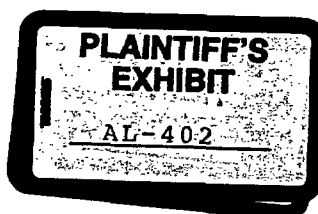


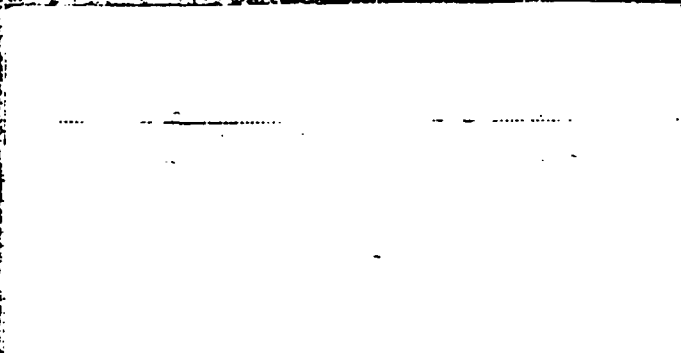
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CONFIDENTIAL

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ARD 010702

ALUMINUM COMPANY OF AMERICA

ROCKDALE WORKS

ROCKDALE, TEXAS

SPECIFICATIONS FOR REFRACTORY
INSTALLATION HOLDING
FURNACE NO. 10 BUILDING 034

AUTHORIZATION RS-810691

LDG:lc

DATED: 1981 OCTOBER 05
REVISED: 1981 NOVEMBER 05

ARD 010703

ALUMINUM COMPANY OF AMERICA

ROCKDALE WORKS

ROCKDALE, TEXAS

SPECIFICATION FOR REFRACTORY
INSTALLATION HOLDING FURNACE NO. 10 BLDG. 034

AUTHORIZATION RS-810691

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I. SCOPE OF WORK

This Contractor shall furnish all labor, materials (except as noted), supervision, tools, construction plant, equipment, unloading, hauling, taxes, insurance, and all other things necessary to install the refractory lining of No. 9 holding furnace as detailed in these specifications and included drawings, at the Owner's Ingot plant at Rockdale, Texas.

During site visitation, this Contractor shall carefully review and study the access to the area of work, disposal area, storage areas and access to the site.

Because some of this work is to be performed in and near an operating area of the plant, special precaution must be taken so as not to disrupt normal plant operations.

This Contractor shall, during site visitation, take note of all restrictions and limitations in working during the performance of his work.

Stockpiling of materials can only take place in the areas assigned to this Contractor by the Owner's engineer.

All materials, equipment, etc., to be removed and not used as part of this work shall be promptly hauled to storage or disposal areas as designated by Owner's engineer.

INSTALLATION OF INSULATION AND REFRACTORIES

This Contractor shall install the insulation and refractories in No. 10 holding furnace. This work shall include installing the furnace refractory walls, roof, hearth, charging blister, tap spout, drain spout and spout as shown and noted on the refractory drawings and Bills of Material listed in Section IV.

The panels containing doors, spouts, etc., must be aligned according to specific instructions shown on drawing L-140792-PE.

(a) Insulation of Side Walls and End Walls

This Contractor shall place the insulation block on the side walls adjacent to the steel plates by securing it with a minimum amount of fibrous adhesive as shown on the refractory arrangement drawing. This Contractor shall cut away the insulation around the tap spout and drain spout.

Before starting the refractory work on the side walls, this Contractor shall first cast the SJP started course as shown on Drawings B-031602-RT and B-031603-RT. This Contractor shall install the big block refractory, plastic refractory, refractory anchor clips and rods, and refractory anchors for the upper walls as shown and noted on the reference drawings in Section IV. Before ramming the refractory plastic, this Contractor shall shim all refractory hangers so that they are both level and sturdy.

The large block refractory is to be installed per Alcoa Standard 26.1.6 Installation of Large Block Refractory Lining and Insulation Workmanship. Note that each block is to be

set dry then removed, mortared and re-installed. This Contractor shall supply the fork truck mentioned in Alcoa Standard 26.1.6. The plastic to be used to fill fork truck slots and big block keyways shall be C-E 85 Ram HS.

This Contractor shall install the flared corners and associated refractory anchor clips and rods only after the refractory roof and steel front end of the furnace have been installed.

(b) Furnace Roof

This Contractor shall install the big block refractory roof and insulation as shown on Drawing A-032330-RT. Included in this work shall be the installation of the forty-eight (48) roof block, the dry seal blocks around the perimeter of the roof, the insulation over the dry seal around the perimeter of the roof and the casting of A.P. Green castable 22 in the "U" joint between the big block in the roof. The refractory blocks for the roof will be installed using Super 3000 mortar and a second seal will be provided by the castable installation in the "U" joint between blocks.

Super 3000 mortar shall be used to mortar the joint between the tiles and the refractory block. A.P. Green castable 22 will be used in the chamfer around the top perimeter of the burner tile. Burners will be re-installed by Alcoa.

Special clips will be necessary in certain portions of the roof where the beam clamp type anchor cannot be used due to the

location of the 16" roof beam.

Large roof blocks have not previously been installed in Alcoa furnaces, therefore, no installation standards exist. One (1) method of installation would be to supply a fork truck with a special platen. The platen would have two (2) degrees of horizontal freedom such that the block could be rested on the platen and elevated into rough position by the fork truck. The degrees of freedom in the platen could then be used for final positioning of the block. Adjustment of the anchor bolts would permit final elevation and leveling of the refractory block. The two (2) foot dimension of the refractory block was sized to permit a man to have access to anchors on the block. It is anticipated that the man could work from temporary scaffolding inside the furnace beside the block. By installing the blocks in rows across the width of the furnace, and by working from the back of the furnace to the front, all roof block can be installed with only minimal access from above the furnace. This access would be required for one end block on each row within the furnace.

(c) Furnace Hearth

This Contractor shall install the subhearth complete with the insulation, as shown on Drawing B-031607-RT. The subhearth refractory castable pour of Alstop lightweight castable and Wahl SJP castable shall be formed and poured in one complete continuous cast so there are no voids or parting due to premature setup of the castable refractory. Wahl SJP is to be used as the subhearth

material between the sub-subhearth castable and the hearth brick. The castable shall be water cured continuously for twenty-four hours. The SJP shall be installed in strict accordance with the notes contained in the general workmanship specifications. Prior to installing the SJP, a perimeter of alumina approximately 3" x 4½" wide is to be installed. Typically, the alumina may be positioned by using a coarse of Coral P brick set 4½" from the hot face of the refractory wall and then filling the void between the brick and the refractory wall. The SJP is then damp rammed over the brick and the alumina.

Prior to installing the hearth soldier coarse, as shown on Drawing B-031606-RT, this Contractor shall lay a "dry" double course across the furnace at each knuckle to assure that the special shapes are adequate to conform to the design slope of the furnace hearth. The hearth brick is to be spaced away from the walls by approximately 4½" and the void is to be filled with CE 85 Ram HS rammed plastic after the hearth has been installed.

This Contractor shall install the ramp and skim shelf refractories as shown on Drawing B-031606-RT.

(d) Charging Blister

This Contractor shall install firebrick, plastic, castable and insulating materials for the charging blister as shown on Drawing B-031600-RT, B-031601-RT, and B-031605-RT. This Contractor shall place the insulation block on the walls and shall secure it in place with the minimum amount of fibrous adhesive; cutouts shall be made for flue door.

II. BASIS OF PAYMENT

Work covered by these specifications paid for on the following
lump sum basis:

A. Refractory Lining Furnace No. 10
Account No. 034537

L.S. \$ _____

TOTAL

L.S. \$ _____

III. CONSTRUCTION SCHEDULE

Work covered under these Specifications shall be performed in accordance with the following schedules. All dates are "week-ending" dates except as noted.

	<u>START</u>	<u>COMPLETE</u>
A. Refractory Lining Furnace No. 10	1981 NOV 14	1981 DEC 12

Scheduled completion dates as shown in this section may be met or bettered by this Contractor on the basis of working two (2) ten (10) hour shifts, five (5) days a week. Accordingly, this Contractor shall submit with his bid a detailed manpower and equipment usage schedule showing build-up requirements for maintaining schedule. After review by Owner, this Contractor shall comply with the schedule and prosecution of this work. In the event, for various reasons, the Contractor fails to meet the detailed schedule, the Owner has the right to require the Contractor to resort to other means to return the work to the previously agreed schedule.

IV. NUMERICAL LIST OF DRAWINGS

<u>DRAWING NO.</u>	<u>REVISION DATE</u>
BM-031600-RT (7 sheets)	81-10-19
B-031600-RT	81-06-08
B-031601-RT	81-06-08
B-031602-RT	81-09-29
B-031603-RT	81-09-29
B-031604-RT	81-06-08
B-031605-RT	81-09-29
B-031606-RT	81-10-19
B-031607-RT	81-10-19
B-031608-RT	81-06-08
B-031609-RT	81-06-08
A-032331-RT	81-09-28
B-032332-RT	81-10-06
D-139267-PE	73-02-28
L-140792-PE	79-02-13
D-143266-PE	73-10-30
D-145737-PE	76-07-16
D-170783-PE	75-10-11
D-172391-PE	76-08-30
D-183175-PE	81-04-24
L-184961-PE	79-05-30
L-184962-PE	79-05-30
A-195697-PE	79-05-30

<u>DRAWING NO.</u>	<u>REVISION DATE</u>
D-202012-PE	81-04-24
D-202013-PE	81-04-24
L-48049	75-05-01
L-48916	75-05-01
D-52300	73-03-26
L-56668	78-05-08
L-77613	73-09-19
L-77614	80-11-03

V. SITE CONDITIONS

ROCKDALE

(UPDATED 80-11-12)

This Contractor and his employees shall conform to the safety rules and regulations of the Federal Construction Safety Standards, to any applicable standards enacted by the State, and to the "Alcoa Engineering Standard 33.2.1, Accident Prevention, Fire Protection and Security Procedures for Outside Contractors and Subcontractors," as referenced herein and/or as supplemented below.

A. CONTRACTOR'S CONSTRUCTION PLANT

This Contractor shall provide his own office, shop, and other plant facilities necessary to complete all of the work covered by this Contract. The Contractor must maintain an office in the construction office area designated by the Owner's Engineer and this Contractor shall, insofar as possible and reasonable, have a representative in this office during working hours for the purpose of escorting visitors, salesmen, and union representatives onto the Site according to the Owner's regulations. All other temporary buildings shall be located as approved by the Owner's Engineer and be in accordance with Section 7 of the attached Engineering Standard 33.2.1. Upon completion of this Contract, all of the Contractor's facilities shall be removed and the area cleared and leveled.

B. UTILITIES AND FACILITIES

1. All power for offices, warehouses, shops, etc., will be 110 volt, single phase or 440 volt, three phase, supplied from existing buildings at no cost to this Contractor. Any distribution lines, transformers, and other appurtenances required shall be installed by this Contractor at his own expense. Upon the completion of this Contract, all distribution lines, transformers and other appurtenances installed by this Contractor shall be removed by this Contractor at his own expense to the satisfaction of the Owner's Engineer.
2. Compressed air will be furnished by the Owner.
3. Water will be supplied to the Contractor free of charge at existing outlets located in the yard or in the buildings. This Contractor shall provide, at his own expense, any distribution lines required and shall at the completion of this Contract, remove same to the satisfaction of the Owner's Engineer. This water is suitable for drinking purposes.
4. The Contractor shall make arrangements for telephone service directly with the local telephone company.
5. The Owner will provide chemical toilets in sufficient numbers at locations throughout the work area.
6. The Owner will make available to this Contractor, the use of the Owner's First Aid Facilities provided

this Contractor signs the necessary agreements governing the use of these facilities and the billing of these services.

C. UNLOADING AND STORING

Entrance to the job site for all equipment and materials will be at the gate designated by the Owner's Engineer. This Contractor's vehicles and equipment will not be allowed to use roads and parking areas other than those designated by the Owner's Engineer.

Materials shall be unloaded and stored in areas designated by the Owner's Engineer.

Railroad trackage available for unloading of this Contractor's materials is limited. This Contractor shall unload all railroad cars as soon as they have been moved into the job site area. All railroad car movements and trackage available for unloading shall be arranged by this Contractor with the Owner's District Traffic Manager. This Contractor shall pay all demurrage charges and claims for damage to cars arising out of his unloading operations. This Contractor shall not be permitted to stockpile materials unloaded from railroad cars adjacent the the tracks.

D. CLEANUP AND DISPOSING

All debris and rubbish shall be hauled to the Owner's land fill area. No burning will be permitted. The Owner will be responsible for covering waste materials. No stockpiling will be permitted on the site. Land fill area is located approximately two miles from the main gate.

E. REQUIREMENTS FOR CONTRACTOR'S EMPLOYEES

1. All construction activity shall be carried out in such a manner that there will be absolutely no possibility of interruption of operation occurring in the operating portions of the Rockdale Works.
2. Welding and burning permits are required in all areas. These permits are obtained from the Plant Protection Department.
3. When construction work is to be done on, from, or near a crane, the following rules shall be observed:
 - (1) Obtain permission from Operating Department Foreman who will lock and tag crane out of service.
 - (2) When department cannot turn crane over to Contractor, a safety man shall be stationed in the crane cab; and he shall be responsible for all crane movement in the working area. In case of floor-operated cranes, a safety man shall be stationed on the floor near working area to prevent crane from entering area until cleared by him.
 - (3) When more than one crane operates on the same rails, separate precautions must be taken for each crane.
4. A "Danger Tag" and lock on power supply shall be used to protect personnel when work is being performed on

operable machines. Only the man who placed the tag may remove it. Tags and locks will be supplied by Alcoa. Only supervisory people shall "tag out" machines and care must be taken to see that tags and locks are removed at the end of shift if the following shift is to operate the machine.

F. ACCESS

This Contractor shall at all times take care in preventing disruption of traffic on job site roads by equipment movements, trucking operations or by employee parking procedures. The road network as shown on the plant map will be maintained by the Owner. All temporary roads to and around the Contractor's work area shall be his responsibility. The Owner will not construct or maintain any temporary roads. All vehicles shall abide by the plant speed limit of 15 miles per hour or as marked.

Entrance to all construction work by Contractor's employees, visitors and deliveries shall be through the construction gate.

Only vehicles owned by the Contractor and bearing an authorized pass issued by the Owner shall be allowed access to the construction area.

G. REMOVAL OF MATERIAL AND EQUIPMENT

All material and equipment which is being removed from the area by the Contractor shall pass through the construction gate. It will be the Owner's guards' prerogative to pass

this material through the gate. In doing so, he, at his own discretion, shall make an itemized listing of material and equipment removed from the area and require the individual in whose care such material or equipment lies to sign the register indicating that such articles were taken from the area.

This requirement applies to the unusual item of materials and equipment. Ordinary traffic will be allowed without registration. The Owner does not assume responsibility for any of the Contractor's material or equipment.

H. GENERAL INSTRUCTIONS

This Contractor will be given a copy of a manual to review at "site visitation" titled, "General Instructions and Procedures for Contractors". This manual will be given to the Contractor when he arrives on the job site to begin work and will spell out in detail what is expected from this Contractor in the way of reports, invoicing, safety and general office procedure.

I. ATTACHMENTS

Alcoa Engineering Standards 33.2.1, 18.1, 18.2, 18.3, 18.4.1, 18.4.2 and 17.10.1.

J. POWDER PLANT SAFETY FOR CONTRACTED WORK

1. General Powder Plant Safety

All workers entering the Powder Plant for any reason shall report to the Powder Plant Office (Building 406). Each worker must be signed in by Powder Plant

supervision before proceeding to work assignment. All workers must also sign out when leaving the Powder Plant.

Safety precautions shall be reviewed with work crews so that the men involved will have a general understanding of the safety precautions needed, in general, as noted above, avoiding the ignition of flammable powder by: (1) cleaning the area ahead of scheduled work, and (2) avoiding sources of ignition around powder areas.

Close contact shall be maintained with operating personnel regarding the scheduling of work, the type of work, and equipment to be used. This will insure that the areas will be left clean and ready for work, and the safety experience of the operating people will be continuously available and used. In general, the safety precautions are very simple in nature but must be followed rigorously.

In general, work areas shall be clean and dust free. Work methods should avoid raising or causing a powder cloud or powder spill and avoid sparks, flames, or impacts on powder or in powder dust clouds.

No matches and/or lighters are permitted in the Powder Plant area. Electric lighters are provided in the "smoking permitted" areas, which do not include the powder-processing buildings.

Special attention must be paid to the following Alcoa Engineering Standards included with the specifications for this work:

<u>Alcoa Engineering Standard</u>	<u>Paragraphs</u>
33.2.1	3.2, 7.1, 7.5, 7.6, 7.7, 7.12, 7.12.2, 7.13
17.10.1	5.17
18.4.1, 18.4.2	

2. Welding and Flame Cutting

No welding or flame cutting is permitted in this area. In cases where welding and cutting are absolutely necessary, special permission must be given by the Powder Plant operating foreman, plant superintendent, or owner's engineer at the time this work is to be performed. The proper procedure is as follows:

- a. Notify one of the Atomizing Plant personnel as listed above and fill in the required welding permit. These permits can be obtained in Building 406 (office).
- b. No work of this nature (work that produces extreme heat, fire, or sparks) shall be performed without this permit and a visual inspection by one of the Atomizing Plant supervisory personnel.

Note: Wherever possible, all work requiring welding or flame cutting should be planned so as to take place a minimum of 100 feet from Powder Plant buildings (with the exception of Buildings 401, 402, and 406).

3. Power Tools

Tools required to complete the work shall be predominantly air powered. This is for two reasons:

(1) There is only one electrical outlet south of Building 402 that is kept locked and requires a permit to use, and (2) the only electrical tools that can be used are those that are safety-rated (Class 2, Group E).

In cases where non-safety-rated equipment must be used, the Contractor shall obtain permission as outlined under Part II. (Also see Alcoa Engineering Standard 17.10.1, Paragraphs 5.17 and 18.4.2, Paragraph 5.3).

4. Hand Tools

Refer to Alcoa Engineering Standard 17.10.1, Paragraph 5.17.

a. Impact Tools - Large and impact type tools must

be spark resistant, i.e., Be-Cu or equivalent.

Included are crow bars, all hammers, pipe wrenches and wire brushes. Shovels and scrappers must be aluminum or Be-Cu. Several of these large spark resistant tools will be maintained at the Powder Plant.

b. Small Hand Tools - Small hand tools need not be

spark resistant. Included are pliers, adjustable wrenches, fixed wrenches, screw drivers, channel locks, and socket sets. Several of each type spark resistant small tool will be maintained

at the Powder Plant for special circumstances. These special circumstances will dictate which type of tool will be used and this decision is strictly the responsibility of Powder Plant supervision.

In cases where non-sparking tools of the impact type are unavailable or impractical, the Contractor shall obtain special permission to use it as outlined under Part II.

5. Additional Safety Procedures

During construction, contracted personnel are not permitted in any of the operating buildings. In those cases where entry into the building is necessary to complete the work (such as removing siding to tie the new buildings to the old), all workers inside the building must wear the following additional safety equipment:

- a. Fire proof smock
- b. Conductive foot straps

This additional protective equipment will be provided by Alcoa and is obtainable by reporting to the Atomizing Plant office, Building 406. All smocks and foot straps are to be returned upon completion of the job.

When the siding is removed between an existing operating building and a new building, the total structure shall then be considered an operating area and the above additional safety equipment shall be worn inside the structure and all Powder Plant safety rules apply.

K. TAGOUT PROCEDURE

1. INTRODUCTION

Purpose

For safety in the installation, maintenance, cleaning, repair, and adjustment of all power driven machines and equipment, such equipment shall be shut down, locked in the SAFE position, tagged out and tried to prevent its operation.

The LOCK-TAG-TRY-RULE is the minimum requirement to ensure the safety of both personnel and equipment. Additional safety features, such as pulling of fuses and disconnecting of drives, may be necessary and included in the appropriate Job Safety Analysis for those specific jobs; however, the plant minimum requirements must be adhered to at all times.

II. PROCEDURE

1. Individuals shall ascertain which isolation devices apply prior to the equipment being shut down. The individual who is assigned to work on equipment shall contact the Operating unit supervisor or the Maintenance Department mechanic or electrician who is authorized to operate the equipment to find out which switch, valve or operating lever makes the equipment in-operable.
2. Notify the unit supervisor in charge of the equipment to be worked on and obtain his approval to shut down the equipment.

3. Shut down equipment through normal stop procedure, usually start-stop controls.
4. Move isolation devices to the SAFE position.
5. Attach properly completed yellow equipment tag to the isolating device.
6. Each person performing work on the equipment shall also install their Personal tag and lock on the isolating device. (Ref. Section V Note Exception).
7. Control circuits (pushbuttons, toggle switches, pressure switches, and similar devices) shall not be considered to be isolating devices.
8. After the equipment is initially shut down, tagged and locked, the controls shall be TRIED to insure that the equipment is shut down and safe to work on (Note Section V).
9. Individuals assigned to work on equipment subsequent to initial shut down of the equipment which has been tagged and locked shall attach their white Personal Danger tag and lock before beginning work. Each individual shall have their own lock and tags.
10. Upon completion of the job or leaving the job site before the work is completed, each individual shall remove their white Personal Danger tag and lock. The white Personal Danger tag and personal locks shall be removed only by the person attaching same. (Exceptions as noted in Section III No. 6).

11. The yellow Equipment tags shall only be removed upon completion of the entire job by individuals who have a thorough knowledge of the equipment and work performed.

12. If the equipment under repair is to be energized for testing or adjustment, each person shall remove their tag and lock before the equipment is energized. Upon completion of these tests and adjustments each person shall again attach their tag and lock if the equipment is to remain de-energized or isolated.

III. DEFINITIONS

1. Individuals Covered by the Tagout Procedure

These procedures apply to all persons working on the plant site, both Alcoa salaried and hourly employees and contractor's employees.

2. Tagout

A tagout is defined as the act of placing a switch, lever, valve, gate, or other isolating device in the SAFE position and tagging it to indicate that it must not be placed in the UNSAFE position until tags have been properly removed.

3. Lockout

A lockout is defined as the act of padlocking a switch, lever, valve, gate or other isolating device in the SAFE position. A lockout device shall accommodate more than one padlock such that each employee required to use a tag shall also apply a padlock. The lockout device will be such as to prevent the isolating device from being placed in the UNSAFE

position until each padlock and related tag have been properly removed. Only Alcoa provided locks shall be used.

4. Try

Means Pushbutton Attempt to Operate In Addition to Lock and Tag -- When the disconnecting device has been locked and tagged out, try to start the isolated equipment by means of the pushbutton control devices or proper start up sequence with suitable instruments to insure that the main disconnect is functioning properly.

5. Isolating Device

An isolating device is an electric circuit breaker, a disconnect switch, a manually-operated switch or valve, a slide gate, a slip blind or a "Figure 8" blind for blanking off piping, or similar device. If a slip blind is used, its presence as an isolating device shall be readily discernible.

6. White Personal Danger Tag

The white Personal Danger Tag in Figure 1 shall be used for PERSONNEL safety only. It provides space for the signature of the person doing the work, the department and date. This tag shall be securely attached to the isolating device (main switch, valve or operating lever) when in the "OFF" or "SAFE" position before any maintenance, cleaning, repair, or adjustment is performed on equipment.

7. Yellow Equipment Tag

The yellow Equipment Warning Tag in Figure 2 shall be used for EQUIPMENT protection only. It provides space for describing the reason for tagging the equipment, the name and department of the individual attaching the tag and the date. This tag shall be securely attached to the proper isolating device (main switch, valve, or operating lever) to prevent the operation of equipment when it is to be inoperable. Never use this tag for personal protection. The equipment tag will not be removed until all personal danger tags are properly removed. This tag shall not be used for as information tag. A general plant information tag shall be used for that purpose.

IV. REMOVAL OF TAGS AND LOCKS

1. Personal Danger Tag:

Each person shall remove their own personal tag and lock. However, if the signer of the tag is not in the plant, and after an attempt has been made to contact the signer, the lock and danger tag may be removed by an authorized supervisor.

This supervisor should have three (3) qualifications:

- A. The supervisor should have authority over the individual, (i.e., should be from the same department).
- B. The supervisor should have sufficient knowledge of the equipment and the work being performed.
- C. The supervisor must be able to exercise proper judgement with regard to the safety of employees and equipment.

The supervisor removing the lock and tag should return it to the signee at the beginning of the next shift. NOTE: The supervisor removing the tag and/or lock will submit a written report to his department superintendent (within 24 hours), see attached form letter, page 9.

2. Yellow Equipment Tag:

It may be removed by anyone within the department responsible for affixing the tag when they are assured the equipment is ready for operation.

V. EXCEPTIONS

1. On those electrical circuits where the isolating device cannot be locked, special procedures in the form of Job Safety Analysis or standard maintenance practices shall be followed.

2. Grounding Device.

For the purposes of Lock-Tag-Try, the potline grounding device shall be considered to be an isolation device. Each person who is working under the protection of the grounding device shall attach a lock and personal danger tag. Whenever an individual leaves the protected area, that person's lock and tag must be removed. Whenever an individual applies a lock and tag to a potline grounding device three (3) items must be checked:

1. Leads are attached to potroom bus and building structure;
2. Contacts are closed as noted by looking through the plexiglass window;
3. Trip circuit is energized as noted by trip circuit light illuminated. The trip circuit light is mounted on the cabinet and usually has a green lens.

3. I.G.C. Power Equipment

Work performed on Power Distribution or Rectifier Station equipment that will require an I.G.C. Power equipment clearance, a minimum of two (2) white Personal Danger tags shall be attached to each disconnect located at I.G.C. high voltage yard.



Engineering Standard

Materials and Standards Section - Pittsburgh

33.2.1

ACCIDENT PREVENTION, FIRE PROTECTION AND SECURITY PROCEDURES
FOR OUTSIDE CONTRACTORS AND SUBCONTRACTORS

PAGE 1

1981-04

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1. SCOPE

This standard is to be used by Contractors* performing work on the property of the Aluminum Company of America and its subsidiaries (hereafter referred to as the Owner). Its purpose is to define responsibility of outside Contractors while working on the property of the Owner and to provide minimum guidelines.

This standard shall be binding under terms of the contract including other referenced engineering standards:

- 15.1.2 Wire Rope Slings
- 16.4.1 Excess Air Flow Safety Valves
- 17.10.1 Low Velocity, Powder Actuated Tools
- 18.1 Entering And Working In Tanks, Casting Pits, Manholes, And Other Confined Spaces
- 18.1.1 Respiratory Protection
- 18.2 Safety Belt Tie-Off Regulations
- 18.3 Tag Out And Lock Out Procedures
- 18.6.1 Safe Handling of Compressed Gases
- 33.2.1.1 Alcoa Safety and Health Evaluation of Outside Contractors and Subcontractors
- 33.2.1.2 Contractor's Safety Check List
- 33.2.2 Safety Standard For Blasting In Construction

2. FEDERAL, STATE AND LOCAL REQUIREMENTS

The Contractor shall comply with all applicable provisions of federal, state and local safety and health laws and building codes. The most stringent of these shall serve as the minimum standard unless the provisions contained in applicable Alcoa Engineering Standards are more stringent, in which case Alcoa's Engineering Standards shall govern.

Nothing in this or other Alcoa Engineering Standards relieves the Contractor from fully understanding and complying with the Federal Occupational Safety and Health Act (OSHA), the Federal Mine Safety and Health Act, (MSHA), and all other applicable laws, regulations and standards.

3. MEETINGS OF THE OWNER'S AND CONTRACTOR'S REPRESENTATIVES

3.1 Pre-bid Site Visitation. Before bidding on a contract, a Contractor shall visit the site and review with the Owner the safety, fire and security requirements outlined in this standard and other such requirements which may be applicable.

*The term Contractor in this standard includes subcontractors also.

Production interferences which may occur during the Contractor's work shall also be discussed at this pre-bid site visitation.

3.2 Pre-job Safety Conference. The Contractor's safety representative and site superintendent shall meet for a pre-job safety conference before the start of the job in order to assure a correct understanding of the safety and security requirements outlined in this standard but not necessarily limited to this standard. At this time, the CONTRACTOR SHALL SUPPLY THE ALCOA REPRESENTATIVE WITH A COPY OF HIS COMPANY'S SAFETY MANUAL AND A PLAN FOR SAFETY TRAINING OF CONSTRUCTION EMPLOYEES ON THE JOB.

The following rules shall also be reviewed and agreed upon at this meeting:

1. Before starting work in any area, the Contractor shall contact the Owner's Construction Engineer regarding hazards in that area and understand specific safety regulations applicable to that area. The Contractor shall comply with these regulations.
2. Meetings shall be held with all concerned to further outline the necessary job procedures and Owner's policy.
3. Additional briefings shall follow the completion of one project and prior to the start of the next.
4. The Contractor shall notify Owner's construction engineer or supervision weekly as to the Contractor's work activity schedule in the work area where the work is being performed. More frequent reporting notification may be required at a respective location.

4. CONDUCT OF CONTRACTOR'S EMPLOYEES

While on the Owner's property, the Contractor shall not permit his employees to:

1. Use or be under the influence of alcoholic beverages or illegal drugs.
2. Fight or gamble.
3. Abuse, steal or destroy property of the Owner or his employees.
4. Use the Owner's lunch wagons or canteens.
5. Use cameras without the written consent of the Owner's Resident Construction Manager or Plant Manager.
6. Carry concealed weapons.

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5. SECURITY

5.1 Personal Property. In the interest of security and plant protection, Contractor's employees are discouraged from bringing packages other than essentials, such as lunches, tool boxes and work clothes, into the plant. All such items, as well as personal vehicles, are subject to inspection by the Owner's security personnel both upon entering and leaving the plant site. Failure to submit to inspection will be sufficient grounds for restricting the individual from further entry to the Owner's property.

5.2 Automobile Parking. Contractor's employees shall park their personal vehicles only in those areas designated by the Owner. The Owner is not liable for these vehicles.

5.3 Entrance Identification and Routing. Identification badges showing the Contractor's name and employee's number shall be required and must be presented by the Contractor's employees before entrance will be permitted by the Owner's guards. The Contractor shall supply to the Owner upon his request a current list of employees' names and their badge numbers. Access gates and routes to the job site for Contractor's employees shall be designated by the Owner. Contractor's employees shall either walk to the site of the work from this gate or be hauled in Contractor's trucks or busses, sitting in a safe manner.

The construction work area may, at Owner's option, be fenced in such a manner that Contractor's employees must pass through a guarded man gate.

5.4 Pass Procedure for Visitors and Vendors to Construction Site. Each visitor must:

1. Obtain an Owner's pass approved by the Owner's authorized personnel.
2. Sign the register at the guard gate.
3. Be escorted by Owner's or Contractor's authorized personnel.
4. Use the protective safety equipment as required by the respective site regulations.

5.5 Servicing of Equipment. Representatives must receive specific instructions concerning site hazards and safety and health regulations required in the area in which they will be working. Compliance with such instructions is mandatory.

6. FIRST AID AND ACCIDENT REPORTING

6.1 Emergency Doctor and Ambulance Service. Before beginning work on a contract, each Contractor must select a qualified local doctor and ambulance service to be used in case of a serious personal injury to one of his employees. The Contractor shall notify the Owner's representative of his selection.

Telephone numbers for emergency calls shall be posted at all Contractor's telephones.

6.2 Personal Injury and Property Damage. When an accident results in injury, a copy of the OSHA Form 101 Report or equivalent detailing the accident shall be submitted to the Owner within 24 hours. The reporting of serious injuries shall be made immediately to the respective agency and the OSHA Form 101 prepared immediately, for the Owner's review. Serious injuries are all work related injuries including fatalities but not first aid cases.

Contractors shall prepare a monthly injury summary report for the Owner. Details shall be explained at the location. The use of OSHA Form #200 (1978) serves as a guide form.

7. FIRE PROTECTION

7.1 Fire Regulations. The Contractor shall observe the Owner's existing fire prevention and protection regulations at the location where the work is to be performed.

7.2 Temporary Buildings. The type of construction, i.e., combustible or non-combustible, and location of temporary buildings shall be approved by the Owner's Construction Engineer, in conjunction with the Supervisor of Plant Fire Protection.

Temporary buildings located within another building or structure shall be of either a non-combustible construction or of a construction having a fire resistance of not less than 1 hour.

Temporary buildings outside another building shall be located at a distance not less than 50 feet from a plant building and not less than 25 feet from other temporary structures, plant equipment or overhead utilities.

7.3 Heating Facilities. Heating facilities for temporary buildings within the Owner's plant site shall be operated by electricity, propane gas, liquid petroleum, steam or other types of fuel approved by the Owner. Kerosene-, wood- or oil-fired salamanders shall not be permitted inside temporary buildings. Stoves or heaters shall be properly vented, and all vent pipes shall have tight joints and be well supported. Each heating facility shall have the following information permanently affixed to the unit: 1) clearances, 2) ventilation, 3) fuel-type and input pressure, 4) lighting, extinguishing and relighting instructions, 5) electrical power supply characteristics. The Contractor shall follow the requirement set forth in ANSI A10.10-1970, "Safety Requirements for Temporary and Portable Space Heating Devices and Equipment Used in the Construction Industry."

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7.4 Transporting Flammable Liquids. Containers approved by Underwriters' Laboratories and clearly labeled to identify the contents shall be used for transporting flammable liquids.

7.5 Precautions for Fire Hazard Areas. When work is to be done in critical fire-hazard areas designated by the Owner, a special fire-prevention meeting shall be held with the Owner's Construction Engineer, the Supervisor of plant fire protection and with operating and maintenance supervisors in the department concerned to familiarize the Contractor with the potential hazards and the precautions that must be taken.

7.6 Owner's Fire Brigade. The Contractor shall notify the Owner's fire brigade in the event of any fire. Notification procedures shall be established by agreement between the Contractor's and the Owner's Engineer or Owner's Supervisor of Plant Fire Protection. If there is no fire brigade, outside help will have to be obtained.

7.7 Prohibition of Open Fires. Open fires for the disposal of refuse are prohibited unless permitted in a designated area by the Owner's representative.

7.8 Refueling of Vehicles. Refueling of vehicles such as small trucks, tractors or autos shall be done only in predesignated outdoor areas. As a minimum, the following procedures for refueling shall be observed:

1. Shut off the vehicle engine.
2. Do not smoke.
3. Do not over-fill fuel tanks.
4. When the fuel is liquid propane gas, the nozzle of the fuel hose shall be grounded to the vehicle filler pipe with a ground wire.

7.9 Storage of Flammable Liquids.

1. Flammable liquids shall not be stored inside permanent buildings unless approved by the Supervisor of Plant Fire Protection who will also designate container capacity and design.
2. Portable storage tanks shall have a maximum capacity of 300 gallons. Portable tanks including 55 gallon drums used for dispensing of flammable and combustible liquids shall be kept in flammable liquid storage vaults or other flammable liquid storage areas as designated by the Supervisor of Plant Fire Protection. Dispensing shall be done by means of self-closing dispensing nozzles or manual drum pumps. Containers of flammable liquids with flash points below 140 Deg F (vapor pressure not exceeding 40 psia at 100 Deg F) shall be equipped with safety bungs or vents with flame arrestors. Tanks or drums from which such flammable liquids

are dispensed shall be electrically grounded and shall be equipped with bonding wires to complete the grounding with the vessel into which the liquid is dispensed.

3. All fuel tanks shall be painted red with a two-inch yellow stripe painted on the circular circumference of all gasoline storage tanks. The tanks shall be identified with the contents stenciled (4" letters) neatly on all viewable sides of the tank.
4. Flammable liquids shall only be transported through plant premises in FM approved or UL listed safety cans or other portable containers.
5. Supply tanks for fuel oil heaters shall not exceed 55 gallons capacity, shall be located outside of the building and shall be equipped with shut-off valves (approved by Underwriters' Laboratories) at the tank.
6. There shall be no smoking or open flames in flammable-liquid storage areas. Conspicuous and legible signs prohibiting smoking shall be posted.
7. The Contractor shall provide portable, dry-chemical, fire extinguishers for his fuel storage tanks, the size of which is determined by NFPA.

7.10 Portable Fire Extinguishers. Portable fire extinguishers suitable for the potential hazard shall be provided by each Contractor for his equipment, office, building and work activities as per instructions issued by the Supervisor of Plant Fire Protection.

Portable fire extinguishers shall be installed on all lubrication trucks and may be installed on all other mobile equipment such as autos, trucks, earth moving equipment, etc.

7.11 Solvents and Other Cleaning Agents. The Contractor shall discontinue using solvents or other cleaning agents if requested by the Owner.

7.12 Burning and Welding.

7.12.1 Restricted Burning and Welding Areas. Burning and welding shall be performed only in areas approved by the Owner's Construction Engineer or other designated person and with an approved welding or burning permit.

7.12.2 Burning and Welding Precautions. The Contractor shall remove all combustibles, provide a fire watch when necessary, and supply fire extinguishers or other fire-fighting equipment prior to burning or welding operations.

When welding or cutting near highly combustible materials such as protective coatings (on various types of insulation), freshly painted



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surfaces and oily surfaces, special precautions, including the use of fire blankets, shall be taken. The fire watch shall stand in the immediate area in sight of the welding or burning with the fire extinguisher in hand. If impractical for the fire watch to stand in the immediate area of welding and burning, the fire watch arrangement shall then be agreed upon between Owner and Contractor.

7.12.3 Gas Cylinder Precautions. The following precautions shall be observed when using or storing oxygen, acetylene and other flammable gas cylinders:

1. Oxygen storage areas shall be separated by at least 25 feet from combustible liquids, flammable materials or heat sources such as fire, molten metal or electric lines. If impossible to comply with this 25-foot distance, the oxygen storage area shall be isolated by a non-combustible fire barrier with a 1/2-hour fire-retardant rating.
2. Gas cylinders shall not be transported by overhead building cranes or truck cranes unless an approved holder or carrier designed for this purpose is used.
3. Oxygen storage areas shall be properly vented.
4. Gas cylinders shall be stored vertically and adequately secured and covered by roof for weather protection.

7.13 Fire Prevention Inspection. Inspection by the Owner's Safety Engineer and Supervisor of Plant Fire Protection will be made frequently enough to maintain good fire prevention awareness. All hazards will be brought to the attention of the Contractor and immediate action shall be initiated to eliminate the hazard.

8. PERSONAL PROTECTIVE EQUIPMENT

Protective devices and personal protective equipment shall be furnished by the Contractor. Contractor's personnel shall conform to plant safety regulations in operating areas. Failure to comply will result in orders to leave the area by responsible area supervision.

8.1 Hard Hats. The wearing of approved non-conductive safety hats is mandatory. Refer to ANSI Z89.1, SAFETY REQUIREMENTS FOR INDUSTRIAL HEAD PROTECTION.

8.2 Eye Protection. Eye protection shall be required in those areas specified by the Owner and must be used when engaged in drilling, grinding, burning, welding, etc.

8.3 Life Lines and Safety Belts. Life lines and safety belts shall be used in all applications where required by federal, state or local safety standards, or Alcoa Engineering Standard 18.2, SAFETY BELT TIE-OFF REGULATIONS.

8.4 Ladders. The Contractor shall provide his employees with ladders that are constructed from non-conductive materials, such as wood or fiberglass. Furthermore, the Contractor shall not be permitted to bring ladders on Alcoa property that do not comply with the above. Ladders shall be equipped with anti-slip shoes. Reference OSHA Subpart L - Ladders, 1926.450(a)(11).

9. IN-PLANT TRAVEL

9.1 Prescribed Paths. Contractor's employees shall use the prescribed walkways, crossovers, roadways and pathways to get to their related work areas.

9.2 Paths not Prescribed. If the Owner's permission is given to deviate from the prescribed areas, applicable plant safety rules shall apply to contractor's personnel.

Do not climb on or over moving machinery.

9.3 Safe Vehicle Speed. A safe vehicle speed shall be maintained at all times. Consider weather conditions and pedestrians. Comply with posted speed limits.

9.4 Warning Signs. Obey all warning signs.

9.5 Traffic Volume. In-plant traffic shall be kept to a minimum. Safe speed--15 mph, unless otherwise posted.

9.6 Vehicle Registration. Before starting work, a list of Contractor's vehicles intended for use on the site shall be submitted to the Owner. Only vehicles with current safety inspection approval may enter the site.

9.7 Vehicle Pass Renewal. Vehicle passes shall be issued for a particular time period as determined by the length of the contract. No passes are valid for more than 12 months. Vehicles must pass inspection before a vehicle pass will be issued.

9.8 Vehicle Safety Belts. Vehicle safety belts shall be used.

10. OWNER'S EQUIPMENT

10.1 Authorization Required. The Contractor shall not operate any equipment belonging to the Owner unless authorized by the Owner's Construction Engineer or other designated person.

10.2 Tagout and Lockout Procedures. Contractors shall follow Alcoa Standard 18.3 on TAG-OUT AND LOCKOUT PROCEDURES when:

1. Installing new equipment which has been or is about to be connected to a power source.
2. Working on existing equipment connected to a power source.

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Note that Contractors shall use personal danger tags and equipment danger tags similar to but distinguishable from the Alcoa tags described in Section 3 of Standard 18.3. One way of marking the Contractor's tags distinctive is to stamp CONTRACTOR in large bold letters on both sides of the Alcoa tags.

11. CONTRACTOR'S MOBILE EQUIPMENT

11.1 Equipment Not In Use. When mobile equipment is not in use, it must be positioned where it will not obstruct railroad tracks, roadways, walkways, electrical lines or temporary passageways. All equipment not in use must be secured to prevent movement or operation. Mobile cranes shall not be parked with the boom suspended over walkways, or other employee passageways, roadways, railroad tracks, electrical or mechanical equipment or buildings, or to obstruct building crane or bridge crane travel.

11.2 Equipment In Use. When mobile equipment is in use, clearances shall be maintained to prevent anyone from being caught between the equipment and structure. The Contractor shall barricade the area or provide a flagman for the protection of persons passing by. Proper clearance distance from electrical lines shall be observed.

11.3 Flagman Escort. Traveling truck cranes or crawler cranes shall be escorted by a flagman for traffic control and to prevent damage to plant power lines, pipe lines or building structures.

12. HOUSEKEEPING

12.1 Debris and Refuse. Materials shall be piled so that safe clearances are maintained and toppling is prevented. Loose overhead material must be removed; oil and water spillage must be removed promptly and properly disposed of; garbage must be disposed of daily. Nails protruding from lumber shall be removed or bent over immediately. Accumulation of refuse that may create a fire hazard shall not be permitted. Daily cleanup to the Owner's satisfaction is required. All applicable Safety and Health Standards shall be followed.

Containers (55 gallon drums) painted bright yellow shall be located throughout the Contractor's work areas to collect his own employees' trash. Each drum shall be identified with 6" letters marked "TRASH." Collection shall be at Contractor's expense.

12.2 Passageways. Unobstructed passageways for movement of fire trucks and ambulances shall be maintained.

12.3 Building Materials. Building material storage shall be at least six feet from the nearest rail along all railroad tracks and eight feet minimum along curved tracks.

12.4 Materials to be Removed from a Roof. Daily, before quitting time, roofing contractors and others must remove from the roof their combustible debris, mops, and combusti-

ble materials stored in cans, buckets or drums. All loose materials, such as stacks of insulation, plywood, aluminum roofing, steel deck, etc., must be secured so that they cannot be blown from the roof. In accordance with Alcoa Standard Specifications on Built-Up Roofing, there shall be no tar kettles on a roof.

13. ELEVATED LEVELS

13.1 Plant Roofs and Tank Tops. Before going on any plant roof or top of tank, the Contractor shall first contact the Owner's Construction Engineer for permission to enter.

13.2 Protection from Workers and Falling Materials at Elevated Levels. When workers are overhead, the area below shall be roped off or other equivalent measures taken to protect personnel below from falling materials. Signs reading "Danger - Men Overhead" shall be conspicuously posted. If, in the opinion of the Owner's engineer, conditions justify, a flagman shall be stationed to warn persons in the vicinity.

13.3 Materials Thrown or Dropped from Roofs. No materials shall be thrown or dropped from plant roofs unless permission has been granted by the Owner's Construction Engineer and a protected area has been established.

13.4 Crane Runways. Before doing any work on or near existing crane runways, the Contractor shall first make arrangements with the Owner's Construction Engineer, who will arrange for a permit to do so through the respective plant area superintendent.

Before any work commences on crane runways, crane master switches shall be padlocked in the OFF position or tagged in the OFF position to indicate that the switch must not be placed in the ON position until tags have been properly removed. (Refer to Alcoa Engineering Standard 18.3, TAGOUT AND LOCKOUT PROCEDURES.)

Safety belts shall be provided by the Contractor to prevent falls. (Refer to Alcoa Engineering Standard 18.2, SAFETY BELT TIE-OFF REGULATIONS.)

14. WATER, STEAM COMPRESSED AIR AND ELECTRIC POWER

14.1 Points of Connection. When steam, water, compressed air or electric power supplied by the Owner are used by the Contractor, the points of connection, method of connection and connected load shall be approved by the Owner's Construction Engineer.

14.2 Pressure Vessels. All pressure vessels belonging to the Contractor shall comply with all applicable government codes and safety standards and shall be inspected and approved as often as required, but at least annually, by an authorized inspector designated by the Contractor. This applies to both fired and

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unfired vessels such as boilers, compressed air receivers and air compressors.

In the absence of applicable government codes and safety standards, fired and unfired pressure vessels shall meet all requirements of the applicable codes of the American Society of Mechanical Engineers (ASME). Upon request of the Contractor, the Owner's Construction Manager will provide copies of ASME codes for reference.

14.3 Electric Power Lines. When the Contractor is required to work on or near power lines, he must first confer with the Owner's Construction Electrical Engineer, who will make arrangements with the Owner's General Maintenance Line Supervisor or the Owner's Electrical Engineer.

An Owner power line supervisor will check locations where work is to be performed. The Contractor shall maintain a safe work procedure as specified in the federal or state Construction Safety Regulations.

If considered necessary, a qualified member of the Owner's line department shall be assigned to the area to insure that the Owner's power line equipment is not damaged or service interrupted.

Crane booms, load lines or swinging loads must maintain a 10 foot minimum clearance from power lines rated up to and including 345 kv and a 16 foot minimum clearance from power lines rated up to and including 750 kv. A 10 foot minimum clearance shall apply to hand carried materials and equipment such as ladders, pipes, etc.

14.4 Ground-Fault or Assured Equipment Grounding Protection. It shall be the Contractor's responsibility to provide the necessary equipment for ground-fault protection or the implementation of an assured equipment grounding conductor program in connection with the use of portable power tools. This applies also to the occasions where construction power is supplied by the Owner. Permanent building outlets shall not be used unless prior approval is granted by the Owner's representative, and the Contractor has determined at the point of outlet that the system is grounded and has made a record of this fact with a letter supplied to the Owner's engineer.

15. EXPLOSIVES

The Contractor shall consult with the Owner's construction engineer before using any explosives or blasting agents. The Contractor shall follow the requirements as stated in Alcoa Standard 33.2.2, Safety Standard for Blasting in Construction.

16. EXPLOSIVE-ACTUATED TOOLS

The Contractor shall consult with the Owner's Construction Engineer before using explosive-actuated tools and shall follow the rules for using such tools given in Alcoa Standard 17.10.1.

17. ENTERING AND WORKING IN CONFINED SPACES

The responsibility for safe procedure both at the time of entry and during the entire operation of entering and working in confined spaces rests with the Contractor. The Contractor must be sure that adequate steps have been taken to eliminate or control the hazards. At no time shall the Contractor's safety standards for entering and working in tanks, pits, manholes and other confined spaces be less than those set forth in the Alcoa Engineering Standard 18.1.

18. EXCAVATIONS

18.1 Underground Utilities. Before any excavating is started, the Contractor shall check with the Owner's Construction Engineer for all known underground utilities such as conduit, pipe lines, tanks, etc. and shall proceed only after receiving the proper permits.

18.2 Temporary Railings. Necessary temporary barricades of substantial construction shall be erected by the Contractor. Lanterns or other illuminated warning devices shall be used at night.

18.3 Trench Shoring. Trench shoring or sloping shall be required to prevent earth slides. Federal, state and local standards on trench wall shoring or sloping shall govern all applications. Escape ladders are required in accordance with federal, state or local regulations. Surcharge material shall not be placed closer than 2 feet of trench edge.

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19. EVALUATION OF CONTRACTOR

The Owner's Safety Representative or the Owner's Resident Construction Manager has the right (but not the obligation) to determine if the Contractor is performing in accordance with the regulations set forth in this standard. The checklist presented in Alcoa Engineering Standard 33.2.1.1 may be used to evaluate Contractors. Evaluations may be made at least once a month and also before the completion of a contract. Deficiencies shall be corrected. Continued unsatisfactory evaluation and injury experience may serve to disqualify the Contractor for further work from the Owner.

Conditions presented in the check list in Standard 33.2.1.1 were obtained from the

Occupational Safety and Health Act, Part 1926, SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION, and Part 1910.12, CONSTRUCTION WORK.

20. SUMMARY

The Owner expects the fullest cooperation of the Contractor on these safety and health regulations. Should any doubt arise as to the meaning or interpretation of these instructions, consult the Owner's Construction Safety Representative, the Resident Construction Manager or the employee assigned to coordinate construction activities. Contractor shall comply with Owner's recommendations for correcting unsafe conditions immediately.



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CONTRACTOR _____
ALCOA PLANT LOCATION _____ BUILDING NO. _____
CONTRACTOR'S SUPT. NAME _____
TOTAL NUMBER OF WORKERS _____
NAME OF EVALUATOR _____ FOR PERIOD OF _____ DATE OF REPORT _____

TYPE OF REPORT - FINAL - QUARTERLY - MONTHLY - SPOT CHECK (Circle one) 1,2

A. Health and Environmental.

	Poor	Fair ²	Good	Excel
1. First Aid Service	—	—	—	—
2. Sanitation	—	—	—	—
3. Noise Control	—	—	—	—
4. Air Quality Control	—	—	—	—
5. Illumination	—	—	—	—
6. Heat Stress Control	—	—	—	—
7. Confined Space Work Procedure	—	—	—	—
8. Radiation Control	—	—	—	—

B. Personal Protective Equipment.

1. Head	—	—	—	—
2. Hearing	—	—	—	—
3. Eye and Face	—	—	—	—
4. Fall Protection	—	—	—	—
5. Respiratory	—	—	—	—
6. Working Apparel	—	—	—	—

C. Fuel and Flammables.

1. Fire Fighting Equipment and Location	—	—	—	—
2. Fuel/Flammables Storage Area	—	—	—	—
3. Fuel/Flammables Transfer	—	—	—	—
4. Bonding/Grounding	—	—	—	—

D. Signs, Signals and Barricades.

1. Danger Signs	—	—	—	—
2. Flag Person	—	—	—	—
3. Barricades	—	—	—	—

E. Rigging Equipment (Slings/Spreaders/ Come-Along/Etc.).

1. Use	—	—	—	—
2. Storage	—	—	—	—
3. Condition	—	—	—	—

F. Tools.

1. Guards	—	—	—	—
2. Pressure Switches	—	—	—	—
3. Hand	—	—	—	—
4. Electric	—	—	—	—
5. Powder Actuated	—	—	—	—
6. Gasoline	—	—	—	—
7. Pneumatic	—	—	—	—
8. Excess Air Flow Valves	—	—	—	—

G. Welding and Cutting.

	Poor	Fair ²	Good	Excel
1. Regulator Condition	—	—	—	—
2. Flashback Device	—	—	—	—
3. Cylinders Condition	—	—	—	—
4. Cylinders Secured	—	—	—	—
5. Cylinders Storage	—	—	—	—
6. Cylinder Transport	—	—	—	—
7. Welding and Cutting	—	—	—	—
8. Hoses	—	—	—	—
9. Torches	—	—	—	—
10. Welding Leads	—	—	—	—
11. Work Grounded	—	—	—	—
12. Protective Screens	—	—	—	—
13. Ventilation	—	—	—	—
14. Fire Protection	—	—	—	—
15. Welding/Burning Permit	—	—	—	—

H. Electrical.

1. Tagout/Lockout	—	—	—	—
2. Extension Cords	—	—	—	—
3. Temporary Power	—	—	—	—
4. Temporary Lighting	—	—	—	—
5. Ground-Fault Interrupter/ Assured Grounding	—	—	—	—
6. Isolation	—	—	—	—
7. Plant Outlet Grounding	—	—	—	—
8. Powerline Clearance	—	—	—	—

I. Portable Ladders.

1. Physical Condition	—	—	—	—
2. Proper Size/Placement	—	—	—	—
3. Job-Made Ladders	—	—	—	—
4. Used Safely	—	—	—	—
5. Ladder Feet/Secured	—	—	—	—
6. Non-Metal	—	—	—	—

J. Scaffolding.

1. Footing	—	—	—	—
2. Anchorage	—	—	—	—
3. Bracing	—	—	—	—
4. Guard Rails	—	—	—	—
5. Toeboards	—	—	—	—
6. Planking	—	—	—	—

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ALCOA SAFETY AND HEALTH EVALUATION
OF OUTSIDE CONTRACTORS AND SUBCONTRACTORS

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J. Scaffolding (Cont.)

	Poor	Fair ²	Good	Excel
7. Safe Access	—	—	—	—
8. General Conditions	—	—	—	—

Suspension Scaffolds.

1. Wire Ropes	—	—	—	—
2. Pulleys	—	—	—	—
3. Outrigger Beams/Counter Wts.	—	—	—	—
4. Hoisting Machine	—	—	—	—
5. Secondary Suspension Fall Protection	—	—	—	—

K. Floor-Wall-Roof Openings and Stairways.

1. Guard Rail	—	—	—	—
2. Hole Covers/Secured	—	—	—	—
3. Handrail	—	—	—	—
4. Edge Protection	—	—	—	—

L. Cranes, Derricks, Hoists, Aerial Lifts Elevators and Conveyors.

1. Load Capacities	—	—	—	—
2. Boom Angle Indicator	—	—	—	—
3. Band Signals Poster	—	—	—	—
4. Wire Rope/Maintenance	—	—	—	—
5. Hook and Attachments	—	—	—	—
6. Fire Extinguisher	—	—	—	—
7. Swing Radius Isolation	—	—	—	—
8. Cab Window Clean	—	—	—	—

M. Motor Vehicles.

1. Brake System	—	—	—	—
2. Brake Lights	—	—	—	—
3. Horn	—	—	—	—
4. Back-up Warning	—	—	—	—
5. Secured Seats for Transporting Employees	—	—	—	—
6. Fire Extinguisher	—	—	—	—
7. Safe Operation	—	—	—	—
8. Seat Belts	—	—	—	—
9. Windshields-Windows	—	—	—	—

N. Excavation, Trenching and Shoring.

1. Angle of Repose & Sloping	—	—	—	—
2. Spoil and Material Storage	—	—	—	—
3. Support System/Shoring	—	—	—	—
4. Provisions for Exit	—	—	—	—
5. Digging Permit	—	—	—	—
6. Barricade/Isolate Area	—	—	—	—

O. Concrete, Concrete Forms and Shoring.

	Poor	Fair ²	Good	Excel
1. Form Support	—	—	—	—
2. Stripped Forms	—	—	—	—
3. Work Platforms/Access	—	—	—	—
4. Fall On Re-Bar Protection	—	—	—	—

P. Steel Erection.

1. Flooring-Planking	—	—	—	—
2. Tools/Materials Secured	—	—	—	—
3. Fall Protection	—	—	—	—
4. Safe Distance From Power Line	—	—	—	—
5. Tag Line	—	—	—	—

Q. Housekeeping.

1. Aisles/Walkways	—	—	—	—
2. Work Areas	—	—	—	—
3. Scrap & Trash Removal	—	—	—	—
4. Material/Equip. Storage	—	—	—	—
5. Nails Clinched or Removed	—	—	—	—

R. Recordkeeping Requirements.

1. Injury Illness Reporting	—	—	—	—
2. Assured Grounding	—	—	—	—
3. Cranes, Derricks, etc.	—	—	—	—
4. Motor Vehicles	—	—	—	—
5. Safety Training	—	—	—	—

S. Subjective Evaluation With Regard to Safety.

1. Attitude (Supervisors)	—	—	—	—
2. Safety Awareness (Supervisors)	—	—	—	—
3. Employees Safety Performance	—	—	—	—
4. Corrective Actions Taken Concerning Violations	—	—	—	—
5. Safety Education and Training	—	—	—	—
6. Subcontractor Performance	—	—	—	—

T. Comments: If the overall evaluation is poor, what can the contractor do to obtain a satisfactory status, be specific. If the evaluation is excellent, please so note.

Legend

¹Each contractor will be evaluated by this check list before the termination of this contract.

²Scoring guide to Federal, State, Local and Alcoa Safety Standards. Poor-Generally out of compliance; Fair-Generally in compliance; Good-Karely out of compliance; Excellent-Always in compliance; N/A-Not applicable at this time.

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1. SCOPE

The Contractor shall be responsible for but not limited to the following job conditions and safe working practices.

2. PRE-JOB PLANNING - JOB REQUIREMENTS

- 2.1 Safety and Health Protection on the Job poster displayed.
- 2.2 Log of Occupational Injuries (OSHA #200) maintained.
- 2.3 Record of Occupational Injuries or Illnesses (#101) up to date.
- 2.4 Summary of Occupational Injuries or Illnesses (#200) posted at end of year.
- 2.5 Records for the respective contractor firms are maintained current by the respective field offices at each location.
- 2.6 Ascertain the names, addresses, and phone numbers of available emergency and medical services, such as: Hospital, Doctor, Clinic, Ambulance, Fire and Police Departments and post this information conspicuously.
- 2.7 If there is no infirmary, clinic or hospital near to the operations, a trained person (or persons) shall be available to render first aid. "First Aid supplies approved by the consulting physician shall be readily available."
- 2.8 Transportation or a communication system for contacting necessary ambulance services shall be provided.
- 2.9 Employees engaged in site clearing shall be protected from hazards or irritant and toxic plants and first aid treatment shall be available.
- 2.10 Adequate lighting in work areas for work or job being performed.
- 2.11 Noise exposure levels shall be measured in areas where necessary and personal protective equipment provided as needed.
- 2.12 An adequate supply of potable water shall be provided.
- 2.13 Portable containers used to dispense drinking water shall be capable of being tightly closed and equipped with a tap.
- 2.14 Toilet facilities shall be adequate for the number of employees.
- 2.15 Personal protective equipment for eyes, face, head and extremities, protective clothing, respiratory devices, protective shields and barriers shall be provided, used, and maintained by the employer.

2.16 The employer shall insist on the wearing of appropriate personal protective equipment in all operations where there is an exposure to hazardous conditions.

2.17 Where the eyes or body of any person may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area.

2.18 Safety Meetings shall be scheduled and held at regular intervals to stimulate safety interest and awareness of all employees.

2.19 PLANT SAFETY REGULATIONS SHALL BE APPLICABLE TO CONTRACTOR'S PERSONNEL WHERE THESE CONTRACTOR'S PEOPLE ARE IN THE PLANT OPERATING AREA.

3. ELECTRICAL HAZARDS

3.1 Before work is begun the employer shall ascertain by inquiry or direct observation, or by instruments, whether any part of an electrical power circuit, exposed or concealed, is so located that the performance of the work may bring any person, tool or machine into physical or electrical contact therewith. The employer shall post and maintain proper warning signs where such a circuit exists. He shall advise his employees of the location of such lines, the hazards involved and the protective measures to be taken.

3.2 No employer shall permit an employee to work in such proximity to any part of an electrical power circuit that he may contact the same in the course of his work unless the employee is protected against electrical shock by de-energizing the circuit and grounding it or by guarding it by effective insulation or other means.

3.3 A positive "Lock Out System" shall be provided to render machines operated by electric motors inoperative while repairs or adjustments are made. See Alcoa Engineering Standard 18.3 Part 5, Tagout and Lockout Procedures for Electrical Powered Equipment.

3.4 Extension cords used with portable electrical tools and appliances shall be of three-wire types. An effective repair and maintenance program shall be conducted.

3.5 All hand-held powered tools, such as circular saws, drills, etc. shall be equipped with a constant pressure switch.

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3.6 In Tunnels

- a. Keep lighting and drop cords in safe locations to avoid short circuits.
- b. Bare wires other than ground wires that are exposed shall be taped or otherwise protected or removed.
- c. Cords shall not be permitted to lay in water.

3.7 Portable Power Tools

- a. Tools that are not grounded or double insulated shall not be used.
- b. Portable power tools used in tank and on superstructure covering work require adequate repair and maintenance in order to assure safe use.

3.8 On Superstructure Covering or Metal Siding

- a. Drop cords can get cut by many things. Inspect the drop cords frequently for cuts in insulation.

3.9 Metal Hard Hats and Metal Ladders shall not be permitted on Alcoa construction projects because of potential hazards including:

- a. Contact with building crane collector rails.
- b. Contact with overhead power lines.
- c. Contact with bus bar.
- d. Contact with power distribution systems while walking or working on roofs and/or yard piping.

3.10 Building Crane Collector Rails require special attention; Keep in Mind the Following:

- a. Be sure that crane rails are effectively isolated in order to prevent personal contact when working aloft.
- b. Tagout and lockout procedures shall be strictly adhered to in connection with de-energizing collector rails.
- c. Avoid erecting metal scaffolding to such elevations that will permit contact with collector rails or obstruct bridge crane travel.
- d. Collector rails warning lights shall be installed for identifying energized conditions.

3.11 Switch Gear - Permanent and Temporary shall have the following:

- a. Adequate cover plates installed.
- b. Adequate grounding.
- c. Isolation of transformer areas and switchyard areas.
- d. Identification as per voltage.

3.12 Electrical Switchyard - Power Distribution Systems Hazards:

- a. Mobile crane travel shall be limited and escorted by a flagman.
- b. Truck dump beds shall be kept in traveling position.
- c. Warning signs shall be posted.
- d. De-energize all uninsulated powerlines when work is performed within 10 feet of them.

3.13 When using Electric Welding Machines:

- a. A ground return cable shall have a safe current carrying capacity equal to or exceeding the specified maximum output capacity of the arc welding or cutting unit which it services. When a single ground return cable services more than one unit, its safe current-carrying capacity shall equal or exceed the total specified maximum output capacities of all the units which it services. (OSHA 1926.351(c)(1))
- b. Ground the case of the machine.
- c. Ground the metal work bench.

3.14 Buried Cable

- a. Pre-job planning prior to excavation is essential in order to reveal all underground facilities especially buried power cables. Digging permits are required.

3.15 Other Requirements as Outlined in the National Electrical Code shall be Used When Applicable.

4. STEEL ERECTION, STAIRWAYS, FLOOR AND WALL OPENINGS AND SCAFFOLDING

- 4.1 Wall openings, from which there is a drop of four feet or more, and the bottom of the opening is less than three feet above the working surface, shall be guarded.

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4.2 Every open-sided floor or platform six feet or more above adjacent ground or floor level shall have standard guard railing or the equivalent.

4.3 Wood guardrails shall be two by four inch white pine (or the equivalent) approximately 42 inches high, with a midrail and toe guard. Supports shall be at intervals not to exceed eight feet. Toeboards shall be a minimum of four inches in height.

4.4 Fixed stairways shall have a minimum width of 22 inches.

4.5 Fixed stairs shall be installed at an angle between 30 and 50 degrees.

4.6 All treads shall be reasonably slip-resistant.

4.7 Standard stair railings shall be provided on the open sides of any exposed stairway and stair platforms. Handrails shall be provided on at least one side (right side descending) on closed stairways.

4.8 All parts of the stairways shall be free of hazardous projections.

4.9 Debris, and other loose materials, shall not be allowed on stairways.

4.10 Slippery conditions on stairways shall be eliminated as soon as possible.

5. LADDERS

5.1 Portable step ladders shall be kept in good condition.

5.2 Portable rung ladders shall have safety shoes securely bolted or fastened.

5.3 Store purchased wood ladders shall be stored in shelter or out of elements.

5.4 Except where permanent or temporary stairways or suitable ramps or runways are provided, ladders shall be used to give safe access.

5.5 The use of ladders with broken or missing rungs or steps, broken or split side rails or other faulty or defective construction is prohibited.

6. SAFETY NETS

6.1 Safety nets shall be provided by the Contractor when work places are more than 25 feet above the ground or water surface, or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors, safety lines, or safety belts are impractical.

6.2 Nets shall extend 8 feet beyond the edge of the work surface when employees are exposed and shall be installed as close under the work surface as practical but in no case more than 25 feet below such work surface.

7. SCAFFOLDS

7.1 The footing or anchorage for scaffolds shall be sound, rigid, and capable of carrying the maximum intended load without settling or displacement.

7.2 No scaffold shall be erected, moved, dismantled, or altered except under the supervision of competent persons.

7.3 Scaffolds and their components shall be capable of supporting without failure at least four times maximum intended load.

7.4 Guardrails and toeboards shall be installed on all open sides and ends of platforms more than 10 feet above the ground or floor except needle beam scaffolds, floats, or pickboards. Scaffolds 4 feet to 10 feet in height, having a minimum horizontal dimension in either direction of less than 45 inches, shall have standard guardrails installed on all open sides and ends.

7.5 Where persons are required to work or pass under the scaffold, scaffolds shall be provided with a screen between the toeboard and the guardrail, extending along the entire opening.

8. FIRE PROTECTION

8.1 Flammable or combustible liquids shall not be stored in areas used for exits, stairways, or normally used for the safe passage of people.

8.2 Locate combustible fuels at least 50 feet away from construction areas to minimize fire loss.

8.3 In the storage of containers outside of buildings they shall not exceed 1,100 gallons in any one pile or area. Piles or groups of containers shall be separated by a 5-foot clearance. Piles or groups of containers shall not be nearer than 50 feet to a building.

8.4 The Contractor shall maintain suitable fire extinguishing equipment, shall be immediately available in the work area and shall be maintained in a state of readiness for instant use.

8.5 Fire extinguishers shall be inspected and operable by the Contractor.

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- 8.6 Fire extinguishers for Class A fires shall be within 75 feet from any point in the work area and extinguishers for Class B fires shall be within 50 feet.
- 8.7 Access to extinguishers shall not be hindered in any way.
- 8.8 "No Smoking" signs shall be posted in areas where conditions require them.
- 8.9 Oxygen and acetylene tanks shall be stored separately.
- 8.10 Compressed gas cylinders shall be clearly marked as to content.
- 8.11 Cylinder protective valve caps shall be in place except when the cylinder is in use.
- 8.12 Cylinders, tanks and air receivers shall be checked for cuts or gouges, corrosion or pitting, hairline cracks in necks, etc.
- 8.13 Whenever practicable, all area welding and cutting operations shall be shielded by noncombustible or flame resistant shields.

9. EXCAVATIONS AND EQUIPMENT OPERATIONS

- 9.1 Prior to opening an excavation, efforts shall be made to determine whether underground installations will be encountered. When it is uncovered, proper supports shall be provided for the existing installations. Utility companies shall be contacted and advised of proposed work.
- 9.2 Sides of trenches in unstable or soft material, 5 feet or more in depth, shall be shored, sheeted, braced, sloped, or otherwise supported.
- 9.3 Banks more than 5 feet high shall be shored, laid back to a stable slope, or some other equivalent means of protection shall be provided.
- 9.4 Daily inspections of excavations shall be made by a competent Contractor's person. If evidence of possible cave-ins or slides is apparent, all work in the excavation shall be stopped until necessary precautions are taken to safeguard the employees.
- 9.5 Excavations shall be inspected by a competent Contractor's person after every rainstorm or other hazard-increasing occurrence.

- 9.6 Additional precautions by way of shoring and bracing shall be taken to prevent slides and cave-ins when excavations or trenches are made in locations adjacent to backfilled excavations or where excavations are subjected to vibrations.
- 9.7 Employees shall not be permitted to work above vertically protruding, reinforcing steel unless it has been covered or protected to eliminate the hazard of persons falling on it.
- 9.8 Employees exposed to vehicular traffic shall be provided with warning vests marked with or made of reflectorized or high visibility material.
- 9.9 All equipment left unattended at night, adjacent to a roadway in normal use, or adjacent to construction areas where work is in progress, shall have appropriate lights, reflectors, and barricades.
- 9.10 Trucks with dump bodies shall be equipped with positive means of support, permanently attached, and capable of being locked in position to prevent accidental lowering of the bed during maintenance and repair work.

10. HOUSEKEEPING

- 10.1 During construction, alterations, or repairs, form and scrap lumber with protruding nails, and all other debris, shall be kept cleared from work area, passageways and stairs.
- 10.2 Combustible scrap and debris shall be removed at regular intervals such as twice per week, and burned in designated areas, according to local regulations.
- 10.3 Containers shall be provided for collection of waste, trash, oily and used rags, etc. Containers used for garbage and oily, flammable, or hazardous wastes shall be periodically removed (such as twice per week) from the work area.
- 10.4 All construction materials shall be piled, racked, or stored in a safe manner.
- 10.5 All materials stored in tiers shall be stacked, racked, blocked, interlocked or otherwise secured to prevent sliding, falling or collapse.
- 10.6 Storage areas shall be kept free of weeds and debris.

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- 10.7 Aisles and passageways shall be kept clear.
- 10.8 Debris, and other loose materials, shall not be allowed on stairways.
- 10.9 Materials shall not be stored on scaffolds or runways, in excess of supplies needed for immediate operations.
- 10.10 Structural steel, poles, pipes, bar stock and other cylindrical materials, shall be stacked and blocked so as to prevent spreading or falling.
- 10.11 Operators of lift trucks shall be instructed and trained as to use and safe operation.
- 10.12 High lift trucks shall have overhead guards and working horn.
- 10.13 Walkways, runways, and sidewalks shall be clear of excavated material or other obstructions and no sidewalks shall be undermined unless shored to carry a minimum live load of 125 pounds per square foot.
- 10.14 Materials stored inside building under construction shall not be placed within 6 feet of any hoistway or inside floor openings.

11. MECHANICAL INSTALLATIONS

- 11.1 Coordinate "start-up" and "tie-ins". Use walkie-talkies if hand signaling is impractical.

- 11.2 Compressed air cleaning equipment shall be limited to less than 30 PSI. Install guarding for protection from flying chips on fixed installations.
- 11.3 Portable power wood working tools shall have dead man guards or switches to prevent accidental operation when not in use.
- 11.4 All other hand-held powered tools or equipment shall have constant pressure switches.
- 11.5 Machines, presses, grinders, saws, etc., shall be properly guarded to protect employees from hazards created by:
 - a. Point of operation
 - b. Nip points
 - c. Rotating parts
 - d. Flying chips and sparks
- 11.6 All mechanically powered transmission apparatus 7 feet or less above floor or work platform shall be guarded. These include:
 - a. V belts, shafts, pulleys
 - b. Chain and sprocket drives
 - c. Fly wheels
- 11.7 A positive "Lock Out System" shall be provided to render mechanically powered equipment inoperative while repairs or adjustments are made. See Alcoa Engineering Standard 18.3, Part 6, Tagout and Lockout Procedures for Mechanically-Powered Equipment.

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17.10.1

PAGE 1

LOW-VELOCITY, POWDER-ACTUATED TOOLS

1978-10

1. SCOPE

This standard describes the operating principles and safe operating procedures for low velocity, powder actuated fastening tools. Such tools propel a stud, pin, fastener, etc, for the purpose of affixing it by penetration to another object. This standard is based on ANSI A10.3-1977 and complies with Occupational Safety and Health Standard 1910.243(d).

2. APPLICATIONS

Among the many applications of powder actuated fastening tools are those illustrated in Figures 1 and 2.

Fasteners shall always be placed in the solid portion of concrete and masonry work, such as the ribs of concrete block. They do not provide a firm connection in mortar. In concrete having coarse aggregate, the fastener may hit a large piece of aggregate and be deflected so that it will not hold securely.

3. DESCRIPTION

3.1 Classes. There are three classes of powder actuated tools--low, medium and high velocity. The low velocity tool is the only class permitted for use in Alcoa construction and maintenance work because it makes over-penetration and ricochet almost impossible and, therefore, minimizes the hazards of use.

3.2 Explosive Power Load. Low velocity tools use an explosive power load either in cartridge form (cased) or pill form (uncased) as the propellant force. Several load levels are available.

3.3 Operation. Instead of shooting the fastener at the work surface with speeds that may exceed 1500 feet per second as is done with a high velocity tool, the low velocity tool starts the fastener in contact with the work surface, then pushes it with a captive piston that is propelled by the power load.

The explosive force propels the piston which, in turn, drives against the fastener which must be moved against the resistance of penetration. The chance for ricochet, under these circumstances, is practically eliminated because the heavy mass of the piston is contained within the tool; and the only free energy is that of the fastener or stud which is a very small mass moving at low velocity. In addition, most fasteners for the low velocity tools have collars or washers which distribute the small amount of remaining energy over a broad area at the work surface and help further to avoid the hazard of even a slow moving ricochet. In free flight, such a fastener could cause comparatively little damage and would be stopped by loose clothing and normal eye protection.

3.4 Guards. Because the hazards inherent in "gun-tool" operation are reduced with the low velocity tool, equipment guards or shields, other than those furnished by the manufacturer of the tool for attachment to the tool, are unnecessary. These tools, therefore, can do many jobs which would require stringent safeguarding rules if the high velocity tools were being used. They can fasten in narrow channels and other confined spaces and drive with safety into round steel surfaces. They can fasten with complete safety through predrilled holes provided the fastener point can be inserted or guided in the hole before driving.

Low velocity powder actuated tools perform a number of fastening and splicing functions much more rapidly than would be possible otherwise and with minimum hazard.

4. APPROVED TOOLS

Only low velocity tools meeting the requirements of ANSI A10.3, and approved by Underwriters' Laboratories, Inc., Factory Mutual or National Board of Fire Underwriters shall be used. Among approved low velocity tools are those offered by Hilti Fastening Systems, Stamford, Conn.; Remington Arms, Park Forest, Ill.; Winchester-Western, New Haven, Conn.



Fig. 1 - Steel pins permanently fasten to concrete and steel such items as clips, channels, laths, sheathing, brackets, flashing, straps, wall ties, furring strips, sill plates and insulation.

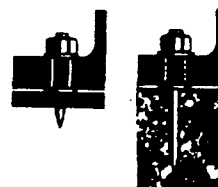


Fig. 2 - Steel studs in concrete and steel provide for removable fastening of hooks, brackets, channels, etc.

INDICATES CHANGES OR ADDITIONS

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LOW-VELOCITY, POWDER-ACTUATED TOOLS

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5. OPERATING RULES

5.1 Training and Licensing. Since powder actuated tools use an explosive power load as the propulsive force to drive the stud or fastener, they should be operated and handled with the same respect that is used in the operation and handling of firearms. Instructions and recommendations of the manufacturer shall be strictly followed with respect to operation, application and maintenance. In many cases, the manufacturer will train workmen and will certify them for regular operation of these tools. Most manufacturers furnish a card of certification to persons who pass their course in powder-driven tools.

The tool shall be used only by a qualified operator in accordance with Section 13 of ANSI A10.3, who shall follow carefully the safety rules and regulations established for its use. He should be trained to clean the tool correctly and to recognize any worn or defective parts. He should also understand the limitations of its use.

5.2 Eye or Face Protection. Eye or face protection or both, shall be worn by operators, assistants, and adjacent personnel when the tool is in use. Hearing protection should be used when making fastenings in confined areas.

5.3 Power Loads. Only power loads specifically approved for the tool shall be used. The lightest load level that will do the job should be used. Loads should be kept and transported in a locked container under the direct custody of authorized personnel. Power loads of different power levels and types shall be kept in separate compartments or containers.

5.4 Fasteners. Only those types of fasteners and power loads specifically recommended for the tool shall be used.

5.5 Job Study. A thorough study of each job should be made, and due care should be taken in the proper selection of stud and power load before the work is started. A light trial shot should be made to test the surface. The operator should know what is behind the surface into which the stud is being driven (electric wires, fluid lines, etc).

5.6 Inspection. Each day, before using a tool, the operator shall inspect it to determine to his satisfaction that it is clean, that all moving parts are in proper working condition, and that the barrel is free from obstructions.

5.7 Defect During Use. When a tool develops a defect during use, the operator shall immediately cease to use it until it is properly repaired by an authorized factory service representative.

5.8 Tool Handling. The tool should never be pointed at anyone and should be carried vertically. Tools shall not be loaded until just prior to firing. Bystanders should not stand close to the operator. Gun safety rules plus special requirements noted shall be followed.

Workers should keep their fingers and hands away from the front of the barrel. The tool should not be rested against the body (knee, thigh, etc) when loading or making adjustments.

Although tools are designed to preclude their firing when dropped, and Underwriters' Laboratories have tested them for this feature from drops of 10-12 feet, it is recommended that every precaution be employed to prevent dropping them. Throwing of the tools shall be definitely prohibited.

Although good design specifies that the tool will not fire before it is properly closed, locked and set against the work, the careful operator will assure himself that the bore is clear before loading, that the power load is fully seated, that the breech is definitely closed and locked, that he maintains a safe position relative to the tool and that the safety devices are in proper working order before using the tool.

5.9 Loading. No tools shall be loaded unless being prepared for immediate use, nor shall an unattended tool be left loaded. If the work is interrupted after loading, the tool shall be unloaded at once.

5.10 Misfires. In case of a misfire, the operator shall hold the tool in the operating position perpendicular to the work surface for at least 30 seconds. He shall then try to operate the tool a second time. He shall wait another 30 seconds, holding the tool in the operating position; then he shall proceed to remove the explosive load in strict accordance with the manufacturer's instructions. Misfired cartridges should be placed carefully in a metal container filled with water, and returned to the supervisor for disposal.

5.11 Safeguarding and Storage. A tool shall never be left unattended in a place where it would be available to unauthorized persons.

5.12 Materials. Fasteners shall not be driven into very hard or brittle materials including, but not limited to, cast iron, glazed tile, surface-hardened steel, glass block, live rock, face brick, or hollow tile. Fasteners shall not be driven into concrete unless material thickness is at least three times the fastener shank penetration.

5.13 Piercing of Materials. Driving into materials easily penetrated shall be avoided unless such materials are backed by a substance that will prevent the pin or fastener from passing completely through and creating a flying-missile hazard on the other side.

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5.14 Distance from Edge of Material. Fasteners shall not be driven closer than 1/2 inch (13 mm) from the edge of steel except for specific applications recommended by the tool manufacturer. Fasteners shall not be driven closer than 3 inches (76 mm) from the unsupported edge of masonry materials¹ except for specific applications recommended by the tool manufacturer. Although these minimum edge distances are taken from the standard ANSI A10.3, local requirements may dictate otherwise.

5.15 Pre-Drilled Holes. Fasteners shall not be driven through existing holes unless a positive guide is used to ensure positive alignment.

5.16 Spalling. No fastener shall be driven into a spalled area.

5.17 Explosive Atmosphere. Tools shall not be used in an explosive or flammable atmosphere or in any area where non-sparking tools are required.

5.18 Guards, Shields and Attachments. All tools shall be used with the correct shield, guard or attachment recommended by the manufacturer.

5.19 Posting. A sign, at least 8 x 10 inches (200 x 250 mm), using boldface type no less than 1 inch (25 mm) in height, shall be posted in plain sight within the area of the operation on all construction projects where tools are used. The sign should bear the wording:

"POWER ACTUATED TOOL IN USE"

6. OUTSIDE CONTRACTORS

When powder-actuated tools are being used by outside contractors on Alcoa property, low velocity tools shall be used and all of the precautions outlined in this standard shall be adhered to. The contractor shall comply with state or local safety regulations governing the use of such tools in addition to the requirements of this standard.

¹In accordance with paragraph 5.14, no fasteners shall be driven into face brick.

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1. SCOPE

This standard outlines the essential precautionary measures necessary when personnel must enter confined spaces to clean, inspect, repair, paint, or perform other duties. Examples of the confined spaces covered by this standard are tanks, casting pits, tubs, vaults, sewers, and process vessels. In this standard, such confined spaces will hereafter be called tanks.

Much of the information in this standard was taken from the Recommended Safe Practices and Procedures Safety Guide adopted by the Manufacturing Chemist's Association, Inc., entitled, "Entering Tanks and Other Enclosed Spaces."

This standard is compatible with OSHA safety requirements contained in 1910.252, Welding, cutting and brazing, and 1926.253, Ventilation and protection in welding, cutting and heating.

Unusual and frequently unexpected acute hazards may be encountered when personnel enter a tank or other confined space for any purpose and for any length of time. Typical of such hazards are: accidental activation of powerful agitating equipment; release of dangerous gases or liquids into the space; exposure to paint volatiles; unexpected exposure to asphyxiating, toxic, corrosive, flammable, or radioactive chemicals; or insufficient oxygen for life.

Although the character and degree of each specific hazard or combination of hazards will usually be different, the fundamental precautions and procedures outlined in this standard must be applied to all cases to insure positive accident prevention.

Confined spaces (tanks) which are potentially hazardous include:

1. Enclosures with limited access openings for personnel, such as closed storage tanks, tank cars, process vessels (usually with only a manhole for entering).
2. Tanks, casting pits, tubs, vaults, vessels, furnaces or other confined spaces with one side open to the air but so deep as to require entrance and aid of an assistant in case of emergency.
3. Ventilation or exhaust ducts, sewers, underground utility tunnels or pipe lines.
4. Small offices, cupboards or closets being painted.

2. RESPONSIBILITY

Responsibility for safe procedure both at the time of entry and during the entire operation rests with the Supervisor. This responsibility covers conditions of work for contractors' employees and workmen from other departments as well as for his own personnel. He must make sure that adequate steps have been taken to eliminate or control the hazards. He must also make sure that everyone understands the nature of such hazards which remain and the precautions that must be followed. Advice on the nature and type of tests to be made to insure safe entry and the equipment to be used can be obtained through the Works Industrial Hygiene Committee.

3. HAZARDS

The hazards commonly encountered are:

1. Toxic vapors in harmful concentrations - may result from material in the tank, by gradual release from sludge or scale, or be introduced by painting or leakage from interconnected systems due to failure to blank off or disconnect pipelines or ducts. Painting or repairing of the protecting coating of casting pits also releases toxic and explosive vapors.
2. Flammable gases, with potential of fire or explosion.
3. Lack of oxygen, causing asphyxiation - may result from chemicals absorbing or replacing oxygen in the air, or from inert gas often used to exclude oxygen to reduce the possibility of explosions. Air in clean tanks closed for an extended period may become deficient in oxygen for various reasons including oxidation of the metal. Improper or inadequate ventilation during work such as welding, gas cutting or arc cutting may also result in a lack of oxygen.
4. Electric shock from portable lights, tools, or associated electrical equipment.
5. Injury from mechanical equipment such as mixers, conveyors, etc., inadvertently activated.
6. Bodily injury from direct contact with corrosives of dermatitis-producing chemicals.
7. Physical hazards such as slipping, falling, and falling objects.
8. Burn hazards resulting from accidental opening of a steam valve in a line which has not been blanked off or disconnected.

| Indicates changes or additions.

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4. PROCEDURES

The hazards inherent in tank entry can be avoided or overcome if the following principles are applied properly each and every time a tank is entered.

4.1 Establish a definite system of pre-planning for entry and a worker instruction program.

4.1.1 Pre-Planning. Survey the various tanks requiring entry and evaluate the hazard potential. All concerned shall agree to the detailed standards and procedures established. There shall be no doubt as to exactly what is meant. Worker and supervisor alike, shall be fully informed both as to fundamentals and specific requirements. Close liaison and job planning between various groups such as production and maintenance are essential.

4.2 Prepare the area or vessel for entry by physically isolating it, cleaning it to remove contaminants, and testing it to insure absence of such contaminants.

4.2.1 Preparation of Tank.

4.2.1.1 Cleaning. According to the nature of the product, the tank shall be cleaned and emptied of residual product by hot or cold water flush, by steaming, by chemical neutralization or by air purge, with harmful vapors vented safely to the outdoors.

If the tank is steamed, it shall be allowed to cool before entry. Steam shall not be introduced below liquid surfaces in tanks being cleaned. Non-miscible solvents sometimes will stratify and burst out at almost explosive pressures due to the difference in boiling point temperatures between the water layer and the solvents.

After the material has been drained, sludge or incrustation shall be removed, to the greatest possible degree, by operation from outside the tank if possible. Protective clothing and respiratory protection shall not be used as a substitute for cleaning and ventilating, except in extreme emergency -- for example, saving a life or making emergency surveys or repairs. For the same reasons no one shall enter a tank containing a flammable atmosphere or one which because of oxygen deficiency or contamination may be so immediately harmful as to prevent escape from the tank in case of failure of the respiratory equipment.

4.2.1.2 Ventilation. The tank shall be thoroughly ventilated by some positive method of mechanical ventilation so arranged as to avoid recirculating contaminated air or

contaminating adjacent areas. After the tank is cleaned and ventilated, the mechanical ventilation equipment shall be kept operating to provide secondary protection in case of accidental introduction of harmful chemicals; to remove contamination that may be produced by residues of the tank's contents or by work in the tank such as welding and cutting, painting, coating; to cool the tank; or to otherwise improve working conditions.

Should decontamination involve flammable liquids, vapors, gases or ducts, all sources of ignition shall be eliminated. For example, to eliminate any accumulation of static electricity and prevent autogenous ignition of flammables which may be in the tank, steam should be introduced at relatively low pressure and velocity. Steam lines shall be electrically bonded to the tank if the tank contains any flammable material. If the percentage of combustible vapors is greater than 20% of the lower explosive limit, no work shall be permitted where a source of ignition is in contact with the enclosed space.

4.2.1.3 Isolation. The tank shall be completely isolated from all other systems and equipment by taking positive and adequate measures to prevent harmful material (solid, liquid or vapor) from entering the tank while workmen are inside or after cleaning. The isolation procedures given below should be coordinated with cleaning operations to prevent recontamination.

All supply lines connected to the tanks shall either be physically disconnected and capped or a "Figure 8" blind or a slip blind shown in Figure 1 inserted between the pipe flanges. The disconnection shall be made or the blind installed as close to the tank as practicable to prevent drainage from trapped sections.

It is not permissible to close and tag out valves to achieve isolation. Sad experience shows that even when closed, a valve may leak dangerous liquids or gas and even when tagged out, a valve can be accidentally opened.

The open ends of disconnected lines shall be capped to prevent any flow from hitting personnel outside the tank or possibly entering a tank opening.

The above procedures apply also to the steam connections of a tank jacket, and, in the case of welding on the wall between the inner tank and the jacket shall apply to water, brine or air lines to the jacket.

Drain or overflow lines shall also be disconnected or blinded if they extend into a sewer from which steam or fumes could be conducted back to the tank or if they connect to other equipment or extend to a remote location.



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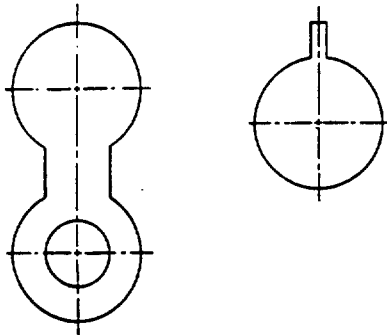


Figure 1. The "Figure 8" blind is a two-position device which is obviously open or closed. With single blinds, a removable annular spacer is often placed in the line to provide space for the blind. Some plants drill a small hole in the handle of the spacer to distinguish it from a blind which, therefore, must have no hole in the handle. With this identification, blinds must be ordered with care since some are commercially available with holes in the handle for hanging.

Exceptions to normal blanking procedure, such as bleeder valves tagged in the open position, shall be approved only by qualified supervision. Exceptions should be made only when thoroughly justified and not as a matter of expediency. Approval of exceptions requires that adequate alternative measures be taken to protect the worker.

Caps and blinds must be of a material and design to withstand the chemicals and pressures to which they are subjected and identified accordingly.

4.2.1.4 Lock Out. Line-disconnect switches supplying power to any mechanical apparatus in the tank such as mixers, conveyors, etc., shall be tagged and locked in the "off" position. It is not adequate to lock a push button station as it still may be possible to energize the circuit. The key should be kept by the man in the tank, and he alone shall be authorized to unlock the switch and remove the tag on completion of the job. Where more than one man is exposed, each shall place his own lock on the switch. In certain cases, it may be advisable, as further protection, to have a plant electrician pull the line fuses in the electrical circuit involved to take other positive steps to guard against accidental energization. Where there is a line shaft, the belt or chain drive shall be removed or similar positive measures provided such as mechanical latches.

See Alcoa Standard 18.3, Tagout and Lockout Procedures.

4.2.1.5 Testing. If the tank has held any flammable or toxic material before flushing; if it contains any residue or sludge which may release flammable or toxic gases or vapors; or if oxygen deficiency or excess is suspected or even possible, tests of atmosphere in the tank at critical points shall be made immediately before entering and before performing any hot work such as the lighting of torches. Presence of flammable or toxic vapors, excess oxygen or oxygen deficiency should be determined by direct reading instruments or chemical analysis. Single-fluid instruments which absorb both oxygen and carbon dioxide should not be used for oxygen determination. Interim tests of the atmosphere in the tank should be made as often as may be necessary while the work is in progress. Continuous sampling and analysis with automatic alarm may be indicated.

4.3 Use a formal permit system requiring written authorization for entry to be issued only after the supervisor in charge is satisfied personally with tank preparation, precautions to be taken, personal protective equipment to be used and procedures to be followed.

4.3.1 Issuance of Permit for Entry. The tank entry permit is authorization and approval in writing. It serves as a check list to insure that all existing hazards are considered and evaluated, and that the correct protective measures are taken.

No employee shall enter any tank without reporting to and securing approval from his immediate supervisor who in turn secures entry approval from the supervisor to whom the tank is assigned. The supervisor to whom the tank is assigned shall discuss the project in detail with those entering the tank. He shall review the hazards of the product or other materials to which they may be exposed. He shall furnish all the safety information he is able to provide. Then supervisors of various men to be involved shall review and complete the permit form jointly. Appropriate supervisors must be certain by personal investigation, immediately before entry and before signing the permit, that the entry and its incidental work will be safe. To insure continuation of safe conditions, if a pause of appreciable duration occurs during the carrying out of a job, the site must be re-investigated by the authorized signer before the job can be resumed. Commencement of a new shift shall always require re-investigation and a new permit. No permit shall be valid except for the job, location, persons and time specified. A sample of a work permit form is shown on the last page of this standard.

4.4 There shall be appropriate follow-up to insure that the system is being followed exactly.

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closing Alcoa's approach, and is not intended to be a recommendation for any recipient other than Alcoa. No warranties, guarantees or representations, express or implied are made as to the utility or effectiveness of the methods, processes, products or procedures described or recommended herein.

Employees should never unduly expose the skin when working in tanks, and should wear full coverage of clothing at all times. When burning or welding is done inside a tank, supervision should consider the use of flame-proofed clothing by the employees involved.

Self-contained, continuous-flow or pressure-demand supplied-air respirators shall be used if the integrity of the atmosphere cannot be guaranteed and if there is any possibility of air contamination of a harmful nature or of oxygen deficiency while employees are within an enclosed vessel. The air supplied shall be of respirable quality. The use of canister-type masks, which operate on the principle of chemical absorption or mechanical filtration, may not afford adequate protection and shall, therefore, not be used.

Equipment shall bear the NIOSH or Bureau of Mines approval, shall be suited specifically to the type of exposure and shall protect against the worst condition that might be encountered. As part of pre-planning, information as to the best type of respiratory protection should be ascertained in advance according to the specified exposure involved.

7. OUTSIDE OBSERVER

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Employees in a tank where the potential exposure is hazardous to life must wear a body harness with a life line attached and an outside observer must be in close attendance at all times. Such an arrangement must be in effect during any painting, welding, other operations where respiratory protection is required or where rescue may be difficult. It is good practice, however, to use a body harness for any vessel entry work.

A body harness and life line or safety coveralls with a built-in harness and life line shall be used when the shape, size and location of the tank space permits the safe emergency removal of personnel by standby personnel without requiring entry of the tank. When the shape, size and location of the tank does not meet this requirement, a specific procedure for the rescue of personnel must be developed in the pre-planning stage of the tank entry work and made a specific part of the tank entry permit. In some cases it is advisable to have a block and tackle positioned on a

tripod or otherwise fastened above the manhole. For obvious reasons, manholes large enough to accommodate the man and his safety gear should be provided, such as a 24" diameter for circular ones. Where existing manholes are smaller than 20" in the largest dimension, wrist harnesses often are practical.

The free end of the life line shall be secured to a fixed object and shall be attended by an observer who will keep the man in the tank always within his vision. The observer may pass tools, but he must have no other job which will take his attention away from the man in the tank, which will interfere with his attempts to withdraw the victim by use of the life line, or which will require his leaving the vicinity of the tank for any time whatever.

In case of emergency, the outside observer must never enter the tank until he is relieved at his post. It is his job to summon aid immediately (various alarms, such as a whistle, may be used), to attempt to remove the victim by use of the life line, and to perform all other necessary rescue functions from outside. Upon the arrival of help, he may enter the tank for rescue work only when he is assured that his outside assistance is adequate. Such safety observers shall be well trained in basic First Aid principles, such as rescue breathing techniques. Rescuers entering the tank must be protected with the safety facilities required by the situation, i.e., life lines and harness, and proper personal protective equipment. For rescue purposes at least one unit of self-contained breathing equipment shall be located outside and convenient to the tank together with harness, rope and such other emergency equipment as may be indicated. It is better to have too much equipment at job site than too little -- too late! Where the possibility of fire is involved, fire extinguishing equipment adequate to cope with the fire that may be encountered shall be provided. The number of men in a tank, particularly at the time of burning or welding, must be reduced to the absolute minimum necessary for the work itself.

The supervisors concerned must be trained to be on the alert, before and during the job to detect and correct immediately new and different hazards or to stop the work until the new hazards are corrected.

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WORK PERMIT

REQUIRED FOR:

1. Welding or cutting in any location other than shops or auxiliary shops.
2. Hot work in hazardous and semi-hazardous areas.
3. Entering or working in confined spaces.

Date	From A.M. P.M.	To A.M. P.M.	Type of Work
------	-------------------	-----------------	--------------

Issued for work on/in

Workman Assigned to Job	Department Assigned Job
Outside Observer Assigned to Job	Authorizing Supervisor

CHECK () ONLY IF ANSWER IS YES

1. ☐ Is welding and cutting necessary?
2. Are lines carrying material to or from equipment blinded or removed?
☐ Flammable ☐ Corrosive ☐ Steam ☐ Toxic
3. Are shut off valves tagged or locked in off position?
☐ Flammable ☐ Corrosive ☐ Steam ☐ Toxic
4. Equipment Preparation
☐ Steamed ☐ Washed ☐ Purged
5. Are sources of power for agitators and pumps locked in off position?
☐ Electrical Switches ☐ Belt Removed
6. Protective equipment needed
☐ Respiratory Protection ☐ Goggles ☐ Air Mover
☐ Hard Hat ☐ Fire Protection ☐ Clothing
☐ Safety Belt ☐ Safety Shoes
7. ☐ Will an Operating Representative be present?
8. ☐ Has the equipment been checked for residuals?
9. ☐ Have hazards of nearby areas been considered?
☐ Other Floor Levels ☐ Welding Machinery Properly Grounded
☐ Sewers ☐ Other Machinery

ARD 010755

VI. ENGINEERING AND INSPECTION

The Owner's engineer will assist the Contractor in establishing elevations or dimensions at the request of the Contractor's Supervisor. This Contractor shall be responsible for all layout and engineering required to complete the work.

The Owner's engineer will inspect all items of work to insure that they comply in full with the Specifications and Drawings. Periodically the Owner's engineer will remove brick recently placed to check the mortared joints for satisfactory bonding and joints. Periodically the Owner's engineer will cut out sections of plastic recently rammed to check for satisfactory knitting and lack of lamination. The Contractor shall at all times facilitate inspection by the Owner's engineer. Any defective workmanship performed by this Contractor which is found and reported by the Owner's engineer to the Contractor shall be corrected or otherwise made entirely satisfactory at no additional cost to the Owner.

VII. MATERIALS

A. Owner Furnished Materials

The Owner will furnish all materials required for the completion of work covered under this Contract except for items which are listed under Paragraph "B" to be furnished by the Contractor.

The brick purchased by the Owner for this installation has been ordered to special thickness tolerance limits in order to obtain thin joints. Special shapes are being provided to assist in establishing shapes and coursing out.

An adequate overage has been ordered for all materials so that with any reasonable care in handling and installation, there should be no shortage of materials. Care should be exercised not to cut special shapes for use where standard shapes can be cut to fit, unless special shapes have been specifically provided.

The Owner will furnish at the job site or within plant site all new steel and refractory materials, including insulating and refractory concrete materials, insulating block, standard and special refractory brick and shapes, cements and mortars.

Steel, refractory and other materials for each furnace are indicated on the Bills of Material and will be furnished by the Owner.

B. Contractor-Furnished Equipment and Materials

This Contractor shall furnish all normal construction tools, and equipment necessary to perform the work outlined in the Specifications.

REFRACTORY MATERIALS (OWNER FURNISHED)NO. 10 HOLDING FURNACE

	<u>Furnace Location</u>	<u>Material</u>	<u>Supplier</u>
1.	Starter Walls (Castable)	SJP	Wahl Refractory
2.	Lower Wall Plastic	85 Ram HS	C-E Refractories
3.	Lower Walls	R-9003	A.P. Green
4.	Belly Band	R-9003	A.P. Green
5.	Upper Walls	R-9009	A.P. Green
6.	Upper Wall Plastic	Super G	A.P. Green
7.	Sub-Subhearth (castable)	Alstop Lightweight	General Refractories
8.	Subhearth	SJP	Wahl Refractory
9.	Hearth Seal	Alumina	Alcoa
10.	Hearth	Coral P Brick	Harbison-Walker
11.	Mortar for Walls	Super 3000	C-E Refractories
12.	Mortar for Hearth	Super 3000	C-E Refractories
13.	Ramp	Coral P Brick	Harbison-Walker
14.	Mortar for Ramp	Super 3000	C-E Refractories
15.	Under Ramp	Coral P	Harbison-Walker
16.	Mortar for Under Ramp	Super 3000	C-E Refractories
17.	Skim Shelf	Coral P	Harbison-Walker
18.	Roof Block	Hymor 2800	
		LWI 22R	Plibrico
19.	Mortar for Roof	Super 3000	C-E Refractories
20.	Flue	Coral P	Harbison-Walker
21.	Mortar for Flue	Super 3000	C-E Refractories

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<u>Furnace Location</u>	<u>Material</u>	<u>Supplier</u>
22. TC Port	Hydrocast 451	A.T.C.
23. Tap Spout	Hydrocast 451	A.T.C.
24. Drain Spout	Hydrocast 451	A.T.C.
25. Door Arch	PSM Wire-N-Cast	Wahl Refractory
26. Roof Seal	Coral P	Harbison-Walker

INSULATING MATERIAL

1. Front Wall Upper	Superex 2000	Johns-Manville
2. Front Wall Lower	Delta T	Keene Refractories
3. Upper Side Walls and Flue Wall		
a. Next to Steel	"PV" Block	Eagle Pitcher
b. Next to Refractory	Superex 2000	Johns-Manville
4. Roof Insulation	Superex 2000	Johns-Manville
5. Roof Joint Cover	A.P.G. No. 22	A.P. Green
6. Charging Well	Delta T	Keene Refractories
7. Flue Walls		
a. Next to Steel	"PV" Block	Eagle Pitcher
b. Next to Refractory	Superex 2000	Johns-Manville
8. Block Adhesive	Fibrous Adhesive	Johns-Manville

VIII. GENERAL WORKMANSHIP SPECIFICATIONS

This Contractor shall use appropriate precautions and proper workmanship throughout the course of the contract such that the piping and wiring existing on the furnace are not damaged and that excessive dust is not created around the area of the furnace. This Contractor shall confine his equipment and furnace site storage to the area outlined by the Owner's engineer. This Contractor shall remove all waste, removed refractories, scrap and dirt from the area at the end of the last working shift of each day.

This Contractor, before placing any insulation or refractory, shall again check the squareness of the steel shell as well as the specific elevations of various components relative to a known benchmark. This Contractor, prior to placing any insulation or refractory, shall also check that all side panels are moved to the front of the furnace limited by the retaining clips. If any panels are not free to move or if any dimensional discrepancies are found, this Contractor shall report it to the Owner's engineer in writing.

The subhearth, hearth and ramp shall NOT be placed until after the walls, flue, and roof have been completed. When placing the sub-hearth, insure that all surfaces are carefully placed to provide the proper elevation base and shape for the hearth and ramp materials.

The Contractor's Supervisor shall carefully inspect the site, furnace shell and review all the drawings, Bill of Material sheets and these Specifications before starting to work to insure there is necessary space, clearance and support for the erection equipment

and materials and that he understands the Specifications and work required.

This Contractor shall install the refractory and insulation materials specified for this job in accordance with Alcoa Engineering Standards 26.1.2 "Installation of the Brick Refractory Lining and Holding Furnaces-Workmanship"; 26.1.3 "Installation of Castable Refractory Lining and Insulation in Aluminum Melting and Holding Furnaces-Workmanship"; 26.1.4 "Installation of Plastic and Ram Monolith Refractory Lining and Insulation in Aluminum Melting and Holding Furnaces-Workmanship"; 26.1.6 "Installation of Large Block Refractory Lining and Insulation-Workmanship".

The damp rammed "SJP-Cast" used for the subhearth shall be prepared and installed following the step-by-step procedure below:

1. A paddle type mixer capable of holding at least four (4) cubic feet of material shall be used. The mixer shall be thoroughly cleaned prior to being used for mixing SJP.
2. The mixer shall be hosed out with clean water, agitated for two (2) minutes and then completely dumped.
3. Wahl "SJP-Cast" shall be mixed in whole bag units of 300 to 500 pounds at a time to insure mix uniformity with respect to both the blend and weight. It shall be mixed dry in a mortar (paddle type) mixer while -
4. Clean water is measured and placed in a garden type fine spray sprinkling can. Water measure shall be about eight (8) pints (eight (8) pounds or one (1) gallon) of clean water for each one hundred (100) pound bag of "SJP-Cast".

5. Add water from sprinkling can to uniformly dampen "SJP-Cast" in the operating mortar mixer.
6. After all the water has been added and the sprinkling can is empty, continue to mix the dampened mix for five (5) additional minutes.
7. At the end of the five (5) minute wet mixing period, dump the mixer and promptly place the "SJP-Cast" in the subhearth.
8. The mortar mixer crew will then repeat Steps 2 through 7 to mix the next batch.
9. The "SJP-Cast" placed in the subhearth shall be rammed into place with a floor rammer pneumatic type hand held ramming tool. The rammer head shall not be greater than six (6) inches diameter with steel or aluminum flat surface head. The ramming tool should be held at a 45 degree angle. The material should not be rammed down from above except very quickly over the surface after having fully rammed it at an angle. NOTE: No more than 4 - 5 inches thickness of loose material shall be added to the subhearth and rammed before adding additional material. Also after each layer is rammed, the smooth rammed surface must be trimmed off or roughened-up to prepare a mating surface to bond additional rammed material.
10. When the desired elevation and contour are approached, ram material one (1) inch higher or thicker than desired. After completing the ramming trim or cut the extra material off with a good straight edge shovel or trowel to the finish elevation. Do not trowel or smoothen the finish surface. Leave as cut.



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PAGE 1

INSTALLATION OF THE BRICK REFRACTORY LINING AND INSULATION IN ALUMINUM MELTING AND HOLDING FURNACES - WORKMANSHIP

1979-04

1. GENERAL

This is the Workmanship Standard for the installation of brick refractory lining and insulation in an aluminum holding and/or melting furnace. It applies to work performed by the Installer's personnel. The "Installer" may be plant forces or outside contractor forces, but if the work is done by a Contractor, "Installer" and "Contractor" shall be considered as one and the same. See Standard 26.1.3 for castable refractory and Standard 26.1.4 for plastic and ram monolithic refractory.

2. CONTRACTOR'S COMPETENCE

2.1. Competent supervision and labor shall be furnished to install the refractory materials specified for this job in a manner satisfactory to the particular requirements herein described.

2.2. The supervisor directing work under this standard shall have had actual experience in installing refractories in aluminum melting furnaces.

2.3. The Contractor's bid on these specifications shall include a history of the past five years of his company's and his supervisor's experience on aluminum melting furnaces including the time, number of furnaces and furnace locations. The proposed supervisor's name shall accompany the bid.

3. INSPECTION

3.1. Sub-standard work or work judged by the Owner's Engineer to be of inferior quality shall be removed and replaced at the request of the Owner's Engineer at no additional cost to the Owner.

3.2. Those workmen who, in the opinion of either the Contractor's supervisor or the Owner's Engineer, persist in the performance of sub-standard work shall be replaced.

3.3. Care shall be exercised in storing, handling or moving brick to minimize breakage or loss. Loss or breakage of refractory shall be at Contractor's expense.

3.4. All shipments of material shall be inspected for loss, damage or shortage prior to starting installation of refractory, and this shall promptly be reported to the Owner's Engineer so that replacement material can be obtained.

3.5. The Owner's Engineer will periodically remove brick to check bonded joints. When air bubbles or unsatisfactory work are found, the brickwork involved shall be removed and replaced correctly.

Note: This standard replaces 26.8.1

4. WORKMANSHIP

4.1 Brick and Mortar.

4.1.1 Brick Details and Drawings. Note that detail drawings are included to show placement of brick in all sections of the furnace, and that brick courses are numbered to locate details and starter courses and sectioned to indicate the specification of brick to be used.

4.1.2 Special Brick Shapes. Where the standard splits, soaps and special shapes do not adequately fulfill requirements for coursing out, the required shapes shall be cut from surplus straights on the job. All brick and shapes will be specified to close dimensions and all refractory sections designated to minimize the amount of brick cutting. However, because of size variation of the brick, it may be necessary to cut some brick. Allow for at least one full cut in each course of each side wall and back wall.

4.1.3 Cutting Brick. High alumina, silicon carbide and zircon refractory shapes shall be cut as required to complete the installation. These materials can be wet cut on regular brick saws using diamond blades. Saw blade specifications shall be checked to determine the number of cuts per blade that can be expected for the various refractory materials. The following is an alphabetical listing of 14-inch diameter saw blades suitable for cutting these materials:

DIAMOND BLADES

MANUFACTURER

Felker M-2 Star
(Formerly X4393-
Spec.ID-35J6TH3)

Avco Felker Corp

BL-60-B11-13

Century Drill and Tool
Co., Chicago, Ill.

Champion No. FX5-7
Special

Champion Manufacturing
Company

Christensen Style
R941

Christensen Diamond
Products Company

Clipper No. MD-440

Clipper Manufacturing
Company

Target Red 6

Robert G. Evans Co.

Target Blue 6 PGM

Robert G. Evans Co.

Blade No. M2233 Type
1 Air SS, D24-50-DM
1020 3/16

Carborundum

GM 99R

Gierke Robinson

Saw blades must be powered by a minimum of 3 horsepower and shall not be less than 14 inches in diameter.

The usual masonry brick saw blades are satisfactory for cutting regular fireclay brick and shapes. Because of dust problems, dry cutting of brick shall not be permitted unless approved by Owner's Engineer.

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4.1.4 Brick Gauging. All brick and shapes have been specified and ordered to close dimensions. However, the brick actually received may not be manufactured to dimensional tolerances close enough to obtain good, tight furnace construction suitable for molten aluminum. For this reason, prior to installation, the brick shall be gauged into five separate lots based on the variation in the 3-inch thickness dimension.

See Figure 1 for a sketch of the gauge which may be used. The extreme tolerances of the 3-inch dimension shall be judged by a "no go" brick in the 3-inch slot and a loose fit to the 2-15/16 slot as shown in Figure 1.

When placing brick in a particular course, all brick should be selected from the same size lot to minimize mortar joint thickness. Where an adequate quantity is not available for the entire course, brick from the next size lot can be used.

4.1.5 Brick Dampening. To insure mortar adherence, wipe off and dampen all nitride-bonded silicon carbide brick by submerging the face to be mortared in room-temperature water for 2 to 3 seconds.

4.1.6 Mortar Metering Trowel. Butter the mortar on all brick with a mortar metering trowel. Such a trowel applies a metered amount of mortar, thus insuring joints that are uniform in thickness and free of air bubbles or voids. A metering trowel is made from a normal 9-inch or larger trowel with one edge saw-toothed or serrated. Mortar is applied using this edge. The other edge is straight for use in clean off, etc. See Figure 2.

4.1.7 Mortar Mixing. Supply and use a slow speed (approximately 300 RPM) power mixer to obtain the proper consistency in mixing all mortar. A slow speed is required to prevent air entrainment. Foamy mortar will be considered unsatisfactory and will be rejected by Owner's Engineer.

Because it is normal practice for all mortar to be purchased in 100 lb cans, the mortar shall be mixed in the cans received. Follow manufacturer's instructions in regard to both quantity and temperature of water additions.

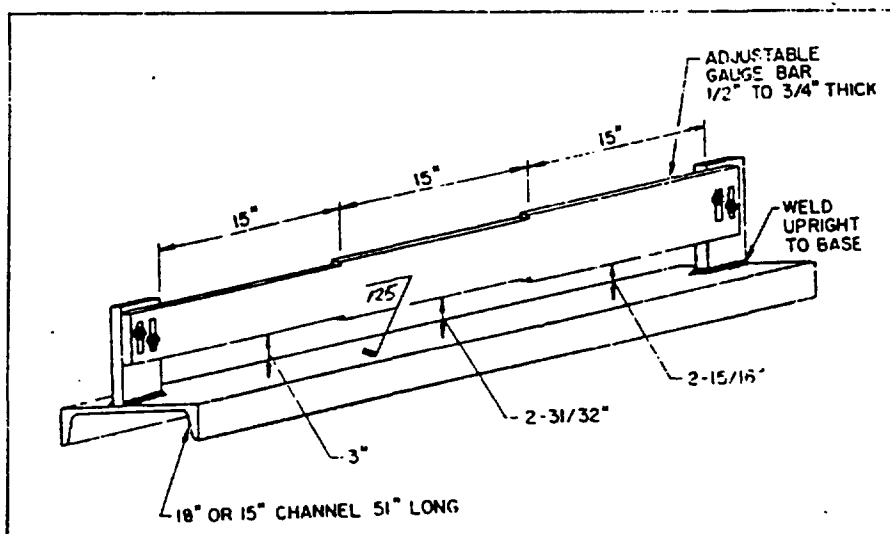


Fig. 1 - Brick Sizing Gauge

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When a brick which has been set or placed is disturbed or moved so that the bond which has been formed is broken, it shall be removed and replaced as described above. Brick with chipped edges or broken corners must be reserved for use in the least critical areas of the furnace.

4.2 Tapping Spout. If furnace leaks occur, they usually occur in the area of spouts; therefore, the proper installation of all tapping, drain and thermocouple spouts is of utmost importance. Experience has indicated that when spouts are carefully installed as outlined below, leaks are rare. Install the spouts as follows:

1. Align furnace steel panel in which spout is located as specified on Drawings No. D-081009-PE or D-085557-PE.
2. Cut an 18" x 18" hole in the wall insulation.
3. Mount spout housing casting, Drawing No. B-48136, on mounting frame with bolts, springs and washers at four corners of casting flange.
4. Assemble spout refractory hole plug tiles and spout insert casting in the housing casting and hold in place with keeper plates and straps, bolts, washers and springs.
5. Apply aluminum foil on the exposed face of the insulation block around the spout housing, covering an area about 18 inches x 18 inches.
6. Install 18x18 inch Tap Hole Tile No. L-48050. Align hole with hole in plug tile and mortar into position.
7. Install brick wall on both sides of the 18x18 tile up to top surface level, leaving the space void around the outside of the spout housing casting.
8. Wash coat all brick and tile surfaces of the opening around the spout housing casting with Plibrico Plistix 900.
9. Coat outside of spout housing casting with Chrome Thermolith No. 292 Mortar or equal.
10. Fill void space around spout housing casting with Alcoa "C-1" Castable or equal to the top level of the 18x18 tile. Be careful to work castable under the casting to completely fill the void space.
11. After the castable fill has set for a minimum of 8 hours, wash coat the top surface of the fill with Plibrico Plistix 900 and continue construction of the furnace wall above the spout.
12. Do not disturb spout until the furnace is heated to the highest temperature used during the initial curing period. At this time, before the furnace is cooled down, the springs will be replaced by shims and shorter bolts to rigidly secure spout to the mounting frame.
13. Attach the troughs.
14. Install spout liner tiles.
15. Caulk the inner casting to the spout housing with 1/4 inch ceramic fiber rope and fibrous adhesive or equal.
16. Funnel pour a liquid mixture of Chrome Thermolith No. 292 Mortar or equal to fill the space between housing and spout castings. The fill hole is located outside the furnace in the top of the spout housing casting.

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INSTALLATION OF CASTABLE REFRACTORY LINING AND INSULATION IN ALUMINUM MELTING AND HOLDING FURNACES - WORKMANSHIP

1. GENERAL

This is the Workmanship Standard for the installation of a castable lining and insulation in an aluminum holding and/or melting furnace. It applies to work performed by the Installer's personnel. The "Installer" may be plant forces or outside contractor forces, but if the work is done by a Contractor, "Installer" and "Contractor" shall be considered as one and the same. See Standard 26.1.2 for brick refractory and Standard 26.1.4 for plastic and ram monolithic refractory.

2. CONTRACTOR'S COMPETENCE

2.1 Competent supervision and labor shall be furnished to install the refractory materials specified for this job in a manner satisfactory to the particular requirements herein described.

2.2 The supervisor directing work under this standard shall have had actual experience in installing refractories in aluminum melting furnaces.

2.3 The Contractor's bid on these specifications shall include a history of the past five years of his company's and his supervisor's experience on aluminum melting furnaces including the time, number of furnaces and furnace locations. The proposed supervisor's name shall accompany the bid.

3. INSPECTION

3.1 Sub-standard work or work judged by the Owner's Engineer to be of inferior quality shall be removed and replaced at the request of the Owner's Engineer at no additional cost to the Owner.

3.2 Those workmen who, in the opinion of either the Contractor's supervisor or the Owner's Engineer, persist in the performance of sub-standard work shall be replaced.

3.3 Care shall be exercised in storing, handling or moving castable refractory to minimize damage or loss. Any loss shall be at Contractor's expense.

3.4 All shipments of material shall be inspected for loss, damage or shortage prior to starting installation of refractory, and this shall promptly be reported to the Owner's Engineer so that replacement material can be obtained.

3.5 The Owner's Engineer will periodically inspect castable refractory installation while in progress.

4. WORKMANSHIP

4.1 Castable Refractory - General. A castable refractory is a mixture of heat-

resistant aggregate and heat-resistant hydraulic cement. The overall behavior of castable refractories and molten aluminum is dependent on the properties and proper installation and application of the materials used. Unfortunately, some installations of a satisfactory castable material have failed because the manufacturer's instructions were either disregarded or unknown to the supervisor. Therefore, extreme care must be used in the placement of castable refractories.

Prepare all castable refractories in accordance with the following instructions:

The first batch to be mixed should have the mixer walls wet. To begin a mix, one-half to three quarters of the total amount of water required for a batch should be poured into a paddle mixer. Then add the dry castable in units of full bags. After the castable obtains a uniform color upon mixing, the balance of water should be added in small increments until the correct casting consistency is reached. The most important factors are summarized as follows:

- Store materials in a clean, dry area.
- Use the proper amount of potable water as determined by the "ball in hand" test.
- Subsequent batches after the first mix should have the castable mixed thoroughly while dry, before the water is added. Use respiratory protection and chemical goggles for the dust.
- Use clean mortar boxes, paddle mixer, and tools.
- Mix as close to the installation as possible and quickly place in the forms and tamp or rod to remove air pockets.
- Do not tamp excessively.
- Do not trowel excessively.
- Do not disturb after initial set has begun (usually within 30 minutes after water addition).
- Follow the recommended schedule for curing, drying and firing.

It is noted above that the mixing water and castable material must be at a temperature range of 50 to 75 F. Both water and castable temperatures in excess of 80 to 85 F will induce a fast set. If mixed castable temperature is below 50 F, excessive cracking or bloating may occur during the curing operations. Therefore, use the exact amount of water specified by the manufacturer and make sure that the water and castable material are at proper temperatures. This work shall be closely supervised and is subject to rejection by the Owner's Engineer.

Note: This standard replaces the castable portion of obsolete Standard 26.8.1.

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A useful check or guide to the proper castable consistency is the ball-in-hand test. A ball of mixed castable tossed 152.4 to 304.8 mm (6 to 12-in.) in the air should adapt to the shape of the hand when it is caught. It should not flow through the fingers nor should it disintegrate or crumble.

To ensure formation of a good ball-in-hand consistency, working time and optimum properties, the castable must be placed at temperatures between 20-30°C (70-85°F). If the dry castable mix is hot from summer heat, it will be necessary to use cold water to reduce the temperature of the mix. If the dry castable mix temperature is low from winter storage cold, it will be necessary to add warm water, or when possible place the mix in a warm room where air can circulate around it for at least 24 hours before use.

Mixing of the castable refractory is best accomplished with a thoroughly clean steel mortar box and hoe; however, for most applications, this method is not practical because of the time required to prepare large volumes of material in this manner. A paddle mixer which has two or more blades rotating on a horizontal axis is acceptable. A concrete mixer shall not be used.

Mixing time is equally important as is the use of the right equipment. If a castable is not mixed long enough, a homogeneous mix is not likely and more water would be required to develop the proper workability. With a paddle mixer, the heavier castables should be mixed 8 to 10 minutes after adding water, whereas lightweight castables only need 2 to 3 minutes. Since the lightweight castables require more water than the heavier materials, the water mixes more readily and the shorter mixing time is permissible.

All forms used shall be clean and impervious to water. A good water-proof coating shall be applied to all wood forms and they shall be dampened before the castable is placed. Steel forms shall be clean and free from rust or scale.

When the castable refractory is cast against insulating castable, insulating block or insulating brick, the contact surface shall be sealed with aluminum foil, or sealed with an approved coating such as Carborundum's QF-180FP or Johns-Manville's "Cera-Kote", to prevent absorption of water from the castable refractory. Care shall be taken so that slivers from the aluminum foil placed in the forms or other foreign materials are not imbedded in the castable.

Forms shall be filled as rapidly as possible without interruption until complete. If the placement operation is stopped for more than 30 minutes, a parting joint may result. If an emergency stops the filling of the forms, the surface of the placed castable shall be dampened and scored so that there will be some bonding when the filling operation is resumed.

Metal tamping tools are preferred because wooden tools sometimes leave large splinters in the castable.

Excessive smoothing with a trowel shall be avoided as this will tend to weaken the refractory castable by sealing the surface of the castable with excessive water and not permitting moisture to escape during dryout. An electric or pneumatic vibrator which does not exceed 1-3/8 inches in diameter can be used if permission is granted by Owner's Engineer. Excessive vibrating after the entire section has been placed shall be avoided. The forms shall not be removed until the end of a 24-hour curing period.

During curing, all exposed castable surfaces should be preferably covered with an impermeable sheet of plastic. However, if this is not possible, damp cloths or bags periodically sprayed with a fine mist of water is acceptable. To fully develop the castable's hydraulic strength and minimize chances of explosive spalling, the castable should be cured for at least 24 hours between 20-30°C (70-85°F). However, if at any time the heat of hydration causes a section of the castable to generate steam, the installer shall, in this case, remove cloths or sheets and apply a water mist to the exposed castable. After the curing period, the refractory may be allowed to air dry almost indefinitely before heat is applied to complete the drying and firing.

4.2 Tapping Spout. If furnace leaks occur, they usually occur in the area of spouts; therefore, the proper installation of all tapping, drain and thermocouple spouts is of utmost importance. Experience has indicated that when spouts are carefully installed as outlined below, leaks are rare. Install the spouts as follows:

1. Align furnace steel panel in which spout is located as specified on Drawings No. D-081C09-PE or D-085557-PC.
2. Cut round hole in wall insulation to fit neatly around the spout housing.
3. Mount spout housing casting, Drawing No. B-48136, on mounting frame with bolts, springs and washers at four corners of casting flange.
4. Assemble spout refractory hole plug tiles and spout insert casting in the housing casting and hold in place with keeper plates and straps, bolts, washers and springs.
5. Apply aluminum foil on the exposed face of the insulation block around the spout housing, covering an area about 18 inches x 18 inches.
6. Coat outside of spout housing casting with Chrome ThermoLith No. 292 Mortar or equal.
7. Install 18x18 inch Tap Hole Tile No. L-48050. Align hole with hole in plug tile and mortar into position.

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8. Install brick wall on both sides of the 18x18 tile up to top surface level, leaving the space void around the outside of the spout housing casting.
9. Wash coat all brick and tile surfaces of the opening around the spout housing casting with Plibrico Plistix 900.
10. Fill void space around spout housing casting with Alcoa approved lower wall grade of castable or plastic to the top level of the 18x18 tile. Be careful to work castable under the casting to completely fill the void space.
11. After the castable fill has set for a minimum of 8 hours, wash coat the top surface of the fill with Plibrico Plistix 900 and continue construction of the furnace wall above the spout.
12. Install spout liner tiles.
13. Caulk the inner casting to the spout housing with 1/4 inch fiberfrax ceramic fiber rope and fibrous adhesive or equal. Asbestos materials should not be used.
14. Funnel pour a liquid mixture of Chrome Thermolith No. 292 Mortar or equal to fill the space between housing and spout castings. The fill hole is located outside the furnace in the top of the spout housing casting.
15. Do not disturb spout until the furnace is heated to the highest temperature used during the initial curing period. At this time, before the furnace is cooled down, the springs will be replaced by shims and shorter bolts to rigidly secure spout to the mounting frame.

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INSTALLATION OF PLASTIC AND RAM MONOLITHIC REFRACTORY LINING AND INSULATION IN ALUMINUM MELTING AND HOLDING FURNACES - WORKMANSHIP

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1. GENERAL

This is the workmanship standard for the installation of monolith refractory, (plastic and ram mixes) in aluminum melting and holding furnaces. It applies to work performance by the Installer's personnel. The "Installer" may be plant forces or outside contractor forces, but if the work is done by a Contractor, "Installer" and "Contractor" shall be considered one and the same. See Standard 26.1.2 for Brick Refractory and Standard 26.1.3 for Castable Refractory Workmanship.

2. CONTRACTOR'S COMPETENCE

2.1 Competent supervision and labor shall be furnished to install the refractory materials specified for this job in a manner satisfactory to the particular requirements herein described.

2.2 The supervisor directing work under this standard shall have had actual experience in installing refractories in aluminum melting furnaces.

2.3 The Contractor's bid on these specifications shall include a history of the past five years of his company's and his supervisor's experience on aluminum melting furnaces including the time, number of furnaces and furnace locations. The proposed supervisor's name shall accompany the bid.

3. INSPECTION

3.1 Sub-standard work or work judged by the Owner's Engineer to be of inferior quality shall be removed and replaced at the request of the Owner's Engineer at no additional cost to the Owner.

3.2 Those workmen who, in the opinion of either the Contractor's supervisor or the Owner's Engineer, persist in the performance of sub-standard work shall be replaced.

3.3 Care shall be exercised in storing, handling or moving monolith refractory to minimize damage or loss. Any loss shall be at Contractor's expense.

3.4 All shipments of material shall be inspected for loss, damage or shortage prior to starting installation of the refractory, and this shall promptly be reported to the Owner's Engineer so that replacement material can be obtained.

3.5 The Owner's Engineer will periodically inspect monolith installation while in progress. This will involve removing sections to inspect knitting characteristics.

3.6 The Contractor shall be attentive to the workability of the material he is installing. If the workability of the material varies or is not consistent with good installation techniques, normally a workability index of 28 to 32, he must immediately report the problem to the Owner Engineer.

4. WORKMANSHIP

4.1 Insulate the furnace completely before attempting to ram any monolithic material. See furnace drawings for proper instructions on installing insulating materials.

After the insulation has been installed, cover the entire surface of the exposed surface of the insulation with 1/8" Fiberfax paper. This paper prevents insulating material dust from falling into the plastic material either by the exhaust air from the ramming hammers or from mechanical abrasion. Use of refractory paper below the metal line also acts as a molten metal barrier. Above the metal line, any type of heavy paper or even aluminum foil will work. The insulating paper or foil shall be installed using liberal amounts of adhesive.

4.2 Lower Walls. The lower walls can be rammed using wooden forms for support or, in the case of some plastic materials which tend to be less thixotropic or have greater green strength than others, can be rammed into place without forms and trimmed to dimension by hand. When forms are used, the wall shall be rammed 1/2 inch wider than the desired dimension. After the forms are removed, the extra material will be trimmed to achieve a consistent monolithic hot face surface.

When using forms, the vertical members shall be constructed of 2 x 4 material. Otherwise, bowing will occur after the wall is three or four feet tall. The wooden form wall shall be held together at the bottom. This can be accomplished by tack welding a 2" x 3" x 1/4" angle to the furnace floor plates to serve as an anchor. The floor plates shall also be temporarily tack welded to the furnace floor beams to prevent the angle anchors from slipping. All welds shall be removed, along with the 2" x 3" x 1/4" angle before the subhearth is poured.

The vertical supports for the lower wall forms shall be fabricated using two 2" x 6" members back to back. They shall be spaced on 24" centers and held by 2" x 6" sill piece placed against the bottom angle anchor. The top of the wall shall be constructed with a 2" x 6" along the outside edge of the vertical members. This member shall be held to the steel shell using 2" diameter all-threaded rods spaced every four to three feet. The threaded rods can be attached to the steel shell using nuts welded to the steel or attached by pre-drilling holes through the wall panels. After the wooden forms are dismantled, the rods shall be removed and the holes filled with refractory plastic material.

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The top of the lower wall form shall be higher than the lower wall material so the threaded rod holes are in the upper wall material, and not below the metal line. The forms shall be constructed such that when a floor is installed on the sidewall forms, the floor is at the correct elevation for masons to ram the upper walls and roof. This is shown in Figure 2.

The sides of the form shall be made with 2 x 12 planks cut to the proper lengths so they can be added to the wall as it is rammed. The planks shall be sprayed with an oil before installation. Holes shall be cut in the planks around the tap holes and pyod hole so alignment can be checked.

The lower wall material shall start on the top of the steel floor plates. A lower grade material, or one that will react with molten aluminum, shall not be used as a starter course in this area since it can cause problems if metal penetrates the hearth in this location. An approved subhearth castable is preferred. A key way between the subhearth material and the sidewall material is also good practice because this provides a tortuous path for bleed out material to find its way to the furnace bottom steel.

4.3 Tap Hole. The area around each tap hole assembly should be rammed with special care. An 18 inch square hold shall be cut in the insulation around the female casting and the casting shall be coated with Super 3000 mortar or equal refractory cement before the plastic ramming material is rammed in tight. A pipe can be used to hold the tap hole refractory tiles in place. The hot face opening left in the furnace wall can be shaped with a hand trowel after the forms are removed.

4.4 Pyod Hole. The standard pyod hole through a furnace wall is constructed using silicon carbide tiles in some plant installations. A pipe can be cut and placed through the wall to hold the shapes in line while they are carefully rammed in place. Any cracks large enough to allow rammed materials between the shapes shall be covered with Fiberfax paper before ramming.

An alternate and more recent practice is to leave the silicon carbide tile out altogether and form the pyod opening with a piece of pipe. The pipe must be withdrawn after ramming the refractory in place.

4.5 Upper Wall Anchors. The installation of upper wall refractory anchors can be different depending on the choice of the installer. One preferred method is to install clips for attaching the anchors by welding them to the inside of the steel shell. This does, however, require a lot of additional cutting of the insulation to clear the clips. It is sometimes possible to shape the insulation accurately enough to minimize the amount of cutting required. Another way is to extend the threaded anchoring bolts through the steel shell and fasten with double nuts on the outside. The welding clip method has proven to be the most desirable.

Each row of anchors can be installed by completing the rammed wall slightly above the correct elevation. Using a rubber mallet and protecting the refractory anchor with an appropriate piece of wood, the mason can drive the refractory anchor into the rammed wall. A typical refractory anchor can be painted and used as a dummy anchor to make the impression in the refractory material. This will lessen the chance of installing a cracked anchor. However, if dummy anchors are used, particular care must be taken to make sure the real anchor is orientated to match the dummy anchor impression. The anchors are then hooked to the welded clips or attached through the holes in the wall of the furnace. The anchors are again pounded into place using the rubber mallet with wood protection. The space between the anchor and the insulation must also be rammed with plastic to make sure the anchor is tight.

4.6 Vertical Walls. When ramming a vertical wall, start at the hot face edge with a whole slab of horizontal material, and use partial, or pieces of whole slabs to fill in next to the insulation. Ram the material down at 30° to 45° from the horizontal and toward the insulation to keep the hot face edge low and the material tight against the insulation.

4.7 Flat Arch and Flue Skews. The flat arch and flue arch skews can be rammed out of plastic at the same angle as a brick skew. A piece of aluminum foil shall be set against the skew face and the arch rammed into place using a wooden form. The foil creates a broken joint which allows ultimate replacement with a pre-bricked or pre-cast arch, for ease of maintenance. The door arch shall be constructed of an approved grade of plastic material, possessing a high MOR at elevated temperature (2500°F) (1370°C). If the material selected has a tendency to sag under load, or has a high thixotropic tendency, a special refractory anchor hanging procedure can be utilized. This involves installing numerous refractory anchor tile vertically in the refractory arch and suspending the tiles with 3/8" stainless steel rods from the door arch steel. See Figure 1 for a typical design showing this arrangement.

4.8 Plastic Roof. The plastic roof should be installed from the back to the front for most installations. The roof form shall consist of 2 x 12 planks supported by three (3) four foot long 2 x 6 double stringers hung from the roof steel. Standard hardware is available for hanging. The roof shall be formed to allow an extra 1/2 inch of thickness on the hot face. This material will be trimmed after the forms have been removed. The complete form requires only two, four foot sections, because after the second section is rammed, the first section can be dismantled and used for the third section. However, complete forming is preferred in most large furnaces.

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The roof material will usually be of the same material as the upper wall material. It shall be rammed horizontally and at a slight angle down from the top. When installing an anchor, the anchor and clip are slipped onto the roof's 3" steel I-beam, pounded into place and the ramming continued. The top of the rammed roof shall be consistently shaved to the desired thickness, 9 or 12", whichever the design calls for. The excess material can be reused in a non-critical location. To speed the installation of a refractory roof, it is desirable to have one crew ramming from the back toward the front, and a second crew ramming the front arch and the roof from the front towards the back wall. The front roof section must extend toward the back far enough to clear the combustion piping, which is usually located above the first four feet of the roof. This is necessary because the last section of the roof must be rammed from the top. When the forms are removed, the holes left by the rods supporting the forms shall be filled with a high temperature refractory material such as Super 3000.

In some cases, it might be desirable to shave a few inches from the incompleting refractory surface before applying new material. This judgment can only be made in the field by making a simple test. This test consists of pressing the old and new materials together in the palms of your hands. If the two parts can be pulled apart without evidence of good knitting tendency, then the two surfaces are not compatible, and the drier surface in place should be shaved back to equal moist material.

4.10 Material Handling. Installation of plastic rammed material requires a lot of labor. Experience indicates one laborer is required for every brick mason operating a ramming hammer. It is recommended that a conveyor be used to convey slabs of material from the front of the furnace to the working area inside. Even with this arrangement, it is sometimes necessary for the brick masons operating hammers to wait on material or they must get their own. The operation outside of the furnace should consist of laborers opening boxes of material and separating them into pre-cut slabs prior to feeding the slabs on the conveyor. A wide spade on the end of a small air hammer is useful in speeding the slab separation operation.

4.9 Venting Holes. After the upper and lower walls, roof and flue plastic has been placed, holes shall be poked into the refractory on approximately 6" to 8" square centers with a 3/32" diameter welding rod. These holes shall penetrate 1/2 the depth of the refractory thickness to make sure entrapped moisture can escape during cure. When refractory installation work stops for an overnight or weekend, a partly completed wall shall be covered with wet rags which in turn are covered with plastic to keep the refractory material moist. Another procedure is to cover the walls with plastic sheet and spray occasionally with water.

4.11 Surface Finish. After the installation of the upper and lower walls, the roof, flue, arch and jams have been completed, and the surface has been perforated with 3/32" diameter vent holes, the entire upper and lower wall surface shall be scratched to a rough finish using a wire brush or currycomb to avoid surface spall. Phosphate-bonded refractories are to be covered with plastic sheet nailed down or stapled. Unless there is extremely low humidity, no cover is needed for heat and air-set fireclay refractories.

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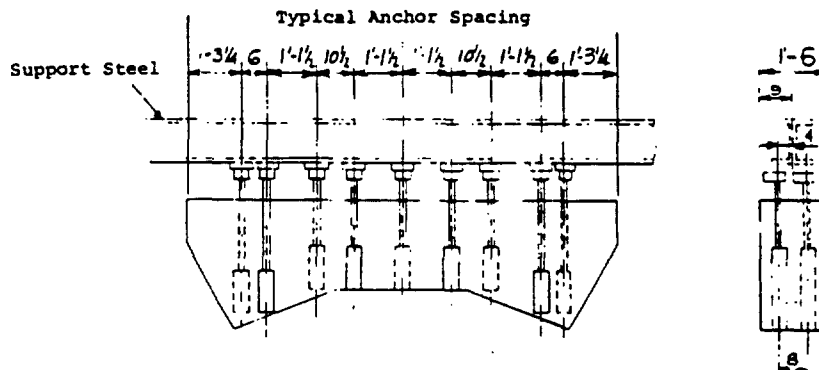


Figure 1 - Typical Anchor Spacing Design

ARD 010772



Engineering Standard

Materials and Standards Section - Pittsburgh

INSTALLATION OF PLASTIC AND RAM MONOLITHIC REFRACTORY LINING

AND INSULATION IN ALUMINUM MELTING AND HOLDING FURNACES -

WORKMANSHIP

26.1.4

PAGE 1

1979-L

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After the upper wall material has been installed, fill this gap with plank spacers. This provides bearing so that the forms will still support the wall after the lower section has been removed for the hearth installation.

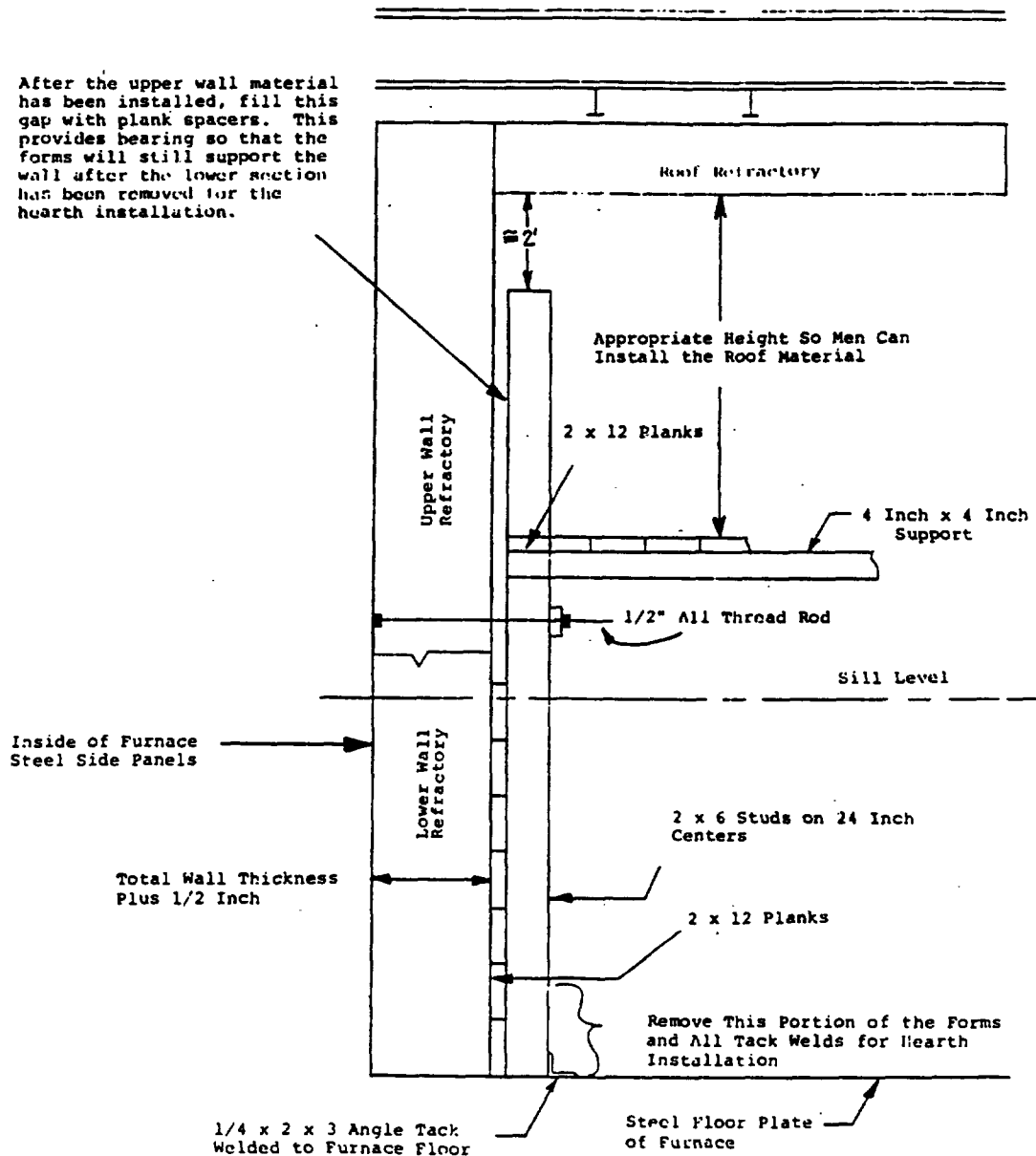


Figure 2 - Cross Section of Forming for Side Walls

ARD 010773



Engineering Standard

Materials and Standards Section - Pittsburgh

INSTALLATION OF LARGE BLOCK REFRACTORY LINING AND INSULATION WORKMANSHIP

26.1.6

PAGE 1

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1. GENERAL

This is the workmanship standard for the installation of a large block refractory lining and insulation in an aluminum holding and/or melting furnace. It applies to work performed by the installer's personnel. The "installer" may be plant forces or outside contractor forces, but if the work is done by a contractor, "installer" and "contractor" shall be considered as one and the same. See Standard 26.1.2 for brick refractory, Standard 26.1.3 for castable refractory and Standard 26.1.4 for plastic and ram monolithic refractory.

2. CONTRACTOR'S COMPETENCE

2.1 Competent supervision and labor shall be furnished to install the refractory materials specified for this job in a manner satisfactory to the particular requirements herein described.

2.2 The supervisor directing work under this standard shall have had actual experience in installing refractories in aluminum melting furnaces.

2.3 The Contractor's bid on these specifications shall include a history of the past five years of his company's and his supervisor's experience on aluminum melting furnaces including the time, number of furnaces and furnace locations. The proposed supervisor's name shall accompany the bid.

3. INSPECTION

3.1 Sub-standard work or work judged by the Owner's Engineer to be of inferior quality shall be removed and replaced at the request of the Owner's Engineer at no additional cost to the Owner.

3.2 Those workmen who, in the opinion of either the Contractor's supervisor or the Owner's Engineer, persist in the performance of sub-standard work shall be replaced.

3.3 Care shall be exercised in storing, handling or moving large refractory blocks to minimize damage or loss. Any loss shall be at contractor's expense.

3.4 All shipments of material shall be inspected for loss, damage or shortage prior to starting installation of refractory, and this shall promptly be reported to the Owner's Engineer so that replacement material can be obtained.

3.5 The owner's engineer will periodically inspect the block refractory installation while in progress.

4. WORKMANSHIP

4.1 Block Refractory - General. Large refractory blocks have been made to close

tolerances in order to reduce joint thickness and to provide accurate "building blocks" for furnace construction. It shall be this contractor's responsibility to check the dimensions of the blocks to insure they conform to the drawings.

4.2 Lowerwall Insulation. Insulate the lowerwall area of the furnace to a height equal to the top of the lowerwall block as per the drawings.

After the insulation has been installed, cover the surface with either aluminum foil or 1/8 in. fiberfrax paper using insulating block adhesive. The lower area where the starter course is to be cast must be covered with foil or approved coating to prevent absorption of water from the castable.

4.3 Starter Course. The starter course is to be formed and cast as per Alcoa Standard 26.1.3. Extreme care is to be used to insure the starter course is level, true and smooth in order to set the lowerwall blocks. Errors in the starter course will be multiplied as courses of block are installed. It shall be this contractor's responsibility to correct errors in the starter course by grinding, chipping, filling, etc. to insure an accurate base on which to set blocks.

4.4 Special Equipment. A small fork truck, preferably electric, is required to handle and install blocks within the furnace. The following specification is given only as a guideline with actual requirements to be discussed with the owner's engineer due to variations in furnace size and block weights:

- a) 4000 to 6000 lb. capacity cushion tire electric walkie or rider stacker fork truck.
- b) 24 in. load center capacity.
- c) Minimum lift height - 11 to 12 ft.
- d) Carriage to allow forks to open to a maximum opening of 37 in. outside to outside dimension.
- e) Fork length - 16 to 18 in. with square cut ends.
- f) Carriage to be equipped with side shifter having approx. 6 in. lateral movement.
- g) Mast to have both forward and backward tilt capability of approx. 8 degrees.

4.5 Lowerwalls. The corner blocks shall be placed first to provide a vertical and horizontal base from which the sidewalls and back-wall are built. The procedure for installation is as follows:

- 1) Place corner block in position on starter course - unmortared.
- 2) Check block faces for plumb and top for level.

ARD 010774

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Engineering Standard

Materials and Standards Section - Pittsburgh

INSTALLATION OF LARGE BLOCK REFRACTORY LINING AND INSULATION WORKMANSHIP

26.1.6

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- 3) If shimming is required, this is to be done using round steel flat washers of various thicknesses or equal.
- 4) Remove block, shim and replace. Check for level and plumb.

Repeat as necessary.
- 5) After proper plumb and level has been obtained, remove block, mortar starter course, carefully replace shims and re-set block. Check to insure block is tight against insulation and is plumb and level.

The lower sidewall blocks are placed using the same procedure. For the backwall, stretch a stringline between the tops of the corner blocks. The line is used to establish the elevation of the backwall blocks. After a block has been set unmortared, checked for level and plumb and shimmed as required, the block is to be removed and both the mating face with the adjacent block and the starter course is to be mortared. The block is then reset and checked for plumb, level and tightness to the insulation and the adjacent block. The side shifter, prybar or a portapower with a kicker board can be used to push blocks together to insure full, tight joints of 1/16 to 1/8 in. thickness nominal with a maximum thickness not to exceed 1/4 in. DO NOT jack directly against the block surface. A piece of wood (approx. 1 x 4 or equal) shall be used between the jack and the block.

For the sidewall, place the block closest to the door in its approximate position. Check for plumb and level and shim as required. Leave this block set unmortared. Stretch a stringline between the top of the corner block and the top of the end side wall block. Again, this line is used to establish the top elevation of the blocks. Place the sidewall blocks starting at the corner block working toward the door end.

When the next to last sidewall block is to be placed, remove the end block and finish the wall using the above procedures. Repeat this procedure for the opposite sidewall.

The fork truck slots in the bottom of the blocks are to now be filled with molten metal contact quality plastic. The key slots between blocks and the voids between blocks where tap holes, drain holes or spaces where blocks are not used can now be filled. These voids shall be filled using either plastic or castable as per the drawings and the owner's engineer's instructions using Alcoa Standards 26.1.3 and 26.1.4.

4.6 Upper Wall Insulation. Insulate the remaining upperwall areas of the furnace as per the drawings. Remove all loose particles of insulation on top of the lowerwall blocks to provide a clean base for the next row of blocks.

4.7 Bellyband. The bellyband blocks are placed using the same procedures used in placing lowerwall blocks. Both sidewalls are typically placed before placing the bellyband blocks in the backwall.

After placing all bellyband blocks, any voids between blocks and the fork slots are to be rammed using molten metal contact quality plastic per the drawings and owner's engineer's instructions.

4.8 Upperwalls. The upper sidewall blocks are to be placed using the same procedures as in placing the lower sidewall and bellyband blocks. A small portable scaffold shall be used to assist in providing adequate access to the upperwall block rows for shimming and mortaring the blocks.

The sidewall blocks are typically placed before placing the backwall blocks and flue sideblocks, if used. Any voids between blocks and the fork slots are to be filled with upperwall quality plastic per the drawings and the owner's engineer's instructions.

NOTE: Some block furnace designs may require installation of backwall bellyband and upperwall blocks before the sidewall blocks. This standard is to be used as a guide with final installation instructions per the drawings and the owner's engineer.



MATERIAL SAFETY DATA SHEET

No. 40

HAZARD CHARACTERISTICS

- ☐ Flammable ☐ Combustible
☐ Corrosive ☐ Explosive
☐ Water Reactive ☐ Radioactive
☐ Oxidizer ☐ Chemically Reactive

- Toxic By:**
☒ Ingestion
☒ Inhalation
☐ Absorption

PRODUCT ASBESTOS

Phone No.
Date: 80-03-28**Section I. MATERIAL DESCRIPTION**

Material Name: ASBESTOS
Chemical Name & Formula: Chrysolite ($H_4Mg_3Si_2O_9$) and Amphibole
Other Designation: Amosite
Corporate Stock No.:
Manufacturer:

Section II. INGREDIENTS

Chrysolite (Serpentine Asbestos)
Hydrated Magnesium Silicate (95% of commercial asbestos is this type)

Amphibole Asbestos - Silicates of iron, calcium and magnesium with little water. Grey-brown color. Fibers have harsh, brittle acicular texture.

%

HAZARD DATA

8-hr. TWA* (OSHA)
2 Fibers/cc of air which are greater than 5 microns length.

OSHA ceiling TLV: 10 Fibers per cc of air

*OSHA has proposed this value be reduced to 0.5 fibers/cc.

Section III. PHYSICAL DATA

Physical Form: Fibrous minerals
Boiling Temp.:
Freeze-Melt Temp.:
Vapor Pressure:
Evaporation Rate:
Specific Gravity:
Density:
"Solubility in H_2O ": Greyish-white fibers
Color:
Odor:

Section IV. FIRE AND EXPLOSION DATA

Flashpoint	Auto-Ignition Temp.	Flammability Limits in Air	Lower	Upper
Non-combustible				

Highly resistant to heat and fire.

Section V. REACTIVITY DATA

Chrysolite: Resistant to degradation by alkaline attack.
Amosite: Heat resistance superior to chrysolite.
Crocidolite (Blue): More resistant to acid attack than the above two. These asbestos materials are stable and relatively inert. In some situations, asbestos can maintain its integrity at temperatures up to $1700^{\circ}C$ ($3092^{\circ}F$).

For Internal Company Use Only -
Not To Be Distributed Outside The Company

ARD 010776

Section VI. HEALTH HAZARD INFORMATION TLV TWA (8 HR) 2 fiber/cc 5 μ m length

The health hazard with asbestos arises from minute fibers which have been statistically shown to have produced lung cancer in asbestos workers after prolonged exposure. Asbestos tape, especially when unsized, will shed fibers on handling. Tape must be handled in such a way that the rate of air-borne fiber generation and the ventilation provided interact to keep the 8 hour TWA and ceiling concentrations below the established legal limit. Plant air sampling and analysis are required to insure conformance. Respiratory protection is required for conditions in which the 8 hour TWA or ceiling concentrations is exceeded. Good hygiene practices should be observed to avoid ingestion of asbestos fibers.

Ingestion of asbestos may lead to cancer of the digestive tract. Suspected exposures should be reported to the Industrial Hygiene Department. Special concern exists during demolition and delagging work which may release large quantities of asbestos dust in the air. Asbestos is a progress disease which may develop fully in 7-9 years and cause death as early as 13 years after first exposure.

Section VII. SPILL, LEAK & DISPOSAL PROCEDURES

Wear dust mask, gloves and disposable paper suit when working in area having excessive asbestos dust concentration. Contact Industrial Hygiene group for air monitoring. Scrap asbestos should be disposed in sealed plastic bags in steel drums. Drums must be marked with special asbestos label and shipped to approved disposal site. For clean-up use special vacuum sweeper to avoid air or water-borne hazards from minute asbestos fibers.

Section VIII. SPECIAL PROTECTION INFORMATION

General ventilation and local exhaust ventilation must be adequate to keep asbestos fiber concentrations in work place air below the TWA and ceiling TLV limits. Use NIOSH approved respiratory protection where the TLV concentration is or may be exceeded. The selection of appropriate respiratory protection (dust mask, self-contained breathing apparatus, supplied-air respirator, etc.) should be based on the actual or potential concentration present. Respiratory apparatus is required for worker protection under conditions in which the 8 hour TWA is exceeded. It is suggested that workers regularly handling large amounts of asbestos should frequently launder outer work clothing and should shower after work before changing into street clothing.

Section IX. SPECIAL PRECAUTIONS & COMMENTS

Dust mask and disposable coveralls must be worn when working with asbestos. All contaminated disposable clothing and asbestos containing wastes must be placed in sealed plastic bags and disposed in steel containers.

Asbestos workers who are also smokers have a substantially increased health risk from lung cancer from asbestos exposure as compared to non-smokers.

D.O.T. Requirements

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Section X. REFERENCES

ASTM No.: D2100

Chemical Abstracts No.:

CMA Chemical Safety Data Sheet No.:

NFPA Guides No.:

NSC Data Sheets:

Supplier Product Literature:

Other: Pg. 545 OSHA Manual 2206, Subpart Z 1910.1001

Other: (1) Journal of Hazardous Material
Vol. 3, No. 2 (1979) 125-147
Review of Asbestos Substitutes
In Industrial Applications
(2) ACW Safety Data Sheet

IX. GENERAL AND SPECIAL CONDITIONS

A. GENERAL CONDITIONS

The General Conditions, which are attached hereto, are hereby made a part of these Contract Specifications.

B. SPECIAL CONDITIONS

1. This Contractor shall be required to sign or initial each page of the Contract Specifications and each Contract drawing. The Owner will also initial each page of the Specifications and each drawing. These initialed documents will be filed in the Owner's field office at the job site and will be used as a basis of determining any additions or deductions to the original Contract prices. As such, this initialed set serves as protection for both this Contractor and the Owner.
2. The Owner will keep a record of all Specifications and drawings issued to this Contractor. Void drawings shall be returned immediately after revised drawings are issued. All drawings shall be returned with a letter of transmittal listing all drawings returned. Returned drawings shall not only include drawings which are still intact, but also any drawings which may have been torn, mutilated, or partially destroyed. All drawings and Specifications shall be returned by this Contractor at the completion of this work before final retention will be approved for payment.

3. In these Contract Specifications, the following words shall be understood to have the significances stated for each:
 - a. The word "shall" signifies an action required of this Contractor.
 - b. The word "may" signifies an action which is optional for this Contractor.
 - c. The word "will" signifies an action by either the Owner or Others.
 - d. The word "approved" signifies that the exact details of the Contractor's method or material must be approved by the Owner.
 - e. The word "acceptable" signifies that the Contractor's method or material must be acceptable to the Owner, but the exact details or performances may vary to a certain extent.
4. Substitutions by this Contractor for material specified by manufacturer's trade name will be considered only when the proposed substitution shall be submitted in writing with the Contractor's proposal. The Contractor shall show the trade name and manufacturer of the proposed substitution and the price difference (if none, so state) which shall be made in the bid price if the substitution is approved. The Contractor shall include the necessary information for the Owner to properly evaluate the proposed substitution. The Owner will approve or disapprove the substitution prior to the execution of the Contract. After the execution of

the Contract, no substitutions will be considered.

5. When extra work is done under General Conditions, Article 3, Paragraph C- (5), the equipment referred to is power-operated equipment (including power-operated tools and burning and welding equipment); and no payment will be made for small hand tools, slings, mats, etc., since such tools are normal job equipment.