

Bechtel Associates Professional Corporation  
Ann Arbor, Michigan


APPENDIX N  
SPEC C208

TECHNICAL SPECIFICATION  
FOR  
FIELD PURCHASE AND INSTALLATION OF  
CONCRETE UNIT MASONRY  
FOR THE  
CONSUMERS POWER COMPANY  
MIDLAND PLANT, UNITS 1 AND 2  
MIDLAND, MICHIGAN

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REVISIONS		BY	CHK	APPR	
1	6-13-79	Incorporated SCN 9001	MU	TRM JC	RLC/MLK
2	7-7-79	Incorporated SCN 8001 and Minor Revisions	MU	TRM JC	RLC/MLK
3	2-6-78	Issued for Field Use	JC	KT JAK	RLC/MLK
4	12-20-77	Issued for Client Review	JC	KT JAK	RLC/MLK

ORIGIN		CONSUMERS POWER COMPANY		JOB No. 7220	
		MIDLAND PLANT UNITS 1 AND 2		SPEC/DES GUIDE No.	
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12	0												
Appendixes													
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NO.	DATE	REVISIONS	BY	CHK'D	APP'D	NO.	DATE	REVISIONS	BY	CHK'D	APP
3	6/13/79	Incorporated SCN 9001	MU	TJM	RLC						
2	2/7/79	Incorporated SCN 8001 and Minor Revisions	MU	TJM	RLC						
1	2-6-78	Issued for Field Use	JC	KT	JAK						
0	12-20-77	Issued for Client Review	JC	KT	JAK						

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FACING SHEET  
MIDLAND PLANT UNITS 1 & 2  
CONCRETE UNIT MASONRY

JOB No. 7220

7220-A-14(Q)

sheet 11

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TECHNICAL SPECIFICATION  
FOR  
FIELD PURCHASE AND INSTALLATION OF  
CONCRETE UNIT MASONRY

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TECHNICAL SPECIFICATION  
FOR  
FIELD PURCHASE AND INSTALLATION OF  
CONCRETE UNIT MASONRY

1.0 WORK INCLUDED

- 1.1 The work includes but is not limited to the following:
- a. Purchasing and installing concrete masonry units, glazed concrete masonry units, wall ties, mortar, grout, and concrete in cavity walls.
  - b. Purchasing and installing reinforcement, anchors, inserts, and other masonry accessories.
  - c. Constructing around preset pipes, ducts and metal frames for openings in concrete unit masonry, including setting anchors, sleeves and inserts.
  - d. Prepare concrete surfaces to receive masonry.

2.0 RELATED WORK NOT INCLUDED

- 2.1 The following items of related work are not included:
- a. Brick masonry
  - b. Concrete foundations
  - c. Foundation dowels cast in concrete, welded dowels and welded anchors and anchor slots embedded in concrete

3.0 STANDARDS AND CODES

3.1 The following standards are incorporated as a part of this Specification as indicated:

3.1.1 American Society for Testing and Materials (ASTM):

A 36 Structural Steel

A 525 Steel Sheet, Zinc-Coated  
(Galvanized) by the Hot-Dip  
Process

A 615 Deformed and Plain Billet-Steel  
Bars for Concrete  
Reinforcement

C 90 Hollow Load-Bearing Concrete  
Masonry Units

C 140 Method for Sampling and Testing  
Concrete Masonry Units

C 270 Mortar for Unit Masonry

C 476 Mortar and Grout for Reinforced  
Masonry

C 145 Solid Load-Bearing Concrete  
Masonry Units

3.1.2 American Concrete Institute (ACI):

ACI 318 Building Code Requirements  
for Reinforced Concrete

3.2 The following code is incorporated as a part of this Specification as indicated:

3.2.1 Uniform Building Code (UBC):

No. 24-22 Field Tests for Grout and  
Mortar. ASTM-C-780 mortar test may  
be used as alternate to UBC test.

4.0 QUALITY ASSURANCE

4.1 Quality Assurance requirements are for installation, inspection and testing in accordance with Sections 9.0 and 12.0 of this specification for concrete block walls indicated in the architectural drawings as "Q" listed walls.

5.0 SUBMITTALS

- 5.1 Contractor shall maintain the following records in accordance with Form G-321-D:
- a. Samples of each type of unit
  - b. Mortar and grout mix design and materials source
  - c. Certificates from manufacturer verifying concrete masonry units have been properly cured before shipping to jobsite and that they comply with requirements in 7.1 below
  - d. Certificate verified by an approved testing laboratory that mortar and grout mix designs conform to this Specification and that concrete masonry units conform to the requirements in 7.1 below
  - e. Certificate of compliance from the manufacturer verifying that materials called out in Sections 7.5 through 7.10 comply with requirements as stated in same sections

6.0 TYPES OF WALLS

Masonry walls shall be constructed of normal weight concrete masonry units and all cells and spaces between wythes shall be grouted solid with heavy-weight grout or concrete as shown in drawings.

Masonry walls shown "removable" shall be constructed of solid, load-bearing concrete masonry units without reinforcing. Voids and spaces between wythes shall be grouted solid. Units and grout shall be heavy weight.

7.0 MATERIALS

- 7.1 Concrete masonry units shall be load-bearing hollow units, Grade N-1 as specified in ASTM C 90 with linear shrinkage not to exceed 0.05 percent, and with a normal weight classification of 130 pounds per cubic foot min. density.
- 7.2 Mortar shall be Type M conforming to ASTM C 270 and shall have a minimum compressive strength of 2500 pounds per square inch at 28 days, Type I or Type II portland cement with masonry cement (no lime or lime putty). Mortar for glazed units shall be integrally colored as approved and shall be sealed as specified in 9.4.2.

7.3 Grout shall conform to ASTM C 476; the minimum compressive strength shall be 2500 pounds per square inch at 28 days, unless otherwise shown. Cement shall be Type I or Type II Portland cement. Aggregate size No. 8 shall be used for grout where the least cavity dimension exceeds 2-1/2 inches and aggregate size No. 1 or 2 shall be used where this dimension is less than 2-1/2 inches. Grout shall have a 6-1/2-inch minimum and 9-inch maximum slump, and shall have a cured density of not less than 135 pounds per cubic foot.

7.4 Reinforcing bars shall be Grade 60 deformed type as specified in ASTM A 615.

7.5 As an alternate to dovetail anchors and slots, the following may be used:

Block anchors, No. 186 manufactured by "Heckmann Building Products," secured to concrete walls with Type DN-27P8 pins manufactured by "Hilti Corporation" @ 16" O.C. vertical spacing. Similar products by Hohman & Barnard, Inc., may be used.

7.6 Calking and joint filler shall be in accordance with the latest revised issue of Specification 7220-A-35 and as shown.

7.7 Glazed concrete masonry units shall conform to ASTM C 90, Grade N-1 with linear shrinkage not to exceed 0.05 percent, and shall be factory finished with "Spectra Glaze" as manufactured by the Burns and Russel Company or the Hanley Company. Color will be selected from manufacturer's standard range and as noted in the Finish Schedule.

7.8 Wall ties and masonry accessories shall be zinc coated in accordance with ASTM A 525 designation G-90, as manufactured by Hohmann & Barnard, Inc., Dur-O-Wall Products, or AA Wire Products Company.

Joint reinforcing may be #9 gage ladder type. Wire shall not be galvanized after fabrication. Joint reinforcement is not required and shall not be used in bond beams.

7.9 Control joint gaskets shall be "Dur-O-Wall Rapid," Hohman & Barnard wide flange control joints, or paper joints sized as shown on design drawings.

7.10 Deformed anchor bars shall be "Nelson Stud Welding Company" as shown on drawings.

8.0 MATERIAL HANDLING AND STORAGE

8.1 Concrete masonry units and cement shall be handled without damage, stored in dry areas for protection from weather, moisture, stain, and other physical damage, until installation. Storage space shall be provided by Contractor.





- 8.2 Glazed concrete masonry units shall be protected against weather, moisture, stain, discoloration and other physical damage of the glazed face. Method of protection shall be in accordance with the glazed units manufacturer's printed instructions.

9.0 INSTALLATION

9.1 Masonry Units

- 9.1.1 Units shall be sound, dry, clean and free from cracks when placed. Units shall be laid plumb, true to line with level and accurately spaced courses. Corners and reveals shall be plumb and true. Each unit shall be solidly bedded in mortar. Units that are moved or shifted shall be relaid in fresh mortar. Joints shall be approximately 3/8 inch wide or as required to maintain coursing, and shall extend full depth of face shells for hollow block and full depth of unit for solid block. Anchors, wall plugs, accessories and other items required to be embedded in masonry shall be built-in as the masonry work progresses. Spaces in metal door frames and around built-in items shall be solidly filled with mortar. Vertical cells to be reinforced shall have vertical alignment sufficient to maintain complete grout cover around bars.
- 9.1.2 The top surface of concrete to receive masonry shall be clean, shall have laitance removed, roughened, and shall be level, aligned within one inch tolerance before installation is begun.
- 9.1.3 Unless otherwise shown, walls shall be laid up straight uniform courses with regular running bond. Bond beam units shall be used where shown.
- 9.1.4 When it is necessary to stop off a longitudinal run of masonry, it shall be done by racking back one-half unit length in each course. Tothing is not permitted without Contractors approval. Tothing of interior, solidly grouted walls is allowed.

9.1.5 Concrete masonry units shall not be wetted before laying. Units partially wetted during cutting may be installed.

9.1.6 Masonry wall corners shall have a standard masonry bond by overlapping units and shall be vertically reinforced with bars.

## 9.2 Reinforcing

9.2.1 Reinforcing bars shall be placed as shown and supported in place.

Nominal dimensions of reinforcing dowels from the outside face of the wall shall be 3 inches minimum and 4 inches maximum. Tolerances for dowel location shall be as follows:

- a. 8 inches thick wall - 10% of the dowels may be less than the nominal dimension from the face.
- b. 12 inches thick wall with two layers of dowels - one layer may be closer to the face than the nominal dimension, as long as 90% of the other layer is within the nominal dimension.
- c. Wall greater than 12 inches thick - 10% of each layer of dowels may be further from the face than the nominal dimension and 100% of each layer may be less.
- d. Minimum clear dimension for a, b, and c above shall not be less than 1 inch.
- e. Dowels location dimension shall be measured at floor level.

9.2.2 Where existing dowels are not in alignment with cells of masonry units, the dowels may be removed, new dowels of similar size and length may be installed in alignment by drilling concrete and grouting the dowels with flowable nonshrink grout in concrete as noted in drawings. Where existing floor dowels are placed so there is interference with the block, ends and/or webs of block may be cut to allow required grout coverage. Face shell may be chipped to allow required grout coverage. Required grout coverage shall be 1 inch minimum clear.

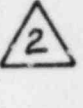
- 9.2.3 Before reinforcing is placed, the surfaces of bars, wire, and supports shall be cleaned free of heavy or flaked rust, loose mill scale, dirt, grease, or other deleterious substances. After placing, the reinforcing steel shall be kept clean until it is embedded.
- 9.2.4 Bending, lapping, splicing, and offsetting of reinforcing bars shall be in accordance with ACI 318 and the latest revised issue of Specification 7220-C-231, unless otherwise shown. Horizontal reinforcement at corners and intersections of walls shall be placed with sufficient clearance to allow full grout fill of cells.
- 9.2.5 Placement of wall ties and accessories shall be in accordance with the manufacturer's published specifications and as shown.

### 9.3 Grout Fill

- 9.3.1 Mortar fins which project more than 3/8" from the fin edge of the face shell into the grouted space shall be removed. Mortar droppings in cell spaces which are to be grouted shall be rodded while wet to remove air pockets and bridging. Mortar which could form air pockets and/or bridging which has been allowed to dry without rodding shall be removed.
- 9.3.2 Grout fill shall be poured in lifts (height of drop) not to exceed four feet. Each pour of grout shall be thoroughly rodded to ensure compaction and bond to the preceding pour. A preceding pour shall be allowed to cure for a minimum of 24 hours prior to the new pour.
- 9.3.3 When work is stopped for a period of 45 minutes or longer, the pour of grout shall be stopped not higher than 1-1/2 inches below the top of the last course and the surface of the fill shall be left rough.

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- 9.3.4 Concrete for core spaces between wythes of masonry shall be placed and cured in accordance with the latest revised issue of Specification 7220-C-231 and as specified in 9.3.2, and shall be Class B-1, B-2, or PG-B, in accordance with the latest revised issue of Specification 7220-C-230(Q). Grout may be used in lieu of concrete for spaces between wythes and shall be batched as specified in Specification 7220-A-14(Q), Section 7.3.



9.4 Joints

- 9.4.1 Mortar joints for regular concrete masonry units shall be solidly filled, straight, and uniform in thickness and appearance. Joints shall be flush filled, including nicks and defects on the masonry units, to obtain a uniform flat surface ready to receive surfacer finish, unless shown differently in the architectural drawings.
- 9.4.2 Mortar joints for glazed concrete masonry units shall be solidly filled, straight, and uniform in thickness and appearance, and shall be raked 1/4 inch and then sealed with integrally colored epoxy grout as American-Orlean No. AAR-11 epoxy or approved equal.

10.0 PROTECTION

- 10.1 Partially completed masonry walls exposed to weather shall be covered with waterproof sheets at the end of each day's work or beginning of each shutdown period. Covering shall overhang at least 2 feet on each side of wall, and shall be secured against displacement by wind or other agent.
- 10.2 Masonry shall be maintained at 35F or above for a period of at least 48 hours after being laid. Materials shall be free from ice or snow.
- 10.3 Masonry erected when the ambient air temperature is more than 90F in the shade and relative humidity is less than 50% shall be protected against rapid drying for at least 48 hours after being laid.

11.0 POINTING AND CLEANING

- 11.1 During the progress of work, walls which are to be left exposed shall be kept clean. Mortar smears shall be allowed to dry for a short period and then shall be promptly removed by trowel, stiff brush, or both. Care shall be taken to avoid damage to the mortar joint when brushing. Mortar burrs shall be promptly removed.
- 11.2 Upon completion and before acceptance, holes in joints of exposed masonry surfaces shall be cut out and pointed with mortar and tooled to match adjacent joints.
- 11.3 Mortar and grout stains on the face of concrete masonry units shall be removed by brushing with a stiff-fiber brush and washing with a 10 percent maximum muriatic acid solution. Immediately after washing, the surfaces which have been acid cleaned shall be thoroughly rinsed with potable water. Effervescent stain shall be removed by whipblasting.
- 11.4 Glazed units shall be cleaned with a solution specified by the glazed units manufacturer. If there is any evidence of blushing, discoloration, or whitening on the glazed face, the Contractor shall correct such defacement including removal of such defaced units as required.

12.0 INSPECTION AND TESTS

- 12.1 Sampling and testing concrete masonry units shall be in accordance with ASTM C140. Testing of grout, mortar, and masonry units shall be performed in accordance with the latest revised issue of Specification 7220-C-208, and ASTM C-90, as noted in Section 7.1 of this specification (7220-A-14(Q)).
- 12.2 Contractor shall provide the following inspection and tests.
- 12.2.1 Contractor shall examine laying and grouting masonry work, including verification of the following.
- a. Concrete surfaces are roughened and otherwise prepared to receive masonry work.

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- b. Proper types and grades of units are used for the respective locations.
- c. Reinforcement is securely installed in accordance with this specification.
- d. Mortar, grout and fill are prepared and placed in accordance with this specification and as shown.

12.2.2 Field testing of grout and mortar shall be in accordance with UBC Standard 24-22, except that physical requirements shall be as specified herei. At least one test sample of the mortar and grout shall be taken every third successive working day beginning with the first day of masonry work. Additional test samples shall be taken whenever any change in the materials or job condition occurs, wherever such tests are necessary to determine the quality of the material. Onsite laboratory curing tanks may be used in lieu of fo room specified in UBC Standard 24-22. ASTM-C-780 mortar test may be used as alternate to UBC test.

12.2.3 Sampling, testing, and inspection of concrete in accordance with ACI 318 requirements.

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12.3 The cost of testing, noted in 12.1, 12.2.2, and 12.2.3, will be borne by Contractor.

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12.4 Erection tolerances for plumb, true, and level shall be in accordance with BIA Technical Notes No. 11D, Part III, Section 3.02J, as follows:

PART III - EXECUTION

3.02 GENERAL ERECTION REQUIREMENTS

J. Construction Tolerances:

1. Maximum variation from plumb in vertical lines and surfaces of columns, walls and arrises:
  - a. 1/4 inch (6.4 mm) in 10 feet (3 m)
  - b. 3/8 inch (9.6 mm) in a story height not to exceed 20 feet (6 m)
  - c. 1/2 inch (12.7 m) in 40 feet (12 m) or more
2. Maximum variation from plumb for external corners, expansion joints, and other conspicuous lines:
  - a. 1/4 inch (6.4 mm) in any story or 20 feet (6 m) maximum
  - b. 1/2 inch (12.7 mm) in 40 feet (12 m) or more
3. Maximum variation from level of grades for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:
  - a. 1/4 inch (6.4 mm) in any bay or 20 feet (6 m)
  - b. 1/2 inch (12.7 mm) in 40 feet (12 m) or more
4. Maximum variation from plan location of related portions of columns, walls, and partitions:
  - a. 1/2 inch (12.7 mm) in any bay or 20 feet (6 m)
  - b. 3/4 inch (19 mm) in 40 feet (12 m) or more
5. Maximum variation in cross-sectional dimensions of columns and thicknesses of walls from dimensions shown on drawings:
  - a. Minus 1/4 inch (6.4 mm)
  - b. Plus 1/2 inch ( 12.7 mm)

**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											
11.0	5.1.b	Reproducible	1	1		X	1	c					
		Microfilm											
17.4	5.1.d	Reproducible	1	1		X	1	c					
		Microfilm											
27.0	12.0	Reproducible	1	1		X	1	c					
		Microfilm											
10.2	5.1.a	Reproducible	1	1		X	2	b					
		Microfilm											
27.0	5.1.c	Reproducible	1	1		X	1	c					
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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 herein have been received and their relationship to the hardware items verified. CONTROL NO. \_\_\_\_\_ FILE NO. \_\_\_\_\_ QCE: \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_

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

 6-321-D AA REV 2 5/74	MIDLAND PLANTS - UNITS 1 & 2 CONSUMERS POWER COMPANY	JOB NO. 7220 P.O./SPEC. NUMBER 7220-A-14 (Q)
	ENGINEERING AND QUALITY VERIFICATION DOCUMENT REQUIREMENTS	SHEET 1 OF 2 REV. 0



**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 code 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.

<p><b>Code a.</b>                  Bechtel Associates Professional Corp.                  P. O. Box 1000                  Ann Arbor, Michigan 48106                  Attn: Project Engineer, Job 7220</p>	<p><b>Code b. With hardware shipment</b>                  Bechtel Power Corp.                  3500 E. Miller Road                  Midland, Michigan 48640</p>	<p><b>Code c.</b>                  Bechtel Power Corp.                  P. O. Box 2167                  Midland, Michigan 48640                  Attn: Quality Control Engineer</p>
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**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. BECTEL 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.

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

QUALITY ASSURANCE REQUIREMENTS FOR Q-LISTED ITEMS AND WORK

- 1.0 Subcontractor shall establish and maintain an effective quality assurance program which will meet the applicable requirements of Specification G-23 to ensure that all materials and workmanship furnished hereunder for Class I structures conform to the specifications.
- 2.0 Contractor shall have free access to all work and shall have the authority to stop work or reject shipment if the specification requirements, including those for documentation, have not been fulfilled.
- 3.0 Subcontractor shall furnish documentation in accordance with the specifications as summarized and directed by Form G-321-D. To complete Form G-321-D, Subcontractor shall check in column 8 which documents are being transmitted, and shall sign line 21. Subcontractor shall fill in lines 13 through 20 as applicable. Entries such as N/A or NA (not applicable) and "see attached sheets" are permissible. Form G321-D completed is then used for a cover sheet as directed on the back of the form.

Attachments:

1. Form G-321-D, Engineering and Quality Verification Document Requirements. Rev. 0
2. Specification 7220 G 23, General Requirements for Supplier Quality Assurance Programs, Rev. 7
3. Data Sheet 1, Quality Assurance Program Elements, Rev. 0

**Appendix P  
Attachment 1**

**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/MR Paragraph Reference	3. Kind of Copies	ENGINEERING DOCUMENTS				QUALITY VERIFICATION DOCUMENTS					12. Remarks	
			4. Quantity Required		5. Permission To Proceed Required		6. Quant. Req'd for Release	7. Distribution Code	8. Supplier Conform. Check	9. Inspection Release	10. Eng. Review		11. Field QCE Check In
			Initial	Final	Yes	NO							
17.1V	6.1.1	Reproducible					2	c					
		Microfilm			NA								
17.1V	6.1.2	Reproducible					2	c					
		Microfilm			NA								
17.1V	6.1.5	Reproducible					2	c					
		Microfilm			NA								
17.1V	6.2	Reproducible					2	c					
		Microfilm			NA								
17.1V	6.3	Reproducible					2	c					
		Microfilm			NA								
8.0E	6.4	Reproducible	1				2	b,c					
		Microfilm				X							
26.0V	6.5	Reproducible					2	c					
		Microfilm			NA								
26.0V	7.2.2	Reproducible					2	c					
		Microfilm			NA								
26.0V	7.3	Reproducible					2	c					
		Microfilm			NA								
26.0V	7.5	Reproducible	1				2	b,c					
		Microfilm				X							
26.0V	7.6	Reproducible					2	c					
		Microfilm			NA								
26.0V	8.0	Reproducible					2	c					
		Microfilm			NA								
26.0V	9.0	Repro.					2	c					
		Microfilm			NA								
26.0V	10.0	Repro.					2	b,c					
		Microfilm			NA								
7.0E	5.1	Repro.				2	X	1	b				
		Microfilm											
1.0E	5.3	Repro.				2	X	1	b				
		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 applicable 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  
 Inspector: \_\_\_\_\_ Signature: \_\_\_\_\_ Date: \_\_\_\_\_

23. Engineering Review Statement: The Quality Verification Documents submitted in Engineering with this form have been reviewed for satisfactory conformance to the specified requirements.  
 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

 G-321-D AA REV 4 8-78	<b>CONSUMERS POWER COMPANY          MIDLAND PLANT UNITS 1 AND 2</b>	JOB NO 7220 P.O. SPEC NUMBER C-208
	<b>ENGINEERING AND QUALITY VERIFICATION DOCUMENT REQUIREMENTS</b>	REV SHEET 1 OF 3 0

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**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/MR Paragraph Reference	3 Kind of Copies	ENGINEERING DOCUMENTS				QUALITY VERIFICATION DOCUMENTS					12 Remarks	
			4 Quantity Required		5 Permission To Proceed Required		6 Quan Req'd for Release	7 Distri-bution Code	8 Supplier Conform Check	9 Inspection Release	10 Eng. Review		11 Field QCE Check In
			Initial	Final	Yes								
26.0V	11.0	Reproducible					2	b,c					
		Microfilm			NA								
26.0E	11.0	Reproducible	2				2	b,c					
		Microfilm			X								
6.0E	14.0	Reproducible	2				2	b,c					
		Microfilm			X								
28.0E	14.3	Reproducible	2				2	b,c					
		Microfilm			X								
26.0E	12.0	Reproducible	2									Extra copy to CPGC	
		Microfilm			X								
		Reproducible											
		Microfilm											
		Reproducible											
		Microfilm											
		Reproducible											
		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 satisfactory conformance to the specified requirements.  
 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.  
 QCE: \_\_\_\_\_ Control No. \_\_\_\_\_ File No. \_\_\_\_\_  
 Signature \_\_\_\_\_ Date \_\_\_\_\_

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

 G 321 D AA REV 4 6 79	CONSUMERS POWER COMPANY MIDLAND PLANT UNITS 1 AND 2	JOB NO 7220 P.O. SPEC NUMBER C-208
	<b>ENGINEERING AND QUALITY VERIFICATION DOCUMENT REQUIREMENTS</b>	SHEET 2 OF 3
		REV 0

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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 it 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 units.
- D **DISTRIBUTION** - All Engineering (E) Documents are to be sent to the Project Engineer at the address shown below (Code a).  
 The Verification (V) Documents are to be distributed to the respective addresses shown below in accordance with the distribution code 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 material shipment and a copy sent separately to the Project Field Quality Control Engineer at the jobsite. SQE release of material for shipment shall be withheld pending completion of engineering review of documentation distributed to Code a. Resubmittal to engineering upon SQE release is not required.

<p>Code a          Bechtel Associates Professional Corp.          P.O. Box 1000          Ann Arbor, Michigan 48106          Attn: Project Engineer, Job 7220</p>	<p>Code b - with hardware shipment          Bechtel Power Corp.          3500 E. Miller Road          Midland, Michigan 48640</p>	<p>Code c          Bechtel Power Corp.          P.O. Box 2167          Midland, Michigan 48640          Attn: Quality Control Engineer</p>
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E **DEFINITION 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, subcontractor, subsupplier, 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.  
**Permission to Proceed Required** - Prior to use of the documents in design, fabrication, installation, or other work process, the Supplier must obtain permission from Bechtel to proceed with such use.  
**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 reproducible 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 references - or N/A as applicable
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. Such documentation submitted to engineering for review shall require a copy of the G-321-D form with Block 2J completed to be submitted with the material
8	Make no entry. For supplier use only
9	Bechtel Inspector to compute upon release. Sign on line 22
10	Enter Bechtel Engineering review confirmation. Sign on line 23
11	Bechtel QCE 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 individual item or 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) accessible 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, if applicable.

<p>10 <b>DRAWINGS (E)</b></p> <p>1.1 Outline Dimensions, Services and Foundation Mounting Details</p> <p>1.2 Assembly Drawings</p> <p>1.3 Shop Detail Drawings</p> <p>1.4 Wiring Diagrams</p> <p>1.5 Control Logic Diagrams</p> <p>1.6 P&amp;IDs</p> <p>20 <b>PARTS LIST AND COST (E)</b></p> <p>30 <b>COMPLETED BECHTEL DATA SHEETS (E)</b></p> <p>40 <b>INSTRUCTIONS (E)</b></p> <p>4.1 Erection Installation</p> <p>4.2 Operation</p> <p>4.3 Maintenance</p> <p>4.4 Site Storage and Handling</p> <p>50 <b>SCHEDULES ENGINEERING AND FABRICATION ERECTION (E)</b></p> <p>60 <b>QUALITY ASSURANCE MANUAL PROCEDURES (E)</b></p> <p>70 <b>SEISMIC DATA REPORT (E)</b></p> <p>80 <b>ANALYSIS AND DESIGN REPORT (E)</b></p> <p>90 <b>ACOUSTIC DATA REPORT (E)</b></p>	<p>100 <b>SAMPLES (E)</b></p> <p>10.1 Typical Quality Verification Document</p> <p>10.2 Typical Material Used</p> <p>110 <b>MATERIAL DESCRIPTION (E)</b></p> <p>120 <b>WELDING PROCEDURES AND QUALIFICATIONS (E) AND VERIFICATION REPORTS (V)</b></p> <p>130 <b>WELD ROD CONTROL PROCEDURES (E) AND VERIFICATION REPORTS (V)</b></p> <p>140 <b>REPAIR PROCEDURES (E) AND MAJOR REPAIR VERIFICATION REPORTS (V)</b></p> <p>150 <b>CLEANING AND COATING PROCEDURES (E) AND VERIFICATION REPORTS (V)</b></p> <p>160 <b>HEAT TREATMENT PROCEDURES (E) AND VERIFICATION REPORTS (V)</b></p> <p>170 <b>CERTIFIED MATERIAL PROPERTY REPORTS (V)</b></p> <p>17.1 MTP (Certified Material Test Reports)</p> <p>17.2 Impact Test Data</p> <p>17.3 Flame Data</p> <p>17.4 Material Certificate of Compliance</p> <p>17.5 Electrical Property Reports</p> <p>180 <b>COOL COMPLIANCE (V)</b></p> <p>190 <b>UT - ULTRASONIC EXAMINATION PROCEDURES (E) AND VERIFICATION REPORTS (V)</b></p>	<p>200 <b>RY - RADIOGRAPHIC EXAMINATION PROCEDURES (E) AND VERIFICATION REPORTS (V)</b></p> <p>210 <b>MT - MAGNETIC PARTICLE EXAMINATION PROCEDURES (E) AND VERIFICATION REPORTS (V)</b></p> <p>220 <b>PT - LIQUID PENETRANT EXAMINATION PROCEDURES (E) AND VERIFICATION REPORTS (V)</b></p> <p>230 <b>EDDY CURRENT EXAMINATION PROCEDURES (E) AND VERIFICATION REPORTS (V)</b></p> <p>240 <b>PRESSURE TEST - HYDRO AIR LEAK BUBBLE OR VACUUM TEST PROCEDURE (E) AND VERIFICATION REPORTS (V)</b></p> <p>250 <b>INSPECTION PROCEDURE (E) AND VERIFICATION REPORTS (V)</b></p> <p>260 <b>PERFORMANCE TEST PROCEDURES (E) AND VERIFICATION REPORTS (V OR E)</b></p> <p>26.1 Mechanical Tests</p> <p>26.2 Electrical Tests</p> <p>270 <b>PROTOTYPE QUALIFICATION TEST PROCEDURES AND TEST REPORTS (E)</b></p> <p>280 <b>PERSONNEL QUALIFICATION PROCEDURES (E)</b></p> <p>290 <b>SUPPLIER SHIPPING PREPARATION PROCEDURE (E)</b></p>
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