligible to be awarded the contract.**
- **Use of Certified Forms**
- **Good Faith Efforts**
- **Prompt Payment**

9. LICENSING

Alaska State Statutes requires that all businesses wishing to engage in business in Alaska obtain license(s). All Bidders are required to furnish with their bid, the applicable, current licenses required to perform the work. Applicable licenses may include the following: Contractor's License, Specialty Contractor License, and Alaska Business License. Failure to submit license(s) with the bid may result in rejection of the Contractor's bid.

10. TAX COMPLIANCE CERTIFICATE

No agreement will be awarded to any individual or entity that is in violation of the tax laws of the City of Kenai or the Kenai Peninsula Borough unless the violation is cured within ten business days of notice. The Tax Compliance Certificate must be

signed by the Bidder only and submitted with the bid. The City will obtain verification of tax compliance from the Kenai Peninsula Borough for the successful bidder. Bids submitted without a completed Tax Compliance Certificate may be considered non-responsive

11. MINIMUM WAGE RATES.

Wage rates are NOT included in project specifications. Prevailing rate shall be paid. Certified payrolls submitted to Engineer. Prime responsible for subcontractors. Payrolls are reviewed for compliance. Payroll issues may delay contractor payments. **(Will be included by addendum)**

12. SPECIAL PROVISIONS.

- **Section 9.00 –Contract Time**

PROJECT 1 - TRAINING EQUIPMENT REHABILITATION

October 1, 2019 – Anticipated - Issue Notice to Proceed with construction.

March 2, 2020 – Substantial Completion Inspection

March 2 – March 6, 2020 - Commissioning of Equipment

March 27, 2020 – Final Inspection and completion of project.

PROJECT 2 – TRAINING BUILDING REHABILITATION

Schedule 1 – Training System Components

October 1, 2019 – Anticipated - Issue Notice to Proceed with construction .

March 2, 2020 – Substantial Completion Inspection

March 2 – March 6, 2020 - Commissioning of Equipment

March 27, 2020 – Final Inspection and completion of project

Schedules 2-6

June 5, 2020 – Substantial Completion Inspection

June 19, 2020 – Final Inspection and completion of project.

Other items discussed during PRE-BID CONFERENCE:

SECTION 03300B CONCRETE

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This section shall include constructing the cast-in-place concrete structures consisting of Portland cement, fine and coarse aggregate, water and selected admixtures, combined, mixed, transported, placed, finished, and cured as herein specified.
- B. This section also includes grout for miscellaneous uses, surface hardeners, bonding agents, fiber reinforcement, and other related concrete accessories and construction requirements.
- C. Contractor is responsible to have all cracks in water-bearing structures repaired by the epoxy injection method. The work shall be done by a certified applicator of the epoxy manufacturer.

1.02 RELATED WORK

- A. Submittals: Section 0 134 00.
- B. Quality Control: Section 0 14 00.

1.03 QUALITY ASSURANCE

- A. The Contractor shall have available on-site a copy of ACI SP-15 "Specifications for Structural Concrete for Buildings with Selected ACI and ASTM References."
- B. The Contractor shall comply with all requirements of the following codes and standards, except as modified herein:
 - 1. ACI 301 "Recommended Practice for Concrete Inspection."
 - 2. ACI 318 "Building Code Requirements for Reinforced Concrete."
 - 3. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete."
 - 4. ACI 305 "Recommended Practice for Hot Weather Concreting."
 - 5. ACI 306 "Recommended Practice for Cold Weather Concreting."
 - 6. ACI 308 "Recommended Practice for Curing Concrete."
- C. Other references:
 - 1. ASTM C-31 - Making and Curing Concrete Test Specimens in the Field
 - 2. ASTM C-33 - Specification for Concrete Aggregates
 - 3. ASTM C-94 - Specification for Ready-Mixed Concrete
 - 4. ASTM C-143 - Standard Test Method for Slump of Portland Cement Concrete
 - 5. ASTM C-150 - Specification for Portland Cement
 - 6. ASTM C-260 - Specification for Air-Entraining Admixtures for Concrete
 - 7. ASTM C-309 - Specification for Liquid Membrane-Forming Compounds for Curing
 - 8. ACI 302 - Concrete Floor and Slab Construction
 - 9. ACI 614 - Specification for Concrete Placement

1.04 SUBMITTALS

- A. Refer to Section 01300, SUBMITTALS.
- B. The Contractor shall submit copies of the manufacturer's data with the application and installation instructions for proprietary materials and items, including reinforcement and forming accessories, admixtures, bonding and patching compounds, joint systems, curing compounds, floor hardeners, grout, and others as requested by the Engineer.
- C. A placement schedule shall be prepared by the Contractor and submitted to the Engineer for review prior to the start of concrete placement operations.
- D. The Contractor shall furnish copies of the delivery tickets for each load of concrete delivered to the site and other information as specified under ASTM C94, Certification.
- E. Concrete Mix Design Proposals
 - 1. Concrete Mix: Submit each mix design to the Engineer for review at least 14 days before first use is planned. Include substantiating test data and mix design details, including aggregate gradation and source, water/cement ratio, mix proportions, air content, slump, and strength. Substantiating data must include tests by an independent testing laboratory verifying the requirements specified under "Section 2.01 PROPORTIONING AND DESIGN OF MIXES" and "PART 4 TESTING". Submit complete information for each mix design which has different strength, different aggregate size or gradation, different proportions or is to be transported differently. For previously used mix submit copies of at least 10 tests meeting these specifications. Do not use any concrete until the mix design and substantiating data for that concrete has been reviewed.
 - 2. Pumped Concrete: At least 14 days before starting work, submit details of proposed pumping operation, equipment to be used, and mix designs. Do not pump concrete if Engineer feels an unsatisfactory concrete may result from the overall planned process and equipment.
- F. To demonstrate their capabilities and experience, provide qualification data for Contractor's proposed independent testing agency that will provide the testing services specified under **PART 4 TESTING**. Do not use the same agency that provides the mix design proposal specified herein. To qualify for acceptance, the independent testing agency must demonstrate, based on the evaluation criteria in ASTM C1093, that it has the experience and capability to satisfactorily conduct the testing indicated.
- G. Water-Holding Basin Repair Methods: As necessary if water holding basins fail tests as specified. Cracks shall be repaired by the epoxy injection process.
- H. Crack Repair Report: Epoxy injection materials manufacturer certification that crack repair was performed by a licensed and certified applicator per the manufacturer's recommendations.

PART 2 PRODUCTS

2.01 PROPORTIONING AND DESIGN OF MIXES

A. The following mix properties are required for all concrete placement within forms:

1. Proportion and design concrete mixes shall meet the following requirements:

Strength @ 7 days	2400 psi
Strength @ 28 days	4000 psi
Maximum water/cement ratio	0.43 by weight
Slump @ point of placement	
Without superplasticizer	3-5 inches
With superplasticizer	5-10 inches
Minimum Cement Content	6 sacks/yard or 564 pounds per cubic yard
Entrained Air	4-6%
Maximum Aggregate Size	1-½ inch, as defined below, un- less shown on the Drawings.

2. Design shall be by an approved independent testing laboratory and a trial mix batch shall be made and tested by that laboratory. Average strength of cylinders in trial batch must exceed specified strength by 15%.

3. A previously used mix design may be used provided aggregate source is the same, the mixing equipment is the same, and provided at least 10 tests were made by an independent laboratory with results meeting these specifications.

4. If any of the first three 7-day cylinder tests fail to meet the specified 7-day strength, the mix shall be modified for more strength. Submit modified mix for review before use.

5. Adjustment to Concrete Mixes: Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, at no additional cost to the Owner. Test data for revised mix designs and strength results must be submitted and accepted before using the mix adjustments.

6. Entrained Air: Air-entraining admixture shall be used unless otherwise shown or specified. Air-entraining admixture shall be added at the manufacturer's prescribed rate to result in concrete at the point of placement with an air content as specified herein (volume basis).

7. Concrete shall be mixed in conformance with ASTM C94.

B. Entrained air admixtures shall be used according to the manufacturer's prescribed rate. Test in accordance with ASTM C231.

C. The use of an accelerating agent is not permitted unless specifically authorized by the Engineer.

D. Combined Aggregate Gradings:

1. Aggregate size shall be 1-inch maximum for slabs, grade beams, interior walls, and sections less than 12 inches thick.
2. Aggregate size shall be 3/4-inch maximum for structures with textured surfaces.
3. Aggregate size shall be 1½-inches maximum for all other areas or sections, unless otherwise indicated on the Drawings.
4. Grading limits for coarse aggregate shall be as follows:

Sieve Size	Percentage Passing		
	1-1/2" Max.	1" Max.	3/4" Max.
2"	-100	--	--
1-1/2"	95-100	-100	--
1"	--	95-100	-100
3/4"	25-60	--	90-100
1/2"	--	25-60	--
3/8"	--	--	40-90
No. 4	0-10	0-10	5-20
No. 8	0-5	0-5	0-5

5. Grading limits for fine aggregate shall be as follows:

Sieve Size	Percentage Passing
3/8"	-100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	2-10
No. 200	0-4

6. The combined mixture of fine and coarse aggregate shall be such that not more than 1.5 percent passes the No. 200 sieve.

2.02 PORTLAND CEMENT

- A. Meet ASTM C150, Type V or Dakotah Cement Type I-III A (low alkali) sulfate resistant, including low alkali provisions of Table 2 of that specification.

- B. Nonhydraulic Abovegrade Structures: Use either Type I-IIA or Type V cement.
- C. Hydraulic and Belowgrade Structures: Use Type V cement.
- D. The use of Type V cement is not absolutely required. If Type V cement is not available, all concrete shall contain Dakotah Cement Type I-IIA with a maximum 15 percent Type F Flyash added, as specified hereinafter.

2.03 AGGREGATES

- A. Fine: Clean, sharp, natural sand, ASTM C 33. Fineness modulus shall not be less than 2.5 nor more than 3.0. Materials passing 200 sieve shall be 4 percent maximum.
- B. Coarse: Crushed stone or gravel, ASTM C 33. Maximum size of coarse aggregate shall be 1½-inches as defined hereinbefore, unless otherwise indicated on the Drawings. Materials passing 200 sieve shall be 0.5 percent maximum.
- C. Aggregates shall be natural, free from deleterious coatings, meeting ASTM C 33, nonreactive. Thoroughly and uniformly wash before use. Local aggregates, including the alkali reactive fine aggregate (Birdsall Blunt sand), are acceptable with the exception that they can only be used with Dakotah Cement Type I-IIA and Type F Flyash added as specified.
- D. Local aggregates not in compliance with the soundness and durability requirements of this standard shall not be used except with prior written approval of the Engineer and provided it can be shown by special testing or a record of past performance that these aggregates produce concrete of adequate strength and durability. Aggregate soundness testing for fine and coarse aggregates shall be in accordance with ASTM C 88 using a sodium sulfate solution.

2.04 WATER

- A. All water for concrete mixtures shall be clean, potable, and free from injurious substances and conforming to ASTM C 94. Water containing 2 percent or more common salt shall not be used and chloride levels shall be less than 500 parts per million.

2.05 AIR ENTRAINING ADMIXTURES

- A. Air entraining admixtures shall be used in all concrete exposed to the weather and as specified for quality of concrete used, ASTM C 260, except that admixture shall be non-toxic after 30 days and contain no chlorides or other chemicals causing corrosion.
 - 1. "Aerolith," Sonneborn Building Products, Inc.
 - 2. "MB-VR," Master Builders Company.
 - 3. "Sika-AER," Sika Chemical Corp.
 - 4. "Darex AEA," W.R. Grace and Company.

5. "Protex," Protex Industries, Inc.

B. Must be compatible with water-reducing admixture.

2.06 WATER-REDUCING ADMIXTURES

A. Water-reducing admixtures shall conform to ASTM C 494, Type A or Type D.

B. Complex, multi-component, nonchloride, noncorrosive admixture providing unique performance qualities unobtainable from conventional water-reducing admixtures.

C. Manufacturer and Product:

1. Master Builders, Inc., Cleveland, OH, Pozzolith or Pozzolith Polyheed.
2. W.R. Grace & Co., Cambridge, MA, WRDA-79.

D. Must be compatible with air entraining admixture.

2.07 SUPERPLASTICIZERS

A. Meet ASTM C494 and use only Type F or G.

B. Hold slump of 5 inches or greater for the time required for placement into the structure.

C. Type F Superplasticizer: Batch plant added to extend plasticity time, control temperature of fresh concrete, reduce water 20 to 30 percent, and give higher strengths at all ages.

D. Type G Superplasticizer: Batch plant added to extend plasticity time, maintain setting characteristics similar to normal concrete throughout its recommended dosage range and at varying concrete temperatures, reduce water 30 to 40 percent, and give high-early and ultimate strengths.

E. Manufacturer and Product:

1. Master Builders, Inc., Cleveland, OH, Rheobuild or Pozzolith Polyheed at a dosage greater than 10 ounces per 100 pounds of cement.
2. W.R. Grace & Co., Cambridge, MA, Daracem 100.
3. Euclid Chemical Co., Cleveland, OH, Eucon Super F or 537G.

2.08 FLY ASH

A. Fly ash is permitted to be used with Dakota Cement Type I-III A. Submit complete manufacturer's literature. If used, conform to ASTM C618, Type F modified to allow $\text{SiO}_2 + \text{Al}_2\text{O}_3 + \text{FeO}_3$ minimum 66 percent and SiO_2 minimum 40 percent and to require a maximum loss on ignition of 2 percent. Do not use to replace more than 15% of cement by weight. Maximum water to cement plus fly ash ratio shall not exceed 0.36 by weight.

2.09 CALCIUM CHLORIDE

- A. Calcium chloride and products containing more than 0.1% chloride ions are not permitted. Provide admixture manufacturer's written certification that chloride ion content complies with specified requirements.

2.10 CONCRETE CURING MATERIALS

- A. Do not use curing compound where additional finishes such as hardeners, paintings, and other special coatings are required. Use water curing as specified instead.
- B. Absorptive cover shall be provided by burlap cloth made from jute or kenaf, weighing approximately 9 ounces per square yard and complying with AASHTO M 182, Class 2.
- C. A moisture retaining cover shall comply with one of the following:
 - 1. Waterproof paper, ASTM C 171 or AASHTO M 171.
 - 2. Polyethylene film, ASTM C 171.
 - 3. Curing Compound: Resin based compound conforming to ASTM C 309, with additional requirement that the moisture loss shall not exceed 0.030 gm/square cm/72 hours.
- D. Manufacturer's certification shall state that curing compound can be applied in one coat and shall show the quantity or coverage required to meet or exceed that above moisture retention.
- E. Provide manufacturer's certification that curing compound is acceptable to the appropriate state agency or health department.

2.11 CRACK REPAIR EPOXY

- A. SCB Process by Adhesive Engineering Co., San Carlos, CA.
- B. Two-component epoxy injection by Sika Chemical Corp., Lyndhurst, NJ.
- C. Or equal.

2.12 NON-SHRINK GROUT

- A. Nonshrink Grout Category I:
 - 1. Nonshrink, nonmetallic, nongas-liberating grout for use in filling tie holes in concrete, blockouts for gate guides, joints of precast components or members, and grouting baseplates of columns that do not exceed one story in height shall be one of the following:
 - a. Crystex, L&M Construction Chemicals, Inc., Omaha, NE
 - b. EUCO NS grout, Euclid Chemical Co., Cleveland, OH
 - c. Five Star Special 100, U.S. Grout Corp., Fairfield, CT
 - d. SET nonshrink grout, Master Builders Co., Cleveland, OH
 - e. Supreme grout, Gifford Hill & Co., Dallas, TX
 - f. UPCON "Super Flow", UPCO Co., Cleveland, OH

2. All grout shall be a fluid consistency in use except that for formwork tie holes the grout shall be dry pack consistency and shall fill the conical section with dense grout hammered in with steel tool and steel hammer.
3. Use Category II grouts for patching defects in walls and slabs after form removal.

B. Nonshrink Grout Category II:

1. Nonshrink grout with natural aggregate for use in high strength, precision support of machine bases of 25 hp or less; bases for precast wall sections, columns, and precast members more than one story in height; and patching defects in walls and slabs after form removal shall conform to the Corps of Engineers' Specification for Non-Shrink Grout, CRD-C261-81 and to these specifications. Fluid grout as determined by the flow cone, CRD-C611-81, shall have a minimum strength of 4,800 psi at 7 days and 6,800 psi at 28 days as determined by CRD-C227. The following listed grouts are acceptable for use as Category II grout (field test requirement shall be met):
 - a. Conbextra High Flow, Fosroc, Twinsburg, OH
 - b. Five Star Special 100, U.S. Grout Corp., Fairfield, CT
 - c. EUCO HI-FLOW Grout, Euclid Chemical Co., Cleveland, OH
 - d. Master Flow 713, Master Builders, Cleveland, OH
 - e. Supreme grout, Gifford Hill & Co., Dallas, TX
 - f. UPCON "Super Flow", UPCO Division, Cleveland, OH
2. No material other than water shall be added to the premixed grout at the jobsite. Follow manufacturer's instructions relative to mixing, placing, and curing.

C. Nonshrink Grout Category III:

1. Nonshrink grout for use in high strength, precision support of machine bases for machinery of 30 hp or greater and soleplates where very large loads and stresses from vibration and other dynamic loads are involved and when the equipment will be subject to thermal movements. The following grouts are acceptable for use as Category III grout (field test requirements shall be met):
 - a. Embeco 636, Master Builders, Cleveland, OH
 - b. Conbextra High Flow, Fosroc, Twinsburg, OH
 - c. EUCO Hi-Mod grout, Euclid Chemical Co., Cleveland, OH
 - d. CRYSTEX, L&M Construction Chemicals, Inc., Omaha, NE
2. The location for use, other than that specified above, shall be as shown on the Drawings and/or as specified hereinafter.
3. The grout shall be free of gas-producing or gas-releasing agents, free of oxidizing catalysts, free of inorganic accelerators, and free of chlorides. Provide performance characteristics when mixed to fluid consistency, 22 to 25 seconds (flow cone method, CRD-C 611-80) as follows:
 - a. When mixed and maintained at 45 degrees F (7 degrees

- C) or higher, no visible bleeding and/or settlement up to 2 hours on 1/2 gallon grout poured into gallon can, covered with glass plate to prevent evaporation.
 - b. Grout shall be cured in accordance with grout manufacturer's instructions.
 - c. Provide (2" x 2" cube) strengths as specified. Prepare specimens and test in accordance with ASTM C 109-80 except as follows: Mix grout in accordance with manufacturer's instructions. Fill molds in two layers, puddling each layer gently with gloved finger five times; strike off excess grout; wipe edges of mold clean with rag and cover with steel plate clamped to mold until time to test. Seal cover 24 hours after placement.
- 4. The grout shall obtain a minimum compressive cube strength of 5,000 psi at 3 days and 9,000 psi at 28 days (2-inch cubes).

2.13 GROUT FOR HORIZONTAL CONSTRUCTION JOINTS IN WALLS

- A. Neat cement grout shall be flowable and shall consist of sand, water, and a minimum of 12 sacks of cement per cubic yard. Provide positive measuring device such as a bucket or other device that will contain only enough grout for depositing in one place in the wall to ensure that any one portion of the form does not receive too much grout. The depositing of grout from pump hoses or large concrete buckets will not be permitted, unless inspection windows close to the joint are available to allow visual measurement of grout thickness and means for grout removal are available for removal of excess grout. Refer to PART 3 EXECUTION portion of these Specifications for other requirements.

2.14 SURFACE HARDENER

- A. Surface hardeners shall consist of a colorless aqueous solution of sodium silicate and magnesium and zinc fluosilicates suitable for application to cured or partially cured concrete surfaces and capable of reacting with the soluble calcium compounds present in the concrete to form a thin surface of increased hardness with reduced potential for dusting.
- B. Approved proprietary hardeners include:
 - 1. Saniseal 100, Master Builders Company.
 - 2. Hornolith, A.C. Horn Incorporated.
 - 3. Lapidolith, Sonneborn Company.
 - 4. Pena-Lith, W.R. Meadows Incorporated.
- C. The solution shall be delivered ready for use at the job site.

2.15 CONTROL JOINT FORMS

- A. Control Joint Forms: A standard manufacturer's item causing a control joint in the slab while providing keying across the joint. It shall not leave any portion projecting at the finished surface and it shall interrupt at least 1/4 of the slab depth. The joint or the method of installation shall insure a straight joint deviating not more than 1/2-inch from a straight line.

2.16 EPOXY BONDING AGENT

- A. Two component material suitable for use on dry or damp surfaces.

Provide material "Type", "Grade", and "Class", to suit project requirements. Meet the requirements of ASTM C 881.

- B. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Edoco 2118 Epoxy Adhesive; Edoco Technical Prod.
 - 2. Sikadur Hi-Mod; Sika Chemical Corp.
 - 3. Euco Epoxy 463 or 615; Euclid Chemical Corp.
 - 4. Patch and Bond Epoxy; The Burke Co.

2.17 FIBER REINFORCEMENT

- A. Polypropylene fibers engineered and designed for secondary reinforcement of concrete tanks, basins, and slabs. Fiber reinforcement shall comply with ASTM C 1116, Type III.
- B. Products shall be subject to compliance with the ASTM requirements, as provided by:
 - 1. Fibermesh, Fibermesh Company, Division Synthetic Industries Inc.
 - 2. Forta CR, Forta Corporation.
 - 3. Grace Fibers, W.R. Grace and Company.
- C. Add fiber reinforcement to concrete mix at a rate of 3.0 pounds/cubic yard for the wetwell walls and 1.5 pounds/cubic yard for concrete slabs unless otherwise recommended by the manufacturer.

2.18 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60(Grade 420, deformed

PART 3 EXECUTION

3.01 CONCRETE MIXING

- A. The materials for concrete shall be mixed at an acceptable concrete batch plant. Meet ACI 304 current edition and other requirements as specified for mix design, testing, and quality control.
- B. Ready-mix concrete shall comply with the requirements of ASTM C94 and as herein specified:
 - 1. The addition of water to the mix at project site must be approved by the Engineer and the maximum water-cement ratio shall not be exceeded. The delivery ticket shall be noted with amount of additional water added and submitted to the Engineer.
 - 2. Concrete shall be discharged at the job within 1-1/2 hours after water has been added to the cement and aggregates or cement batched with the aggregates, unless a longer time is specifically authorized by the Engineer.

3. During hot weather or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required:
 - a. When the air temperature is between 85 degrees Fahrenheit and 90 degrees Fahrenheit, the mixing and delivery time shall be reduced from a maximum of 1-1/2 hours to 75 minutes and when the air temperature is above 90 degrees Fahrenheit, the mixing and delivery time shall be reduced to no more than 60 minutes.

C. Truck Mixers:

1. Equip with electrically actuated counters to readily verify the number of revolutions of the drum or blades.
2. Counter:
 - a. Resettable, recording type, mounted in driver's cab.
 - b. Actuated at time of starting mixers at mixing speeds.
3. Performance Requirements:
 - a. Truck mixer operation shall provide a concrete batch as discharged within acceptable limits of uniformity with respect to consistency, mix and grading.
 - b. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than 1 inch when specified slump is 3 inches or less, or differing by more than 2 inches when specified slump is more than 3 inches, discontinue use of truck mixer unless causing condition is corrected and satisfactory performance is verified by additional slump tests.
 - c. Check mechanical details of mixer, such as water measuring, and discharge apparatus, condition of blades, speed of rotation, general mechanical condition of unit, and clearance of drum before attempting to reuse unit.
4. Do not use nonagitating or combination truck and trailer equipment for transporting ready-mixed concrete.

D. Mixing Process:

1. Concrete Volume in Truck:
 - a. Limit to 63 percent of total volume capacity per ASTM C94 when truck mixed.
 - b. Limit to 80 percent of total volume capacity when central mixed.
2. Mix each batch of concrete in truck mixer for minimum 70 revolutions of drum or blades at rate of rotation designated by equipment manufacturer as mixing speed.
3. Perform additional mixing, if required, at speed designated by equipment manufacturer as agitating speed.
4. Place materials, including mixing water, in mixer drum before actuating the revolution counter for determining the number of mixing revolutions.

3.02 PREPARATION

- A. Pre-Placement Inspection:
 - 1. Before placing concrete, the Contractor will inspect and complete the formwork installation, placement of reinforcing steel, and items to be embedded or cast-in. Reinforcing shall not be stabbed into freshly placed concrete.
 - 2. The wood forms shall be wetted immediately before placing the concrete when form coatings are not used. Dampen subgrade before placing concrete for slabs on grade unless a vapor barrier is used.
 - 3. The installation of joint materials shall be coordinated with the placement of forms and reinforcing steel.
 - 4. Secure reinforcement in position and allow Engineer to review acceptability before placing concrete.
- B. Sleeves, Anchors and Inserts: All sleeves, anchors, and inserts required shall be properly placed, as detailed in the Drawings, in the concrete formwork and securely anchored to prevent displacement during the placing of the concrete.

3.03 CONCRETE PLACEMENT

- A. Concrete shall be placed in compliance with the practices and recommendations of ACI Standards 304, 318, and 614, and as herein specified:
 - 1. Concrete shall be placed continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, the Contractor shall provide construction joints as specified in Section 03251, EXPANSION AND CONSTRUCTION JOINTS. The placement of concrete shall be done at such a rate that concrete is still workable. Concrete shall be placed as near as practicable to its final location to prevent segregation due to rehandling or flowing. Do not subject concrete to any procedure which will cause segregation.
 - 2. In no case shall concrete be allowed to freely drop more than five feet.
 - 3. Screed concrete which is to receive other construction to the proper level to avoid excessive skimming or grouting.
 - 4. Concrete which has become non-plastic and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign material shall not be used. Do not use retempered concrete. Remove rejected concrete from the project site and dispose of it at an approved location.
 - 5. Concrete discharge time shall be less than 90 minutes after adding cement to water and aggregate.
- B. Placing Concrete Into Forms:

1. Concrete shall be placed in forms in horizontal layers not deeper than 18 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while the preceding layer is still workable to avoid cold joints.
 2. Temporary spreaders in forms shall be removed when concrete placement has reached the elevation of such spreaders.
 3. Concrete placed in forms shall be consolidated by mechanical vibrating equipment supplemented by hand-spading, rodding, and tamping. Use equipment and procedures for consolidation of concrete in accordance with the recommended practices of ACI 309, to suit the type of concrete and project conditions. Vibration of forms and reinforcing will not be permitted.
 4. Vibrators shall not be used to transport concrete inside of the forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the layer of concrete and at least 6 inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration of the vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix. Generally, this will be from 5 to 15 seconds in accordance with ACI 301.
 5. Allowable Vertical Free Fall Drop to Final Placement:
 - a. 5 feet in forms 8-inch or less wide and 8 feet in forms wider than 8 inches, except as hereinafter specified.
 - b. Superplasticized Mixes: Up to 15 feet if slump is over 6 inches.
 6. Do not use aluminum pipe or other aluminum conveying devices.
 7. Provide sufficient illumination for interior of forms so concrete at places of deposit is visible to permit confirmation of consolidation quality.
- C. Conveyor Belts and Chutes:
1. Design and arrange ends of chutes, hopper gates, and other points of concrete discharge throughout conveying, hoisting, and placing system such that concrete passing from them will not become segregated.
 2. Do not use chutes longer than 50 feet.
 3. Minimum Slopes of Chutes: Angled to allow concrete of specified consistency to readily flow without segregation.
 4. Conveyor Belts:
 - a. Approved by Engineer.
 - b. Wipe clean with a device which does not allow mortar adhering to the belt to be wasted.
 - c. Cover conveyor belts and chutes.
- D. Retempering: For concrete or mortar in which cement has partially

hydrated, retempering is not permitted.

E. Pumping of Concrete:

1. General:

- a. Pumping is the preferred method of placing concrete.
- b. If pumped concrete does not produce satisfactory end results, discontinue pumping operation until the problem is corrected.
- c. At Contractor's option, other approved methods of placement may be used.

2. Equipment:

- a. Provide standby pump, conveyor system, crane and concrete bucket, or other system acceptable to Engineer, on site during pumping, for adequate redundancy to assure completion of concrete placement without cold joints in case of a primary placing equipment breakdown.
- b. Minimum Pump Hose (Conduit) Diameter: 4 inches.
- c. Replace pumping equipment and hoses (conduits) that are not functioning properly.
- d. Do not use aluminum conduits for conveying concrete.

3. Field Control (For Pumped Concrete): Take concrete samples for slump (ASTM C143) and test cylinders (ASTM C31 and C39) and shrinkage specimens (ASTM C157) at placement (discharge) end of line.

F. Maximum Size of Concrete Placements:

1. Limit size of each pour regardless whether slabs or walls, to allow for strength gain and some volume change due to shrinkage to take place. Size shall be as specified hereinafter.
2. Expansion and Construction Joints:
 - a. Unless otherwise shown, where expansion joints are shown at approximately 60 feet spacing, intermediate construction joints are not required.
 - b. Where expansion joints are not shown or where expansion joints are spaced at larger distances, provide intermediate construction joints at maximum 40 feet unless approved in writing.
 - c. Locate joints, where not otherwise shown, as detailed on approved shop drawings.
 - d. Alternate pours at each side of construction joints with 10 days minimum curing time between pours.

G. Removal of Water: Remove all water from space to be occupied by concrete.

H. Consolidation And Visual Observation:

1. Consolidate concrete with internal vibrators with minimum frequency of 8,000 vpm and amplitude required to consolidate concrete in section being placed.
2. Provide at least one standby vibrator in operable condition at

3. placement site prior to placing concrete. Consolidation equipment and methods shall meet ACI 309.
 4. Provide sufficient windows in the forms or limit form height to allow visual observation of concrete.
 5. Vibrator operator shall be required to see concrete being consolidated to ensure good quality workmanship, or an individual shall actually observe the vibration of concrete at all times and advise vibrator operator of any changes needed to ensure complete consolidation.
 6. Consolidation and placement locations shall be planned and accomplished so that vibrators shall be inserted in the concrete as it is placed and in locations not to exceed a distance of 5 feet from point of placement.
- I. Placing Concrete Slabs on Grade:
1. Prior to concrete placing, any area of subgrade on which concrete is to be placed shall be properly wetted. Concrete slabs shall be placed in a continuous operation, within the limits of construction joints, until the placement of a panel or section is completed. When in-place concrete has sufficiently set up (at least 24 hours), an alternate section shall be placed. All joints between sections shall be properly keyed. The edges of all sections shall be tooled with a minimum radius or chamfer edging tool.
 2. Concrete shall be consolidated during placement operations using vibrating equipment, so that the concrete is thoroughly worked around reinforcement and other embedded items and into the corners.
 3. Slab surfaces shall be brought up to the correct level with a straightedge and struck off. Bull floats or darbies may be used to smooth the surface, leaving it free from humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.
 4. Control Joints for Slabs on Grade:
 - a. Locate as shown on the Drawings. Where not indicated, locate at 13 foot maximum intervals in both directions.
 - b. Construct with a manufactured, embedded, preformed control joint form or stop pour at each control joint using keyway forms. Install form with no offsets and in straight lines as specified elsewhere.
 - c. Sawn control joints will be permitted. Saw joint 1½-inches deep or to depth indicated on the Drawings. Start sawing within 12-hours of final floating, but delay as necessary to prevent raveling.
 5. Reinforcing steel shall be continuously maintained in the proper position during concrete placement operations.

6. All exterior concrete slabs shall be sloped in a manner to prevent the collection of water.

J. Bonding:

1. Surfaces of set concrete at all joints shall be roughened, except where bonding is obtained by use of an approved concrete bonding agent, and the surfaces shall be cleaned of laitance coating, loose particles, and foreign matter. Surfaces shall be roughened in a manner to expose bonded aggregate uniformly and laitance, loose particles of aggregates, or damaged concrete at the surface shall be removed.
2. Bonding of fresh concrete to new concrete that has set, but is less than 60 days old or is not fully cured shall be done as follows:
 - a. At joints between a footing and walls or columns, and between walls or columns and beams or slabs that they support, and elsewhere unless otherwise specified herein, dampen, but do not saturate, the roughened and cleaned surface of set concrete immediately before placing the fresh concrete.
 - b. At horizontal joints in exposed work, and at joints designed to contain liquids, dampen, but do not saturate, the roughened and cleaned surface of set concrete and apply a minimum 2-inch layer of neat cement grout.
 - c. Neat cement grout as specified hereinbefore shall be applied to a minimum thickness of 2 inches. Fresh concrete shall be placed before the cement grout has attained its initial set. Limit concrete lift placed immediately on top of grout to 12 inches.
 - d. An approved commercial bonding agent may be used in lieu of neat cement grout. The agent shall be applied to cleaned concrete surfaces in accordance with the printed instruction of the bonding agent manufacturer.
3. Epoxy bonding adhesive shall be applied in accordance with the manufacturer's recommendations for bonding to old concrete (more than 60 days old). Coat contact surfaces with bonding agent after mechanically roughening surface to a clean, rough surface.

K. Cold Weather Placing:

1. All concrete work shall be protected from physical damage or reduced strength which could be caused by freezing or low temperatures, in compliance with the requirements of ACI 306 and ACI 318 and as herein specified.
2. When the temperature of the surrounding air is expected to be below 40 degrees Fahrenheit during concrete placement or within 3 days (72 hours) thereafter, the temperature of the placed concrete shall be maintained at temperatures no lower than 60 degrees Fahrenheit for sections less than 12 inches in

any dimension or 55 degrees for any other section. Heated water and/or aggregate shall be used in accordance with ACI 306.

- a. The placed concrete temperature shall be main-tained at or above the specified temperatures for curing for at least 7 days.
3. Frozen concrete materials containing ice or snow shall not be used. Concrete shall not be placed on frozen subgrade or on subgrade containing frozen materials. The Contractor shall determine that the forms, reinforcing steel, and adjacent concrete surfaces are entirely free of frost, snow, and ice before placing any concrete.
4. The use of calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators shall not be allowed, unless authorized in writing by the Engineer.
5. Strength requirements may require additional protection and curing during cold weather due to delayed field strength gain.
6. Determine strength attainment, and the requirement for continue protection, from field test cylinders, cured along side the cast concrete structure.
7. Surface Temperature:
 - a. The actual temperature of concrete surface determines effectiveness of protection, regardless of air temperatures or whether the objective is durability or strength.
 - b. Provide a sufficient number of thermometers placed on concrete surfaces spaced throughout the work to allow inspection and monitoring of concrete surface temperatures representative of all the work.
8. External Heating Units:
 - a. Vent heating units and do not locally heat or dry concrete.
 - b. Do not exhaust flue gases directly into an enclosed area.
 - c. Ensure fire safety and fire prevention measures are enforced during use of heating units.
9. Maintain curing conditions which will foster normal strength development without excessive heat, and without critical saturation of concrete at the close of the protection period.
10. Limit rapid temperature changes, particularly before strength has developed sufficiently to withstand temperature stresses.
11. At end of the required period, discontinue protection in such a manner that the drop in temperature of any portion of concrete will be gradual and will not exceed, in 24 hours, 50 degrees F.
- L. Hot Weather Placing:
 1. When hot weather conditions exist that would seriously impair

the quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

2. The ingredients shall be cooled before mixing to maintain the concrete temperatures at the time of placement below 80 degrees Fahrenheit. Mixing water may be chilled or chopped ice may be used.
3. The use of retarding admixtures will not be allowed, unless otherwise accepted in mix designs by the Engineer.
4. The forms shall be thoroughly wetted before placement of concrete. Make provisions for windbreaks, shading, fog sprays, sprinkling, or wet cover, when necessary.
5. Reflective Cracking:
 - a. Prevent reflective cracking due to differential temperatures between concrete and reinforcing steel.
 - b. If reinforcement is in direct sunlight or is more than 20 degrees F higher in temperature than concrete temperature before placement, wet reinforcement to cool it with water fog spray 10 minutes before placing concrete. Alternatively, reinforcing steel may be covered with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
 - c. Verify temperature of reinforcing is not more than 20 degrees F higher than fresh concrete.

3.04 JOINTS

A. Construction Joints:

1. Construction joints shall be located and installed as shown on the Drawings in a manner that will not impair the strength and appearance of the structure. Construction joints, if not shown, shall be located only with approval of the Engineer and as follows:
 - a. The Contractor shall provide key-ways at least 1-1/2 inch deep in all construction joints in walls, slabs, and between walls and footings.
 - b. Construction joints shall be placed perpendicular to the main reinforcement and all reinforcement shall continue across construction joints.
 - c. Construction joints shall be prepared as specified in ACI Standard 318.

B. Expansion joints shall be located as shown on the Drawings. Expansion joints shall be held down to receive the joint sealant. The horizontal and vertical waterstop shall be welded together to provide a continuous watertight seal.

C. For bonding to new concrete horizontal construction joints, roughen the

surface of the hardened concrete. Thoroughly clean and saturate with water, cover the horizontal surfaces only with at least two to three inches of grout, as hereinbefore specified, and immediately place concrete. New concrete is defined as less than 60 days old. Limit the concrete lift placed immediately on top of the grout to 12-inches thick and thoroughly vibrate to mix and consolidate the grout and concrete together.

D. Also see Section 03251, EXPANSION AND CONSTRUCTION JOINTS.

3.05 FINISH OF FORMED SURFACES

A. Rough Form Finish:

1. This finish shall include formed concrete surfaces buried from view by backfill in the finish work or covered by other construction, unless otherwise shown or specified. Any surface which will be exposed to the air or water in the completed structure shall be a smooth form finish.
2. The standard rough form finish shall leave the concrete surface with the texture imparted by the form facing material used, with tie holes and defective areas repaired and patched and all fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.
3. Fill snap-tie holes with nonshrink, non-metallic grout as specified herein. Patch honeycomb areas and rock pockets with grout as specified herein. Small air holes do not require patching.

B. Smooth Form Finish (trowel finish):

1. This finish includes formed concrete surfaces which will be exposed to the air or water in the completed structure or to be covered with a coating material applied directly to the concrete, or a covering material bonded to the concrete, such as water proofing, damp-proofing, painting, or other similar system.
2. A smooth form finish shall be provided by selecting form materials that will impart a smooth, hard, uniform texture and arranging them orderly and symmetrically with a minimum of seams. All defective areas shall be patched and repaired with all fins or other projections completely removed and smoothed.
3. For smooth form finish walls:
 - a. Fill snap-tie holes with approved nonshrink, nonmetallic color matched grout as specified herein.
 - b. Grind off projections, fins, and rough spots.
 - c. Repair other defects such as honeycomb areas, rock pockets, and rough spots resulting from form release agent failure or other reason with color matched nonshrink grout as specified herein.
4. For smooth form trowel finish slabs:
 - a. Finish by screeding and floating with straight-edges to bring surface to required finish elevation shown.
 - b. While concrete is still green, but sufficiently hardened to bear a person's weight without deep imprint, wood float to true, even plane with no coarse aggregate visible.

- c. Use sufficient pressure on wood floats to bring moisture to surface.
- d. After surface moisture has disappeared, hand trowel concrete to produce smooth, impervious surface, free from trowel marks.
- e. Burnish surface with an additional troweling. Final troweling shall produce a ringing sound from trowel.
- f. Do not use dry cement or additional water during troweling. No excessive troweling will be permitted.
- g. Power Finishing:
"An approved power machine may be used in lieu of hand finishing for finishing concrete floors and slabs in accordance with directions of machine manufacturer.
"Do not use power machine when concrete has not attained the necessary set to allow finishing without introducing high and low spots in slab.
"Do first steel troweling for slab by hand.

C. Grout Cleaned Finish (sacked rubbed finish):

1. A grout cleaned finish will be applied to all concrete surfaces as specified hereinafter which have received smooth form finish treatment.
2. The grout cleaned finish will use one part portland cement to 1-1/2 parts fine sand by volume, and shall be mixed with water to a consistency of thick paint. Proprietary additives may be used at the Contractor's option. Standard portland cement and white portland cement amounts shall be blended as determined by trial patches, so that final color of dry grout will match adjacent surfaces.
3. The concrete surfaces shall be thoroughly wetted before the application of grout to the surfaces and to fill small holes. Excess grout will be removed by scraping and rubbing with clean burlap.

D. Broomed Finish:

1. Finish as specified for trowel floor finish, except omit final troweling and finish surface by drawing a fine-hair broom lightly across the surface.
2. Brooming: In same direction and parallel to expansion joints, or, in the case of inclined slabs, perpendicular to slope, except for round roof slab, broom surface in radial direction.

E. Sidewalk Finish:

1. Slope walks down ¼ inch per foot away from structures, unless otherwise shown.
2. Strike off surface by means of strike board and float with wood or cork float to a true plane, then flat steel trowel before brooming.
3. Broom surface at right angles to direction of traffic.
4. Lay out sidewalk surfaces in blocks with an approved grooving tool as shown or as directed by Engineer.

F. Related Unformed Surfaces:

1. At horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, the placed concrete shall be struck off smooth and finished with a texture matching the adjacent formed surfaces. Continue the final surface treatment of the formed surfaces uniformly across the adjacent unformed surfaces, unless otherwise shown on the Drawings.

- G. A 3/4-inch chamfer shall be provided at the top of all exposed walls, except where support angles are installed, and at exposed vertical corners.

- H. In addition to the description of various finishes above, concrete surfaces shall be finished in accordance with ACI Standards 301 and 302 as scheduled below:

<u>Surface</u>	<u>Finish</u>
Interior Slabs	Smooth Trowel Finish
Exterior Slabs	Broom Finish
Exterior Concrete Above Grade; Interior Walls, Grade	Rubbed Finish
Columns, Beams and Ceilings	Rough Finish, Correct Defective Areas including Stone Pocket and Fill Tie Holes
Exterior Concrete Below Sidewalks	Sidewalk Finish

3.06 CONCRETE CURING AND PROTECTION

A. General:

1. Freshly placed concrete shall be protected from premature drying and excessive cold or hot temperature, and maintained without drying at a relatively constant temperature for the 7 day period of time necessary for the proper hydration of the cement. Concrete damaged by improper curing or placement methods shall be replaced by the Contractor and at no additional expense to the Owner.
2. Curing procedures shall begin immediately after placement of the concrete and continue for at least seven days or until concrete has attained 75 percent of its compressive strength in accordance with ACI 308.

B. Curing Method:

1. Liquid membrane curing shall be provided as follows:
 - a. The Contractor shall use a commercially produced liquid membrane forming curing compound for curing concrete which meets the requirements of ASTM C309.
 - b. Apply the specified membrane-forming curing compound to damp concrete surfaces as soon as the water film has disappeared. Apply uniformly in a 2-coat continuous operation by power spray equipment in accordance with

- the manufacturer's directions. Recoat all areas which are subjected to heavy rainfall within 3 hours after initial application. Maintain the continuity of the coating and repair any damage to the coat during the entire 7 day curing period.
- c. Membrane compounds shall not be used on surfaces which are to be covered with a coating material applied directly to the concrete or with a covering material bonded to the concrete, such as other concrete, liquid floor hardener, water-proofing, damp-proofing, flooring, paintings, and other coatings and finish materials.
- 2. Use approved water curing method where membrane compounds are not allowed.
 - 3. For walls, use one of the following curing methods:
 - a. Method 1: Leave concrete forms in place and keep entire exposed surfaces wet at all times.
 - b. Method 2: Apply specified curing compound as specified, where allowed, immediately after removal of forms. Apply curing compound in two coats. Each coat shall be applied at the manufacturers recommended rate for one coat application.
 - c. Method 3: Continuously sprinkle 100 percent of all exposed surfaces.
 - 4. For slabs, curbs, and sidewalks use one of the following curing methods:
 - a. Method 1: Protect surface by ponding.
 - b. Method 2: Cover with burlap or cotton mats and keep continuously wet.
 - c. Method 3: Cover with 1-inch layer of wet sand, earth, or sawdust, and keep continuously wet.
 - d. Method 4: Continuously sprinkle exposed surface.
 - e. Other agreed upon method that will provide moisture to be present and uniform at all times on all surface of slabs.
- C. Unformed surfaces shall be cured after finishing operations have been completed and as soon as marring of the concrete will not occur. The curing procedures shall continue for 7 days or until the concrete has attained 70 percent of its compressive strength in accordance with ACI 308.
- D. Temperature of Concrete During Curing:
- 1. When the atmospheric temperature is 40 degrees Fahrenheit and below, the concrete temperature shall be maintained between 50 and 70 degrees Fahrenheit continuously throughout the 7 day curing period. When necessary, the Contractor shall make arrangements before the placement of concrete for heating, covering, insulation or housing as required to maintain the specified temperature and moisture conditions continuously throughout the concrete curing period. Cold weather protections shall comply with the requirements of ACI 306.

- a. Where water curing as specified herein for slabs is not possible, use an approved curing compound as herein specified at twice the manufacturer's recommended coverage per gallon.
 - b. Where specified curing compound cannot be used, special methods using moisture shall be agreed upon prior to pouring the concrete slabs.
 - c. Protect slabs during cold weather with poly-ethylene sheeting or other material inside required heated enclosure if foot traffic is permitted on slabs.
2. When the atmospheric temperature is 80 degrees Fahrenheit and above, or during other climatic conditions which will cause a rapid drying of the concrete, the Contractor shall make arrangements before the start of concrete placement for the installation of wind breaks or shading, and for fog spraying, wet sprinkling, or a moisture-retaining covering. The concrete shall be protected continuously for the 7 day concrete-curing period. Hot weather concrete protection shall comply with the requirements of ACI 305.
3. The concrete temperature shall be maintained as un-iformly as possible, and protected from rapid at-mospheric temperature changes. Temperature changes in concrete which exceed 5 degrees Fahrenheit in any one hour and 50 degrees Fahrenheit in any 24-hour period shall be avoided and protected against.
- E. During the curing period the concrete shall be protected from damaging mechanical disturbances including load stresses, excessive vibration and from damage caused by rain or flowing water. All finished concrete surfaces shall be protected from damage by subsequent construction operations. Any damage incurred shall be repaired by the Contractor at no additional expense to the Owner.

3.07 CONCRETE REPAIRS

- A. Cracks in waterholding structures that are determined to have caused excessive leakage or damp spots, or if seepage is present on exposed surfaces:
 1. Epoxy inject all cracks with a two component epoxy as specified hereinbefore. Crack repairs shall be performed by a licensed applicator as specified hereinbefore.
- B. Defective surface areas shall be repaired and patched with grout as specified hereinbefore immediately after removal of forms and as directed by the Engineer.
- C. Repair of Formed Surfaces:
 1. Formed surfaces which will be exposed-to-view or air in the completed structure and contain defects which adversely affect the appearance of the finish shall be repaired. The concrete with the defective surfaces shall be removed and replaced at no additional expense to the Owner if the defects cannot be repaired to the satisfaction of the Engineer. Surface defects

- include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, and holes left by rods and bolts, fins, and other discolorations that cannot be removed by cleaning.
2. Concealed formed concrete surfaces that contain defects that adversely affect the durability of the concrete shall be repaired. If defects cannot be repaired, the defective concrete shall be removed and replaced at no additional expense to the Owner.

D. Repair of Unformed Surfaces:

1. Unformed surfaces such as monolithic slabs may be tested by the Engineer for smoothness and to verify that the surface planeness meets the tolerances specified for each surface and finish. Any low and high areas shall be repaired by the Contractor at no additional expense to the Owner as specified herein.
2. Unformed surfaces that contain defects which adversely affect the durability of the concrete shall be repaired. Surface defects include crazing, cracks in excess of 0.01 inch in width or which penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.
3. High areas in unformed surfaces shall be repaired by grinding after the concrete has cured sufficiently so that repairs can be made without any damage to adjacent areas.
4. Low areas in unformed surfaces shall be repaired during, or immediately after, completion of surface finishing operations by cutting out the low areas and replacing with fresh concrete. The repaired areas shall be finished to blend into adjacent concrete. Proprietary patching compounds may be used when approved by the Engineer.
5. Defective areas, except random cracks and single holes not exceeding 1-inch diameter shall be repaired, by cutting the area out and placing fresh concrete. Defective areas shall be removed to sound concrete with clean, square cuts, and shall expose reinforcing steel with at least 3/4-inch clearance all around. Concrete surfaces in contact with patching concrete shall be dampened and brushed with a neat cement grout coating or approved epoxy adhesive, or a concrete of the same type or class as the original adjacent concrete. Place, compact, and finish as required to blend with the adjacent finished concrete. The repaired area shall be cured in the same manner as adjacent concrete.
6. Isolated random cracks in non-water holding structures and single holes not over 1 inch in diameter shall be repaired by the dry-pack method. Groove the top of cracks, and cut out holes to sound concrete. Clean off all dust, dirt, and loose particles. Dampen all cleaned concrete surfaces and apply by brush a neat grout coating. Place dry-pack before the cement grout takes its initial set. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact the dry-pack mixture in place and finish

to match the adjacent concrete. Keep the patched areas continuously moist for not less than 72 hours.

7. Repair methods not specified above may only be used if approved by the Engineer.

3.08 SURFACE HARDENERS

- A. Interior slabs shall receive an application of surface hardener as recommended by the manufacturer of the surface hardener.
- B. Floors to receive hardener shall be thoroughly cured for at least 28 days, clean, unpainted, free from membrane curing compounds, and perfectly dry with all work above them completed. Apply liquid hardener evenly, using three coats, allowing 24 hours between coats. The first coat shall be 1/3 strength, second coat 1/2 strength, and third coat 2/3 strength, mix with water. Each coat shall be applied so as to remain wet on the concrete surface for 15 minutes. Apply approved proprietary hardeners in conformance with the manufacturer's instructions. After the final coat is completed and dry, remove surplus hardener from the surface by scrubbing and mopping with water.

3.09 CLEANING AND DISINFECTION OF STRUCTURES

- A. General: Refer to Section 13435, DISINFECTION AND CLEANING for more detailed description of cleaning and disinfection requirements.
- B. Cleaning: Clean thoroughly all interior concrete surfaces using water under pressure. The cleaning method adopted should accomplish the following: (1) remove all deposits of foreign nature; (2) remove all growths; (3) clean the slopes, walls, top, and bottom; (4) avoid damage to the structure; and (5) avoid pollution or oil deposits by workers and equipment. All water used in cleaning the concrete structures should be disposed of before allowing water to the structure.

3.10 MISCELLANEOUS CONCRETE ITEMS

- A. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on Drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.
- B. Grout base plates and foundations as indicated, using specified non-shrink grout. Use non-metallic grout for exposed conditions, unless otherwise indicated. Block out the original concrete or finish off a sufficient distance below the bottom of the machinery base to provide for the thickness of grout shown on the Drawings. After the machinery has been set in position and wedged to the proper elevation by steel wedges, the space between the bottom of the machinery base and the original pour of concrete shall be filled with a pourable nonshrinking type grout as hereinbefore specified.

3.11 REJECTIONS

- A. Concrete Strength: Concrete strength shall be considered satisfactory if the average test of the two 28-day specimens exceeds the specified

strength and neither specimen test falls below 95% of the specified strength. If the average strength of the two test specimens is less than specified and either specimen test is less than 95% of the specified strength, the concrete represented by the tests is rejected and must be removed and replaced at the Contractor's expense.

- B. Alignment: Where concrete slabs or walls do not meet the alignment requirements, the Contractor must grind off irregularities until they comply. However, if such removal leaves less concrete section than indicated, the Engineer may reject concrete if he feels the remaining section would not be adequate.
- C. Flatwork: Finished flatwork exceeding the tolerances of these specifications shall be repaired or replaced so that strength or appearance is not adversely affected. Follow paragraph 3.07 for repair work or as directed by Engineer.
- D. Appearance: Concrete exposed to view with defects which adversely affect the appearance of the specified finish may be repaired, if possible in accordance with paragraph 3.07. If, in the opinion of the Engineer, the defects cannot be repaired to equal the specified finish, the concrete shall be rejected.
- E. Misplaced Members: Concrete members cast in the wrong location may be rejected if the strength, appearance, or function of the structure is adversely affected or misplaced items interfere with other construction.
- F. Rejected Concrete: Rejected concrete shall be removed and replaced. Limits of removal shall be as directed by the Engineer to accomplish a structure equal in strength, serviceability, and appearance, to that which would have been achieved by acceptable concrete.
- G. Expense of Repairs: The cost of all repairs, removal, replacement, etc., required by the provisions of this Article shall be borne by the Contractor.

3.11 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice and other foreign materials that reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

PART 4 TESTING

4.01 TESTS OF AGGREGATE

- A. Provide tests of aggregate before concreting per ASTM C33. Tests may be waived by Engineer if aggregates to be used have shown actual use to produce concrete or required strength, durability, water-tightness, fire resistance, and wearing qualities. See Section 2.03 for additional information concerning local aggregates.

4.02 STRENGTH TEST OF CYLINDERS DURING WORK

- A. Provide for test purposes, sets of four cylinders each, taken for each 50 cubic yards or portions placed each day. Test one cylinder per set at 7 days, two at 28 days, and retain one for backup.
- B. Evaluation will be in accordance with ACI Standard Building Code Requirements for Reinforced Concrete (ACI 318 latest edition), Section 4.7, "Evaluation and Acceptance of Concrete", and these Specifications. Where the term "building official" is used in Section 5.6 of ACI 318, term shall be redefined to "the Owner's representative".
- C. Specimens will be made, cured, and tested by the Contractor's independent testing firm in accordance with ASTM C31 and ASTM C39.
- D. Frequency of testing may be increased at discretion of Engineer.
- E. Cold Weather Placement Tests:
 - 1. During cold weather concreting, Contractor's independent testing firm will cast cylinders for field curing as follows. Use method which will produce greater number of specimens:
 - a. Six extra test cylinders from the last 100 cubic yards of concrete.
 - b. Minimum three specimens for each 2 hours of placing time or for each 100 yards.
 - 2. These specimens shall be in addition to those cast by Contractor for lab testing.
 - 3. Protect test cylinders from the weather until they can be placed under same protection provided for the parts of the structure which they represent.
 - 4. Keep field test cylinders in same protective environment as the parts of the structure they represent, to determine if specified strength has been obtained and no further protection is needed.
 - 5. Test cylinders in accordance with applicable sections of ASTM C 31 and C39.
 - 6. Evaluation and Acceptance: As specified herein.

4.03 SLUMP TESTS

- A. Take slump tests with each strength test and as directed in accordance

with ASTM C143.

4.04 AIR CONTENT

- A. ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.

4.05 CONCRETE TEMPERATURE

- A. ASTM C1064; one test hourly when air temperature is 40 degrees F and below and when 80 degrees F and above, and one test for each set of compressive strength specimens.

4.06 TEST OF HARDENED CONCRETE

- A. Acceptance shall be based on concrete cylinder tests in accordance with Paragraph 3.11. Contractor may provide additional test by coring per ASTM C42 or load tests for that portion of job where questionable concrete has been placed. Such additional testing will be accepted in lieu of cylinder tests. Results of rebound hammer tests will not be accepted except in defining problem areas.

4.07 TESTING AGENCY

- A. All tests shall be made by an independent testing laboratory approved by the Engineer.

4.08 COST OF TESTING

- A. The Contractor shall bear all costs of testing required by this section including tests of hardened concrete where cylinder strengths indicate high or low strength concrete.

4.09 TEST RESULTS

- A. Submit two (2) copies of all tests to Engineer within 24 hours of testing.

4.10 CURE BOX

- A. Provide a cure box at the project site for initial cure of test cylinders. Construct and equip box to provide initial cure in accordance with ASTM C31.

4.11 WATER LEAKAGE TESTS

- A. Purpose: Determine integrity of finished concrete and to show exposed wall surfaces are visually acceptable.
- B. All Water-Holding Structures:
 - 1. Perform leakage tests after concrete has cured and obtained its design strength, and before backfill, or other work which will cover concrete wall surfaces is begun.
 - 2. Make other equipment, i.e., stop gates, sluice gates, valves,

etc., or temporary bulkheads water-tight prior to test.

3. As an alternative to having watertight bulkheads, gates, or valves, accurately measure the leakage through gates, valves, and bulkheads with methods acceptable to Engineer. An assumed leakage through gates and valves based on manufacturer's recommendations is not acceptable.
4. Fill with water to maximum liquid level prior to leak testing, and maintain level for 48 hours for moisture absorption by concrete.
5. Close all valves and gates to the structure and measure the change in water surface for a 24-hour period.
6. During test period, examine exposed portions of structure for dampness or leaks and mark visible leaks or damp spots.

C. Test Evaluation Criteria:

1. An acceptable test shall have a drop in water surface in 24-hour period with basin full less than 1/10 of 1 percent of normal volume of liquid contained in water-holding structure, after accounting for evaporation and precipitation in open basins, and damp spots or seepage are not present on walls or other areas exposed to view.
2. Determine evaporation by floating an evaporation pan in structure during test period.

D. Excessive Leakage and Leakage Test Failure: If drop in water surface exceeds test evaluation criteria or if damp spots or seepage is visible in exposed surfaces, the leak test shall be considered as failing.

E. Repairs:

1. If leakage is excessive, or if damp spots or observed seepage is present on exposed surfaces, drain water-holding structure, repair all leaks and damp spots previously marked, and make necessary repairs, and retest basin.
2. Repair in accordance with these Specifications and as approved by Engineer.

F. Retest:

1. Refill water-holding structure and test for leakage until structure meets test criteria.
2. Successful Test: If liquid level criteria is met and damp spots and seepage problems are corrected, the retest will be considered acceptable.

END OF SECTION 03300

PART 1 GENERAL**1.01 WORK INCLUDED**

- A. This section includes furnishing and installing all fabricated grating and grating supports, complete.

1.02 GENERAL REQUIREMENTS

- A. See CONDITIONS OF THE CONTRACT, and Division 1, GENERAL REQUIREMENTS, which contains information and requirements that apply to the work specified herein and are mandatory for this project.
- B. Like items of materials provided hereunder shall be the end products of one manufacturer or supplier in order to achieve standardization for operation, maintenance, spare parts, and manufacturer's service.

1.03 QUALITY ASSURANCE

- A. Regulatory Requirements: Fabrication, installation, standard clearances, banding and tolerances shall be in accordance with the Aluminum Association standards.

1.04 SUBMITTALS

- A. Product Data:
 - 1. Catalog information and catalog cuts.
 - 2. Manufacturer's specifications, including coatings.
 - 3. Special handling and storage requirements.
 - 4. Installation instructions.
- B. Shop Drawings:
 - 1. Grating: Show dimensions, weight, and size, and location of connections to adjacent grating, supports, and other work.
 - 2. Grating Anchorage: Show structural calculations and details of anchorage to supports to prevent displacement from traffic impact.
 - 3. Grating supports: Show dimensions, weight, size, location, and anchorage to supporting structure.
- C. Quality Control Submittals:

1. Factory test reports.
2. Manufacturer's certification of compliance for specified products.
3. Manufacturer's report that swaged cross bars, if used on grating, meet the requirements of these Specifications.

1.05 DELIVERY, STORAGE, AND HANDLING**A. Preparation for Shipment:**

1. Insofar as is practical, factory assemble items provided hereunder.
2. Package and clearly tag parts and assemblies that are of necessity shipped unassembled in a manner that will protect the materials from damage, and facilitate identification and final assembly in the field.

B. Storage and Handling: In accordance with manufacturer's recommendations.**PART 2 PRODUCTS****2.01 GENERAL****A. Materials shall meet the following ASTM Specifications:**

1. Hot Dipped Galvanized Steel:
 - a. All grating
 - b. Bolts: A193, Type 316.
 - c. Nuts: A194, Type 316.
 - d. Bars and Shapes: A276, Type 316.
 - e. Plate, Sheet, Strip: A167, Type 316.
2. Anchor Bolts and Nuts:
 - a. Stainless: A193, Type 316.
3. Flat Washers (Unhardened): F844, use A153 for zinc coating.

B. Design and Fabrication:

1. Meet minimum dimensional requirements as shown or as specified.
2. Field measure areas to receive grating, verify dimensions of new fabricated supports, and fabricate to dimension required for specified clearances.
3. Section Length: Sufficient to prevent its falling down through clear opening when oriented in the span direction when one end is touching either the concrete or the vertical leg of grating support.
4. Minimum Depth of Grating: As shown.
5. Minimum bearing of main bars on each support and end clearance of installed grating sections: As specified under Article QUALITY ASSURANCE hereinbefore.
6. Metal Cross Bar Spacing: 2-inch maximum, unless otherwise shown or specified.
7. Cross Bars:
 - a. Flush with top of main bar and extend downward a minimum of 50 percent of the main bar depth.
 - b. Swaged Cross Bars:
 - (1) Within 1/4-inch of top of grating with 1/2-inch minimum vertical dimension after swaging, and minimum before swaging dimension of 5/16-inch square.
 - (2) Cross Bar Dimension After Swaging: Minimum 1/8-inch wider than the opening at minimum of two corners at each side of each square opening in main bar.
 - (3) Tightly fit main bars and cross bars allowing no differential movement.
8. Do not use weld type cross bars.
9. Banding:
 - a. Same material as grating.
 - b. Band grating edges and openings in grating as specified under Article QUALITY ASSURANCE herein.

10. Metals for Embedment, or Seat Angles for Partial Embedment in Concrete: Type 316 stainless steel, unless otherwise specified.
- C. Grating Accessories: Anchor bolts, bolts, inserts, threaded anchor studs, wedge anchors, expansion anchors, adhesive anchors and as necessary for anchorage of grating to supports:
 1. Stainless steel Type 316.
 2. Fastener Capability: Firmly secure grating section to supports.
 3. Fastener Clip(s) and Bolt(s): In accordance with grating manufacturer's recommendations, except minimum of four fasteners per grating section and removable from above grating walkway surface.
 4. Provide stainless steel Type 316 threaded anchor studs, as fasteners for grating attachment to metal supports either not embedded or partially embedded in concrete, as manufactured by:
 - a. Nelson Studs Welding Co., Lorain, OH.
 - b. Omark Industries, KSM Fastenings Systems Div., Seattle, WA, or Portland, OR.
- D. Grating Supports:
 1. Seat angles and beams where shown.
 2. Stainless steel Type 316.
 3. Coordinate dimensions and fabrication with grating to be supported.

2.02 FOOT TRAFFIC GRATING

- A. Uniform Service Load: 100 psf minimum, unless otherwise shown.
- B. Maximum Deflection: 1/4-inch, unless otherwise shown.
- C. Banding: 3/16-inch minimum.

2.03 FABRICATION

- A. General:
 1. Exposed Surfaces: Smooth finish and sharp, well-defined lines.
 2. Provide necessary rabbets, lugs, and brackets so work can be

assembled in a neat, substantial manner.

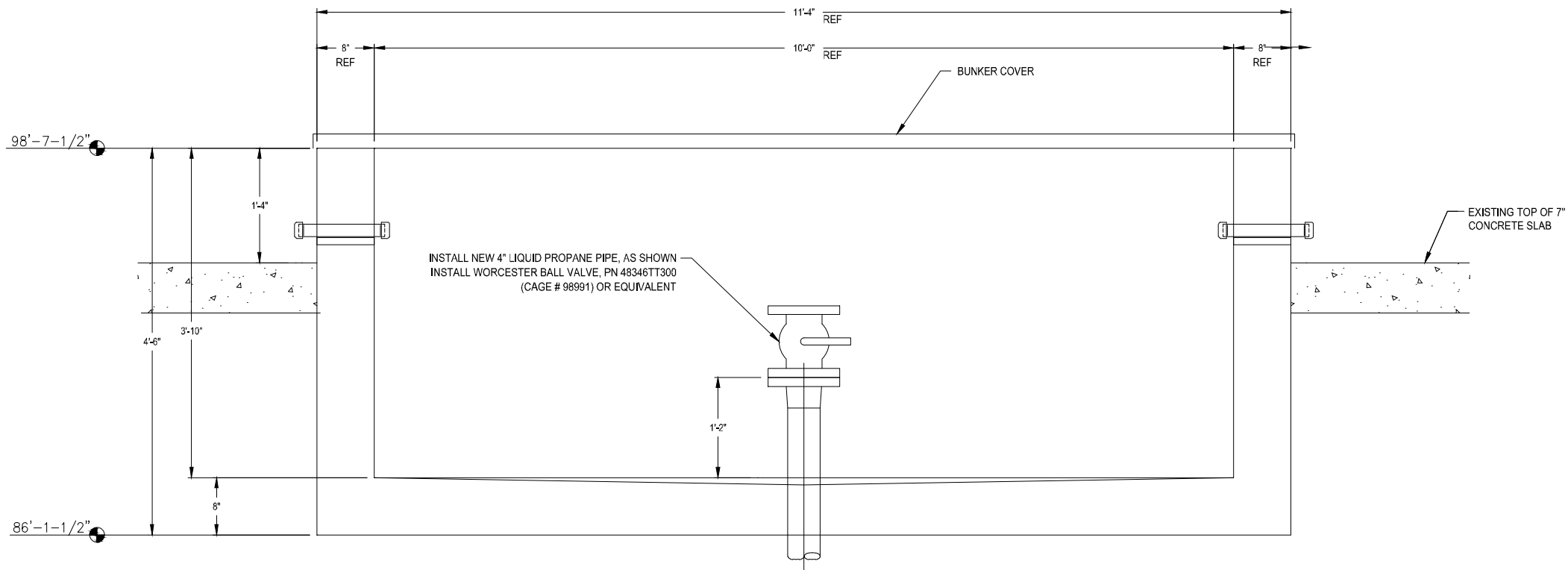
3. Conceal fastenings where practical.
 4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
 5. Weld Connections: Not permitted on grating except at banding bars.
- B. Foot Traffic Grating: Any single grating section, individual plank, or plank assembly shall not be less than 1 foot 6 inches or greater than 3 feet 0 inches in width or weigh more than 150 pounds, unless otherwise shown on approved shop drawings.

PART 3 EXECUTION

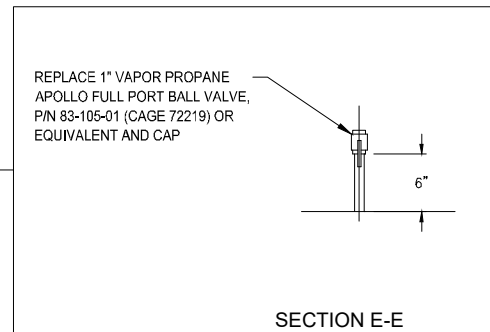
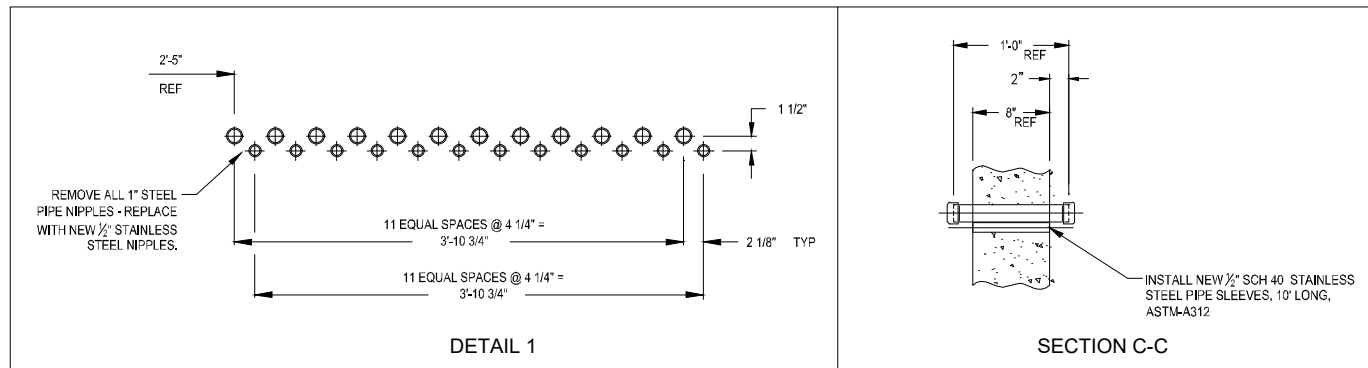
3.01 INSTALLATION

- A. Provide equipment for lifting and placing as necessary.
- B. Install in accordance with approved shop drawings, and as shown and as specified.
- C. Install plumb or level as applicable in locations as shown.
- D. Anchor grating securely to supports to prevent displacement from traffic impact.
- E. Completed Installation: Rigid and neat in appearance.
- F. Commercially Manufactured Products:
 1. Install in accordance with manufacturer's recommendations as approved.
 2. Secure grating to support members with fasteners.
 3. Welding is not permitted.
 4. Fasteners: Field locate and install.
 5. Permit each grating section or plank style grating assembly to be easily removed and replaced.

END OF SECTION 05530



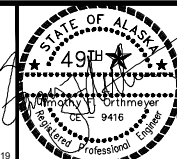
SECTION A-A
BUNKER SECTION

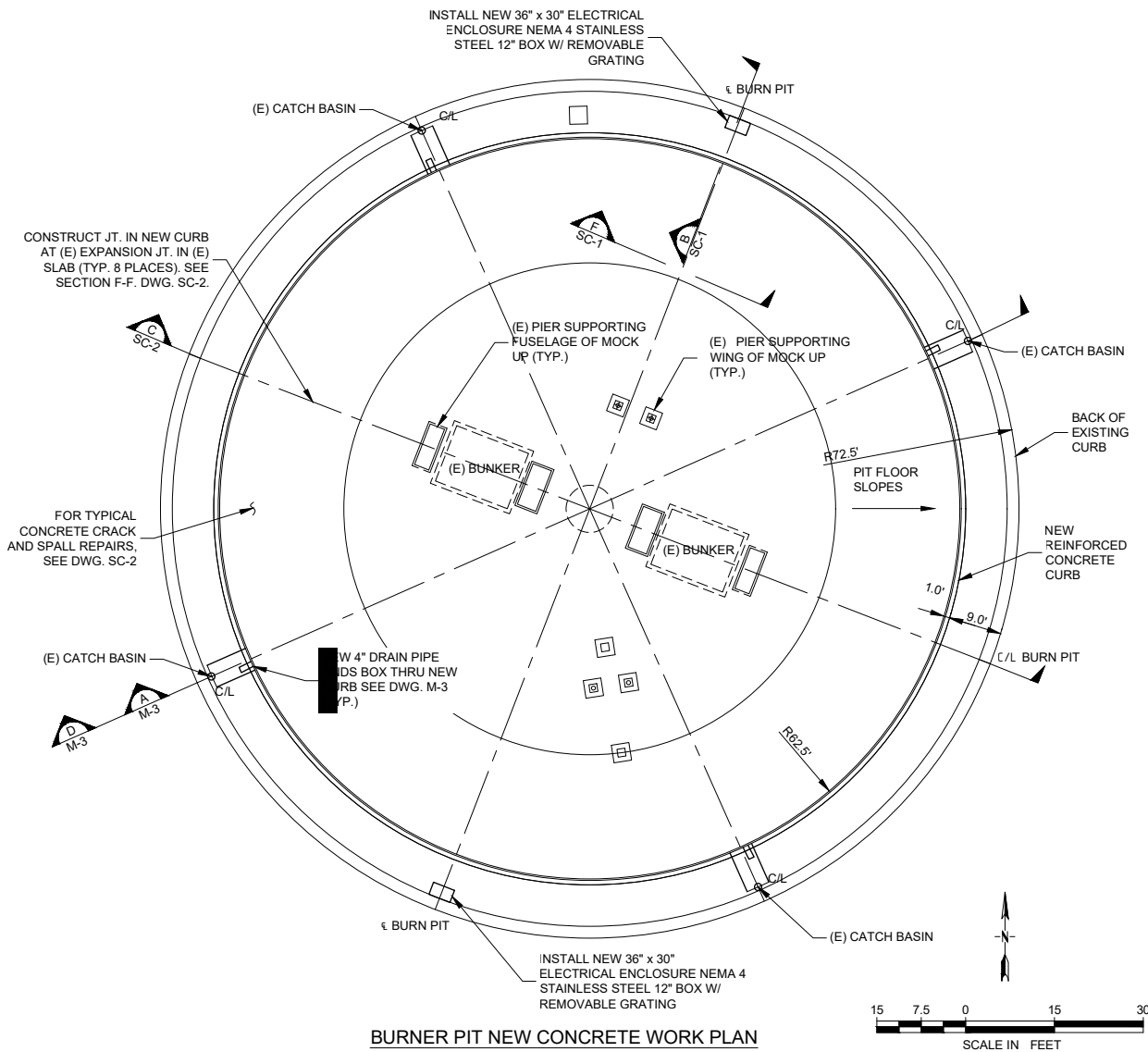


GENERAL NOTES

1. ALL WORK ON THIS DRAWING SHALL BE FOR BOTH BUNKERS.

REFER TO SECTION 1.6
MEASUREMENT AND PAYMENT

VERIFY SCALE! THESE PRINTS MAY BE REDUCED. LINE BELOW MEASURES ONE INCH ON ORIGINAL DRAWING. MODIFY SCALE ACCORDINGLY!		REVISIONS				 engineers • surveyors • planners • scientists	1 Engineering Place Helena, MT 59602 406.442.3050 www.m-m.net		DRAWN BY: <u>BJD</u>	ALASKA REGIONAL FIRE TRAINING CENTER TRAINING EQUIPMENT REHABILITATION				PROJECT NUMBER 2950/042
NO.	DESCRIPTION	BY	DATE	DSGN. BY: <u>TFO</u>	SHEET NUMBER 10									
1	ADDENDUM #1	BJD	8/12/19	APPR. BY: <u>TFO</u>	KENAI				ALASKA	DRAWING NUMBER 2-4				
				DATE: <u>07/2019</u>										
R:\2950 - KENAI\ACAD\SHEETS\2-4 BURNER CONTROL BUNKER.DWG PLOTTED BY:BRAD DRINVILLE ON Aug/22/2019														
SPILL FIRE BURN PIT CONTROL BUNKERS														

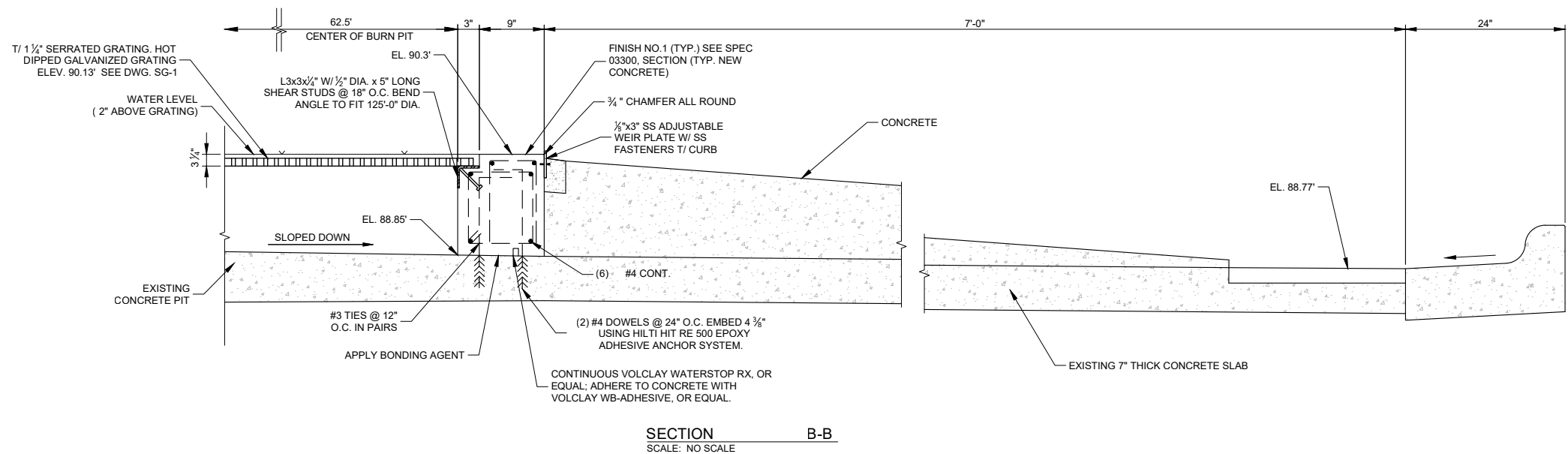


GENERAL NOTES

1. CONTRACTOR WILL PROTECT CATCH BASINS IN THE BURN PIT CONSTRUCTION WITH BARRIERS TO PREVENT SEDIMENT, STONE AND CONSTRUCTION DEBRIS FROM ENTERING. AT THE COMPLETION OF THE PROJECT, CATCH BASINS IN THE BURN PIT WILL BE CLEANED TO REMOVE SEDIMENT, AND THE MATERIALS REMOVED WILL BE SCRAPPED.
2. PLACE THE NEW CURB IN 8 SEGMENTS, WITH JOINTS DIRECTLY ABOVE EXISTING JOINTS. SEE SECTION F-F, DWG SC-2.
3. PREPARE THE EXPOSED ENDS OF THE FLUSH GROUND STAINLESS STEEL ANCHORS USING BASF CONCRECIVE 142[®] EPOXY. APPLY THIS MATERIAL IMMEDIATELY PRIOR TO THE APPLICATION OF THE WATER PROOFING MATERIAL (SEE NOTE 4) TO MAXIMIZE THE BONDING BETWEEN THE CONCRECIVE 142[®] AND THE TEGRAPROOF WATERPROOFING MATERIAL.
4. APPLY TEGRAPROOF (BY BASF) CEMENTITIOUS WATERPROOFING OR EQUAL OVER THE ENTIRE SLAB. WORK A SLURRY COAT INTO THE CONCRETE AND THEN APPLY SECOND COAT EITHER SPRAYED OR TOWELED. GRIND EXISTING CONCRETE EXPANSION JOINTS (DWG SD-1) OUT WHEN THE TEGRAPROOF IS CURED. PRIME THE EDGES OF THE JOINT WITH BASF PRIMER 733. WITHIN THE EXPANSION JOINTS, INSTALL EXPANSION JOINT FILLER AND SONOLASTIC NP-1. NOTE THE RECOMMENDED CURE TIME ON NP-1 PRIOR TO SUBMERSION.
5. BEFORE INSTALLING BURNER ELEMENTS AND GRATING SUPPORTS, CONTRACTOR WILL TEST THE PIT FOR LEAKS BY PLACING A BUCKET OF WATER NEXT TO THE PIT AND MARKING THE WATER LEVEL IN BOTH THE BUCKET AND THE PIT. CHECK THE WATER LEVEL AFTER 24 HOURS. IF THE PIT LOSES MORE WATER THAN THE BUCKET, THERE IS A LEAK.
6. USE THE FOLLOWING METHOD TO DETECT WHERE LEAKS ARE COMING FROM. PURCHASE A DYE TEST KIT OR MAKE ONE USING A SQUEEZE BOTTLE FILLED WITH FOOD DYE. AFTER TURNING OFF THE PUMP AND WAITING UNTIL THE WATER IS CALM, LOWER THE DYE BOTTLE INTO THE WATER WITHOUT STIRRING UP ANY CURRENTS, AND SQUEEZE OUT SMALL AMOUNTS OF DYE NEAR AREAS SUSPECTED OF LEAKING. THE DYE WILL BE DRAWN INTO ANY LEAKING AREAS LIKE SMOKE IN A DRAFT.
7. REPAIR CRACK USING EMECOLE 101 SERIES OR EQUAL.
8. CONSTRUCTION TOLERANCE IN TOP OF CURB ELEVATION IS 1/8\".
9. CONSTRUCTION TOLERANCE IN TOP OF ANGLE EMBEDDED IN CURB IS 1/8\".

MATERIALS

1. COMPRESSIVE STRENGTH OF CONCRETE f_c WILL BE 4,000 PSI AT 28 DAYS.
2. REINFORCING BARS WILL BE NEW GRADE 60 BILLET STEEL AND SHALL CONFORM TO ASTM A 615, EPOXY COATED.
3. ALL STRUCTURAL STEEL, EXCEPT THE VALVE ENCLOSURE BOXES, WILL BE GALVANIZED STEEL - PLATES, ANGLES, CHANNELS AND GRATING WILL BE ASTM A36. THE VALVE ENCLOSURE BOXES WILL BE A36 CARBON STEEL UNPAINTED.
4. HILTI, OR EQUAL, ANCHOR RODS WILL BE HAS SS AISI 304³/16 SS.



CONTRACTOR TO VERIFY ALL ELEVATIONS AND DIMENSIONS IN THE FIELD PRIOR TO SHOP DRAWING SUBMITTAL

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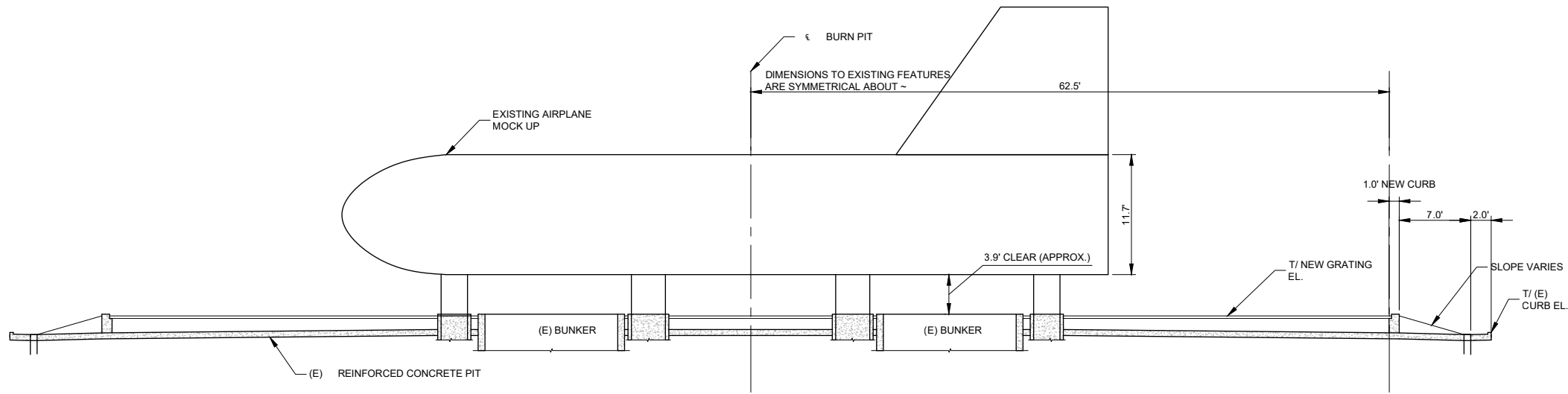
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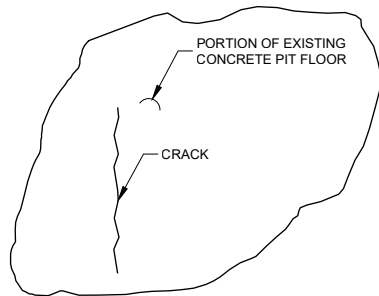
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APPR. BY: TFO
DATE: 07/2019
Q.C. REVIEW
BY:
DATE:

ALASKA REGIONAL FIRE TRAINING CENTER TRAINING EQUIPMENT REHABILITATION		
KENAI		ALASKA
SPILL FIRE BURN PIT PLAN		

PROJECT NUMBER 2950/042
SHEET NUMBER 11
DRAWING NUMBER SC-1

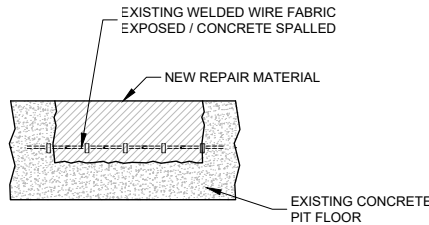


SECTION C-C (DWG SC-1)
SCALE: NO SCALE



1. CLEAN CONCRETE CRACK AND PRESSURE GROUT WITH DEGUSSA EPOFIL, OR EQUAL; OR IF THE CRACKS HAVE THE FLOWING WATER, DEGUSSA CONCRESE 1210 IUG, OR EQUAL, INSTALLED IN ACCORDANCE WITH THE MANUFACTURE'S INSTRUCTIONS.

CRACK REPAIR
SCALE: NO SCALE



1. ALL LOOSE AND DETERIORATED CONCRETE SHALL BE REMOVED BY MECHANICAL MEANS.
2. MECHANICALLY PREPARE CONCRETE SUBSTRATE TO OBTAIN A PROFILE OF $\pm \frac{1}{16}$ " WITH NEW EXPOSED AGGREGATE SURFACE.
3. IF (E) WWF IS DAMAGED, LEAVE IN PLACE AND ADD EQUIVALENT NEW WWF.
4. REPAIR CONCRETE USING SIKATOP 123 PLUS OR EQUAL. FOLLOW MANUFACTURE'S INSTRUCTIONS.

BROKEN AND SPALLED EXISTING CONCRETE REPAIR
SCALE: NO SCALE

CONTRACTOR TO VERIFY ALL
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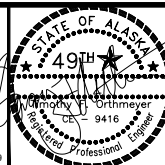
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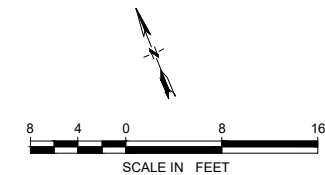
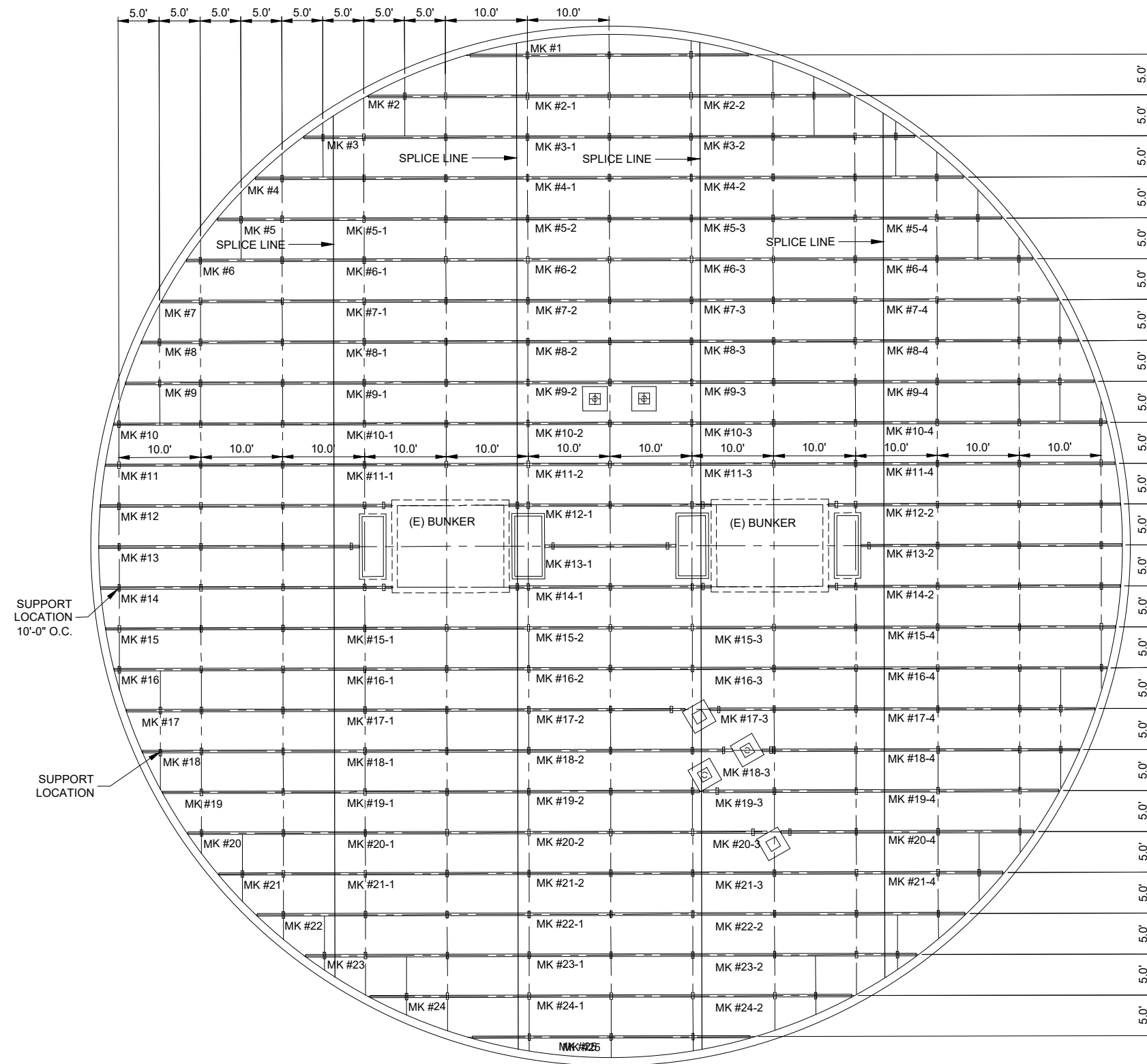
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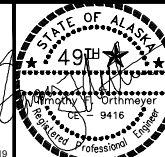


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APPR. BY: TFO
DATE: 07/2019
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BY: _____
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ALASKA REGIONAL FIRE TRAINING CENTER TRAINING EQUIPMENT REHABILITATION		
KENAI		ALASKA
SPILL FIRE BURN PIT SECTION		

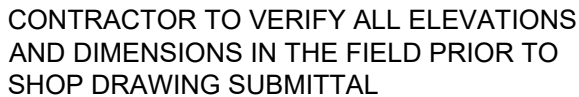


CONTRACTOR TO VERIFY ALL ELEVATIONS
AND DIMENSIONS IN THE FIELD PRIOR TO
SHOP DRAWING SUBMITTAL

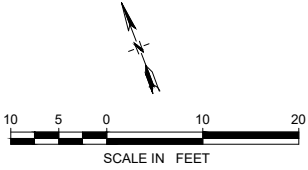
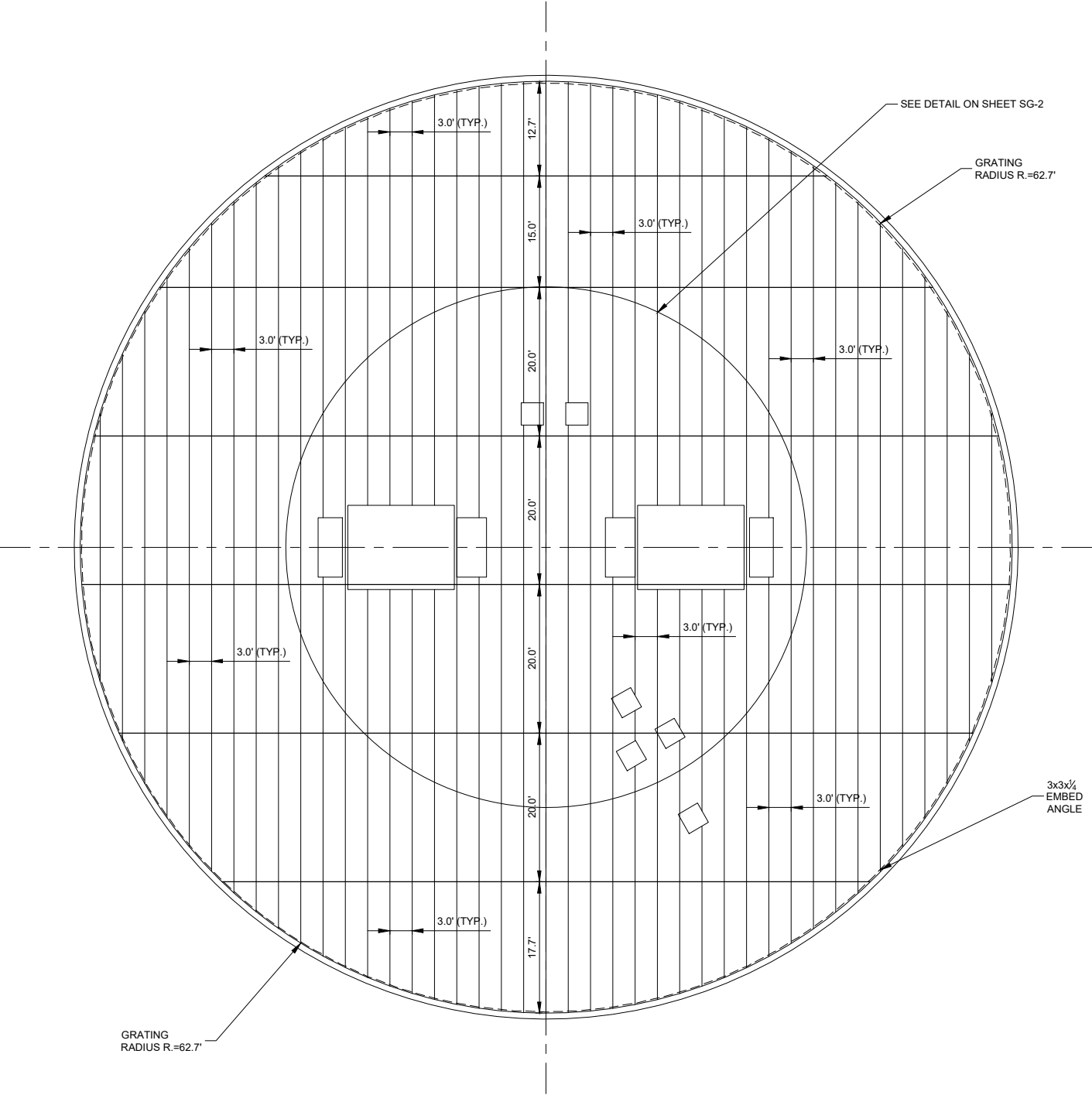
VERIFY SCALE! THESE PRINTS MAY BE REDUCED. LINE BELOW MEASURES ONE INCH ON ORIGINAL DRAWING. MODIFY SCALE ACCORDINGLY!	REVISIONS				 engineers • surveyors • planners • scientists	1 Engineering Place Helena, MT 59602 406.442.3050 www.m-m.net		DRAWN BY: <u>BJD</u>	ALASKA REGIONAL FIRE TRAINING CENTER TRAINING EQUIPMENT REHABILITATION	PROJECT NUMBER 2950/042	
	NO.	DESCRIPTION	BY	DATE				DSGN. BY: <u>TFO</u>		SHEET NUMBER 13	
	1	ADDENDUM #1	BJD	8/12/19				APPR. BY: <u>TFO</u>		DRAWING NUMBER	
								DATE: <u>07/2019</u>		SG-1	
								Q.C. REVIEW	KENAI	ALASKA	DRAWING NUMBER
								BY: _____			
								DATE: _____	SPILL FIRE BURN PIT GRATING SUPPORT PLAN		

R:\2950 - KENAI\ACAD\SHEETS\SG-1 GRATING SUPPORT PLAN.DWG PLOTTED BY:BRAD DRINVILLE ON Aug/22/2019

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SG-2

ALL 1 ¼" STEEL DECK
SYSTEM COMPONENTS,
SHALL BE HOT DIPPED
GALVANIZED



CONTRACTOR TO VERIFY ALL
ELEVATIONS AND DIMENSIONS
IN THE FIELD PRIOR TO SHOP
DRAWING SUBMITTAL

REVISIONS			
NO.	DESCRIPTION	BY	DATE
1	ADDENDUM #1	BJD	8/12/19

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Helena, MT 59602

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STATE OF ALASKA
49th
Timothy Orthmeyer
Professional Engineer
License No. 9416

DRAWN BY: BJD

DSGN. BY: TFO

APPR. BY: TFO

DATE: 07/2019

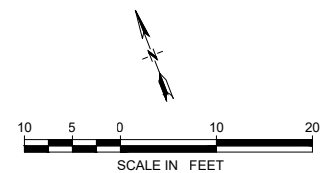
Q.C. REVIEW

BY: _____

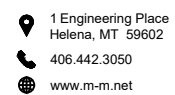
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KENAI	ALASKA	ALASKA REGIONAL FIRE TRAINING CENTER TRAINING EQUIPMENT REHABILITATION
		SPILL FIRE BURN PIT GRATING PLAN

PROJECT NUMBER 2950/042
SHEET NUMBER 19
DRAWING NUMBER SG-7



VERIFY SCALE! THESE PRINTS MAY BE REDUCED. LINE BELOW MEASURES ONE INCH ON ORIGINAL DRAWING.  MODIFY SCALE ACCORDINGLY!	REVISIONS			
	NO.	DESCRIPTION	BY	DATE
	1	ADDENDUM #1	BJD	8/12/19

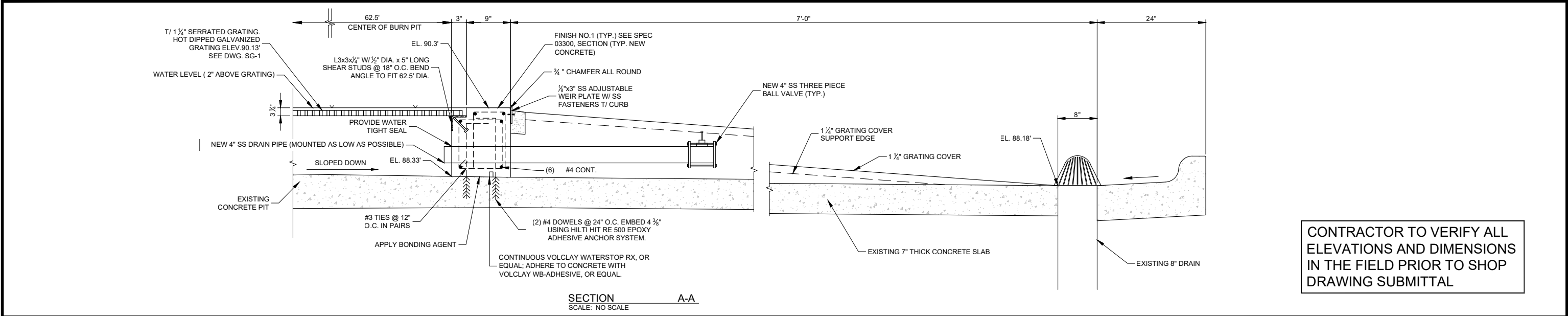
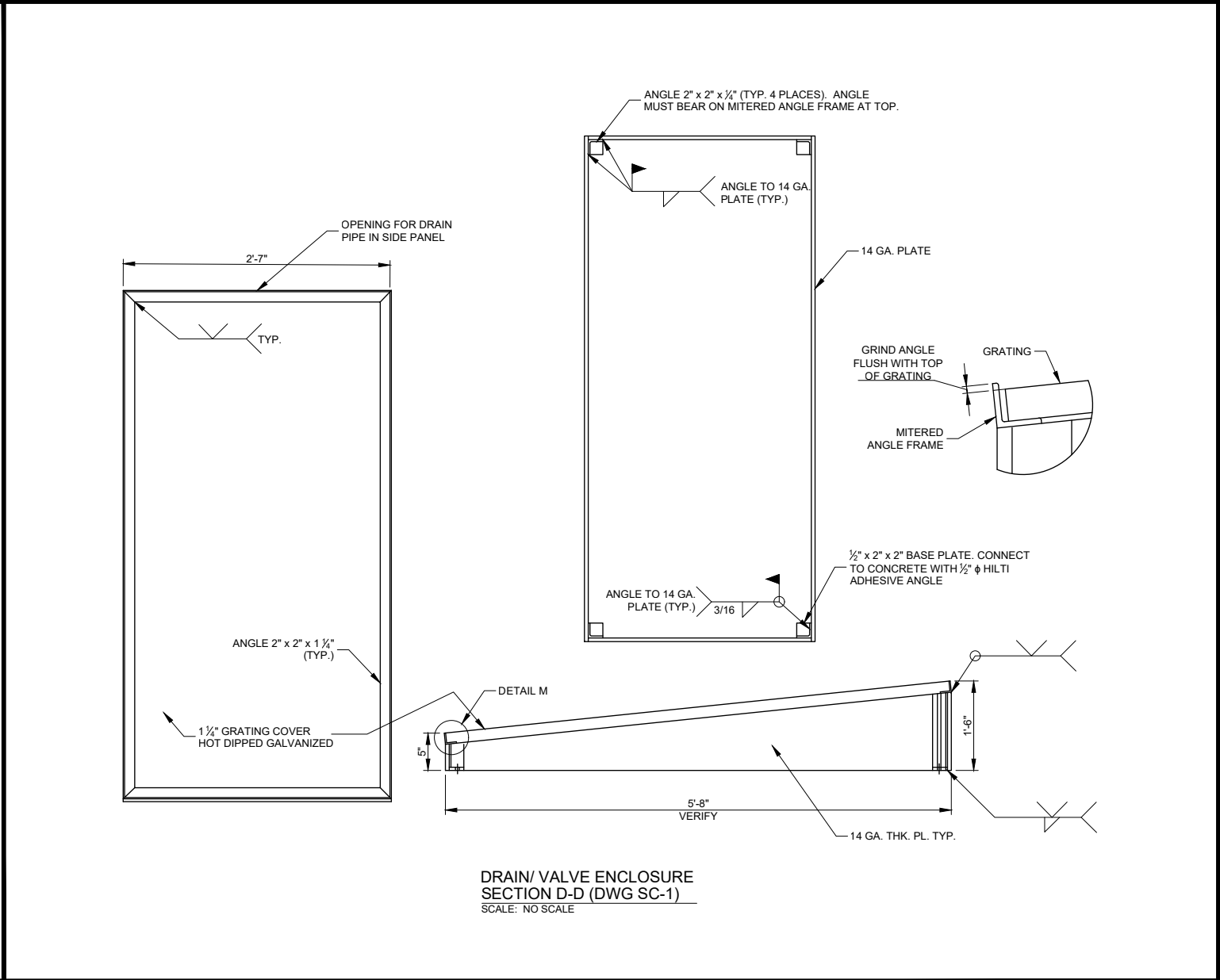
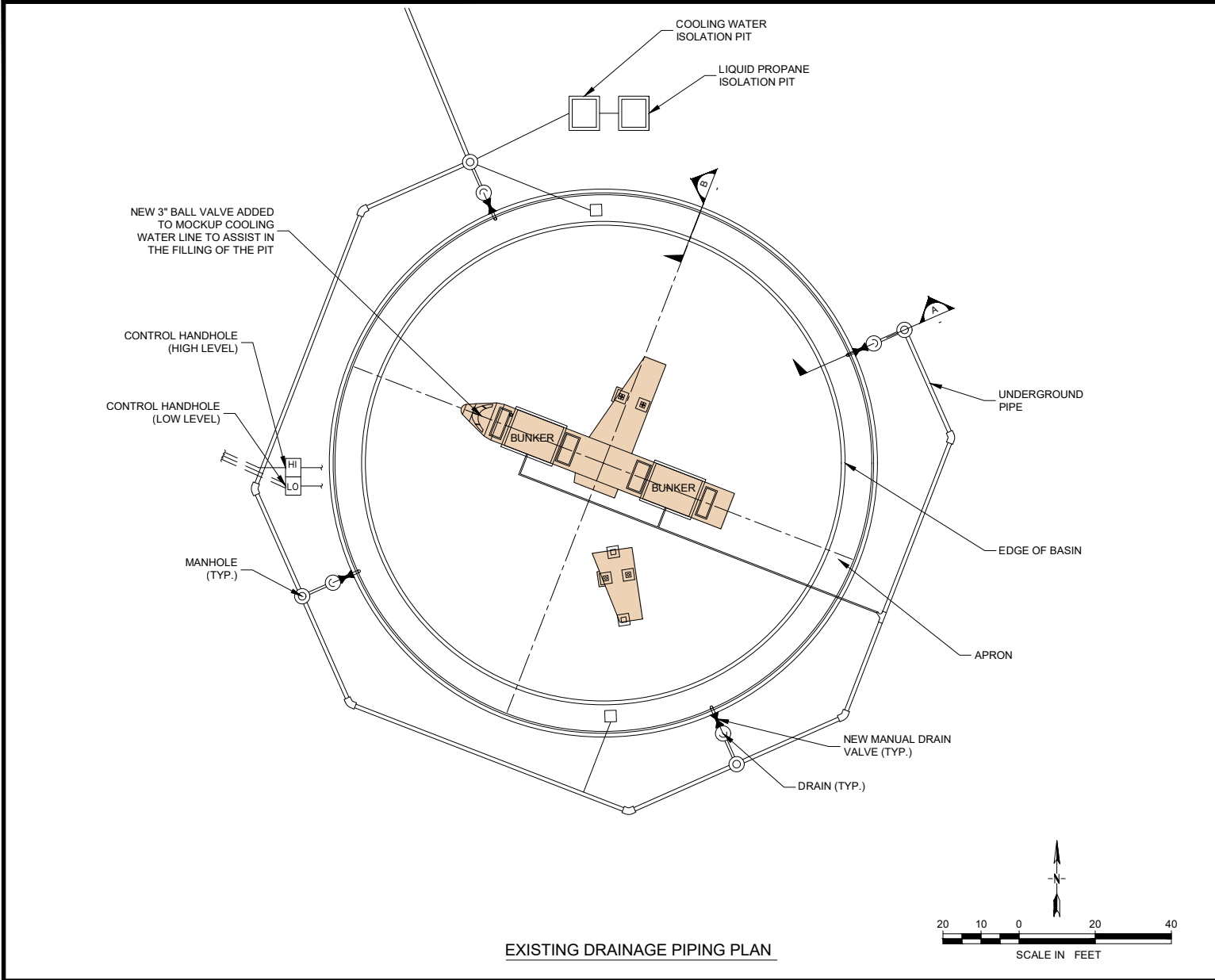


STATE OF ALASKA
49TH
MURPHY F. ORTHMEYER
CE - 9416
Registered Professional Engineer

DRAWN BY: BJD
 DSGN. BY: TFO
 APPR. BY: TFO
 DATE: 07/2019
 Q.C. REVIEW
 BY: _____
 DATE: _____

SPILL FIRE BURN PIT PROPANE PIPING CIRCUITING

M-1



CONTRACTOR TO VERIFY ALL ELEVATIONS AND DIMENSIONS IN THE FIELD PRIOR TO SHOP DRAWING SUBMITTAL

REVISIONS				
NO.	DESCRIPTION	BY	DATE	
1	ADDENDUM #1	BJD	8/12/19	

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STATE OF ALASKA
49th
Professional Engineer
Morrison Maierle
No. 9416
Exp. 12/31/2021

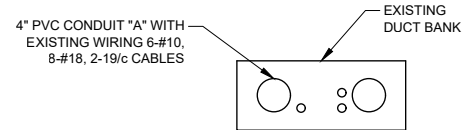
DRAWN BY: BJD
DSGN. BY: TFO
APPR. BY: TFO
DATE: 07/2019
Q.C. REVIEW BY:
DATE:

KENAI

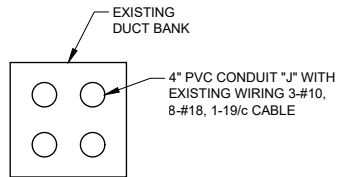
ALASKA REGIONAL FIRE TRAINING CENTER
TRAINING EQUIPMENT REHABILITATION
ALASKA

SPILL FIRE BURN PIT DRAINAGE PIPING PLAN

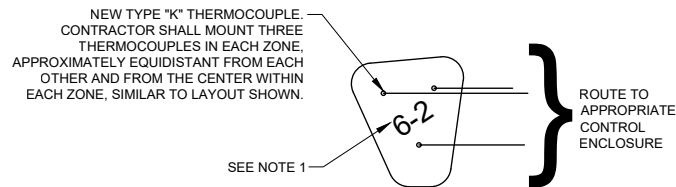
PROJECT NUMBER 2950/042
SHEET NUMBER 21
DRAWING NUMBER M-3



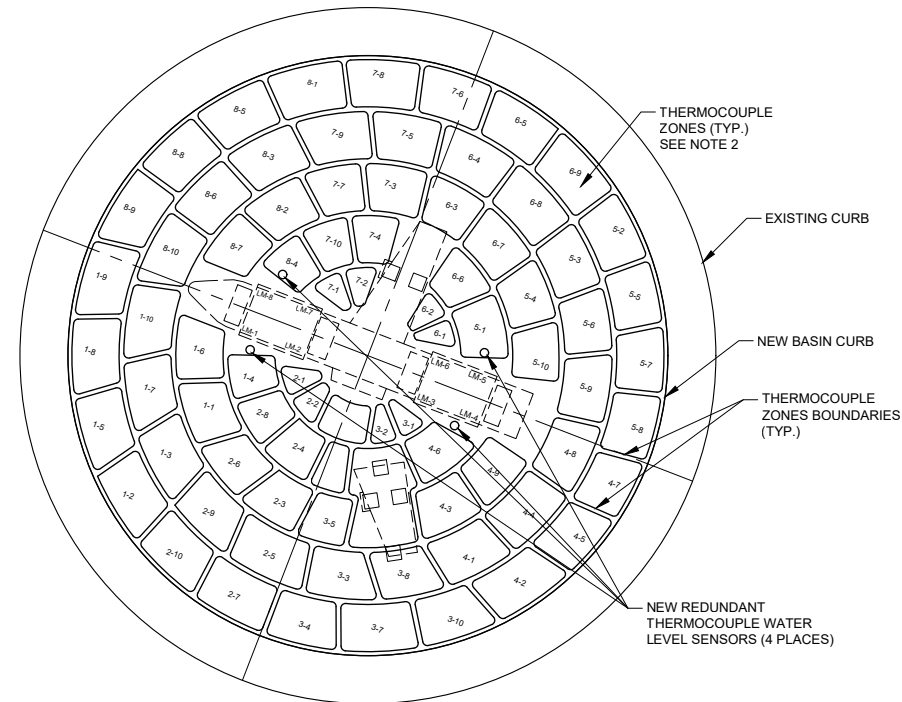
SECTION A-A
SCALE: NO SCALE



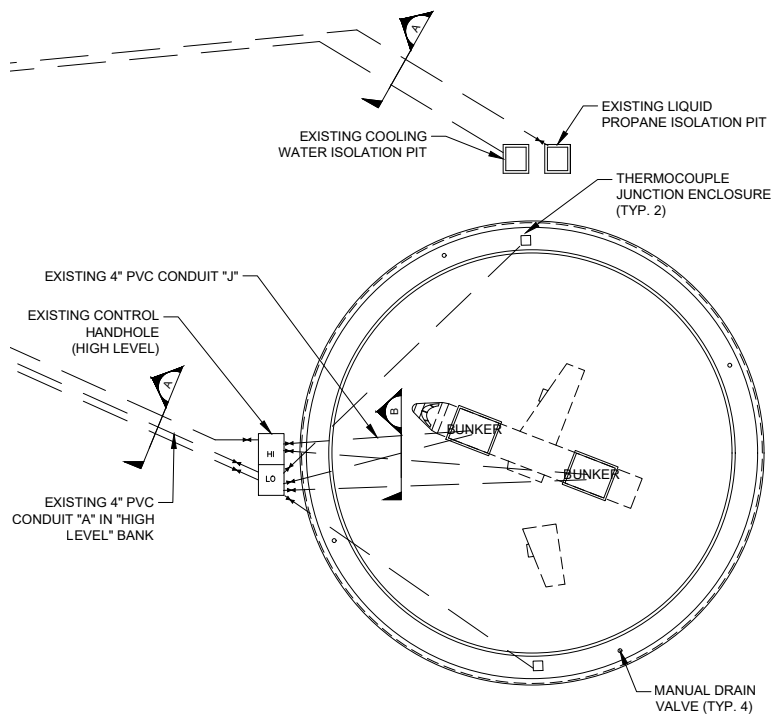
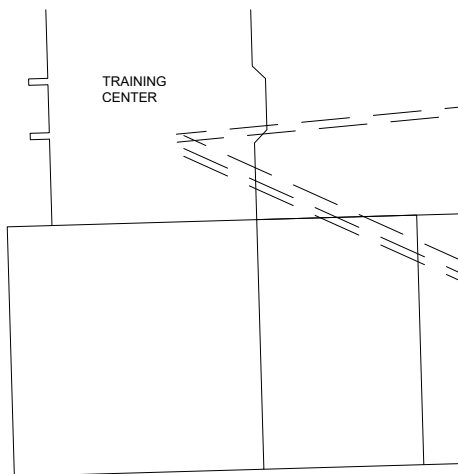
SECTION B-B
SCALE: NO SCALE



DETAIL 1
TYPICAL THERMOCOUPLE LAYOUT IN EACH FIRE ZONE
SCALE: NO SCALE



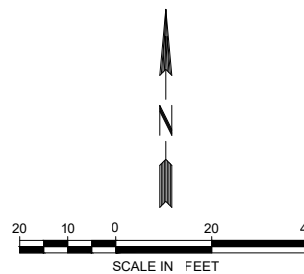
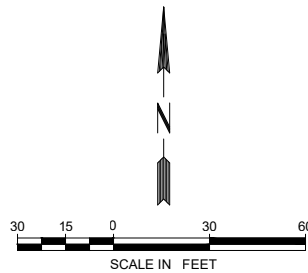
EXISTING AND FUTURE FIRE ZONE PLAN



CONDUIT ROUTING PLAN

NOTES:

1. NUMBER DESIGNATES THERMOCOUPLE SECTOR, ZONE AND CONTROLLER CONNECTION (i.e. - DESIGNATES THERMOCOUPLES AS BELONGING TO THE SECOND ZONE IN SECTOR 6.)
2. CONTRACTOR SHALL COORDINATE WITH SOFTWARE PROGRAMMER SO NEW THERMOCOUPLE WIRING MATCHES EXISTING THERMOCOUPLE ZONE LAYOUTS. SEE FIRE ZONE PLAN. 3 MINIMUM PER ZONE.



CONTRACTOR TO VERIFY ALL ELEVATIONS AND DIMENSIONS IN THE FIELD PRIOR TO SHOP DRAWING SUBMITTAL

REVISIONS				
NO.	DESCRIPTION	BY	DATE	
1	ADDENDUM #1	BJD	8/12/19	

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DRAWN BY: BJD
DSGN. BY: TFO
APPR. BY: TFO
DATE: 07/2019
Q.C. REVIEW
BY:
DATE:

KENAI ALASKA
ALASKA REGIONAL FIRE TRAINING CENTER
TRAINING EQUIPMENT REHABILITATION
SPILL FIRE BURN PIT CONDUIT ROUTING AND FIRE ZONE PLANS AND DETAIL

PROJECT NUMBER
2950/042
SHEET NUMBER
22
DRAWING NUMBER
E-1

Project: AK Regional Fire Training Center Training Equip Rehab
Pre-Bid Meeting: Aug 14th, 2019 at 1:00 pm Council Chambers
Site Visit / Tour of Site
Last Day for Ques: Aug 21th, 2019 4pm
Bid Due Date and Time: Aug 29th, 2019 by 2pm

	COMPANY	CONTACT PERSON	MAILING ADDRESS	CITY, STATE, ZIP CODE	PHONE	EMAIL	FAX
E	The Plans Room	Laurie	4831 Old Seward Hwy., Ste 102	Anchorage, AK 99503	(907) 563-2029	mary@theplansroom.com	
E	Builders Exchange of Washington, Inc.	Rich Morgan	2607 Wetmore Ave	Everett, WA 98201	(425) 258-1303	production@bxwa.com	
E	Constructconnect	Maria Delfino	30 Technology Parkway S, Ste. 500	Norcross, GA 30092	(303) 602-5079	maria.delfino@cmdgroup.com	
E	Daily Journal of Commerce	Laura Heberlein	P.O. Box 11050	Seattle, WA 98111	(206) 622-8272	laura.heberlein@djc.com	
	Contractor Plan Center	Svea Erickson	5468 SE International Way	Milwaukie, OR 97222	(503)-650-0148	svea@contractorplancenter.com	
	City of Kenai	Jamie Heinz	210 Fidalgo Ave	Kenai, Alaska 99611	(907) 283-8236	jheinz@kenai.city	
	City of Kenai	Jacquelyn LaPlante	210 Fidalgo Ave	Kenai, Alaska 99611	(907) 283-8249	jlaplante@kenai.city	
1	City of Kenai	Admin Assistant	210 Fidalgo Ave	Kenai, Alaska 99611	(907) 283-8236	publicworks@kenai.city	
2	City of Kenai	Scott Curtin	210 Fidalgo Ave	Kenai, Alaska 99611	(907) 283-8236	publicworks@kenai.city	
	Rain Proof Roofing	John Birchfield	2201 East 84th Court	Anchorage, AK 99507	907 344-5545	jbirchfield@rainproofroofing.com	
	KFT Fire Trainer, LLC	Steven J. Williamson	17 Phillips Parkway	Montvale, NJ 07645	201 300 8107	Steve.Williamson@kft.firetrainer.com	
	Kirila Fire Training Facilities	Wes Barbour	3007 State Route 7	Fowler, OH 44418	330-969-9920	wes@kirilafire.com	
	FANDM Commerical Construction	Floyd Lindbloom	13880 Fire Creek Trail	Eagle River, AK 99577	907 602 2313	store2206@theUSPSstore.com	
	Tim Orthmeyer	Morrison-Maierle	1 Engineering Place	Helena, MT 59602	406-495-3425	torthmeyer@m-m.net	
	K+A Designstudios	Chris Parker	130 Trading Bay Road	Kenai, Alaska 99611	907 283 3698	cparker@ka-designstudios.com	
	Udelhoven	Jake Arness	184 E. 53rd Ave	Anchorage, AK 99518	907 394 2610	jarness@udelhoven.com	
	Simulation/Amt	Thomas Wagner		Pittsburg, PA	412-215-0343	thomas.wagner@simulationfire.com	
	City of Kenai	Mary Bondurant	305 N Willow Street	Kenai, Alaska 99611	907 283-8282	mbondurant@kenai.city	
	Anchorage Roofing & Contracting Inc.	Rick Purcella	10961Lake Otis Parkway	Anchorage, AK 99516	907 344-4554	ari-rick@alaskan.com	
	Meridian Systems, Inc.	Brett Allemann	200 W. 34th Ave	Anchorage, AK	907 360-6239	balleman@msicontrols.com	
	Peninsula Plumbing	Dylan Shay	35581 Kenai Spur Hwy	Soldotna, AK 99669	907 262-5879	penph@acsalaska.net	
	Blazy Construction	Randall Nelson	36130 Kenai Spur Hwy	Soldotna, AK 99669	907 262-3810	randall@blazycon.com	
	Constructconnect	John N. Fermiza	30 Technology Parkway S, Ste. 500	Norcross, GA 30092	323 602 5079	John.Fermiza@ConstructConnect.com	
	Water Works Plumbing & Heating		36269 Lakeshore Drive	Soldotna, AK 99669	907 398-8580	hillyer@alaska.net	
	Legacy Electric	Derek Leichter	46113 Sather Court	Soldotna, AK 99669	907 252-4391	legacyelectricak@gmail.com	
	Alpine Metal Tech North America Inc.	Cynthia Frazier	4853 Campbells Run Rd	Pittsburg, PA 15205	412 787-2832	cynthia.frazier@alpinemetaltech.com	
	Home Gallery	Lee and Dee Cassel	11312 Kenai Spur Hwy #24	Kenai, Alaska 99611	907 335-4663	dee@homegallery2.com	