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FOR  
SUBCONTRACT  
FOR  
OPERATING ON-SITE BATCH PLANT AND  
FURNISHING CONCRETE  
FOR THE  
CONSUMERS POWER COMPANY  
MIDLAND PLANT  
MIDLAND, MICHIGAN

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TECHNICAL SPECIFICATIONS  
FOR  
SUBCONTRACT  
FOR  
OPERATING ON-SITE BATCH PLANT AND  
FURNISHING CONCRETE

1.0 WORK INCLUDED

The work includes but is not limited to the following:

- a. Testing, maintaining, and operating on the jobsite the necessary plant and equipment for the batching, mixing, and delivering of Portland cement concrete.
- b. Furnishing cement, aggregates, and all other materials herein specified for the production of concrete.
- c. Storage and protection of materials.
- d. Demobilization and removal from the jobsite of plant, equipment and materials at completion of the work.

2.0 RELATED WORK NOT INCLUDED

The following items of related work are not included:

- a. Sampling and testing of concrete and materials, except as specified herein.
- b. Forming, placing, finishing and curing of the concrete.
- c. Placing of non-shrink grout, masonry mortar and drypack mortar.
- d. Furnishing, fabricating and placing of reinforcement.
- e. Furnishing of construction water.
- f. Design of concrete mixes.
- g. Providing electrical service to batch plant switch terminal and furnishing of electric power to operate batching plant.

### 3.0 ABBREVIATIONS

The abbreviations listed below, where used in these Specifications shall have the following meanings:

- ACI - American Concrete Institute
- ASTM - American Society for Testing and Materials
- AASHTO - American Association of State Highway Officials
- NRMCA - National Ready Mixed Concrete Association

### 4.0 CODES AND STANDARDS

Materials, procedures and the furnished concrete, unless otherwise specified herein, shall conform to the "Standard Specification for Ready Mixed Concrete" (ASTM C94-72), the "Building Code Requirements for Reinforced Concrete" (ACI Standard 318-71), the "Standard Specifications for Structural Concrete for Buildings" (ACI Standard 301-72), the "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete" (ACI Standard 304-73), the ACI Manual of Concrete Inspection (SP-2, 1967), and other codes and standards specified herein.

### 5.0 BATCH PLANT LOCATION

The batch plant is located as shown on the reference drawings.

### 6.0 QUALITY ASSURANCE PROVISIONS

- 6.1 A Quality Assurance Program covering all phases of concrete production shall be established and implemented by the Subcontractor. The program shall be in accordance with Appendix C and include procedures which will assure quality production of concrete, and documentation procedures that will verify that all materials and procedures used in the work comply with these specifications.
- 6.2 The Contractor shall have free access to all work and shall have authority to stop or reject work if the specification requirements, including those for documentation, have not been fulfilled.
- 6.3 Documentation required in Appendix C shall be furnished by the Subcontractor to the Contractor and be retained by the Contractor for inclusion in the Quality Assurance files.
- 6.4 Additional documentation relating to concrete quality that may be originated by the Subcontractor shall be retained by the Subcontractor and made available at the option of the Contractor for inclusion in the Quality Assurance files.

## 7.0 MATERIALS

Materials furnished by the Subcontractor shall conform to the following specifications.

### 7.1 Cement

Cement shall be Portland cement, Type II conforming to the Specification for Portland Cement (ASTM C150-72). For Type II cement, the sum of tricalcium silicate and tricalcium aluminate shall not exceed 58% and the cement shall not contain more than 1.00% by weight of alkalis calculated as  $Na_2O$  plus  $0.658 K_2O$ . When applicable, Type I cement, conforming to ASTM C150-78a, may be used. Only one brand of cement shall be used for all work, unless specifically authorized by the Contractor. The temperature of cement at the time of delivery shall not be greater than 150F unless otherwise approved by the Engineer.

### 7.2 Aggregate

#### 7.2.1 General

All aggregates shall conform to the "Standard Specifications for Concrete Aggregate" (ASTM C33-71a), unless herein specified otherwise.

Fine aggregate shall consist of clean, sharp, washed natural or washed crushed sand of uniform gradation when delivered to batch plant storage. Coarse aggregate shall consist of washed gravel or washed crushed rock having hard, strong, durable pieces, free from adherent coatings when delivered to batch plant storage.

#### 7.2.2 Gradation

Fine and coarse aggregate shall meet the following grading requirements:

Sieve Size U.S. Std. Sq. Mesh	Fine Agg. (Sand)	Percentage Passing			
		3/8	3/4	1-1/2	3 in.
4 inch					100
3 inch					90-100
2 inch				100	35-55
1-1/2 inch				90-100	0-15
1 inch			100	20-55	0-5
3/4 inch			90-100	0-15	
3/8 inch	100	85-100	20-55	0-5	
No. 4	95-100	10-30	0-10		
No. 8	80-100	0-10	0-5		
No. 16	50-85	0-5			
No. 30	25-60				
No. 50	10-30				
No. 100	2-10				



The minimum percentage shown for sand material passing the No. 50 and No. 100 sieves may be reduced to 5 and 0, respectively, providing at least one of the conditions stated in paragraph 3.2 of ASTM C33 is met.

In addition to the specified gradation, the fine aggregate (sand) shall have a fineness modulus of not less than 2.5 nor more than 3.0 during normal operations, and at least 4 of 5 successive test samples shall vary not more than 0.20 from the average.

The particle shape of the coarse aggregate shall generally be rounded or cubical and not contain flat and elongated particles in excess of 15 percent by weight in any nominal size group.

Tests for and definitions of thin, flat and elongated particles shall be in accordance with Technical Specifications 7220-C-208.



In the case of crushed aggregates, when the material finer than the No. 200 sieve consists of the dust of fracture, essentially free of clay or shale, the percentage of material passing the No. 200 sieve is restricted to 2.5.

7.2.3 Source of Aggregate

The Subcontractor shall obtain aggregates from one of the sources listed below or other approved sources. The source selected shall not be changed unless approved.

- a. Inland Lime and Stone Co., Manistique, Michigan
- b. Drummond Dolomite, Inc., Drummond Island, Michigan
- c. George Hubscher and Sons, Mt. Pleasant, Michigan
- d. Kuzma Pit, Juniata, Michigan
- e. J. P. Burroughs and Sons, Inc. - Hersey Pit at Hersey, Michigan (3/8 inch aggregate only)

7.3 Water and Ice

Water and ice furnished by the Subcontractor for use in mixing concrete shall be free of injurious amounts of oil, acid, alkali, organic matter and other deleterious substances. Water shall be initially qualified and will be tested for chlorides, compressive strength, soundness and time of setting at the frequency specified in Specification 7220-C-208, Table 1. The water shall not contain more than 250 parts per million of chlorides



as C1. Water from the existing well will be tested by the Contractor to determine the effects of the mixing water compared with distilled water. The acceptance criteria for compressive strength, soundness and time of setting shall be as follows:

<u>Requirement and Test Method</u>	<u>Acceptance Criteria</u>
Compressive strength, ASTM C109	Reduction in strength not in excess of 10 percent
Soundness, ASTM C151	Increase in length limited to 0.10 percent
Time of setting, ASTM C191 (1)	+10 min for initial set, <u>+1 hr for final set</u>

(1) After allowing specimen to remain undisturbed for 30 min. after molding as specified in ASTM C191 Section 5.2, the penetration of the 1 mm needle shall be determined every 10 minutes thereafter.





#### 7.4 Admixtures

Concrete shall contain a pozzolan, an air entraining agent and a water reducing agent unless noted otherwise on the drawings. No other admixtures shall be used unless authorized. When available, admixtures shall be purchased and stored in liquid solution. The manufacturer or shipper of admixtures shall submit an infrared spectrophotometry analysis on each shipment for review by the Contractor's field engineering personnel. A certification of conformance shall also be furnished with delivery.

##### 7.4.1 Pozzolans

Pozzolans shall conform to "Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolans for use in Portland Cement Concrete" (ASTM C618-72).

All pozzolans shall be sampled and tested in accordance with "Methods of Sampling and Testing Fly Ash" (ASTM C311-68). Approximately 15 percent by weight of pozzolan will be used to replace cement in the mixes. The subcontractor shall submit documents certifying that the pozzolan to be furnished complies with these Specifications. The cement shall not be replaced by pozzolan if the pozzolan fails to comply with ASTM C618-72.

Non pozzolan mixes may be substituted for mixes containing pozzolans provided the quantity of the placement does not exceed 3 cubic yards and required strength  $f'c$  does not exceed 5,000 psi.

##### 7.4.2 Air Entraining Agent

Air entraining agents shall conform to "Specification for Air Entraining Admixtures for Concrete" (ASTM C260-69), capable of entraining 2-6 percent air.

Manufacturer's certification shall be submitted stating that the air entraining agent conforms with ASTM C260-69 is capable of entraining 2-6 percent air.

The Subcontractor shall specify by name, in his proposal, the air entraining agent he proposes to use.

##### 7.4.3 Water Reducing Agent

Water reducing and retarding agent shall conform to the "Standard Specification for Chemical Admixtures for Concrete" (ASTM C494-71), Type A or Type D.

Manufacturer's certification shall be submitted stating that the water reducing agent conforms with ASTM C494-71, Type A or Type D, as applicable. Tests as specified for Type A or D in Sections 1, 2, 3, 4.1, 4.3, 5, 6, 7 and 9.3 shall apply.

During the time of year that the average ambient air temperature for the daylight period is above 70°F, Type D shall be used; except that for floor slabs 2 1/2 feet or less in thickness Type A may be used regardless of ambient temperature. When the average ambient air temperature for the daylight period is 70°F or below, either Type A or Type D may be used.

The Subcontractor shall specify by name, in his proposal, the water reducing agents he proposes to use.



**7.5 Mortar Sand**

Mortar Sand shall conform to ASTM C-144-70 or ASTM-C-33-71a , with 100% passing No. 4 sieve.

**7.6 Non-Shrink Grout**

Non-shrink grout shall be either of the following or equal.

- 7.6.1 Embecco "636" as manufactured by Master Builders Co. (premixed).
- 7.6.2 Embecco "713" as manufactured by Master Builders Co. (premixed)
- 7.6.3 Intraplast "N" as manufactured by Sika Chemical Corp. (Additive).
- 7.6.4 Five Star Grout as manufactured by U. S. Grout Corp. (premixed).
- 7.6.5 Masterflow "LL612" as manufactured by Master Builders Co. (Additive)
- 7.6.6 Sauereisen "F-100" as manufactured by Sauereisen Cements Co. (premixed)
- 7.6.7 Saueriesen No. 72 "Special Casting Grade" as manufactured by Saueriesen Cements Co. (premixed) (to be used only when specifically noted on the design drawings)



The nonshrink grout may be furnished by the Contractor, at his option.

**7.7 Hydrated Lime**

Hydrated lime for masonry mortar shall conform to the "Standard Specifications for Hydrated Lime for Masonry Purposes", Type "S", (ASTM C207-49) (1968).

**7.8 Mineral Oxide Coloring**

Mineral oxide coloring for concrete shall be Sonobrite as manufactured by Sonneborn Building Products, Inc., or Permatint Pigment as manufactured by Conrad Sovig Co. Inc., or equal.

**8.0 STORAGE OF MATERIALS**

Storage and handling of materials shall comply with these Specifications applicable referenced ASTM Specifications, the ACI Manual of Concrete Inspection (SP-2, 1967), ACI 304-73, and ACI 301-72.

**8.1 Cement, Pozzolan and Lime**

Cement, pozzolan, and lime shall be stored in a dry, weather-tight properly ventilated structure with adequate provision for prevention of moisture absorption. Bins shall be constructed so as to avoid dead storage. When sacked cement is used, it shall not be stacked higher than 14 sacks for storage periods of not more than 30 calendar days nor higher than 7 sacks for longer periods. Cement and pozzolan shall be stored at the batch plant in sufficient quantities to permit continuous placement for any size placement undertaker



## 8.2 Aggregate

Aggregate shall be stored and maintained in such a manner as to avoid the inclusion of any foreign materials in the concrete. No muddy or oil leaking traction equipment shall be allowed to operate on the storage piles. The placing of the material in storage and its removal therefrom shall be done in such a manner as to maintain the uniformity of the grading. All fine aggregate (sand) shall have a uniform and stable moisture content of not more than 7 percent by weight (oven dry weight basis) when delivered to the batching plant bins. The stockpiles at the point of supply shall be provided with suitable drainage facilities arranged in such a manner as to give a minimum of 24 hours drainage prior to use of the aggregate. Aggregate shall be stockpiled at the batch plant site before the start of concrete operations in a sufficient quantity to permit continuous placement of concrete. Fine and coarse aggregate storage piles shall be built and maintained to prevent segregation and excessive breakage. Suitable bulkheads or space shall be provided between specific size groups of aggregate to preclude mixing of the different size groups. The bottom of storage areas intended to be used as the primary or active storage (these are the areas from which the aggregate bins will normally be charged) shall be paved with concrete within 90 days after the contract award. Any additional secondary storage areas which may later become necessary shall be as directed or approved by the Contractor, to assure that the requirements of this Section are met.



## 8.3 Admixtures

Admixtures which are kept in their original containers shall be stored in such a manner as to prevent damage. Dry admixtures delivered in bulk shall be stored in approved tanks or silos at the site. Liquid admixtures, delivered in tank cars or tank trailers, shall be stored in tanks approved for storage at the site. Equipment for agitation of admixture shall be provided if recommended by the admixture manufacturer.

## 9.0 CONCRETE

### 9.1 Concrete Quality

#### 9.1.1 General

Portland cement concrete shall conform to "Standard Specification for Ready-Mixed Concrete" (ASTM C94-72) and "Specifications for Structural Concrete for Buildings" (ACI Standard 301-72) unless otherwise specified. The basis for determining the proportions of the concrete shall be Alternative No. 1 ASTM C94-72, except in lieu of paragraph 4.2.1(2) the concrete shall be mixed so as to be placed at slumps specified in Sections 9.1.2 and 9.1.3 herein.

#### 9.1.2 Classification

Concrete shall meet the following requirements unless shown otherwise on the drawings or as approved by Project Engineering.

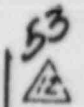


TABLE 9.1

## CONCRETE CLASSIFICATION TABLE

Class	90 Day Strength (psi) UON <sup>1</sup> f'c	Slump Working Limit at Point of Placement (in.)	Inadvertency Margin (in.)	Rejection Limit (in.)	Maximum Aggregate Size (in.)	Use and Location
A-1	2,000	4	1	5	3/4	Electrical duct encasement and lean concrete backfill <sup>2</sup>
A-2	2,000	4	1	5	1-1/2	Lean concrete backfill <sup>2</sup>
A-Grout	2,000	-	-	-	No. 4	Construction joints <sup>2</sup>
B-1	3,000	3	2	5	3/4	Structural concrete walls and slabs 12 inches thick or less and congested reinforcing areas; elect. duct encasement
B-2	3,000	3	2	5	1-1/2	Foundation and walls more than 12 inches thick including turbine pedestal concrete
B-Starter	3,000	5	1	6	3/4	Starter mix
B-Grout	3,000	-	-	-	No. 4	Construction joints
C-1	4,000	3	2	5	3/4	Walls and slabs 12 inches thick or less and congested reinforcing areas
C-2	4,000	3	2	5	1-1/2	Foundations and walls more than 12 inches thick
C-Starter	4,000	5	1	6	3/4	Starter mix
C-Grout	4,000	-	-	-	No. 4	Construction joints
D-1	5,000	3	2	5	3/4	Walls and slabs 12 inches thick or less and congested reinforcing areas
D-2	5,000	3	2	5	1-1/2	Foundations and walls more than 12 inches thick
D-Starter	5,000	5	1	6	3/4	Starter mix
D-Grout	5,000	-	-	-	No. 4	Construction joints
E-1	6,000	3	2	5	3/4	Reactor Bldg. walls and dome in congested reinforcing areas
E-2	6,000	3	2	5	1-1/2	Reactor Bldg. walls and dome
E-Starter	6,000	5	1	6	3/4	Starter mix
F-Grout	6,000	-	-	-	No. 4	Construction joints
Dry Pack	4,000	0	-	-	No. 4	As directed

TABLE 9.1 (continued)

<u><sup>1</sup>Class</u>	<u>90 Day Strength (psi) UON<sup>1</sup> f'c</u>	<u>Slump Working Limit at Point of Placement (in.)</u>	<u>Inadvertency Margin (in.)</u>	<u>Rejection Limit (in.)</u>	<u>Maximum Aggregate Size (in.)</u>	<u>Use and Location</u>
Tremie conc.	4,000	6-8	-	-	3/4	As directed
PG-A	2,000	5	1	6	3/8	Lean concrete backfill, electrical duct encasement, and where noted on drawings.
PG-B	3,000	5	1	6	3/8	Lean concrete backfill, electrical duct encasement, equipment pads, temporary construction blackout pourbacks, concrete repairs, core & wythe spaces in block walls, and where noted on drawings.
PG-C	4,000	5	1	6	3/8	Interior structural concrete in areas of extreme congestion, equipment pads, temporary construction blackout pourbacks, concrete repairs and where noted on drawings
PG-D	5,000	5	1	6	3/8	Structural concrete in areas of extreme congestion, equipment pads, temporary construction blackout pourbacks, concrete repairs, and where noted on Drawings.

alternative to D-1 mix for poured block walls.

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TABLE 9.1 (continued)

<u>Class</u>	<u>90 Day Strength (psi) UON<sup>1</sup> f'c</u>	<u>Slump Working Limit at Point of Placement (in.)</u>	<u>Inadvertency Margin (in.)</u>	<u>Rejection Limit (in.)</u>	<u>Maximum Aggregate Size (in.)</u>	<u>Use and Location</u>
PG-E	6,000	5	1	6	3/8	Structural concrete in areas of extreme congestion, equipment pads, temporary construction blockout pourbacks, concrete repairs, and where noted on drawings, except containment exterior.
PG-Grout	6,000	-	-	-	No. 4	Construction joints

<sup>1</sup>The class designation shown indicates mixes which contain flyash. A class designation may be altered by the addition of the letter 'C' to indicate a mix which contains no flyash (i.e., A-1 becomes A-1-C or D-Grout becomes DC-Grout, etc). Mixes which contain no flyash shall meet specified strength (f'c) at 28 days in lieu of 90 days. Mixes which contain flyash shall not be used in the construction of the counting room or controlled laboratories.

<sup>2</sup>Unless where specifically referenced, these classes of concrete are not Category I items; therefore, they are not required to conform to quality assurance requirements.

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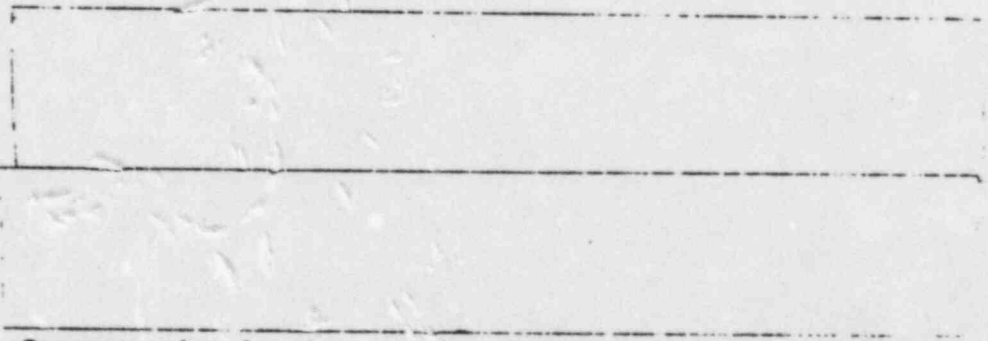


### 9.1.3 Slump

The "Working Limit" as specified in Table 9.1, will be the basis for evaluating concrete consistency at the point of placement. The "Inadvertency Margin" is the allowable deviation from the "Working Limit" for occasional batches of concrete, provided such batches can be properly placed and consolidated. Concrete consistency shall be uniform from batch to batch. Batches of concrete with slumps in the "Inadvertency Margin" will be rejected after the Subcontractor has been instructed by the Contractor to bring the slump within the "Working Limit".



The amount of water added at the batch plant shall be in accordance with the mix design furnished by the Contractor, except that the Subcontractor shall be responsible for adjusting the amount of water to account for variations in the moisture content in the aggregates. The Contractor shall be notified of such changes and accurate records of such adjustments maintained.



Concrete that has been rejected for failure to meet slump limits shall not be salvaged for use in the work; increased mixing time, addition of dry materials, or similar modification of a rejected batch for the purpose of conforming to slump limits shall not be permitted.

Slump measurements shall be made as specified in Specification 7220-C-208.



Starter mixes in lieu of mortar may be used on construction joints and shall have a slump working limit of 5 inches with a rejection limit of 6 inches. Starter mix slumps will not be included with the slumps of the concrete placement.



#### 9.1.4 Grout

All grout shall be proportioned and mixed as directed or otherwise approved. Standard grout for bond at construction joints shall have, as a minimum, the same cement-sand ratio as the concrete with which it is to be used. Mortars of higher cement-sand ratios approved by Project Engineering may be used.

#### 9.1.5 Air Content

Where air entrainment is required, it shall be the subcontractor's responsibility that the total air content of the concrete, as measured at the point of placement, shall not be less than 3 percent nor more than 6 percent of the concrete by volume with the following exceptions:

- a. For interior walls and slabs, the total air content of the concrete at the point of placement may be reduced to 2 percent.
- b. All concrete except that used for the containment exterior shall meet the requirements of 9.1.5 with an inadvertency margin of 1 percent above or below specified limits for occasional batches provided prompt corrective action is taken to bring the air content within limits. However, in no case shall the air content fall below 2 percent.
- c. Concrete mixes containing pozzolans which will not be permanently exposed and which will not be subject to freezing temperatures while wet may be placed with an air content less than the specified minimum if approved by the Field Engineer.

#### 9.1.6 Mix Design

The Contractor will furnish the Subcontractor with mix designs one month prior to the manufacture of concrete. Furnishing mix design shall not relieve the Subcontractor of his responsibility for compliance with the provisions of these specifications. Where necessary, the Contractor will increase or decrease cement factors as deemed necessary for design mixes. No gap graded concrete will be allowed. Concrete mixes shall contain all aggregate size groups up to and including the maximum size to be used in the concrete.

### 9.2 Measuring, Batching, Mixing, and Delivering

#### 9.2.1 General

The measuring of materials, batching, mixing, and delivery of all concrete shall conform to "Standard Specification for Ready-Mixed Concrete" (ASTM C94-72), ACI 304 and NRMCA Concrete Plant Standard and Truck Mixer and Agitator Standard unless otherwise specified.



### 9.2.2 Measurement

The measurement of all solid materials shall be by weight. Water and liquid admixtures shall be measured by weight or volume. Ice may be measured by weighing on platform scales, provided it is immediately placed in the chipper and then blown directly into the central mixer or onto the central mixer charging belt (or truck mixer, if applicable). The design water cement ratio of the mix may be exceeded, provided the batch weights are within the tolerances allowed by ASTM C 94.

### 9.2.3 Batching

Batching shall be performed by either a central batch plant or, at the option of the Contractor, by a dry mix batch plant. When batching is performed by a central batch plant, Sections 9.2.3.a and 9.2.3.c shall apply. When batching is performed by a dry mix batch plant, Sections 9.2.3.b and 9.2.3.c shall apply.

#### a. Central Batch Plant

The Contractor will furnish, for purchase by the Subcontractor, an existing onsite batch plant. The Contractor, before turning the batch plant over to the Subcontractor, shall make all necessary improvements and modifications to the batch plant to provide a modern, dependable automatic batch plant to accurately determine and control the specified quantities of the various materials entering the concrete.

Prior to turning the batch plant over to the Subcontractor, the Contractor, at its expense, shall have the plant certified in accordance with standards established by the NRMCA and the scales tested and sealed by the Bureau of Weights and Measures or a qualified independent agency or testing laboratory. The agency will certify the scale and metering tests in the state in which it is to be used.

Plant and equipment shall be capable of a continuous production of 150 yd<sup>3</sup>/hr and a maximum rate of 200 yd<sup>3</sup>/hr. Furthermore, the plant shall be capable of batching six previously set mixes, or shall have a digital mix selector.

b. Dry Mix Batch Plant

The Subcontractor shall furnish, at its expense, a modern dry mix batch plant. The Subcontractor, at its expense, shall test the mixer trucks in accordance with Appendix XI, ASTM C 94 to ensure that they will produce concrete meeting these uniformity requirements. Furthermore, the dry batch plant and mixer trucks must be certified in accordance with the NRCMA's Certification of Ready Mixed Concrete Production Facilities. The documentation for both of these tasks should be complete prior to start of concrete production. The plant and equipment shall be capable of a continuous production of 90 yd<sup>3</sup>/hr and a maximum rate of 110 yd<sup>3</sup>/hr. Furthermore, the plant shall be capable of batching four previously set mixes, or shall have a digital mix selector.

c. Central Batch Plant and Dry Mix Batch Plant

The batch plant shall be inspected every 6 months in accordance with ASTM C 94 and at the Subcontractor's expense. Test certificates and the test reports showing errors found shall be submitted to the Contractor at the completion of each test. Such means and equipment and its operation at all times shall be subject to the approval of the Contractor.

The batch plant shall be capable of ready adjustment to compensate for the varying moisture contents of the aggregates and to change the weights of the materials being batched. Adjustments to the mix may be made based on a moisture content determined by ASTM C 70. An accurate recorder batch counter shall be provided. The recorder shall be digital, producing on a trip ticket supplied by Subcontractor the individual names, weights, or volumes of all materials in the batch (except for ice, which may be recorded on the ticket by hand), the class of concrete, the batch number, the mixer number (if more than one mixer), batch volume (yd<sup>3</sup>), and date and time the mix is discharged. Space shall be provided on the trip ticket for the truck number, time of final discharge from the truck, and signature for receipt of concrete at point of truck discharge. In the event of a digital recorder failure, the Subcontractor may provide handwritten trip tickets. The recorder shall be repaired or replaced within 30 days, unless approved otherwise by project engineering.

9.2.4 Mixing and Delivery

Concrete shall be mixed by either a central batch plant or, at the option of the Contractor, by agitator mixer trucks. When concrete is mixed by a central batch plant, Sections 9.2.4.a and 9.2.4.c shall apply. When concrete is mixed by agitator mixer trucks, Sections 9.2.4.b and 9.2.4.c shall apply.

a. Central Concrete Batch Plant

Concrete shall be mixed completely in stationary mixers at the onsite plant and transported to the point of delivery in agitator mixer trucks. The stationary mixer shall contain a consistency meter to control slump. A water jogging switch shall be available at the batcher console for adjusting slump. Accurate records shall be made of water added to each batch with the water jogging switch.

b. Dry Mix Batch Plant

Concrete shall be mixed and delivered to the point designated by the Contractor according to the truck-mixed concrete method.

Truck-mixed concrete shall consist of concrete that is completely mixed in a truck mixer (70 to 100 revolutions) at the mixing speed designated by the manufacturer to produce the uniformity of concrete indicated in Appendix XI of ASTM C 94. Concrete uniformity tests shall be made in accordance with Section 10.5.1 of ASTM C 94 and, if requirements for uniformity of concrete indicated in Appendix XI are not met with 100 revolutions of mixing after all ingredients, including water, are in the drum, that mixer shall not be used until the condition is corrected, except as provided in Section 9.5 of ASTM C 94. When satisfactory performance is found in one truck mixer, the performance of mixers of substantially the same design and condition of blades may be regarded as satisfactory.

When a truck mixer is approved for mixing and delivery of concrete, no water from the truck water system or elsewhere shall be added after the initial introduction of the mixing water for the batch. Discharge of the concrete shall be completed within 1-1/2 hours, or before the drum has revolved 300 revolutions, whichever comes first, after the introduction of the mixing water to the cement and aggregate. These limitations may be waived by the field engineer if the concrete is of such slump that it can be readily placed.

Truck mixers shall operate within the limits of capacity and the speed of rotation designated by the manufacturer of the equipment. Additional revolutions of the mixer beyond the number found to produce the required uniformity of concrete shall be at the designated agitating speed.

c. Central Batch Plant or Dry Mix Batch Plant

The Subcontractor shall arrange routing so that placement of various classes of concrete can be made simultaneously. At such times, the Subcontractor shall ensure that changes in batching are correctly made and that each class of concrete is delivered to the proper destination.

The Contractor shall furnish, for purchase by the Subcontractor, eight agitator trucks. The agitator trucks shall be maintained by the Subcontractor at its expense to properly discharge the specified low slump, large aggregate concrete. For all major placements, backup trucks shall be provided by the Subcontractor at its expense.

For dry batching concrete, the mixer trucks shall be as indicated in Sections 9.2.3.b and 9.2.4.b.

### 9.3 Colored Concrete

Concrete furnished for encasement of underground electrical conduit (external to the building perimeters) shall be colored with oxide coloring as directed by the Contractor.

## 10.0 NONSHRINK GROUT AND DRYPACK MORTAR

### 10.1 General

Materials for nonshrink grout and mortars shall generally be provided by the Subcontractor for mixing and placing by others. However, when large quantities are involved, the Subcontractor may be required to furnish mixed nonshrink grout or mortars.

### 10.2 Nonshrink Grout

Nonshrink grout shall be proportioned and mixed in accordance with the manufacturer's instructions.

Prior to use, a test batch shall be made and submitted to the Contractor for testing to determine the percent of expansion and the compressive strength of the grout.

### 10.3 Masonry Mortar

Masonry mortar shall be proportioned by volume as follows:

- 1 part Portland cement
- 1/4 part hydrated lime
- 3 parts of motor sand



10.4 Drypack Mortar

Drypack mortar shall be proportioned by volume as follows:

1 part Portland cement (White cement shall be substituted for the regular cement as required to match adjacent color) to 2-1/2 parts of a well graded concrete sand conforming with ASTM C-144-70 or ASTM C-33-71a with 100% passing No. 4 sieve.



Only enough water shall be used to produce a mortar, which when used, shall stick together on being molded into a ball by a slight pressure of the hands, and shall not exude water, but will leave the hands damp. The proper amount of mixing water and the proper consistency shall be that which produce a mortar which is of the point of becoming rubbery when the material is solidly packed.

11.0 COLD AND HOT WEATHER CONCRETING

Methods and means of batching, mixing and delivering of concrete in cold and hot weather shall comply with the "Recommended Practice for Cold Weather Concreting" (ACI Standard 306-66) and the "Recommended Practice for Hot Weather Concreting" (ACI 305-72) and as specified herein or otherwise directed. The Subcontractor shall submit proposed procedures for approval by the Contractor.

11.1 Cold Weather Concreting

A boiler plant will be provided, as part of the Contractor furnished batch plant, for heating the water and the aggregate, during the placing of concrete in cold weather.

Concrete, when deposited in the forms during cold weather, shall have a temperature within plus or minus 10°F of the following:

Ambient Air Temp. Deg. F	Thin Sections Less than 2-1/2 ft. In Least Dimension (w/ or w/o Flyash)	Mass Concrete 2-1/2 ft. or More In Least Dimension (w/ Flyash)	Mass Concrete Using Mix Design Without Flyash
31F to 45F	60F	50F	50F
0F to 30F	60F	55F	50F
Below 0F	70F	60F	50F



During cold weather concreting when the ambient air temperature occasionally rises above 45°F, the temperature requirements of this section will apply, but the criteria for rejection due to high temperatures shall be the requirements given in Section 11.2 for Thin and Thick sections.

In the event of concurrent pours including both thin and massive concrete sections, the temperature of the concrete batched shall comply with the temperature requirements for the thickest section



poured. Adequate weather protection must be provided, particularly for the thin sections, to preclude weather damage to this concrete.



The Subcontractor shall preheat the mixing water and aggregate as required to assure heated materials are available when needed. The use of heated materials will not be permitted until the temperature of the concrete has decreased to the temperatures in the table above. The materials shall be free of ice, snow and frozen lumps before they enter the mixer. All methods and equipment shall be subject to approval by the Contractor.



11.2 Hot Weather Concreting

During warm weather, the Subcontractor shall, at his expense, and before ice is added, employ approved means and measures for reducing the temperature of the concrete, such as: (1) cooling the aggregate; (2) shading materials and facilities from the direct rays of the sun; (3) insulating water supply lines; or (4) spraying the mixing drum and truck drums.

When the use of ice is contemplated as a hot weather concreting measure and such temperatures are imminent, the Subcontractor shall provide ice storage and facilities for weighing, chipping, and mixer charging on a "ready-to-go" basis.

Flaked or chipped ice shall be substituted, as necessary, for up to 100 percent of added mixing water to obtain the following placing temperatures:

Thin Sections 3 ft. and less In Least Dimension	Thick Sections more than 3 ft. to 6 ft. In Least Dimension	Mass Sections More than 6 ft. In Least Dimension
85°F max.	75°F max. (A)	As near 50°F as possible but not to exceed 70°F, (B)



- (A) For Thick Sections, the average temperature of the concrete tested will be less than 70°F. Temperatures will be taken whenever concrete tests are performed, or as otherwise directed by the Contractor.
- (B) 70°F criterion is applicable only after all the methods of cooling the aggregates (including upto 100% ice) have been used.

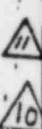


Whenever it is necessary to use 100 percent ice, the moisture content of the fine aggregate (sand) shall be limited to 5 percent (oven dry basis). No unmelted ice shall remain in the concrete at the end of the mixing period.

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The Subcontractor shall submit for testing, the water used in the ice if such water comes from a different source than the mixing water. Water for ice shall conform to Section 7.3.

The Contractor shall advise the Subcontractor in writing, of the proposed use of concrete for each placement. It is the Subcontractor's responsibility to see that the concrete does not exceed the specified temperatures. Temperatures shall be measured at the point of placement, unless correlation tests are performed. Where correlation testing is in effect, temperature may be taken at the truck discharge. Ice so used will be paid for under pay item 30.





## 12.0 SAMPLES AND TESTS

### 12.1 General

As specified herein and in Technical Specifications 7220-C-208, "Subcontract for Materials Testing Services", the Subcontractor shall, at his expense, provide, in the amount required and from the sampling points designated by the Contractor, samples to be tested by the Contractor.

### 12.2 Testing of Materials

All tests shall be performed in strict accordance with applicable ASTM Standards and the Subcontractor shall furnish all materials for user tests.

#### 12.2.1 Cement

Subcontractor shall furnish mill test reports for each load of cement delivered, showing the chemical composition and physical properties and certifying that the cement complies with Section 7.1 of these Specifications.

To confirm the mill tests and the compliance certifications, the Contractor will sample cement on the job as required by Technical Specification 7220-C-208, and make the necessary tests. No cement shall be used until notice has been given by the Contractor that the Acceptance Test results are satisfactory. Cement which has been stored elsewhere than in the bins at the mills for more than 4 months after being tested shall be retested before use. Any cement delivered at the site and found to be unsuitable shall be removed from the premises by the Subcontractor at his expense.

#### 12.2.2 Aggregates

Upon award of the Subcontract, the Subcontractor shall submit samples from his selected aggregate source, as required by Technical Specifications 7220-C-208, for testing by the Contractor in accordance with methods specified in the "Standard Specifications for Concrete Aggregates" (ASTM C33-71a). Acceptability of aggregates and source shall be based on the following ASTM tests:

Method of Test	ASTM Designation
L. A. Abrasion	C 131-69
Friable Particles	C 142-71

Method of Test	ASTM Designation
Material Finer No. 200 Sieve	C 117-69
Effect Organic Impurities on Strength of Mortar	C 87-69
Organic Impurities in Sands	C 40-66
Potential Reactivity of Aggregates (Chemical)	C 289-71
Potential Reactivity of Aggregates (Mortar Bar)	C 227-71 (If neces- sary after perform- ing C-289)
Sieve Analysis	C 136-71
Soundness of Aggregates	C 88-71a
Specific Gravity and Absorption-Coarse Aggregate	C 127-68
Specific Gravity and Absorption-Fine Aggregate	C 128-68
Scratch Hardness of Coarse Aggregate	C 235-68
Petrographic	C 295-65

Coarse aggregate may be rejected if the loss from the Los Angeles abrasion test, ASTM C 131-69, using Grading A exceeds 40 percent by weight at 500 revolutions.

When aggregates contain montmorillonite clays, topsoil and claystone, fine aggregate shall have a minimum Sand Equivalent of 75 when tested in accordance with Test Method No. Calif 217 and coarse aggregate shall have a minimum cleanness value of 75 when tested in accordance with Test Method No. Calif 227, as specified in the California Division of Highways Test Methods.

During the progress of the work, aggregates will be tested as specified by Technical Specifications 7220-C-208 and ACI Manual of Concrete Inspection (SP-2, 1967).

No aggregate shall be used in concrete for the work until acceptability has been verified by Contractor.



### 12.2.3 Admixtures

#### a. Pozzolans

Chemical and physical tests will be performed by the Contractor on pozzolans during the work as specified in ASTM C311-68, ASTM C618-72, and Technical Specifications 7220-C-208.

#### b. Water Reducing and Air Entraining Agents

Upon selection and approval of the water reducing agent and the air entraining agent, the manufacturer shall furnish certifications for every delivery stating that the materials originally approved have not been changed. An infrared spectrophotometry analysis report shall also be furnished with each delivery.



### 12.3 Concrete and Grout Testing

During the progress of the work, concrete, as mixed, will be sampled and tested by the Contractor for slump, air content, temperature, unit weight, and compressive strength, as required by Technical Specifications 7220-C-208. Grouts with higher cement-sand ratios than the associated concrete mix shall be sampled and tested as required by Technical Specification 7220-C-208



### 12.4 Test Results

#### 12.4.1 Materials

Materials which fail to meet the requirements of the tests shall not be used and shall be removed from the site by the Subcontractor, unless the Contractor directs otherwise.

#### 12.4.2 Temperature, Slump, and Air Tests

If the temperature, slump or air content is estimated by correlation (Spec. 7220 C-208 sec. 7.4) or found to be outside the limits specified, a check test will be made. In the event of a second failure, the batch of concrete represented will be rejected.



#### 12.4.3 Compressive Strength Tests

Compressive strength cylinders will be cast, cured and tested by the Contractor. The Subcontractor shall, at his expense, provide necessary tools, equipment and personnel to assist Contractor in obtaining samples and casting cylinders.

Cause for concrete rejection shall be in accordance with the "Building Requirements for Reinforced Concrete" (ACI Standard 318-71, paragraph 4.3.3).

#### 12.4.4 Failure to Meet Strength Requirements

If the compressive strength tests fail to meet the above requirements, the Contractor may require that load tests be made or cores drilled and tested for those portions of the work where the questionable concrete has been placed. The Contractor will determine the cause of the questionable concrete. If it is determined that the concrete does not conform to these specifications and the required mix design such tests or drilling shall be at the Subcontractor's expense and the Contractor will backcharge the Subcontractor to either replace or repair the defective concrete or take other corrective measures.

#### 12.5 Records

Engineering and quality verification documents shall be submitted to Contractor in accordance with the provisions of Form G-321-D. While in the Subcontractor's facilities these and other records required by applicable codes and standards which are necessary to verify activities affecting quality, shall be maintained in facilities to protect contents from possible destruction by causes such as fire, flooding, tornadoes, insects, rodents, and from possible deterioration by a combination of extreme variations in temperature and humidity conditions. Storage systems shall be provided for the accurate retrieval of information without undue delay. (Compliance to ANSI N45.2.9, "Requirements for Collection, Storage, and Maintenance of Quality Assurance Records for Nuclear Power Plants" fulfills these requirements.) Quality assurance records are those records which furnish documentary evidence of the quality of items and of activities affecting quality. Records become quality assurance records upon issuance for use.

### 13.0 INSPECTION

#### 13.1 General

The measuring, batching and mixing of all concrete and materials shall be in accordance with the ACI Manual of Concrete Inspection (SP-2, 1967), and the "Specifications for Structural Concrete Buildings" (ACI Standard 301-72).

The inspection of concrete construction will follow the requirements of ANSI N45.2.5 Sections 4.1 through 4.3 as modified below or within this specification:

- 13.1.1 Inspection of preparations for concreting, placement, curing, and protection is not included under this subcontract.
- 13.1.2 Printing zero tare weight on the batch plant tickets as required by NRMCA Concrete Plant Standard is not applicable.
- 13.1.3 Inspection of water measuring devices on transporting equipment is not required.



### 13.2 Batch Plant Inspection

During concreting operations, the Contractor will have an inspector at the batch plant who will certify the mixed proportion of each batch delivered to the site by signing the batch delivery ticket and recording the location of the pour. The inspector will sample and test at least once per day the concrete and the concrete ingredients and verify the proper setting and operation of scales and devices. Adequate standard test weights shall be furnished by the Subcontractor for checking accuracy of scales when required. The inspector will also determine yield of concrete to ascertain compliance with the design mix weights.

The Subcontractor shall provide suitable devices for obtaining representative samples from the discharge of the mixer and for delivering samples of concrete to ground level. Suitable and convenient devices shall be provided for sampling and handling each size of aggregate as it drops from the bins or weigh hoppers or from other designated locations. A platform with ladder or stairs for access from the control room floor, shall be provided to permit visual inspection of the concrete in the mixer while mixing operations are in progress. All necessary platforms, tools, equipment and personnel used to assist the inspector in obtaining samples shall be furnished by the Subcontractor. Concrete specimens will be prepared from the mixtures used in the work and tested to determine the adequacy of control of the materials entering the concrete mix.

The Contractor's Batch Plant Inspector shall not act as a foreman or perform other duties for the concrete supplier. Work will be checked as it progresses, but failure to detect any defective work or materials shall not in any way prevent later rejection when such defect is discovered, nor shall it obligate the Contractor for final acceptance. Inspectors are not authorized to revoke, alter, relax, enlarge, or release any requirement of the Specifications.

## 14.0 MEASUREMENT AND PAYMENT

### 14.1 On-Site Batch Plant

The Subcontractor shall purchase from the Contractor the existing on-site batch plant and associated equipment. This includes: (See SC-4A for details)

- Batch plant and all appurtenant equipment
- Trucks
- Well equipment (See SC-3 for details)

The bidder shall, therefore, include in the bid a lump sum amount (Item 1) to be paid for this equipment. This amount will constitute payment in full for the batch plant and all associated equipment, and is to be paid before the transfer of ownership.

The transfer of ownership of the batch plant will be effective on the day the Subcontractor assumes operation of the batch plant under this Subcontract.

### 14.2 Mobilization Fee

The Subcontractor will be paid a lump sum mobilization fee (Item 2) to cover the cost of mobilizing his manpower and equipment and providing the additional equipment essential to meet the specified job requirements but not furnished by the Contractor. Payment will be made under this item when the Subcontractor has assumed operation of the batch plant, a sufficient stock of approved materials is on hand to permit continuous placement of at least 5,000 cubic yards of concrete, and all required certifications for plant and materials have been submitted to and approved by the Contractor.

### 14.3 Material Stockpiled On-Site

Stockpiled adjacent to the batch plant is an unknown quantity of aggregate remaining from a previous Subcontract. This material will be given to the Subcontractor at no charge and, hence, becomes his responsibility. If used in the work the Subcontractor will be responsible for the material meeting the provisions of this specification.

### 14.4 Concrete and Grout

The quantity of Portland cement concrete and grout for which payment will be made will be the number of cubic yards or the various classes (Items 3-16) ordered by the Contractor and delivered in

accordance with these Specifications, and used in the completed work or in tests. Standby time and air entraining agents will not be measured for direct payment, but will be considered subsidiary obligations of the Subcontractor, payment for which shall be included in the Subcontract unit price per cubic yard for the various classes of concrete. All cement and admixtures (other than AEA) will be paid for under other pay items; this item includes payment for all aggregates, sand, and water used. Measurement of quantities of concrete and grout produced at the on-site batch plant will be based on Concrete Mixer Report QC-2C, which will be made out at the end of each shift and signed by representatives of the Contractor and Subcontractor.

#### 14.5 Cement

The quantities of Portland cement for which payment will be made will be the number of 376 pound barrels (measured to the nearest barrel) of Portland cement satisfactorily used in the work. (Item 21)

Quantities recorded on the Concrete Mixer Report QC-2C shall provide the measurement for payment for cement used in the on-site batch plant.

#### 14.6 Admixtures

The quantity of admixtures of the various types, for which payment will be made, will be the number of pounds or gallons of the various types of admixtures. (Items 23, 24 and 28)

The quantity of pozzolan admixture for which payment will be made, will be the number of tons of pozzolan used in the completed work (Item 22), measured to the nearest 1/10 ton (200 lbs).

As stated in Section 14.4, no payment will be made for air entraining agents.

Quantities recorded on the Concrete Mixer Report QC-2C shall provide the measurement for payment for admixtures used in the on-site batch plant.

#### 14.7 Heating and Cooling

The quantity of heating and cooling provided in accordance with Section 11.0, for which payment will be made, will be the number of cubic yards of concrete, used in the completed work, which required heating or cooling (Items 29, 30a, 30b, and 30c).

Quantities recorded on the Concrete Mixer Report QC-2C shall provide the measurement for payment for the number of cubic yards of concrete requiring heating or cooling.

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## 14.8 Non-Shrink Grout and Mortars

### 14.8.1 Furnishing Component Materials

The quantities of materials for non-shrink grout, masonry mortar, and dry pack mortar for which payment will be made, will be the quantities, furnished at the job site, required for mixing and/or placing by others.

Sand will be measured and paid for by the cubic yard. (Item 20)

Hydrated lime will be measured and paid for by the sack. (Item 27)

Non-shrink grout additives and premixes will be measured and paid for by the pound. (Items 25 and 26)

Measurement for payment for the quantities of materials furnished under these items, shall be based upon supplier's invoices submitted by the Subcontractor.

### 14.8.2 Furnishing Mixed Non-Shrink Grout and Mortar

The quantities of mixed non-shrink grout, mixed masonry mortar and mixed dry pack mortar (Items 17, 18 and 19), for which payment will be made, will be the number of cubic yards furnished for placing by others.

The bid prices shall not include costs of cement, hydrated lime or non-shrink grout additives.

Cement will be measured for payment as stated in Section 14.5. (Item 21)

Hydrated lime will be measured for payment as stated in Section 14.8.1. (Item 27)

Non-shrink grout admixtures and premixes will be measured for payment as stated in Section 14.8.1. (Items 25 and 26)

Measurement for payment for the quantities of mixed non-shrink grout, mixed masonry mortar, and mixed dry pack mortar shall be based upon the quantities recorded on the Concrete Mixer Report QC-2C.

## 14.9 Overtime

Compensation for overtime will be the direct excess labor cost, for the premium time only, for overtime required to complete pours scheduled by the Contractor. Premium time for overtime required by the Subcontractor to perform routine maintenance and other work in connection with his batch plant operations will be at the Subcontractor's expense.



# BECHTEL CORPORATION CONCRETE MIXER REPORT

QC-2C

Project \_\_\_\_\_  
 Site \_\_\_\_\_  
 Spec. No. \_\_\_\_\_  
 Location \_\_\_\_\_  
 Elevation \_\_\_\_\_



Specification No. \_\_\_\_\_  
 Pour Number \_\_\_\_\_  
 Inspector \_\_\_\_\_  
 Shift: From \_\_\_\_\_ To \_\_\_\_\_  
 Weather \_\_\_\_\_

MIX NO.	CEMENT	POZZO-LAN	SAND	AGGREGATE			WATER	AEA OZ.	WRA OZ.	BATCH SIZE	NO. OF BATCHES	CU. YDS CONCRETE MIXED	CU. YDS WASTE	CU. YDS IN STRUCTURE
				3/4"	1 1/2"	3"								
CEMENT		ADMIXTURES			TOTALS									
	POUNDS	BARRELS		POZZOLAN TONS	WRA OZ.									
Mixed			Mixed											cu. yds
Waste			Waste											cu. yds
In Structure			In Structure			Start of Pour: _____								
						End of Pour: _____								

## TEST DATA

MIX NO.	CYL. NO.	UNIT WEIGHT	% AIR ENTR.	TEMPERATURE		BATCH PLANT		TRUCK DISCHARGE		FORM	
				AIR	CONCRETE	TIME	SLUMP	TIME	SLUMP	TIME	SLUMP

Reason for Waste: \_\_\_\_\_  
 Plant Inspector (Initial) \_\_\_\_\_ Central Rep. (Initial) \_\_\_\_\_  
 Delay: From \_\_\_\_\_ To \_\_\_\_\_  
 Reason for Delay: \_\_\_\_\_

Plant Operator \_\_\_\_\_ Placing Inspector \_\_\_\_\_

**READ INSTRUCTIONS ON BACK BEFORE FILLING IN FORM**

These requirements for Engineering and Quality Verification Documents are to be fulfilled in accordance with the schedule set forth below. Supplier's failure to comply with these requirements may result in order cancellation or withholding of payment until compliance is established.

1. Document Category Number	2. Specification Paragraph Reference	3. Kind of Copies	ENGINEERING DOCUMENTS				QUALITY VERIFICATION DOCUMENTS					12. Remarks	
			4. Quantity Required		5. Prior Approval Required		6. Quantity Required for Release	7. Distribution Code	8. Supplier Conform Check	9. Inspection Release	10. Engineering Review		11. Field QCE Check In
			Initial	Final	Yes	No							
		Reproducible											
		Microfilm											
6.0E	6.0	Reproducible	1	1	X		a						
		Microfilm											
10.0E	11.2	Reproducible	1	1	X		b						
		Microfilm											
10.0E	12.2.2	Reproducible	1	1	X		b						
		Microfilm											
10.0E	10.2	Reproducible	1	1	X		b						
		Microfilm											
17.1V	12.2.1	Reproducible				1	c						
		Microfilm											
17.4V	7.4	Reproducible				1	c						
		Microfilm											
26.0V	9.2.3	Reproducible				1	c						
		Microfilm											
		Reproducible											
		Microfilm											
		Reproducible											
		Microfilm											
		Reproducible											
		Microfilm											

13. Supplier's Order No.	14. Supplier's Part No.	15. Supplier's Part Name	16. Quantity
17. Buyer's Req. Item No.	18. Buyer's Line/Equip., Tag or Code No.	19. Buyer's Part Name	20. Traceability


21. Supplier's Conformance Statement: We certify that the listed work and required documents meet the requirements of the procuring documents. Supplier: \_\_\_\_\_ Signature \_\_\_\_\_ Title \_\_\_\_\_ Date \_\_\_\_\_

22. Inspection Release Statement: Work was released based on satisfactory completion of inspection and review of documentation. Authorized Deviations:  YES, Noted under 12, Remarks  NONE. Bechtel Inspector: \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_

23. Engineering Review Statement: The Quality Verification Documents submitted to Engineering with this form have been reviewed for conformance to the specified requirements and are acceptable. Engineer: \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_

24. QCE Check-In Statement: This form and the Quality Verification Documents referenced hereon have been received and their relationship to the hardware items verified. CONTROL NO. \_\_\_\_\_ FILE NO. \_\_\_\_\_ QCE: \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_

After QCE Check-in Distribute to: Procurement Manager, Field Office Manager, Material Supervisor

 © 321-D AA REV 2 5/74	MIDLAND PLANTS - UNITS 1 & 2 CONSUMER POWER COMPANY	JOB NO. 7220 P.O./SPEC. NUMB. 7220-C-230
	ENGINEERING AND QUALITY VERIFICATION DOCUMENT REQUIREMENTS	SHEET 1 OF 1 REV. 1

**INSTRUCTIONS FOR PREPARING G-321-D**

- A. PURPOSE:** This is a multi-purpose form to be used by Buyer/Contractor to specifically identify documents required of the supplier to satisfy specification requirements, and is to be used by the supplier as a cover sheet for Quality Verification Documents when submitting them to the Buyer/Contractor.
- B. GENERAL INFORMATION:** Engineering (E) and Quality Verification (V) Documents are identified by Category number and title in section H, below.
- C. USE:** A copy of the front of this form shall be completed by the supplier and provided to the Buyer's/Contractor's Inspector along with the applicable Quality Verification Documents for his review prior to release of the unit(s).
- D. DISTRIBUTION:** All Engineering (E) Documents are to be sent to the Project Engineer at the address shown below (Code a).

When inspection release is completed, the Verification (V) Documents are to be distributed to the respective addresses shown below in accordance with the distribution codes specified in Column 7. A copy of the completed Form G-321-D must accompany each "package" of Verification Documents to its destination. Also, a copy of completed Form G-321-D is to be included with the hardware shipment and a copy sent separately to the Project Field Quality Control Engineer at the jobsite.

**Code a.**  
 Bechtel Associates Professional Corp.  
 P. O. Box 1000  
 Ann Arbor, Michigan 48106  
 Attn: Project Engineer, Job 7220

**Code b.**  
 Bechtel Power Corp.  
 3500 E. Miller Road  
 Midland, Michigan 48640  
 Attn: Project Field Engineer

**Code c.**  
 Bechtel Power Corp.  
 P. O. Box 2167  
 Midland, Michigan 48640  
 Attn: Quality Control Engineer

**E. DEFINITIONS OF TERMS:** (See also Document Category Definitions G-321-SUP A)

- Supplier** - This is a generic term and is synonymous with the terms seller, vendor, contractor, sub-contractor, sub-supplier, etc.
- Reproducible** - can be legibly duplicated by either microreproduction or electrostatic dry process.
- Microfilm** - 35mm microfilm conforming to the requirements of the procurement documents. When not specified, supplier shall submit his standard for approval.
- Prior Approval Required** - Bechtel approval required prior to use of documents in the design, fabrication, installation, or other work process.
- Initial** - the first submittal of a document in accordance with the schedule mutually agreed to by the Buyer and the supplier.
- Final** - the submittal that reflects the resolution of review comments, or the complete submittal required. Both are to be accepted prior to rendering final payment. Drawings submitted as final must be full size reproducibles made from original document. Adjacent to the title block, each drawing must be certified and show Buyer's job title, job number, purchase order number, line, equipment, tag or code number, and the manufacturer's serial number(s).
- Certified** - the dated Signature and Title of an authorized and responsible employee of the supplier.
- N/A** - Not applicable - can be used for individual entries, columns and lines by Project engineering, and for individual entries by the supplier.

**F. BECHTEL ENTRY INSTRUCTIONS**

Entry No.	Information Required
1	Enter Document Category Number.
2	Enter Specification paragraph reference.
3	Make no entry. Relates to kind of copies required.
4	Enter the number of each kind of copy for "initial" or "final" submittals of Engineering Documents.
5	Enter approval requirement by X under "Yes" or "No" column.
6	Enter the number of each kind of copy of Quality Verification Documents required for release of the item or installation.
7	Enter Quality Verification Document distribution code letter in accordance with paragraph D above.
8	Make no entry. For supplier use only.
9	Bechtel Inspector to complete upon release. Sign on line 22.
10	Enter Bechtel Engineering review confirmation. Sign on line 23.
11	Bechtel OCE to complete check-in. Sign on line 24.
12	Enter remarks as appropriate.

**G. SUPPLIER ENTRY INSTRUCTIONS**

Entry No.	Information Required
8	Enter number of pages of each type of Quality Verification Documents being submitted for the unit(s) being released. Sign Statement of Conformance on line 21.
12	Enter remarks as appropriate. When a deviation has occurred, reference the deviation(s) and Buyer/Contractor's authorization in this column, and include the authorization document(s) in the Verification Document Package.
13, 14, 15	Enter information as required.
16	Enter the numbers of units covered by the Quality Verification Documents being submitted. For each requisition item no. being released provide a separate copy of this completed form and the supporting Quality Verification Documents.
17, 18, 19	Enter information as required.
20	Enter identification number(s) traceable to the unit(s) being released, e.g. serial no., heat no. of major component, cable reel no. or other unique designator.

**H. DOCUMENT CATEGORY NUMBERS:** Engineering (E) and Quality Verification (V) Document Requirements as entered in Column 1, and defined in G-321-SUP A Document Category Definitions. For details, see specification paragraph(s) referenced in Column 2.

<b>1.0 DRAWINGS (E)</b>	<b>10.2 Typical Material Used</b>	<b>20.0 RT - RADIOGRAPHIC EXAMINATION PROCEDURES (E), AND VERIFICATION REPORTS (V)</b>
1.1 Outline Dimensions, Services and Foundation/Mounting Details	<b>11.0 MATERIAL DESCRIPTION (E)</b>	<b>21.0 MT - MAGNETIC PARTICLE EXAMINATION PROCEDURES (E), AND VERIFICATION REPORTS (V)</b>
1.2 Assembly Drawings	<b>12.0 WELDING PROCEDURES AND QUALIFICATIONS (E), AND VERIFICATION REPORTS (V)</b>	<b>22.0 PT - LIQUID PENETRANT EXAMINATION PROCEDURES (E), AND VERIFICATION REPORTS (V)</b>
1.3 Shop Detail Drawings	<b>13.0 WELD ROD CONTROL PROCEDURES (E), AND VERIFICATION REPORTS (V)</b>	<b>23.0 EDDY CURRENT EXAMINATION PROCEDURES (E), AND VERIFICATION REPORTS (V)</b>
1.4 Wiring Diagrams	<b>14.0 REPAIR PROCEDURES (E), AND MAJOR REPAIR VERIFICATION REPORTS (V)</b>	<b>24.0 PRESSURE TEST - HYDRO, AIR, LEAK, BUBBLE OR VACUUM TEST PROCEDURE (E), AND VERIFICATION REPORTS (V)</b>
1.5 Control Logic Diagrams	<b>15.0 CLEANING AND COATING PROCEDURES (E), AND VERIFICATION REPORTS (V)</b>	<b>25.0 INSPECTION PROCEDURE (E), AND VERIFICATION REPORTS (V)</b>
1.6 P & IDs	<b>16.0 HEAT TREATMENT PROCEDURES (E), AND VERIFICATION REPORTS (V)</b>	<b>26.0 PERFORMANCE TEST PROCEDURES (E), AND VERIFICATION REPORTS (V)</b>
<b>2.0 PARTS LIST AND COST (E)</b>	<b>17.0 CERTIFIED MATERIAL PROPERTY REPORTS (V)</b>	<b>26.1 Mechanical Tests</b>
<b>3.0 COMPLETED BECHTEL DATA SHEETS (E)</b>	17.1 MTR (Certified Material Test Reports)	<b>26.2 Electrical Tests</b>
<b>4.0 INSTRUCTIONS (E)</b>	17.2 Impact Test Data	<b>27.0 PROTOTYPE TEST REPORT (E &amp; V)</b>
4.1 Erection/Installation	17.3 Ferrite Data	<b>28.0 SUPPLIER SHIPPING PREPARATION PROCEDURE (E)</b>
4.2 Operating	17.4 Material Certificate of Compliance	
4.3 Maintenance	17.5 Electrical Property Reports	
4.4 Site Storage and Handling	<b>18.0 CODE COMPLIANCE (V)</b>	
<b>5.0 SCHEDULES: ENGINEERING AND FABRICATION/ERECTION (E)</b>	<b>19.0 UT - ULTRASONIC EXAMINATION PROCEDURES (E), AND VERIFICATION REPORTS (V)</b>	
<b>6.0 QUALITY ASSURANCE MANUAL/PROCEDURES (E)</b>		
<b>7.0 SEISMIC DATA REPORT (E)</b>		
<b>8.0 ANALYSIS AND DESIGN REPORT (E)</b>		
<b>9.0 ACOUSTIC DATA REPORT (E)</b>		
<b>10.0 SAMPLES (E)</b>		
10.1 Typical Quality Verification Documents		



CALCULATION SHEET

MS-1070

DESIGN BY: J. E. Hank DATE: 5/2/73 CHECKED BY: [Signature]

PROJECT: Midland Plant - Units 1 & 2 SHEET NO. 7220

SUBJECT: Design Mixes - With Flyash JOB NO. 7220 FILE NO. \_\_\_\_\_

# TABLE 1

Mix No.	A-1	A-2	A	B-1	B-2	B	C-1	C-2	C	D-1	D-2	D
Design Strength	2000	2000	2000	3000	3000	3000	4000	4000	4000	5000	5000	5000
Max. Aggregate	3/4"	1 1/2"	No. 4	3/4"	1 1/2"	No. 4	3/4"	1 1/2"	No. 4	3/4"	1 1/2"	No. 4
Slump	4"	4"	-	3"	3"	-	3"	3"	-	3"	2 1/2"	-
Unit Weight	145.7	145.9	136.9	145.6	146.7	136.9	145.5	146.5	136.8	144.5	145.0	136.0
Cement	325 350 365	275 300 315	645 600 565	465 435 405	425 395 365	75 75 75	510 475 440	468 433 398	974 939 904	533 508 473	574 549 514	571 546 511
Flyash	0.65	0.80	1.13	0.82	0.75	1.38	0.90	0.82	1.51	1.05	1.01	1.72
Sand	47	45	106	45	45	190	45	75	142	95	95	165
3/4" Agg.	1525	1550	2539	1422	1406	2424	1397	1410	2432	1304	1291	2142
1 1/2" Agg.	55	55	1578	55	55	1473	852	850	1422	782	782	1262
Water	1741	549	54	1712	917	1719	55	29	1670	878	29	1670
WRA	57	5.1	97	70	64	11.7	1.5	1.5	12.8	8.5	8.6	14.6
AEA(%)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6



CALCULATION SHEET

01111310

DESIGN BY: S. L. Hobbs DATE: 5/12/73 CHECKED BY: [Signature]

PROJECT: Mission 2 First - Units 1 & 2 JOB NO: 7:20

SUBJECT: Design Mixes - No Flyash FILE NO: \_\_\_\_\_

# TABLE 2

Mix No	A-1-C	A-2-C	AC Groat	B-1-C	B-2-C	BC Groat	C-1-C	C-2-C	CC Groat	D-1-C	D-2-C	DC Groat
Design Strength	2000	2000	2000	3000	3000	3000	4000	4000	4000	5000	5000	5000
Max Aggregate	3/4"	1 1/2"	No. 4	3/4"	1 1/2"	No. 4	3/4"	1 1/2"	No. 4	3/4"	1 1/2"	No. 4
Slump	4"	4"	-	3"	3"	-	3"	2 1/2"	-	3"	2 1/2"	-
Unit Weight	146.3	147.5	138.0	146.4	147.5	138.2	146.4	147.4	138.2	145.6	146.1	
Cement	Sacks	4.5	4.0	5.5	5.0	9.24	6.0	5.5	10.1	7.0	6.75	11.57
	Pounds	433	376	517	470	868	564	517	949	658	635	1046
	Yield (C.F.)	2.15	1.91	3.63	2.62	2.59	4.41	2.96	4.81	3.4	3.22	5.51
Sand	% Agg	47	46	46	45	100	45	44	100	44	43	100
	Pounds	1543	1556	2614	1475	2460	1409	1417	2369	1317	1207	2174
	Yield (C.F.)	9.41	9.49	15.94	9.00	15.00	8.59	8.64	14.43	8.03	7.97	15.26
3/4" Agg.	% Agg	53	25	54	28	28	55	29	29	56	29	29
	Pounds	1751	954	1729	924	1733	941	941	1696	856	856	856
	Yield (C.F.)	10.81	5.73	10.43	5.60	10.50	5.70	5.70	10.22	5.37	5.37	5.37
1/2" Agg.	% Agg	26	26	26	27	27	27	27	27	28	28	28
	Pounds	886	886	886	891	891	873	873	855	855	855	855
	Yield (C.F.)	5.37	5.37	5.37	5.60	5.60	5.31	5.31	5.19	5.19	5.19	5.19
Water	W/C Ratio	0.55	0.55	0.55	0.47	0.47	0.44	0.44	0.44	0.41	0.41	0.41
	Pounds	254	210	396	245	221	426	248	417	270	290	446
	Yield (C.F.)	3.75	3.37	6.35	3.89	3.53	6.51	3.97	6.68	4.33	4.17	7.15
WRA	oz/Sack	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.0	2.0	2.0
	Weight (lb)	5.5	6.0	11.4	6.3	7.5	13.8	9.0	15.1	14.0	14.5	23.1
	Yield (C.F.)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
AEAGG	oz/Sack	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Weight (lb)	2.7	2.4	4.6	3.3	3.0	5.5	3.6	6.05	4.2	4.1	6.9
	Yield (C.F.)	1.09	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08