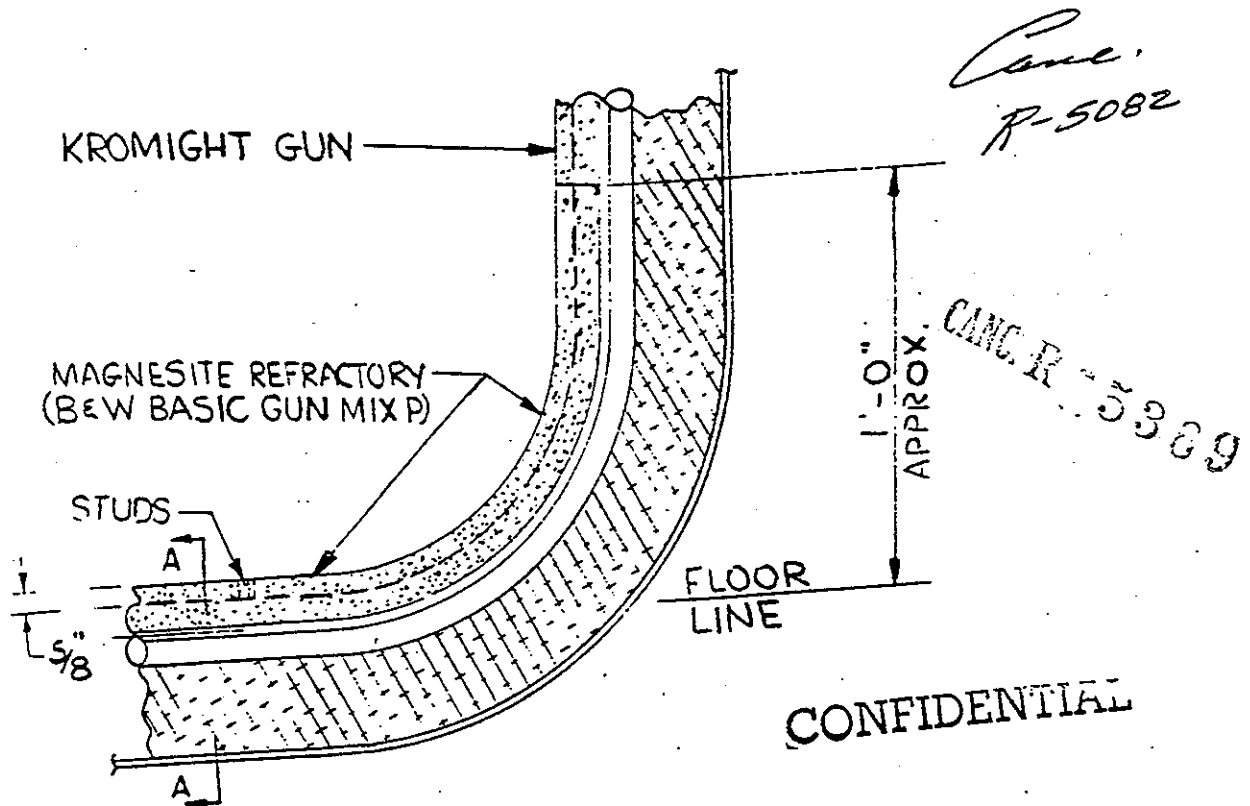




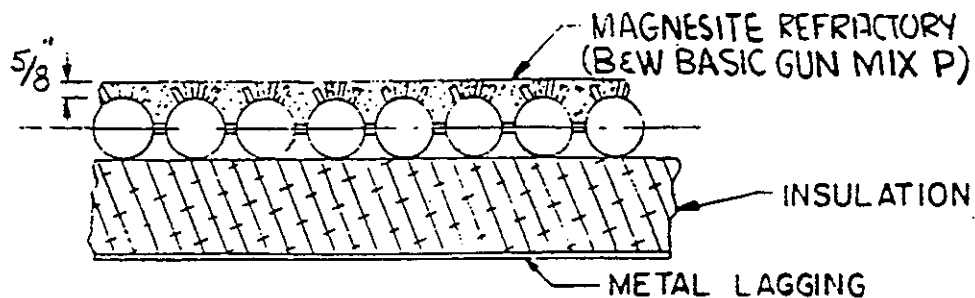
3Y
4Y
IP
2/3-31-70

REVISIONS		MICRO- FILM
DASH	DESCRIPTION	ORIG.

MEMPHANE FURNACE FLOOR
& WALLS

CONFIDENTIAL

- NOTES. 1. SUPERVISION OF GUN PLACEMENT OF MAGNESITE REFRACTORY BY REFRACTORY MANUFACTURER RECOMMENDED
2. REFRACTORY TO MAKE INTIMATE CONTACT WITH ALL METAL SURFACES. REBOUND MATERIAL SHALL NOT BE ENTRAPPED



SECTION A-A

DWN. BY 26F

CHK-01

DATE 7-1-60

1999-01

INSULATION DETAILS

SCALE INCHES = 1 FOOT

A-

THE BABCOCK & WILCOX COMPANY

BOILER DIVISION

REFRACTORY

4Y

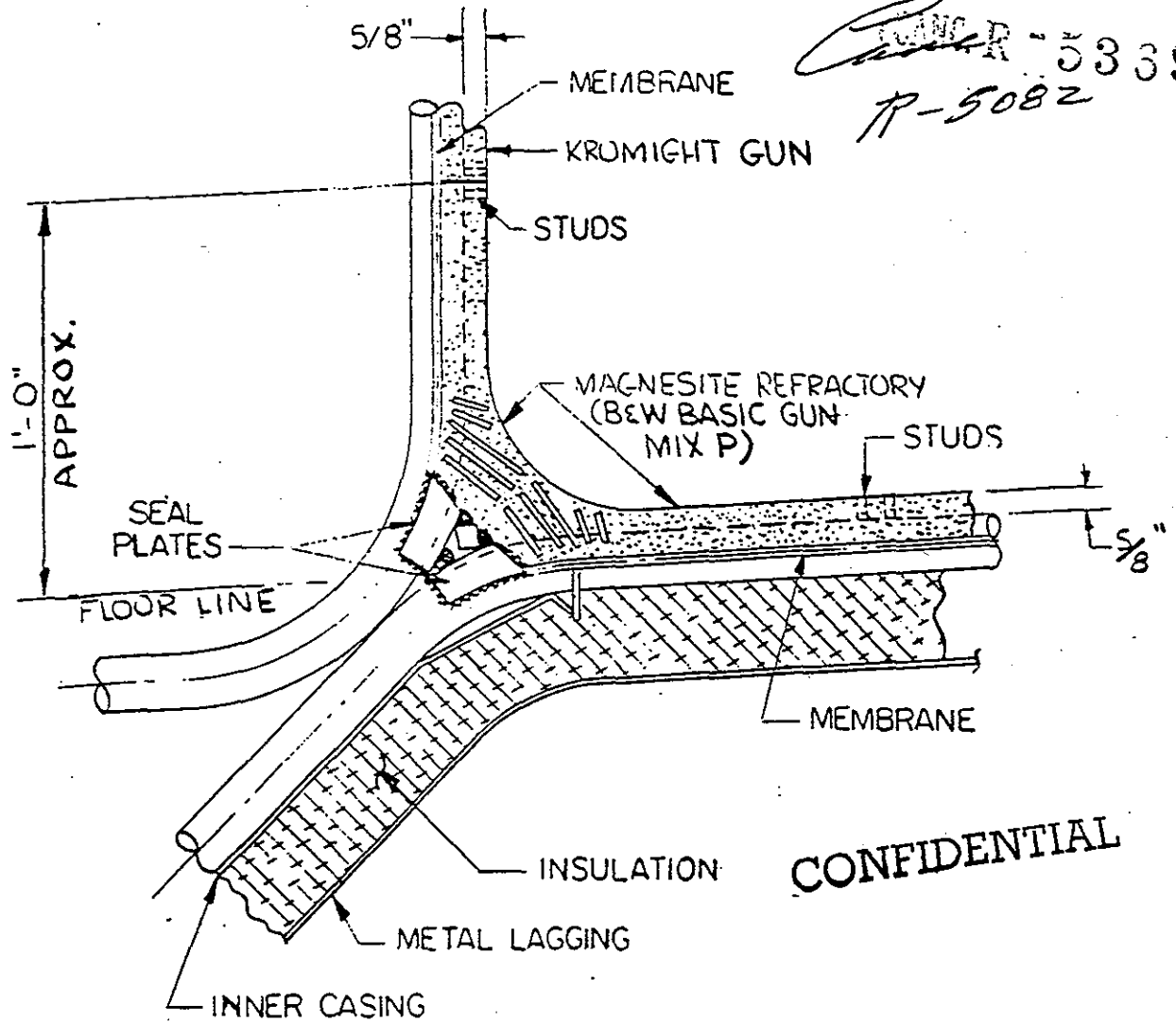
IP

3/3-31-70

REVISIONS		MICRO-FILM
DASH	DESCRIPTION	ORIG.

MEMBRANE FURNACE FLOORS & WALLS

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CONFIDENTIAL

- NOTES - 1. SUPERVISION OF GUN PLACEMENT OF MAGNESITE REFRACTORY BY REFRACTORY MANUFACTURER RECOMMENDED
2. REFRACTORY PLACEMENT TO BE SUCH THAT NO VOIDS OCCUR AND REBOUND MATERIAL IS NOT ENTRAPPED. REFRACTORY TO MAKE CONTACT WITH ALL METAL SURFACES.

DWN. BY 38F	CHK'D.	INSULATION DETAILS	SCALE INCHES = 1 FOOT
7.5 10			A-

INSULATION
REFRACTORIES
DESIGN

CONFIDENTIAL

FACTORS AFFECTING THE USE OF CASTABLE REFRACTORIES

14. HEATING (Cont'd)

The heating rates as given are not intended to apply to refinery vessels, which are subject to special conditions.

15. KROMIGHT-GUN

This material is, strictly speaking, not a castable but is normally applied by means of a gun or by slap troweling in a manner similar to a castable. When gunning this material, it should be placed with as much water as the material will absorb without slumping. Also, for a slap troweling mixture, it is desirable to have it on the wet side rather than the dry side.

A furnace lined with Kromight-Gun must be protected before firing as follows:

B&W Kromight-Gun will air-set and the top surface will dry in a comparatively short time after installation but the portion beneath the surface will remain plastic for quite some time. Walking or resting tools, ladders, etc., on the dried surface while in this condition will produce cracks and depressions in the upper surface which will permit slag penetration, shorten the life of the installation, and close off the vent holes causing the surface to peel upon heating. Even placing boards on the floor will not protect it if traffic over the floor is permitted before it has deeply air-set.

Firing a furnace with Kromight-Gun lining should be as follows:

Provided that the refractory has been thoroughly vented, the best installation will result if heat is applied immediately upon completion. Since on most jobs this is impossible and the refractory is allowed to stand for a considerable length of time, shrinkage cracks will develop. If these cracks are large (over 1/8"), it is necessary to fill them before applying heat with a chrome bonding mortar having good air-setting qualities. Smaller cracks (under 1/8") may be neglected since they will close up when heat is applied.

The furnace temperature should not be increased too rapidly. If the moisture in the refractory changes into steam too rapidly, it will not be able to escape through the vent holes quickly enough, resulting in a blistered or bloated surface. For the average furnace, the refractory should be thoroughly dried out if the temperature is brought up to about 500F and held for 6 to 8 hours and then raised to about 1200F and held for 3 to 4 hours. After drying out by the above procedure the refractory must be "burned-in" at the final operating temperature of the furnace. The period of the "burning-in" process should be a minimum of 5 hours. The Kromight-Gun cannot be overfired by increasing the burning-in temperature. Actually the structure of the refractory is improved if burned-in at temperatures somewhat above the maximum operating temperature of the furnace provided other components and materials in the boiler will permit this overfiring.

16. STORAGE

When our refractory castables are stored under dry, well ventilated conditions, the loss of strength over a period of a year is very low, on the order of only 10%.

If, however, the material is stored where the sacks can become wet or exposed to dampness for extended periods, a certain amount of moisture may get to the material and cause a partial setting up with loss of strength.

If necessary to store it outside, the castable should be placed on a ventilated platform off the ground. It should be protected by some type of covering, such as a tarpaulin so arranged that no water can come in contact with any of the sacks. The covering should stop a short distance from the ground and effective ventilation must be provided. This is important to avoid the possibility of ground moisture building up a high humidity.

POWER GENERATION DIVISION

4Y2
4A2
9/4-16-70

INSULATION
REFRACTORIES
ORDERING

MAT'L	REQUIRED QUANTITY	SHIPPING UNITS
B&W Basic Gun Mix P	152 #/cu. ft.	100# Bags

Quantity shown does not include extra material to cover rebound losses.

Limited storage life is four (4) months.

Applied with dry type nozzle mix gun.

Compressed air required-----300 CFM @ 100 PSI.

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SCOPE AND PURPOSE
BRICKWORK & REFRACTORIES

EFF. 2-58 69

This section contains information on brickwork and refractories which are commonly used on industrial boilers. Jobs having special conditions requiring constructions outside the scope of this section should be referred to Design Engineering.

On contracts where the material and labor or material only for brickwork are in the B&W contract, all brickwork and refractories (with the exception of special shaped tile which shall be specified and furnished by Engineering) shall be supplied and applied by Erection or their subcontractor. See 3Y-1A and 3Y-1A5-VI.

On all contracts, the drawings should show B&W products where applicable. Where B&W products are not applicable, the drawings are to refer to the required material by ASTM specification and pyrometric cone equivalent rather than trade name. For example A. P. Green first quality firebrick should be referred to merely as high duty firebrick, PCE 31-32.

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BABCOCK & WILCOX

INSULATION, REFRACTORY, LAGGING
REFRACTORY MATERIALS

4Y
2A1
1/6-29-89

Approved Manufacturing Materials

To insure that proper materials are used that will result in the most satisfactory jobs, it has been necessary to develop a list of approved manufacturing materials.

Due to the large quantity of B&W standards and contract drawings showing the Thermal Ceramics products, no changes will be made to the drawings presently on record or on future drawing releases. B&W will continue to show only Thermal Ceramics products where applicable and the following comparative listing will be used to determine equivalent substitutes.

If any manufacturer's product, which is not listed, is desired on a contract, the manufacturer's name and material name should be referred to Design Engineering for written approval, and for addition to these comparison listings, if warranted.

In specific cases where a single or limited number of products are acceptable for a given application, the brand name or names should be shown on the BRIL drawing with no substitution indicated.

Over the past several years, the following companies have undergone name changes as indicated herein.

Present Name

Previous Name

Thermal Ceramics
Premier Refractories
National

B&W Refractories Division
C-E Refractories
Kaiser Refractories

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BABCOCK & WILCOX
INSULATION-REFRATORIES-LAGGING
LIGHTWEIGHT CASTABLES
COMPARATIVE LISTING

4Y
291
3/6-29-

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Thermal Ceramics	Premier Refractories	National	Plibrico	North American Refractories	A. P. Green	Harbison Walker	Resco	
Kaolite 1600	---	Vee Block 35 Mix	Plicast Verilite & Airlite	---	---	---	---	
Kaolite 2000 HS	---	IRC 20	Plicast LWI 20	Litacrete HS 2053	Cast Insul #20	H-W Lightweight Castable 20	LHV 124	
Kaolite 2200	Lite Wate 58	IRC 22	Plicast LWI 22	Litacrete 2350	Cast Insul #22	H-W Lightweight Castable 22	RS-3	
Kaolite 2200 HS	Lite Wate 70	IRC 22/ SI-208	Pligun Super Sunita	---	---	H-W Lightweight Castable 22	RS-7	
Kaolite 2300 LI	LIHS 50	IRC 24-LI Puro-lite	---	---	VSL-50	---	RS-3A	
Kaolite 2500 LI	---	IRC 26-LI	Plicast Tuff-Lite	---	---	---	---	
Kaolite 2500 HS	Lite Wate 80	IRC	Pligun LWI 26	Litacrete HS 2580	Kastolie 25	H-W Lightweight Castable 25	---	
Kaolite 2800	Carlite 75	IRC 29-LI	Pligun LWI 28	---	---	---	RS-26	
Kaolite 3000 C	---	No. EG. Bubble Alumina	---	---	---	H-W Lightweight Castable 30	---	
Kaolite 3000 G	---	No. EG. Bubble Alumina	---	---	---	H-W Lightweight Castable 30	---	
Kaolite 3300	Bubble Alumina	---	Bubble Cast	---	Bubble Cast	H-W Lightweight Castable 33	---	

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291
5/ 6-29-89

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BABCOCK & WILCOX
INSULATION-REFRATORIES-LAGGING
CERAMIC BOARD PRODUCTS
COMPARATIVE LISTING

4Y
291
7/ 6-29-89

Thermal Ceramics	Carborundum	Johns Manville	Premier Refractories	Industrial Insulations		
M Board	Duraboard LD	Type 103 Type 126	Thermotec LD Board	Indo-Form 2100		
S Board	Duraboard LD	Type 143	----	----		
HS Board	Duraboard HD	----	Thermotec A Board	Indo-Form 2400		
Kaowool Block	Duraboard Hot Board	----	----	----		
Millboard 822	----	Cerafiber Millboard	----	----		
Kaowool 12C Board	----	Type 130	Thermotec RT Board	Indo-Form 2500		
Kaowool 14C Board	Duraboard 2500	----	Thermotec HPX Board	----		
Kaowool 2600 Board	Duraboard 2600	----	----	Indo-Form 2800		
Kaowool 15C Board	2500	----	Thermotec HT Board	----		
Kaowool 3000 Board	Duraboard 3000	----	----	Indo-Form 3000		
Unifelt Board	6H Board	----	----	----		
Kaowool 17C Board	3100	----	----	----		

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BABCOCK & WILCOX
INSULATION-REFRACTORIES-LAGGING
PAPER PRODUCTS
COMPARATIVE LISTING

4Y
2A1
9/6-29-89

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Thermal Ceramics	Carborundum					
Rollboard	448 Rollboard					
Millboard 838	118					
Kaowool 2388	558					
Kaowool 2688	888					
Kaowool Unifelt	H Grades (972/882H)					
Kaowool 3888	Fibermax HSA					

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5-16085
4Y
2A1
11/ 6-29-89

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BABCOCK & WILCOX

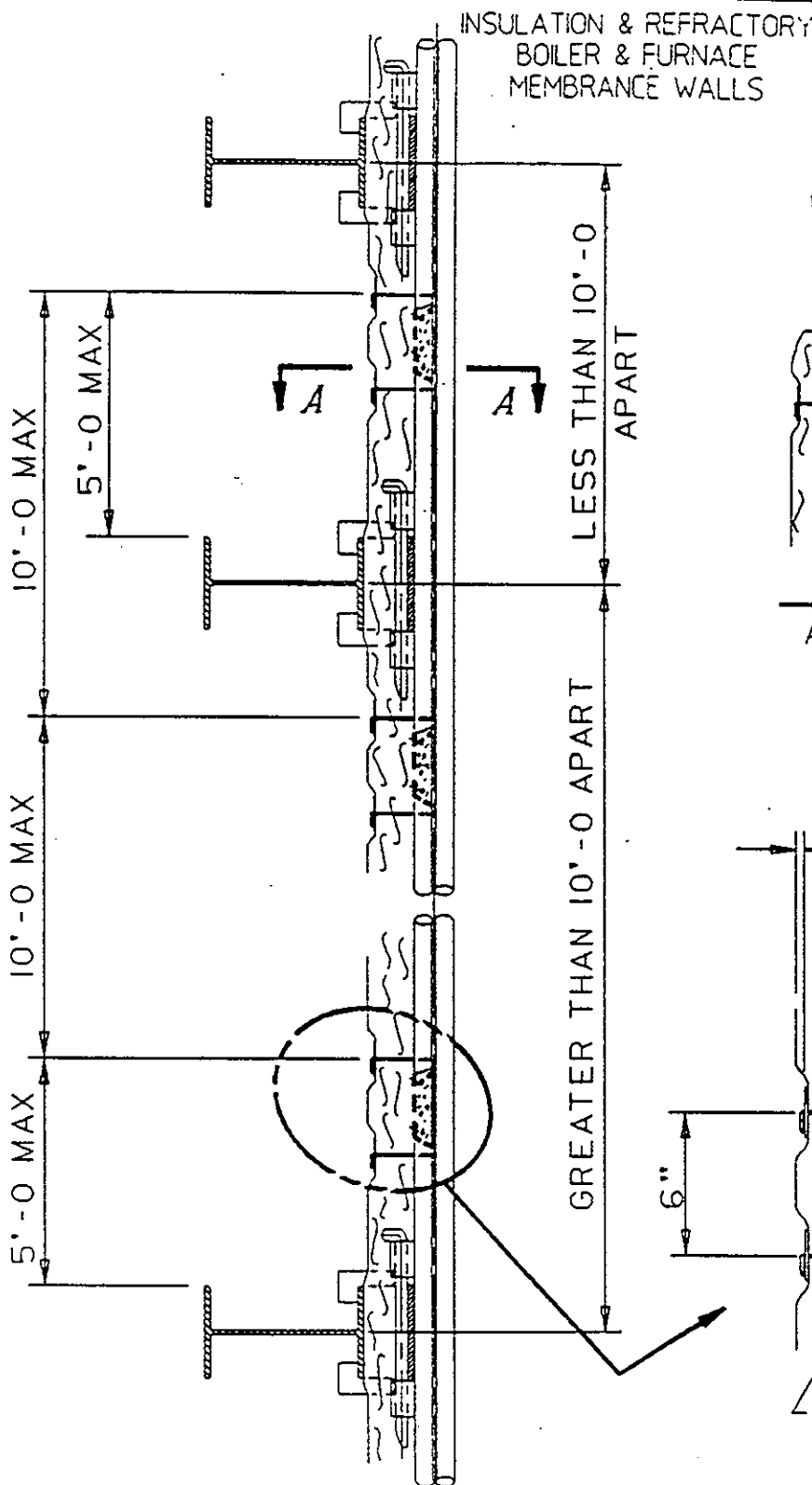
A McDERMOTT COMPANY

4Y
6A
2R03
1/12-17-86

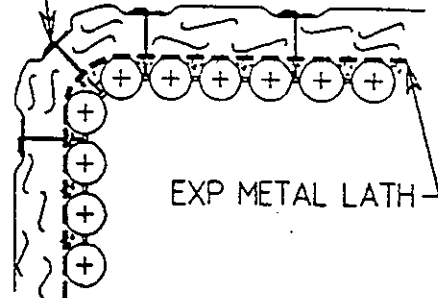
REVISIONS

DASH NO.	DATE	DESCRIPTION	ORIS.

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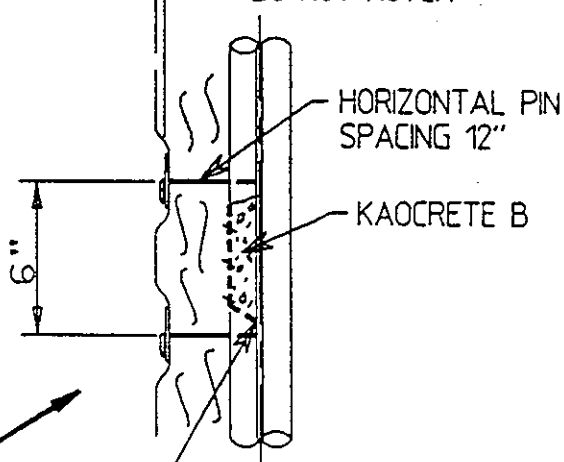
ADD EXTRA PINS AS REQ'D
TO MAINTAIN INSULATION
BARRIER SEAL AT CORNERS



SECTION A-A

APPLICABLE FOR INDUST. &
UTILITY BOILERS
— UP BLR SHOWN —

1/2 COMPRESS INSULATION
AT TOP & BOTTOM OF
REFRACTORY BARRIER
— DO NOT NOTCH —



TACK WELD 1 1/2 X 18 GA EXP.
METAL LATH (NOT GALV)
TO TUBES ON 12" CTRS

BARRIER SPACING
FOR BUCKSTAYS

661-4Y.6A-2R03.164939A-0/09375

OWN. BY S.A.C. CMX'D F.E.M.
PASSED BY T.P.S. APP'D T.J.O.

THERMAL BARRIERS

SCALE DATE 12/1/86
DRWG. NO. 164939A-0

DUPLICATED IN 3Y-6A-2R03

LOCKED DRAWER DWG

FD

A McDERMOTT COMPANY

Rev 515577

2R03
1/8-1-84

REFRACTORY APPLICATION MEMBRANE WALL

REVISIONS

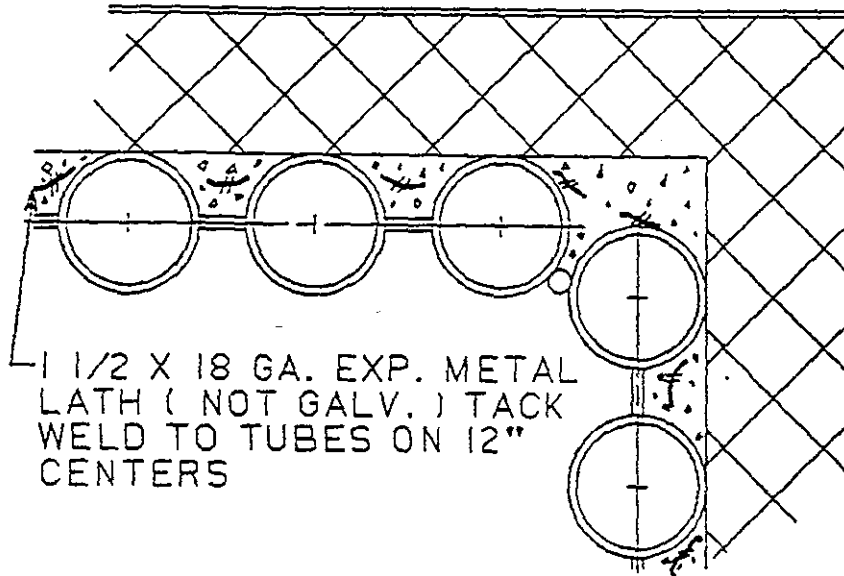
DASH NO.	DATE	DESCRIPTION	ORIG.

eff R5503

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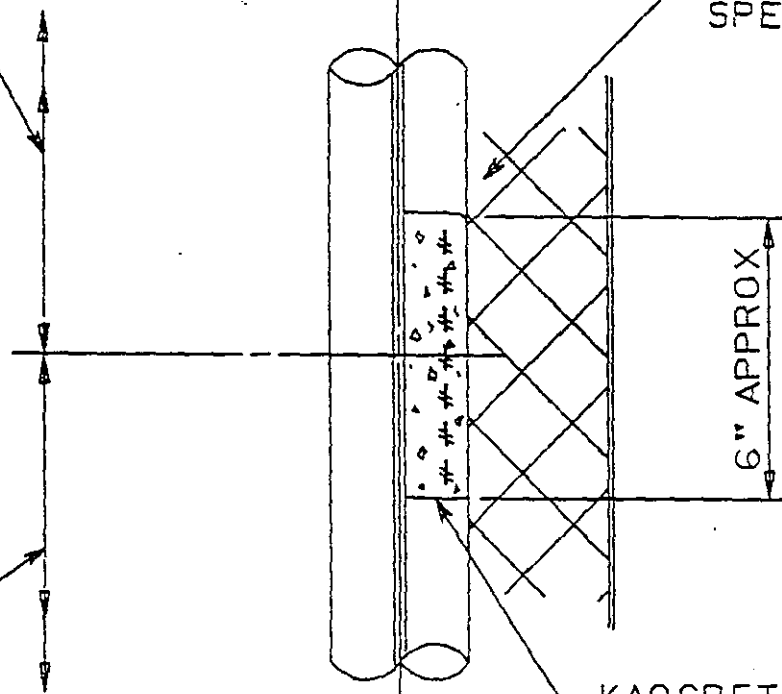
DO NOT SCALE - USE DIMENSIONS ONLY



1 1/2 X 18 GA. EXP. METAL LATH (NOT GALV.) TACK WELD TO TUBES ON 12" CENTERS

METAL LAGGING

5'-0 MIN 10'-0 MAX TO NEXT THERMAL BARRIER



INSULATION AS SPECIFIED

6" APPROX

KAOCRETE "B" FIELD INSTALLED

REFERENCE:
SPECIFICATION INSULATION MATERIALS 3Y-1A5-1,
PARA 56Ma

THIS IS A CAD DRAWING DO NOT REVISE MANUALLY

DESIGN.4Y.6A.2R03.205246A-C

OWN. BY S.A.C.	CHK'D S.C.	THERMAL BARRIER MEMBRANE	SCALE 1/4"=12"	DATE 7/27/
PASSED BY T.P.S.	APP'D T.J.O.	WALL BETWEEN BUCKSTAY	DRWG. NO. 205246A-	

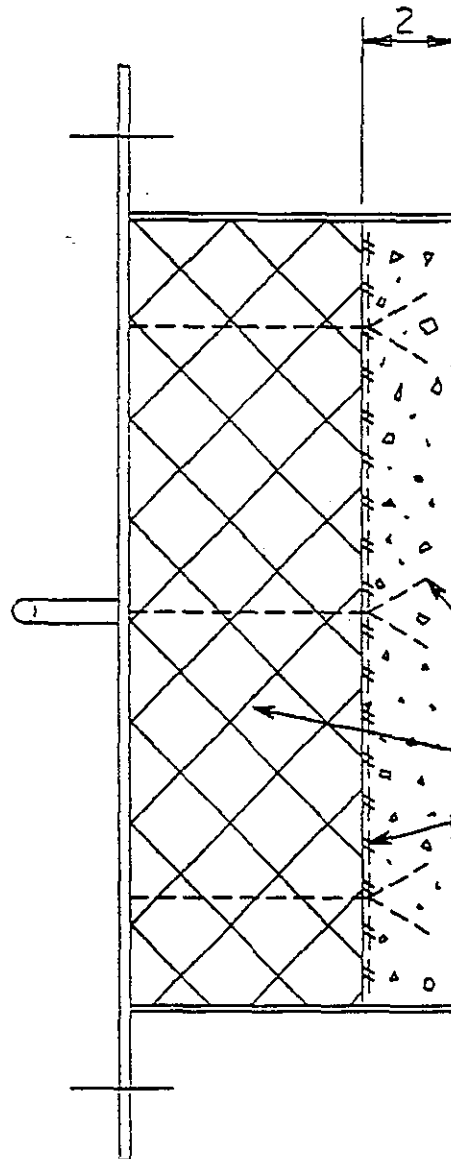
1000

REFRACTORY
APPLICATION
DOORS

REVISIONS			MICRO- FILM
DASH NO.	DATE	DESCRIPTION	ORIG.

Eff
R5503

CONFIDENTIAL



KAocreTE "B"
FIELD INSTALLED

REFRACTORY ANCHORS,
INSULATION AND
EXP. METAL LATH
SHOP INSTALLED

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DESIGN.4Y.6A.8U.205245A-0/25

OWN. BY S.A.C.

CHK'D S.C.

REFRACTORY LINED
PLATE DOOR

SCALE 1/4"=12" DATE 7/27/84

PASSED BY T.P.S.

APP'D T.J.O.

DRWG.
NO.

205245A-0

IPGD

(F)

THE BABCOCK & WILCOX COMPANY
POWER GENERATION DIVISION

6A
12R1
1/12-12-83

INSULATION, BRICKWORK
REFRACTORY
APPLICATION
SOOT BLOWERS

REVISIONS			MICRO. FILM
DASH NO.	DATE	DESCRIPTION	ORIG. X
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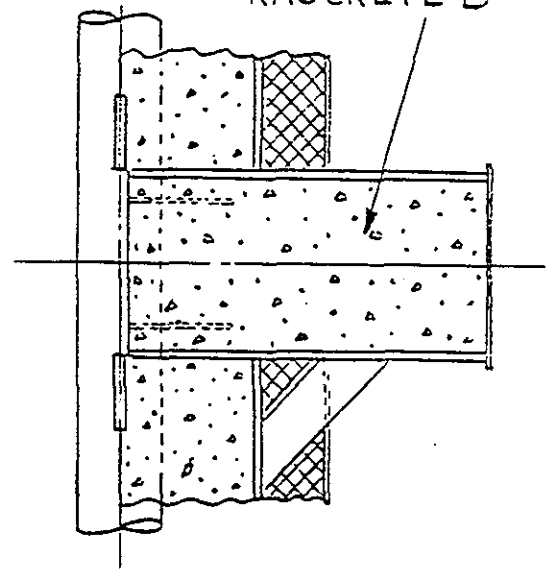
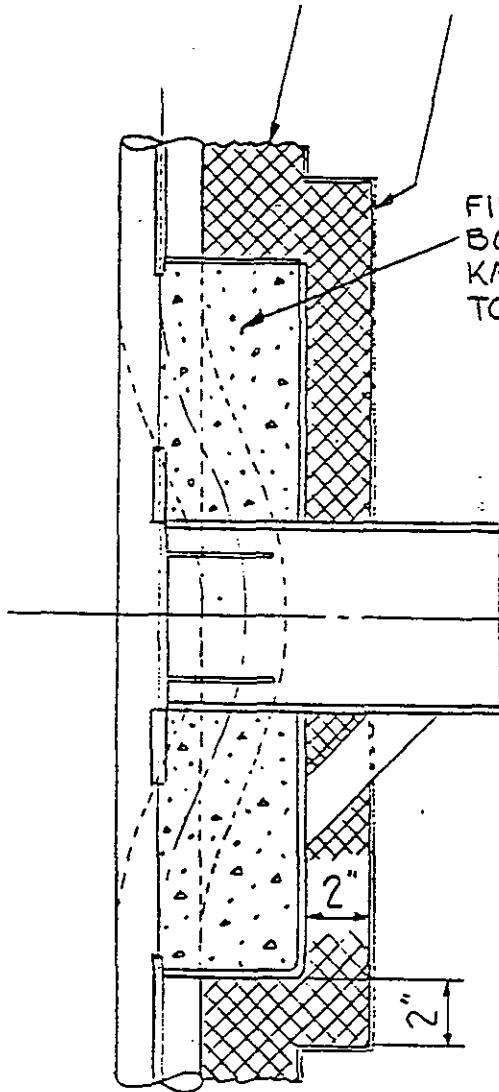
INSULATION AND OUTER
COVERING AS SPECIFIED

REF. 1-5859

CONFIDENTIAL

FILL AREA BETWEEN WALL
BOX AND TUBES WITH
KAocreTE B, FLUSH WITH
TOP PLATE

KAocreTE B



WALL BOX FOR
FUTURE SOOT BLOWER

LOCKED DRAWER DRAWING

FOR PRESSURE OR SUCTION BOILER

OWN BY S.A.S.	CHE'D
PASSED BY	APP'D

SOOT BLOWERS
MEMBRANE WALL

SCALE	DATE 1-17-72
DRWG. NO. 101960A1	

DUPLICATED IN 3Y-6A-12R1

60

FORM BOM 1087 A-2
12-83

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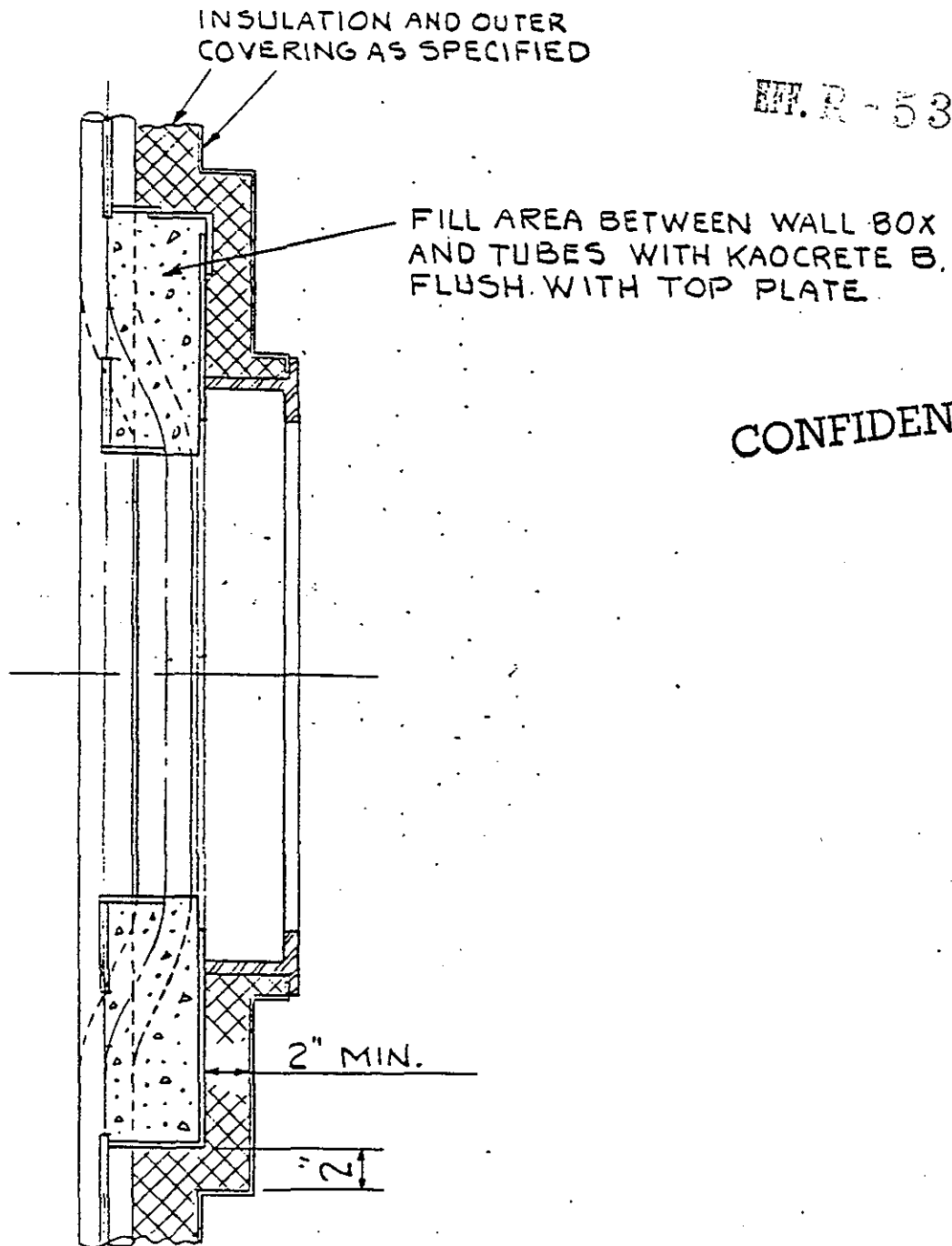
THE BABCOCK & WILCOX COMPANY
POWER GENERATION DIVISION

GA (1790)
8U
1/12-12-83

INSULATION, BRICKWORK & REFRACTORY
APPLICATION
ACCESS DOOR

REVISIONS			MICRO-FILM
DASH NO.	DATE	DESCRIPTION	ORIG. *
1	1/43	CHGD APPLICATION	

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OWN. BY S.A.S.	CHK'D	ACCESS DOOR MEMBRANE WALL	SCALE	DATE 1-18-72
PASSED BY	APP'D		DRWG. NO. 101957A-1	

DUPLICATED IN 4Y-6A-8U LOCKED DRAWER DRAWING 60 1PGD FORM BOM 1087 A-2

LOCKED DRAWER DRAWING

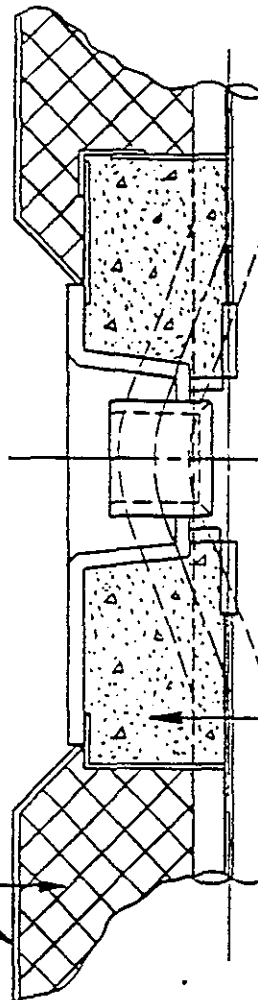
77 (IPGD)
6A
8U
2/12-12-83

INSULATION, BRICKWORK & REFRACTORY APPLICATION DOORS

REVISIONS			MICRO-FILM	
DASH NO.	DATE	DESCRIPTION	ORIG.	T.

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INSULATION AND OUTER COVERING AS SPECIFIED.

FILL AREA BETWEEN TUBES AND CASING WITH KAOCRETE B FLUSH WITH TOP PLATE. APPLIED IN FIELD BY BRICK WORK CONTRACTOR.

CONFIDENTIAL

EFF. 2-5359

LOCKED DRAWER DRAWING

DWN. BY C.A.W. CHK'D ✓
PASSED BY TPS APP'D DRS

SMALL ACCESS DOORS

SCALE 7/4 DATE 3-17-81
DRWG. NO. 205115 A.O

DUPLICATED IN 3Y-6A-8U

IPGD DIV

60

LOCKED DRAWER DRAWING

6A
803
1/12-12-83

INSULATION, BRICKWORK & REFRACTORY
APPLICATION
DOORS

REVISIONS			MICRO- FILM
DASH NO.	DATE	DESCRIPTION	ORIG.
1	1/83	CHGD APPLICATION	

INSULATION
AS SPECIFIED



EXPANDED METAL LATH
SHOP APPLIED

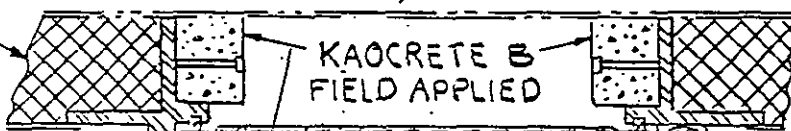
ACCESS DOOR IN FLUE, DUCT OR PENTHOUSE
INSIDE OR OUTSIDE INSULATED

NO REFRACTORY, PINS AND EXPANDED METAL LATH
REQUIRED FOR TEMP. 150° AND BELOW.

MAX. TEMP. WITH REFRACTORY LINING 899°

CONFIDENTIAL

INSULATION
AS SPECIFIED



EXPANDED METAL LATH
SHOP APPLIED

ACCESS DOOR
MAX. TEMP. 1500°

LOCKED DRAWER DRAWING

DWN. BY S.A.S.	CHK'D
PASSED BY	APP'D

ACCESS DOORS

SCALE	DATE 1-12-72
DRWG. NO.	101955A-1

DUPLICATED IN 4Y-6A-803

60 IPGD

FORM BOM 1087 A-2

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DO NOT SCALE—USE DIMENSIONS ONLY

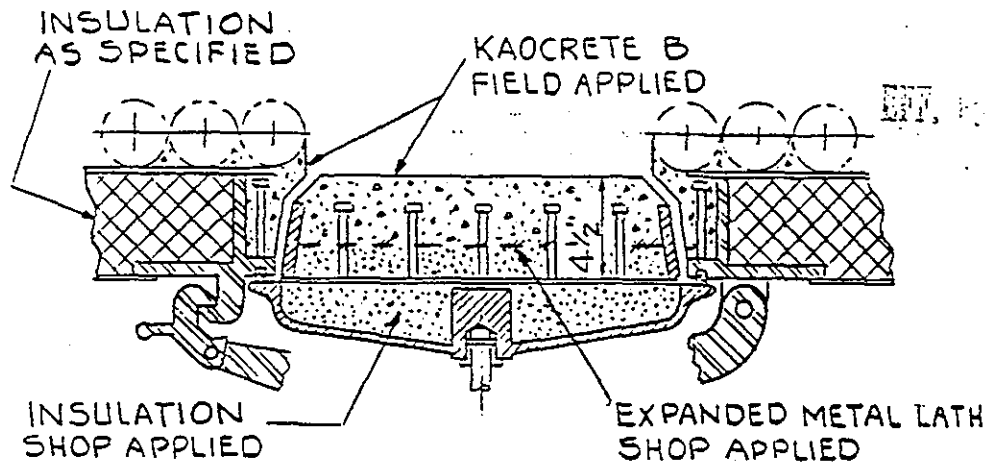
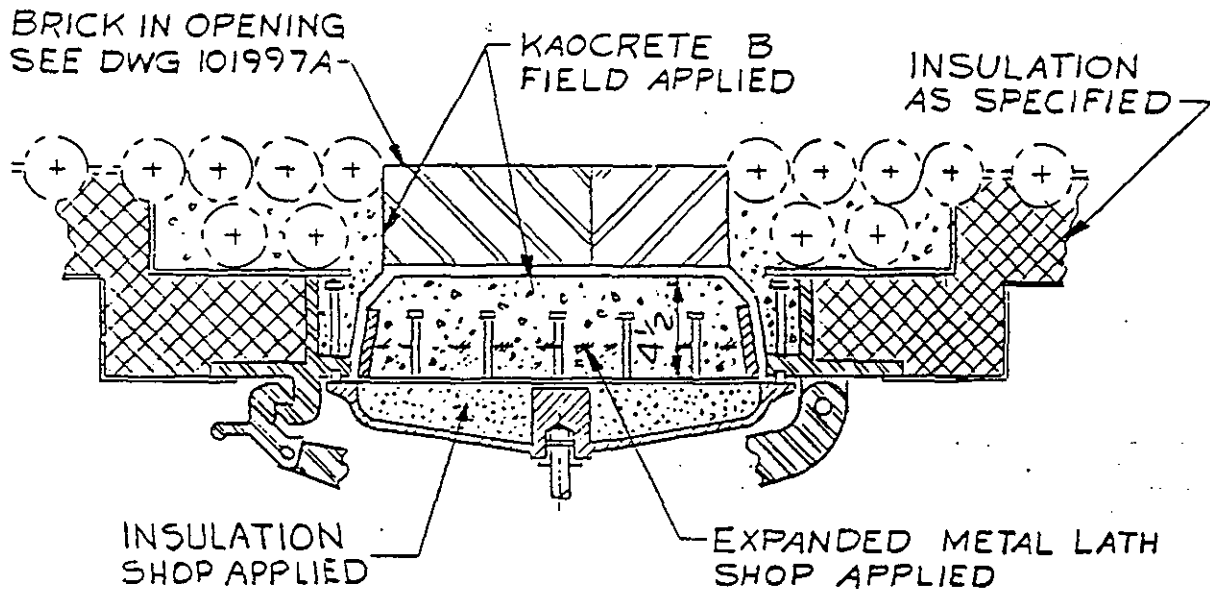
LOCKED DRAWER DRAWING

8U3
2/12-12-83INSULATION, BRICKWORK & REFRACTORY
APPLICATION

DOORS

CONFIDENTIAL

REVISIONS			MICRO-FILM
DASH NO.	DATE	DESCRIPTION	ORIG.
1	9/4/82	3000°F 60% ALUMINIA WAS PLASTIC CHROME OR	
2	10/6/82	CHGD DOOR FOR TEMP OVER 2200°F	
3	12/6/83	CHGD TYPE OF APPUC.	

ACCESS DOOR - REFRACTORY LINED
MAX. TEMP. 2200°ACCESS DOOR - REFRACTORY LINED
FOR TEMP. OVER 2200°

15x21 WATER COOLED ACCESS DOOR DWG 32039E OPTIONAL

OWN. BY S.A.S.	CHK'D	ACCESS DOORS		SCALE ~	DATE 1-12-72
PASSED BY	APP'D	IRGD DIV.		DRWG. NO. 101956A-3	

DUPLICATED IN 3Y-6A-8U3

LOOKED DRAWER DRAWING

60

FORM BOM 1087 A-2

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POWER GENERATION DIVISION

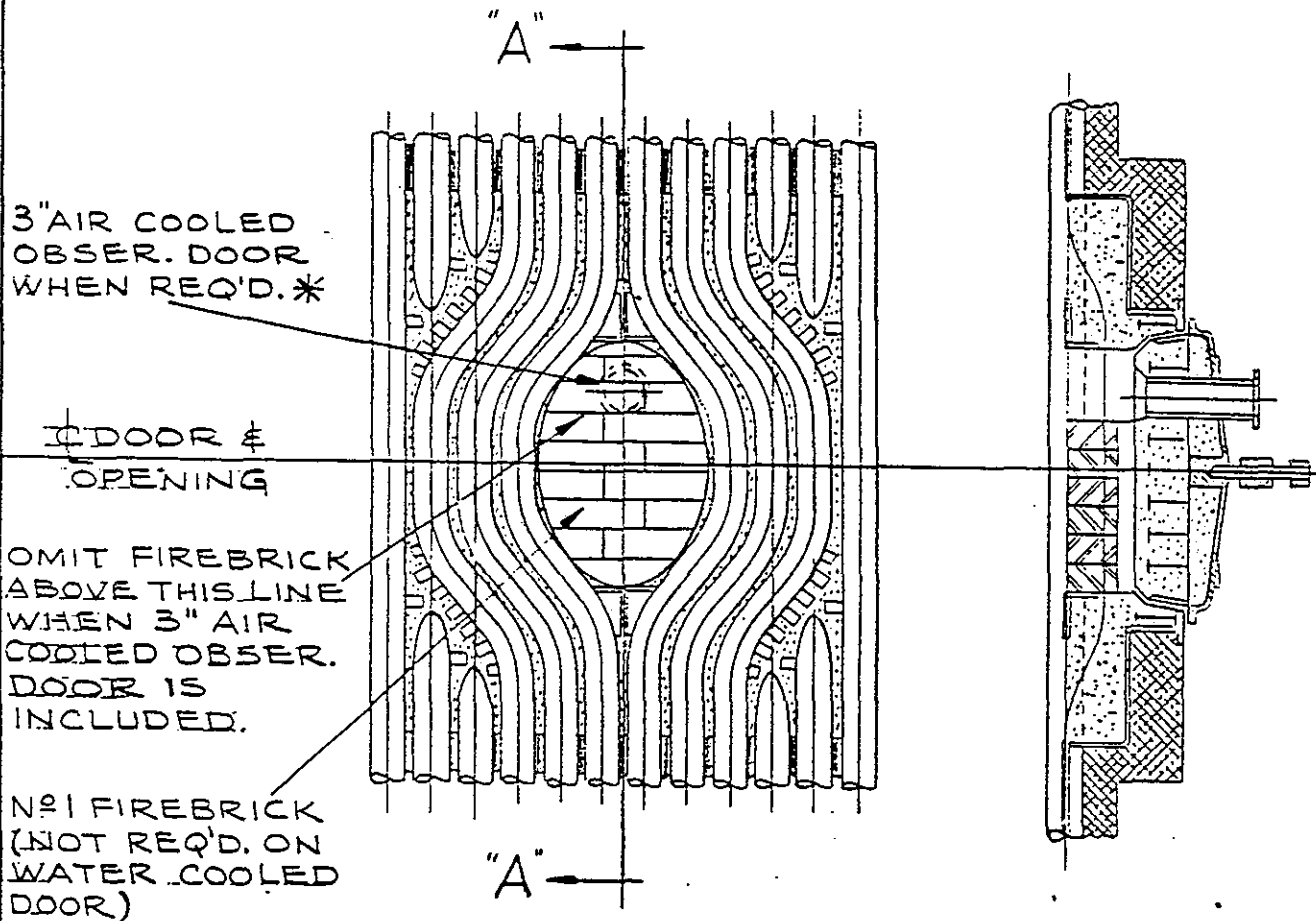
64
803
3/12-12-83

INSULATION, BRICKWORK & REFRACTORY
APPLICATION
DOORS

REVISIONS			MICRO- FILM
DASH NO.	DATE	DESCRIPTION	ORIG.
2	7/6/83	DELETED REF TO 60555E	
3	7/83	CHGD TYPE OF APPLICATION	

CONFIDENTIAL

5389



VIEW FROM SECTION "A-A"
INSIDE FURNACE (218546 E SHOWN)

15" x 21" ACCESS DOOR WITH REFR. RETAINER DWG. 32047 E

* WHEN 15" x 21" DOOR LOCATION OVERLAPS STD.
LOCATION FOR 3" OBSER. DOOR - USE ARRGT. 218546 E

DWN. BY T.P.S.	CHK'D S.A.S.	ARRGT. OF 15" x 21" FURN. ACCESS DOOR WITH BRICK IN OPENING	SCALE $\frac{1}{4}'' = 1'-0''$	DATE 6-15-75
PASSED BY A.R.K.	APP'D ✓		DRWG. NO. 101997 A-3	

60 101997 A-3 IRGD DWG

FORM BOM 1087 A-2

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DO NOT SCALE—USE DIMENSIONS ONLY

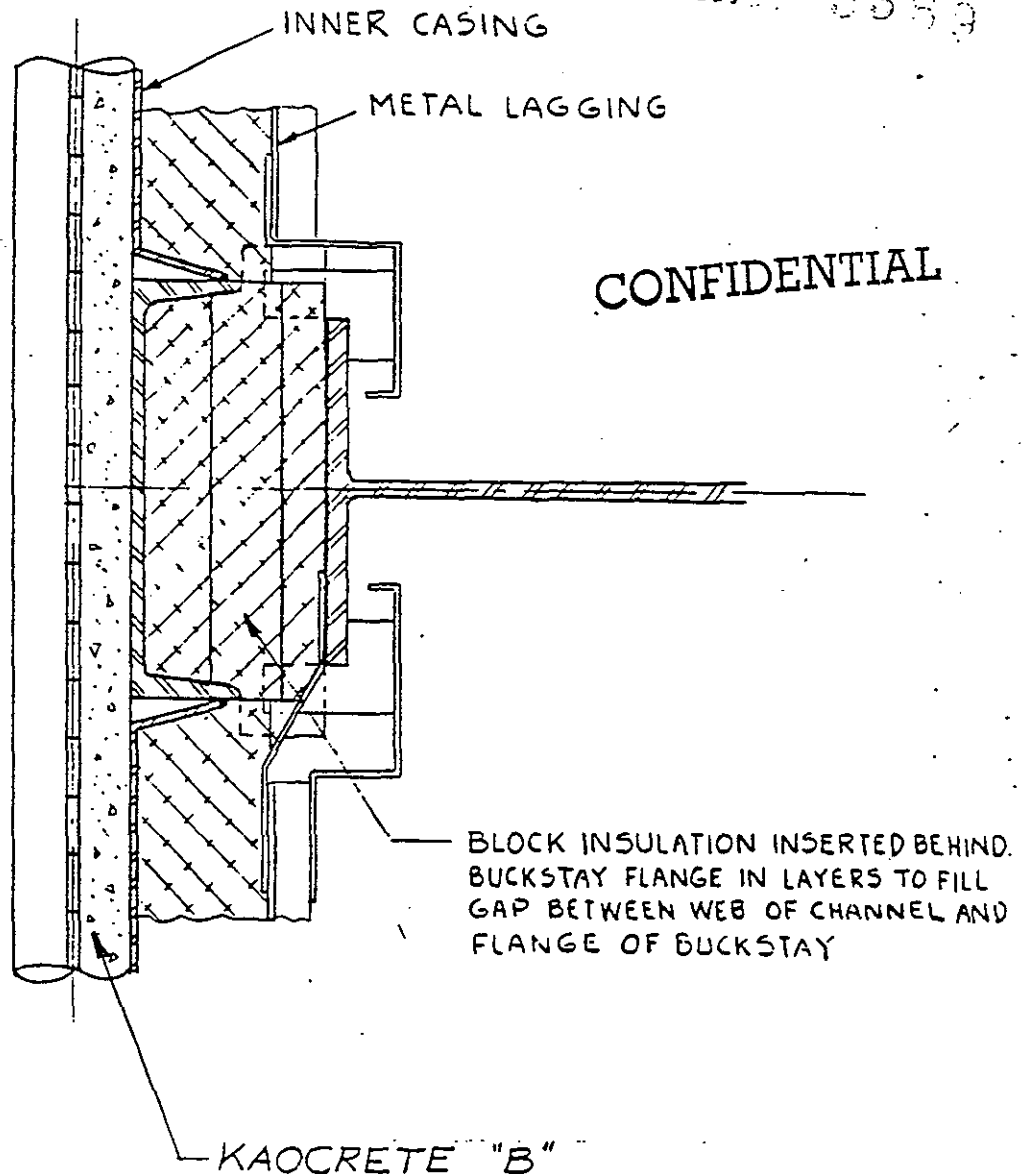
THE BABCOCK & WILCOX COMPANY
POWER GENERATION DIVISION

6A
3Y1
1/12-12-83

INSULATION, BRICKWORK & REFRACTORY
APPLICATION
AT BUCKSTAY

REVISIONS			MICRO. FILM
DASH NO.	DATE	DESCRIPTION	ORIG
1	12-12-83	CHG APPLICATION AND NOTED KAOCRETE B	★

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FOR PRESSURE OR SUCTION BLR.

OWN BY S.A.S.	CHK'D	INSULATION AT BUCKSTAY STUDDED WALL	SCALE ~	DATE 1-26-72
PASSED BY	APP'D		DRWG. NO. 101964 A-1	

LOANED OFFICE DRAWING

THE BABCOCK & WILCOX COMPANY
POWER GENERATION DIVISION

4Y
6A
BY 1
2/12-17-86

INSULATION
APPLICATION AT BUCKSTAYS

REVISIONS			MICRO FILM
DASH NO	DATE	DESCRIPTION	ORIG
1	5/2/83	CHG'D. BARRIER TO REFR.	T.P.S.
2	1/18/83	CHG'D TYPE OF APPLICATION	
3	12/5/84	ADDED INSUL NOTE & BARRIER NOTE	

BLOCK INSULATION
TO FILL ENTIRE
SPACE BETWEEN
TIE BAR AND
FLANGE

CONFIDENTIAL

TIE BAR

CUT AND FIT INSULATION
AROUND STAND-OFF
BARS AND SUPPORT
LUGS BEHIND BUCKSTAY

METAL LAGGING

MEMBRANE WALL

FOR THERMAL BARRIER
LOCATION, SEE DWG 164939A

OWN BY S.A.S.	CHK'D	INSULATION AT BUCKSTAY MEMBRANE WALL	SCALE	DATE 1-26-72
PASSED BY	APP'D		DWG NO 101363 A 3	

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DO NOT SCALE—USE DIMENSIONS ONLY

DUPLICATE — ORIGINAL LOST DUPLICATED IN 3Y-6A-3Y LUGGED L. 1007 A 2

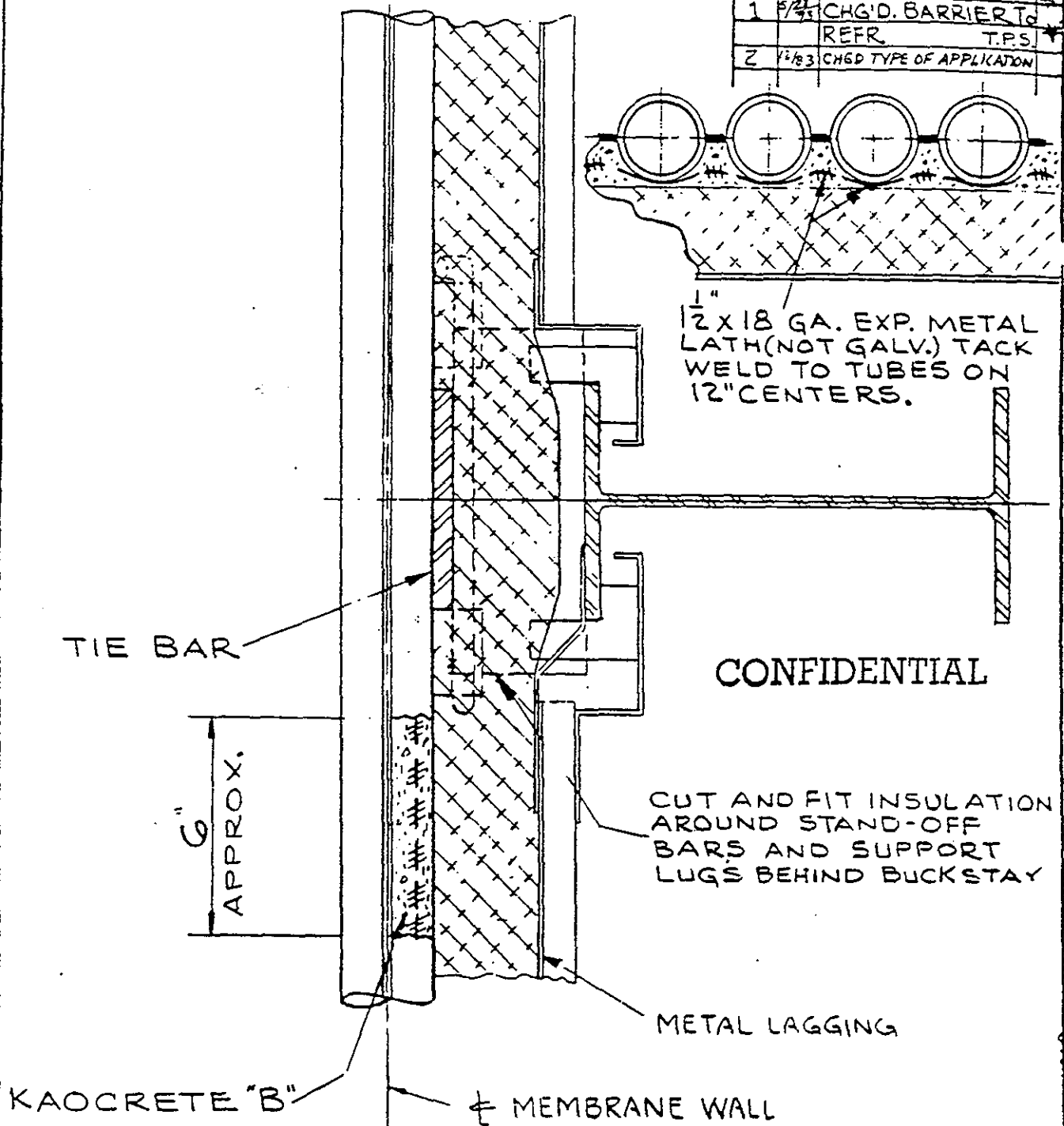
POWER GENERATION DIVISION

GA
3Y-6A-3Y1
12-12-83

INSULATION, BRICKWORK & REFRACTORY
APPLICATION AT BUCKSTAYS

REVISIONS			MICRO. FILM
DASH NO	DATE	DESCRIPTION	ORIG
1	5/4	CHG'D. BARRIER TO REFR.	T.P.S.
2	11/83	CHGD TYPE OF APPLICATION	

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CONFIDENTIAL

IPGD DIV. LOCKED DRAWER DRAWING

OWN BY S.A.S.	CHK'D	INSULATION AT BUCKSTAY MEMBRANE WALL	SCALE	DATE 1-26-72
PASSED BY	APP'D		DRWG. NO. 101963A-2	

DUPLICATE - ORIGINAL LOST DUPLICATED IN 3Y-6A-3Y1 60 FORM BOM 1087 A-1 IPGD

12M DIV. SKED DRAWER DRAWING

BOILER DIVISION

4Y (IPGD)

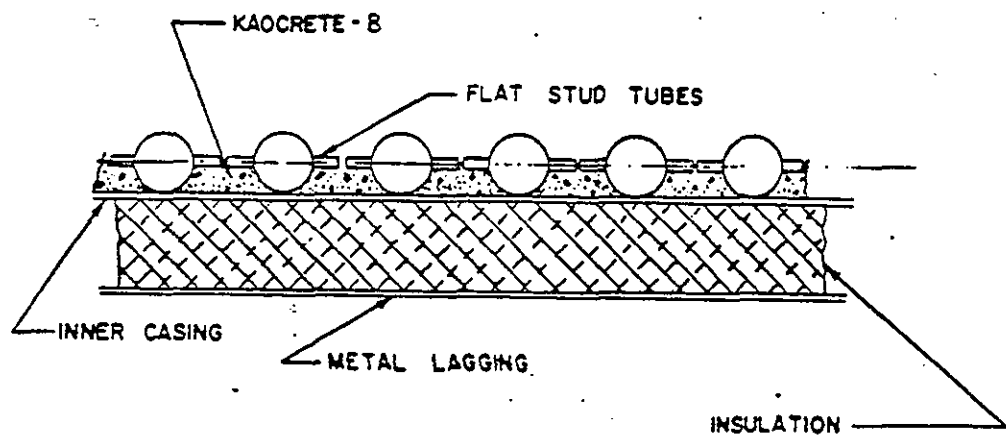
2R01

INT. 8-5369 1/12-12-83

BOILER & FURNACE WALLS

INNER CAGED
BRICKWORK & REFRACTORY
INSULATION

REVISIONS		NO. OF FILM
DATE	DESCRIPTION	(CONS.)



CONFIDENTIAL

DEVL. BY	CHK'D.	INNER CAGED BLR & FURNACE WALLS WITH METAL LAGGING FINISH	SCALE NTS	INCHES = 1 FOOT
DATE	APP'D.			A-

DUPLICATED IN 3Y-2R01

BOILER DIVISION

12-12-83

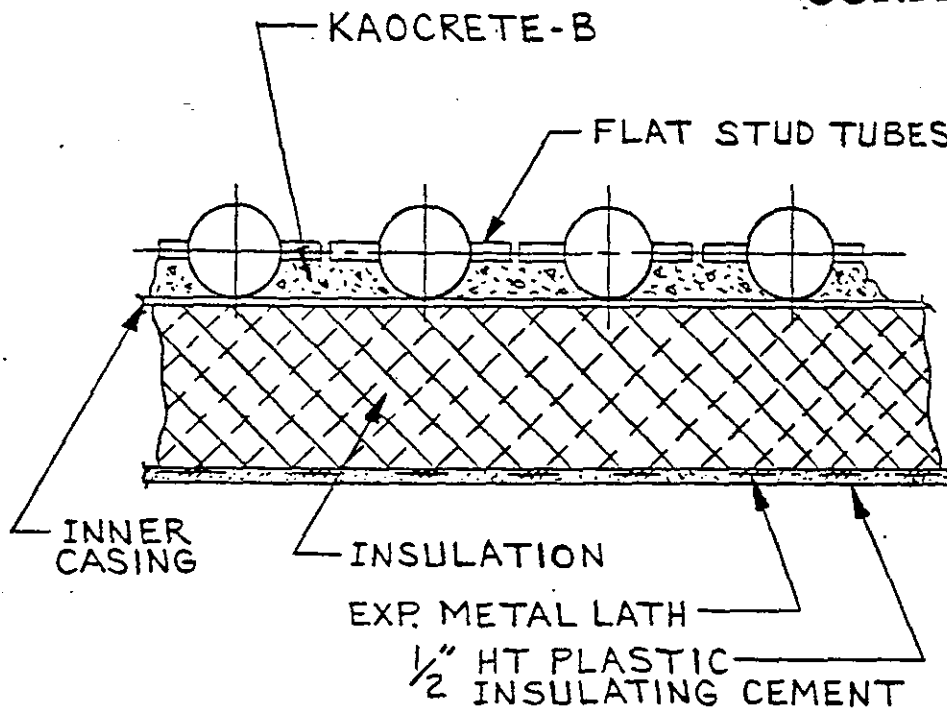
2R01
2/12-12-83

1/2" INNER CASED
1/2" PLASTIC FINISH

REVISIONS				MICRO-FILM
DASH NO.	DATE	DESCRIPTION	ORIG.	
1	12/83	CHGD TO IPGD IN NOTE		

INT. 7-5369

CONFIDENTIAL



FOR APPLICATION OF PLASTIC FINISH
REFER TO 3Y(IPGD)-6A-3Y4.

LOCKED DRAWER DRAWING

OWN. BY K.D.	CHK'D ✓	INNER CASED BLR & FURNACE	SCALE 1/2" = 1'-0"	DATE 9-26-80
PASSED BY T.P.S.	APP'D D.R.S.	WALLS WITH 1/2" PLASTIC FINISH	DRWG. NO. 205102 A-1	

DUPLICATED IN 3Y-2R01

60 IPGD DIV. IPGD FORM BDM 1087 A-4

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NOT DRAWN BY DIV. 1 K. 53 69

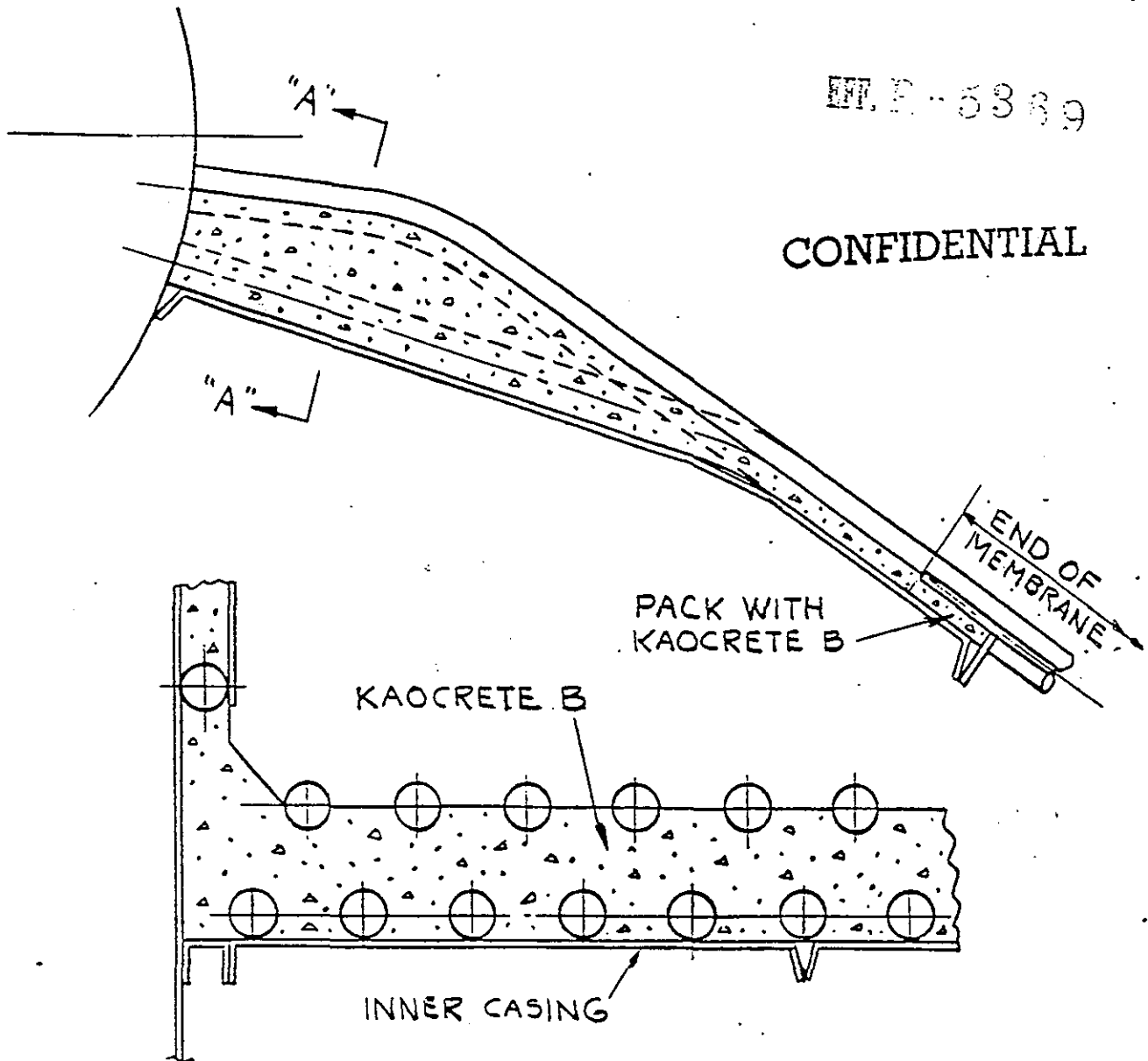
THE BABCOCK & WILCOX COMPANY
POWER GENERATION DIVISION
INSULATION

2R03
1/12-12-83

BOILER & FURNACE WALLS
MEMBRANE WALL AT JUNC-
TION WITH INNER CASING

REVISIONS			MICRO- FILM
DASH NO.	DATE	DESCRIPTION	ORIG.

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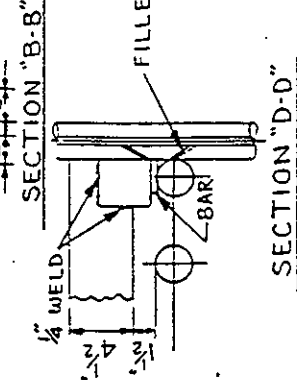
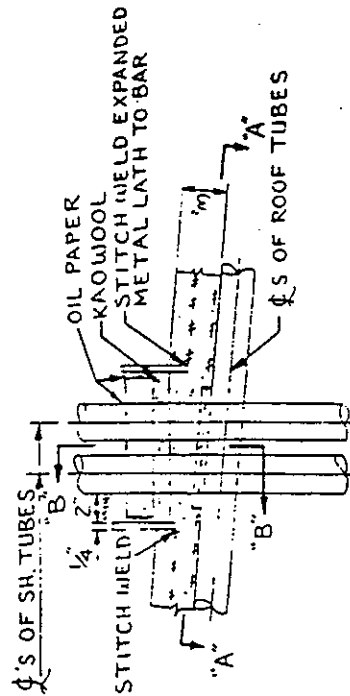
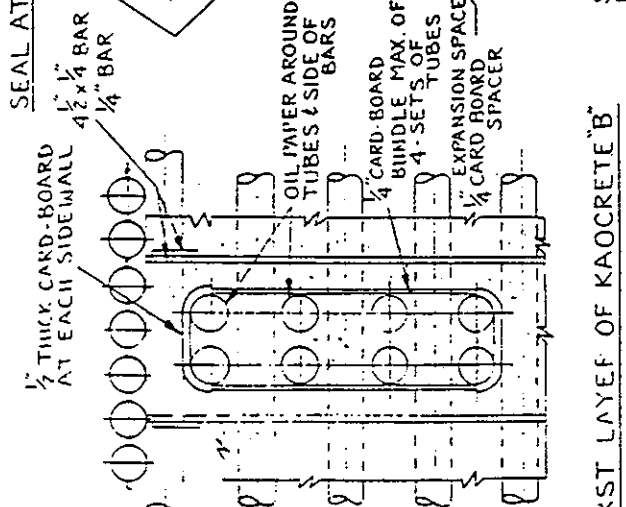
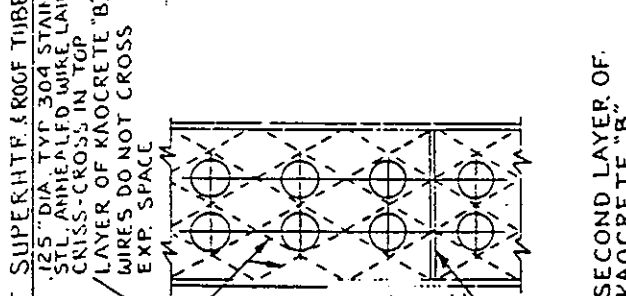
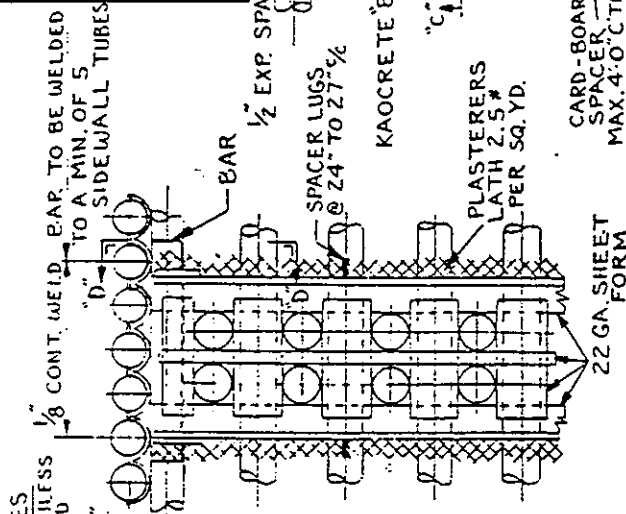


SECTION "A-A"

OWN. BY S.A.S.	CHK'D	FURNACE REAR WALL AT LOWER DRUM	SCALE	DATE 1-14-72
PASSED BY	APP'D		ORWG. NO. 101959A-0	

LOANED DRAWER DRAWING 60 IPGD IPGD FORM 80M 1087 A-2

LOANED DRAWER DRAWING

[illegible]

NOTE
AFTER FIRST LAYER OF KAOCKRETE "B" IS DRY, TAMP LOOSE KAOWOOL TO A THICKNESS OF 2" WET DOWN KAOWOOL, THEN POUR TOP 2" LAYER OF KAOCKRETE "B" WHICH WILL COMPRESS THE KAOWOOL TO ABOUT 1" THICKNESS.

SECTION "C-C"

[illegible]

DATE	3-26-80	TS/NM.	REFRACTORY DETAILS
BY	K.L.D.	CHK'D	

205042 B-0

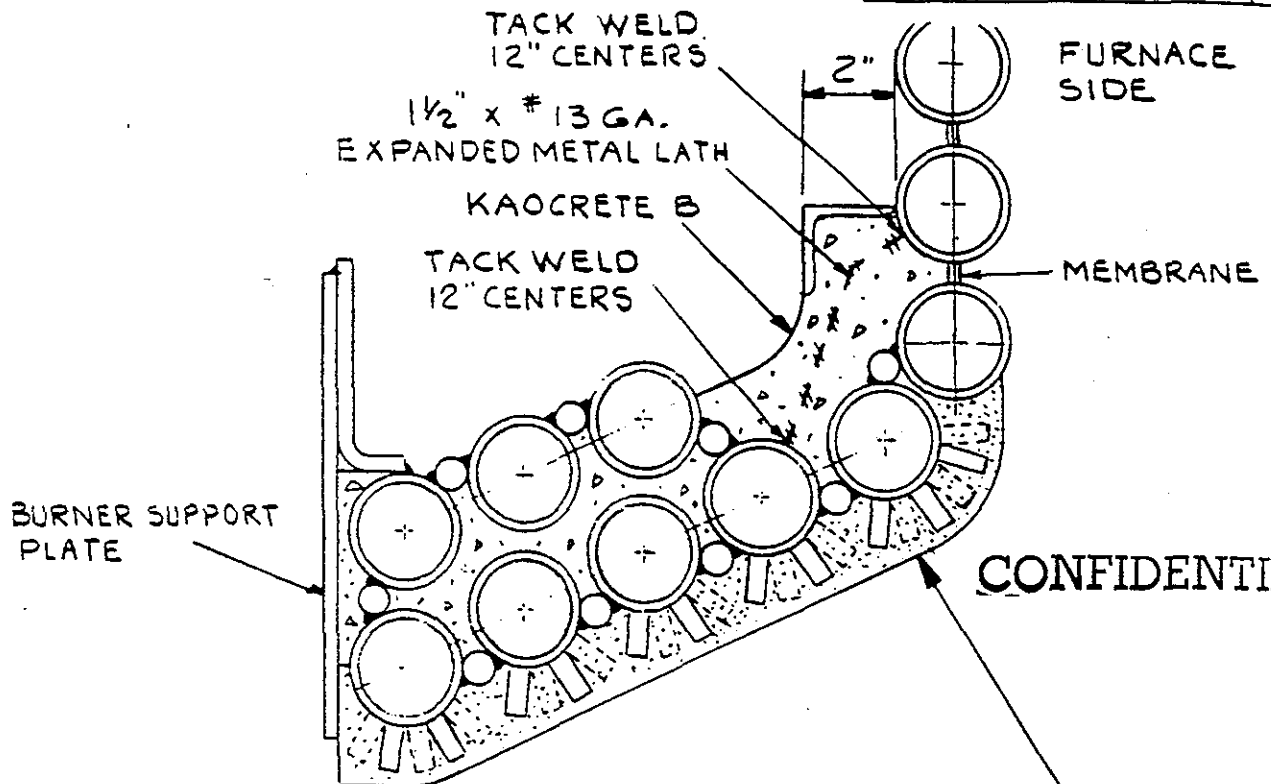
LOCKED DRAWER DRAWING 60 11.22 DIV.

LOCKED DRAWER DRAWING

BRICKWORK & REFRACTORY APPLICATION BURNER THROATS

KAOCRETE NOT REQUIRED ON
PORTION OF WALL WITH
MEMBRANE CONSTRUCTION

REVISIONS			DATE
DASH NO.	DATE	DESCRIPTION	ORIG.
1	1/12/83	ADDED PLASTIC MOLD. FOR OIL & GAS FIRED. T.S.	
2	1/12/83	CHGD PLASTIC MOLD. NOTE FOR OIL & GAS FIRED. T.S.	
3	1/12/83	CHGD PCO TO PLASTIC MOLD CHGD TYPE OF APPLICATION	
4	1/12/83	ADDED PCO & KROMALOX P	



COAL FIRED
OR
COAL & OIL OR
GAS FIRED

B&W APPROVED
PLASTIC MOLDABLE:
B&W KROMALOX P
B&W PLASTIC CHROME ORE

OIL & GAS FIRED

APPROVED 60% ALUMINA AIR SETTING
3000°F USE LIMIT PLASTIC MOLDABLES:
B&W KROMALOX P
PLIBRICO 60 AB
KAISER MONO-60 AIRSET
PYRAMID 60 (INTERPACE CORP)
HW APACHE PLASTIC CS

DWN. BY S.A.S. CHK'D ✓
PASSED BY ✓ APP'D ✓

BURNER THROATS
MEMBRANE WALL

SCALE ~ DATE 1-20-72
DRWG. NO. 101961A-4

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LOCKED & DRAWING

1000000

THE BABCOCK & WILCOX COMPANY
BOILER DIVISION
BRICKWORK - REFRACTORY

EFF.

R-5339

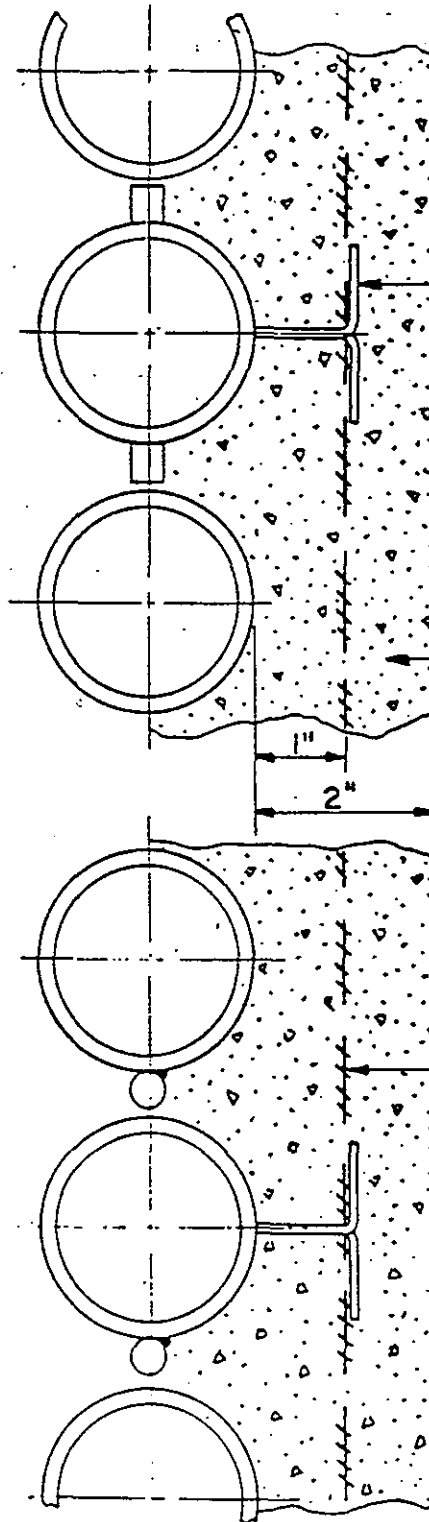
4Y (IPGD)
5R
AY2
1/12-12-83

REVISIONS

DASH NO.	DATE	DESCRIPTION	ORIG.
1	12-4-61	CHGD KAOCRETE S TO B	ALC

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FURNACE
SIDE



3 TINE SELF-WELDING
PIN SPACED 18" VERT-
ICAL 12" HORIZONTAL

CONFIDENTIAL

KAOCRETE B

13 GA. EXP. METAL
LATH

BURNER WALL INSULATION DETAILS
INSIDE WINDBOX
2 1/2" OD. TUBES ON 3" CENTERS

DWN. BY J. F. RENO
CHK'D LWF
PASELBY
APP'D EBS

SCALE
DATE 2-16-62
DRWG. NO. 39793-A-1

LOCKED DRAWER DRAWING

IPGTT

BABCOCK & WILCOX
INDUSTRIAL POWER GENERATION DIVISION

4Y(IPGD)
11R
1/12-12-83

BRICKWORK REFRACTORY
FLUES & DUCTS
LININGS

EFF. 2-5889

When carbon steel flues and ducts are used for temperature above 850F it is necessary to provide a refractory lining to protect the casing from the excessive temperatures. For material and reinforcement systems refer below:

Kaocrete HS is an acceptable refractory lining to protect casing for those areas where the flue gas or hot air does not contain excessive erosive particulate. For abnormal conditions contact Design Engineering.

The refractory linings shall have a minimum thickness of 2".

Linings shall be reinforced by several acceptable methods, when gas or air temperatures are below 1000°F.

1. 2" x 2" x #12 B.W.G. wire mesh
2. 4" x 4" x 8GA. Road Mesh
3. Two or three tine self welded studs
4. Bent rod "V" Anchors Hand Welded
5. Self Weld "V" Anchors

CONFIDENTIAL

For conditions at 1000 F and above, gas temperature, stainless tines or anchors must be used as a reinforcement. Refer Below.

GAS TEMPERATURE

ANCHOR MATERIAL

Up to 999°F.

Carbon Steel

1000°F. thru 1600°F.

Type 304 Stainless Steel

1601°F. thru 2000°F.

Type 309 or 310 Stainless Steel

The reinforcing mesh shall be held to the flue lining by suitable carbon steel supports such as Gateway Engineering Carbon Steel SS Slab spacers, T-slot self welded studs, nuts or drilled studs. The mesh shall be located approximately 1 inch from the hot face of the refractory lining.

The corrosion resistant lining construction details are the same as stack lining details which are shown on 3Y (IPGD)-13R, with exception to overhead surfaces which shall have the mesh supports installed on 12" x 12" centers.

All anchors for temperatures above 1000°F shall be installed on 6" x 6" staggered centers.

BABCOCK & WILCOX
INDUSTRIAL POWER GENERATION DIVISION

4Y(IPGD)
13R
1/12-12-83

BRICKWORK - REFRACTORY
STACKS
LININGS

277. 6869

When it is necessary to line the inside of a stack with refractory to prevent corrosion, a minimum of 2 in. thick lining shall be made up by gunning a refractory mix composed of three parts of acid-resistance aggregate plus one part on Lumnite cement by volume. The acid-resistant aggregate may be acid resistant crushed firebrick, #4 x 0 mesh, or trap rock. Silica sand 95% or better is an acceptable aggregate for stack conditions below 400F. The sand must be of a coarse grade that approximately 99% will be retained on a 70 Tyler sieve and meet ASTM C40-79 for impurity limits. B&W Kaocrete-HS is an acceptable prepared refractory.

This lining shall be reinforced by several acceptable methods, when stack gas temperatures are below 1000°F.

1. 2" x 2" x #12 B.W.G. wire mesh
2. Chicken wire mesh
3. Two or three line self welded studs
4. Bent rod V anchors hand welded
5. Road Mesh 4" x 4" x 8 GA

CONFIDENTIAL

For conditions 1000°F and above gas temperatures, only stainless tines or anchors must be used as a reinforcement. (Refer to Table below)

The reinforcing mesh shall be held to the stack lining by suitable carbon steel supports such as Gateway Engineering Carbon Steel slab spacers, T-slot self welded studs, nuts or drilled studs. The mesh shall be located approximately 1 inch from the hot face of the refractory lining. For details refer to 4Y-13R, drawing 203099A.

GAS TEMPERATURE

ANCHOR MATERIAL

0 thru 999F
1000F thru 1600F
1601F thru 2000F

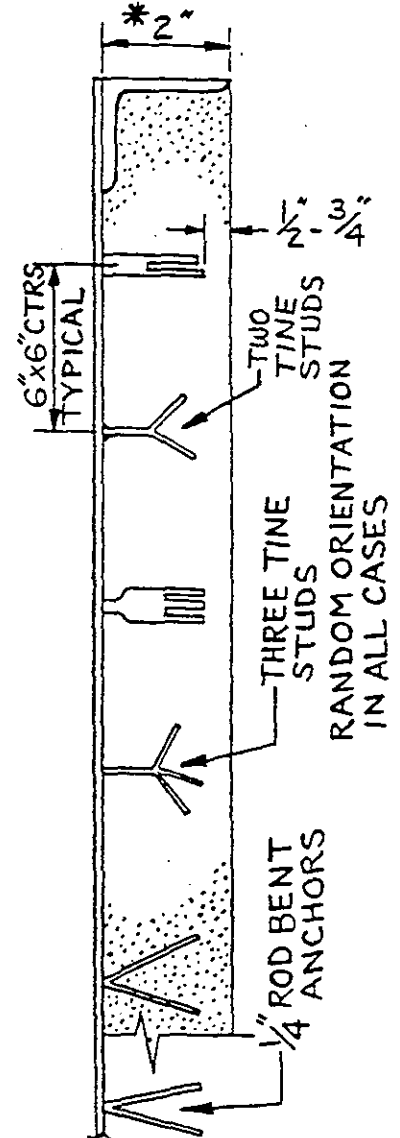
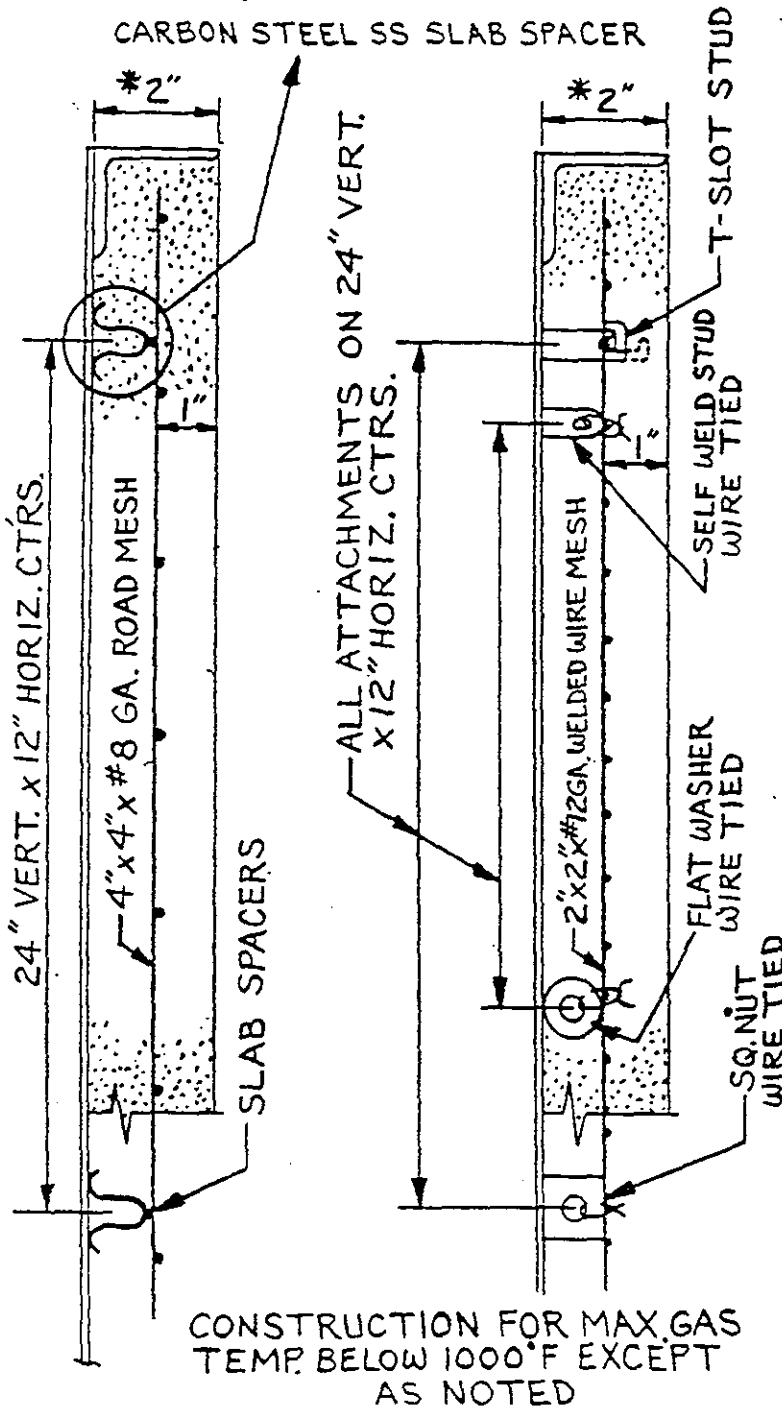
Carbon Steel
Type 304 Stainless Steel
Type 309 or 310 Stainless Steel

CONFIDENTIAL STACK LINING

REVISIONS			MICRO FILM
DASH NO.	DATE	DESCRIPTION	ORIG.

203099

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THIS CONSTRUCTION MAY BE USED 1000°F AND OVER WITH STAINLESS TINES OR ANCHORS. CARBON STEEL MAY BE USED FOR TEMPS. BELOW 1000°F.

* FOR LINING COMPOSITION SEE PRECEDING PAGE

DWG. BY K.D.	CHK'D	TYPICAL ARRANGEMENTS REFRACTORY TIES
PASSED BY	APP'D	

SCALE 1/2"	DATE 9-26-80
DWG. NO. 203099	A. O.

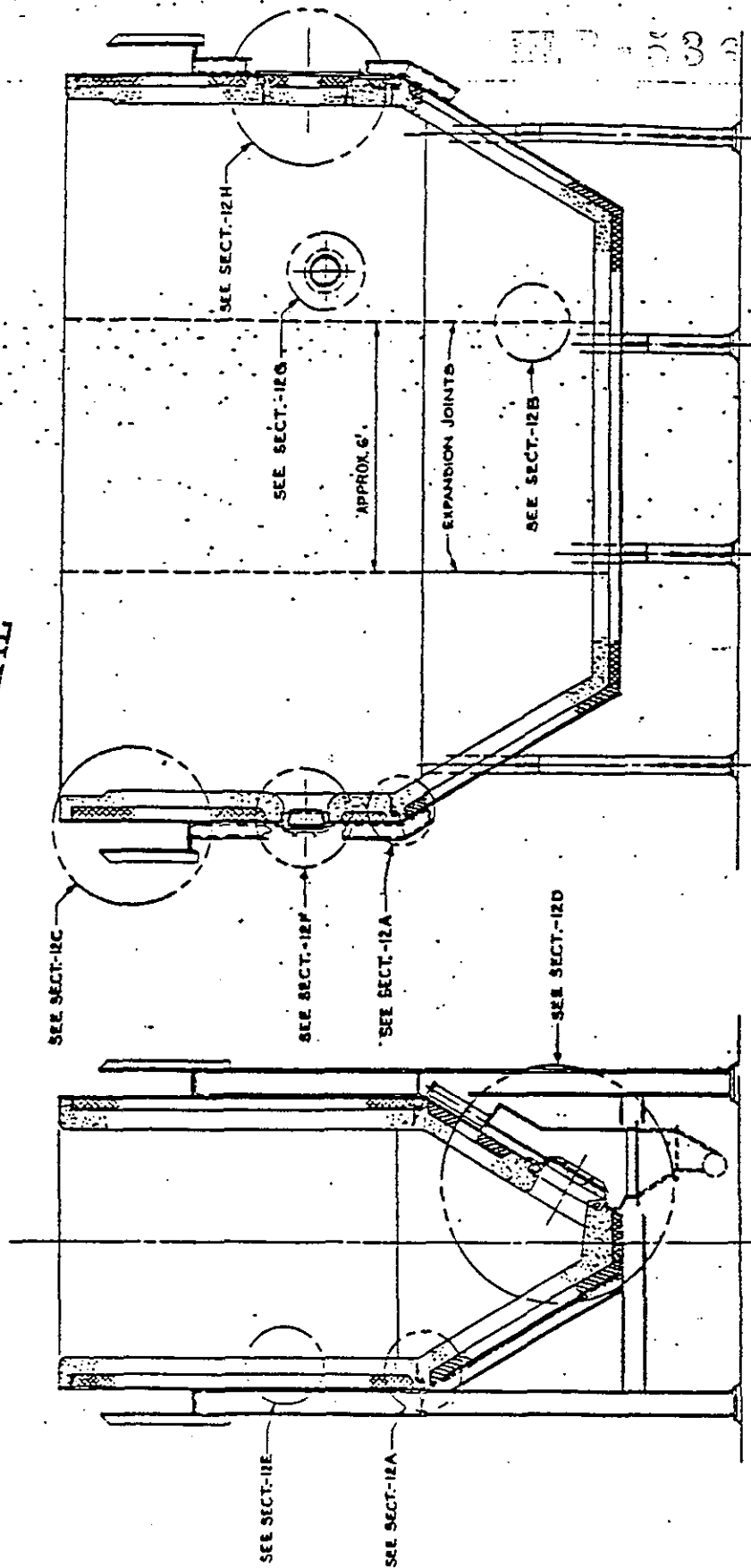
LOCKED DRAWER DRAWING

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CONFIDENTIAL

REVISIONS

NO.	DESCRIPTION	DATE	APPROVAL
1	ADDED PULVERIZED COAL	1/21/51	TPB
2	ADDED NOTE 5	2/16/51	TPB



NOTES - UNLESS OTHERWISE SPECIFIED:

1. APPLY ONE COAT OF MASTIC TO INSULATING BLOCK TO INHIBIT WATER TRANSFER FROM THE REFRACTORY.
R.I.I. (OR EQUAL) MASTIC @ 25 SQ. FT. PER GALLON COVERAGE.
2. WHERE NO INSULATION BLOCK IS APPLIED, 2 COATS OF R.I.I. (OR EQUAL) MASTIC ARE TO BE APPLIED TO STEEL SURFACES AND ANCHOR PROJECTIONS PRIOR TO INSTALLING REFRACTORY.
3. REFRACTORY WALL ANCHORS - KSM'SURELOCK 1/2" x 3/8" RIBBED (IP 5045) RECTANGULAR REFRACTORY STUD ANCHORS WITH RIPPED TINES (OR EQUAL).
4. LINING ANCHORS 10' 0" EACH WAY STAGGERED ON VERTICAL WALLS.

5. COAT REFRACTORY WALL ANCHORS & BRACKETS WITH HIGH MELT ROOFING ASPHALT OR WRAP WITH A FEW TURNS OF WATERPROOF PAPER OR EQUAL. THIS IS TO PREVENT BONDING OF REFRACTORY TO THE ANCHORS & BRACKETS AND PROVIDES A SPACE FOR DIFFERENTIAL EXPANSION.
6. LINING ANCHORS 18' 0" EACH WAY STAGGERED ON SLOPING WALLS.
7. NO ANCHORS REQUIRED ON BOTTOM.

8. WHERE R.I. BLOCK IS CALLED FOR IT MUST BE DIATOMACEOUS EARTH.

REFER TO CONTRACT
FOR REQUIRED HOPPER
ACCESSORIES

SECTION-12

DRILLER: L. H. JOUSLEY
SINKER: J. H. P.
CARRIER: D. L. FOREST
ANCHOR: W. L. G. G. G.
RIB: L. L. G. G. G.
STUD: L. L. G. G. G.
CODE: 60
STANDARD

ASH HOPPER
TYPICAL LINING DETAILS
PULVERIZED COAL
FIRING

SCALE: 1" = 1'-0"

172958 C 2

LOCKED DRAWER DRAWING

A LOCKED DRAWER DRAWING

1.00 I.M. DIV.

IPG 172958 C 2

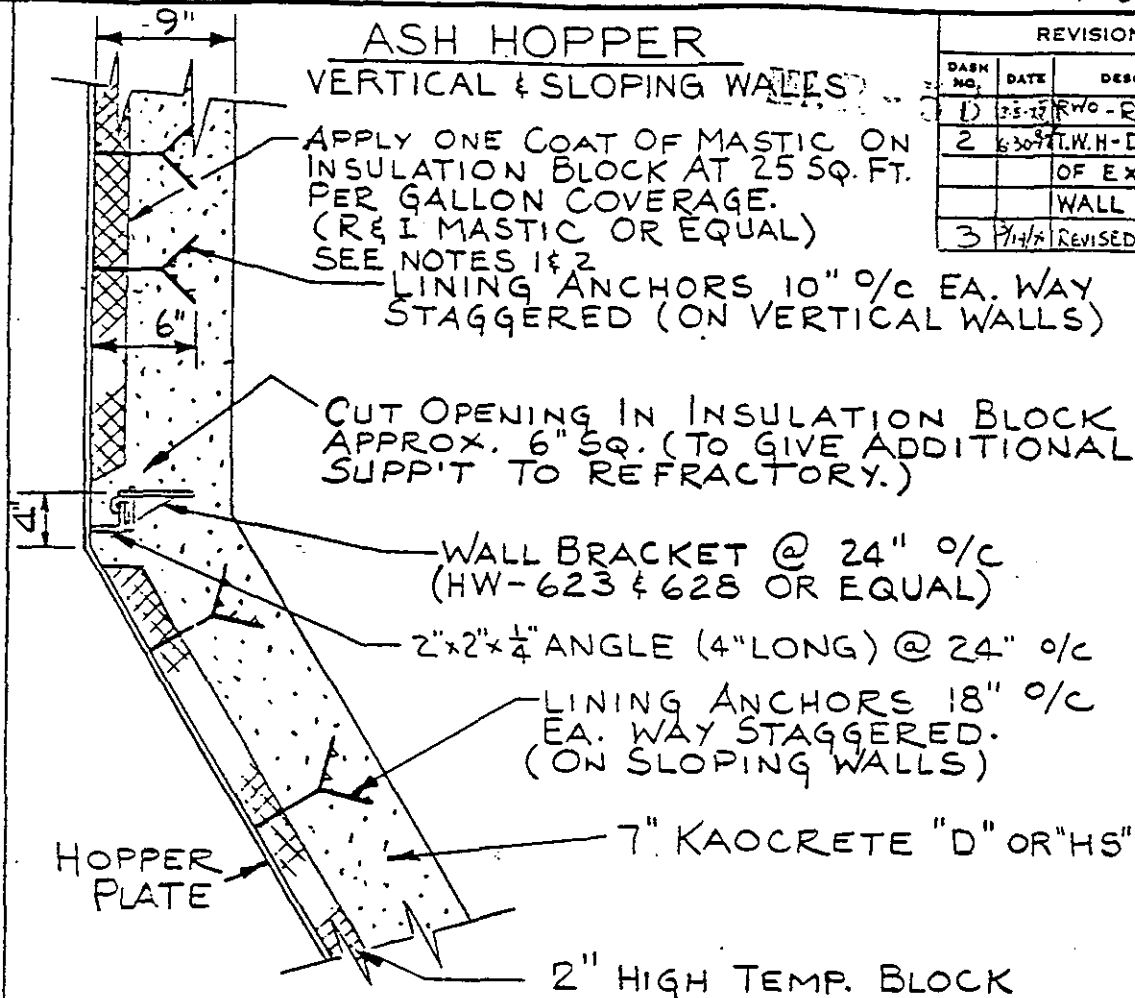
THE BABCOCK & WILCOX COMPANY
POWER GENERATION GROUP

4 Y (IPGD)

110

2/12-12-83

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REVISIONS				MICRO-FILM
DASH NO.	DATE	DESCRIPTION	ORIG.	
1	3-5-77	RWO-REDRAWN PK		
2	6-30-77	T.W.H-DELETED VIEW OF EXP. JT. & CHGD WALL BRACKET M.N.E.		
3	7-14-78	REVISED WALL BRACKET		

FOR GENERAL NOTES
SEE DWG. 172958C.

CONFIDENTIAL

SECTION-12A

OWN. BY T.W.H.	CHK'D SRJ	INSULATION DETAILS	SCALE $\frac{1}{2}$	DATE 1-10-77
DESIGNED BY T.W.H.	APPROVED [Signature]		DRWG. NO. 132648	A-3

BIRMINGHAM 26546



60

IPGD

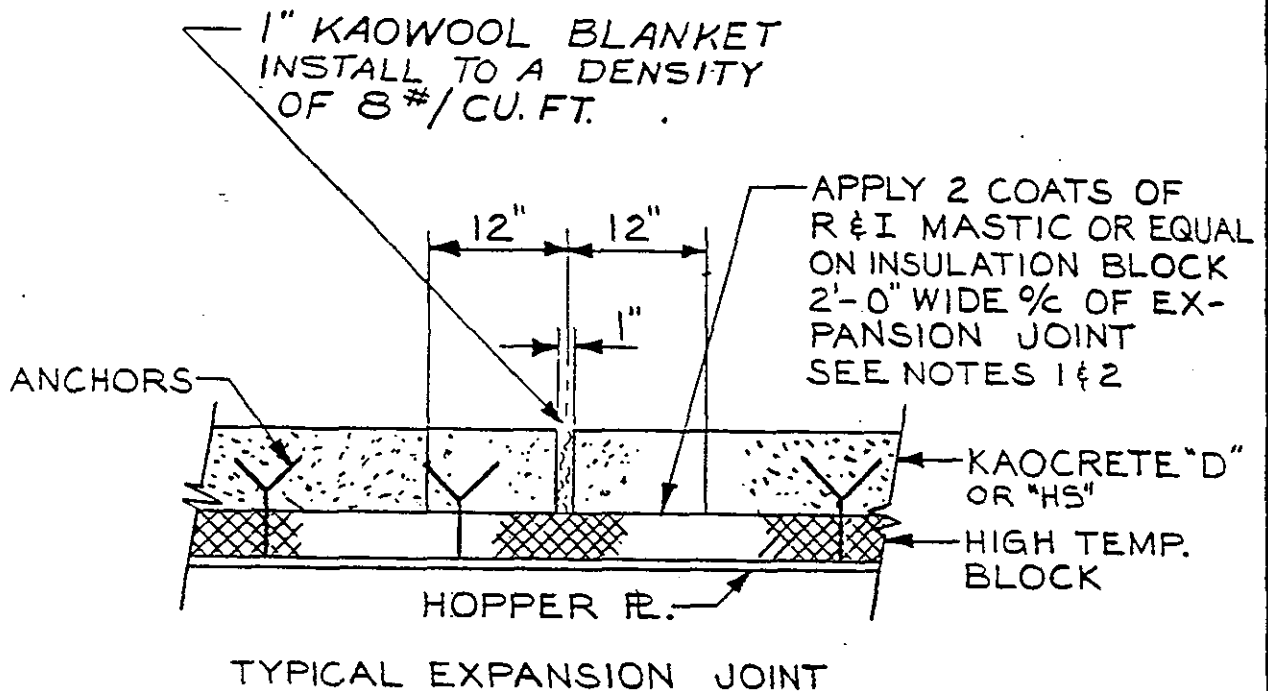
FORM BDM 1087 A-4

THE BABCOCK & WILCOX COMPANY
POWER GENERATION GROUP

4Y (1 PGD)
11U
3/12-12-83

ASH HOPPER
DETAIL OF EXP. JOINT

3 REVISIONS			MICRO-FILM
DASH NO.	DATE	DESCRIPTION	ORIG.
1	6/1/83	ADDED DWG TO GEN NOTE	
2	4/1/83	CHG EXP. BRD TO BLANKET	



CONFIDENTIAL

FOR GENERAL NOTES
SEE APPLICABLE DWG:
172958C

SECTION-12B

DWN. BY T.W.H.
DL FORST
PASSED BY
CHK'D JHP
APPROVED

INSULATION DETAILS

SCALE 1/4" = 1'-0"
DATE 6-30-77
DRWG. NO. 132665A-2

60 LOCKED DRAWING

1 PG DIV. 1

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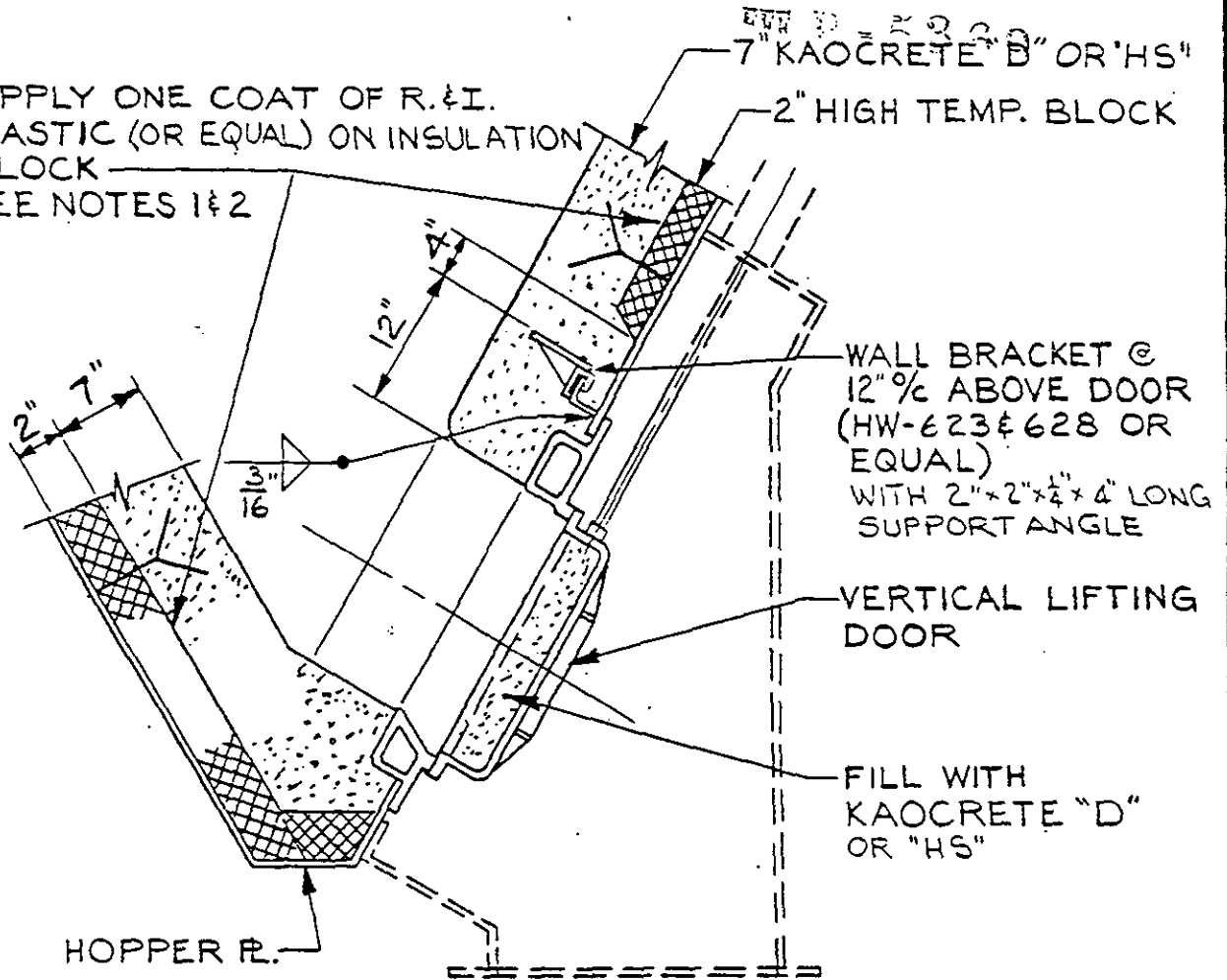
BRUNING 26346

5/12-12-83

ASH HOPPER DETAIL OF ASH REMOVAL DOOR

REVISIONS			MICRO-FILM
DASH NO.	DATE	DESCRIPTION	ORIG.
1	3/4/83	REVISED WALL BRACKET	
2	4/1/83	REVISED BRACKETING FROM HW-623 TO HW-623.	

APPLY ONE COAT OF R. & I.
MASTIC (OR EQUAL) ON INSULATION
BLOCK
SEE NOTES 1 & 2



CONFIDENTIAL

INCLINED DOOR SHOWN
VERTICAL DOOR SIMILAR

FOR GENERAL NOTES
SEE DWG. 172958C.

SECTION -12D

DWN. BY T.W.H.	CHK'D JHP	INSULATION DETAILS	SCALE 1/4" = 1'-0"	DATE 6-30-77
DESIGNED BY DLEFST	APP'D [Signature]		DRWG. NO. 132667	A-2

60 1PGD [Signature]

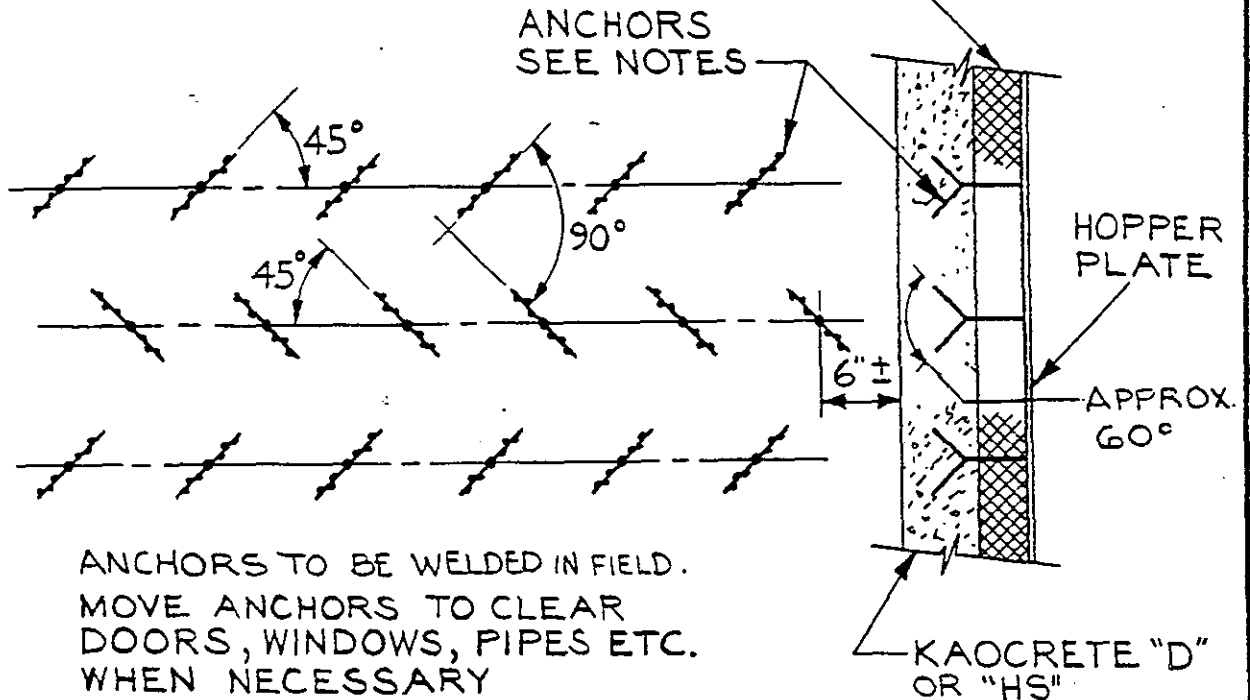
110
6/12-2-83

ASH HOPPER TYPICAL LAYOUT FOR REFRACTORY ANCHORS

REVISIONS			MICRO-FILM
DASH NO.	DATE	DESCRIPTION	ORIG.
1	4/17/79	REVISED BLOCK INSTN	
		NOTE: ADDED ANCHOR COATING	
		NOTE: ADDED NS TO G.N. REF.	

172958C

IMPALE INSULATION BLOCK ON CLOSED ANCHOR USING DABS OF BLOCK STICK MASTIC. OPEN ANCHORS AFTER BLOCK INSTALLATION & COAT ANCHORS & BLOCK WITH R. & I. MASTIC (OR EQUAL) BEFORE INSTALLING REFRACTORY. SEE GENERAL NOTES.



ANCHORS TO BE WELDED IN FIELD. MOVE ANCHORS TO CLEAR DOORS, WINDOWS, PIPES ETC. WHEN NECESSARY

LINING ANCHORS TO BE ANGLED AS SHOWN @ SPACINGS CALLED FOR ON DETAIL DRAWINGS

FOR GENERAL NOTES
SEE APPLICABLE DWG:
172958C

CONFIDENTIAL

SECTION-12E

DWN. BY T.W.H.	CHK'D JHP
D.L. FORST	APP'D

INSULATION DETAILS

SCALE	DATE 6-30-77
DRWG. NO. 132668 A. +	

BRUNING 26946

60

IPGD

FORM EDM 1087 A-4

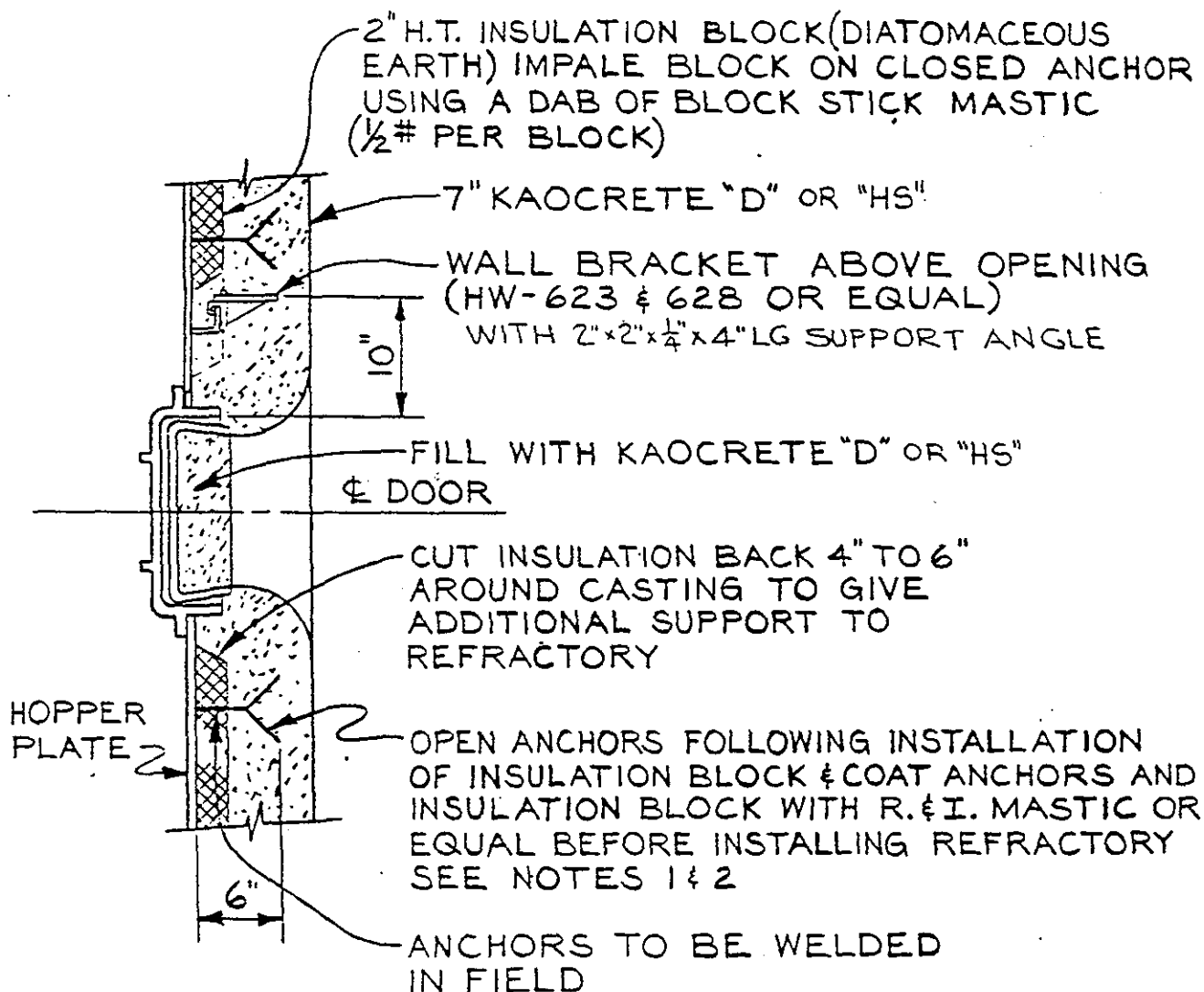
THE BABCOCK & WILCOX COMPANY
POWER GENERATION GROUP

4Y (IPGD)
110
7/12/2-B

ASH HOPPER
DETAIL @ OBSERVATION DOOR

REVISIONS			MICRO-FILM
DASH NO.	DATE	DESCRIPTION	ORIG.
1	3/14/79	REVISED WALL BRACKET	

5369



FOR GENERAL NOTES
SEE DWG. 172958C.

CONFIDENTIAL

SECTION-12F

DWN. BY T.W.H.	CHK'D J.H.P.	INSULATION DETAILS	SCALE $\frac{1}{4}$ " = 1"	DATE 6-30-77
DL FORST	APPRO		DRWG. NO. 132669	A-1

LOCKED DRAWER DRAWING

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IPGD IP(1) 110

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BRUNING 26546

THE BABCOCK & WILCOX COMPANY
POWER GENERATION GROUP

4Y (IPGD)

11U

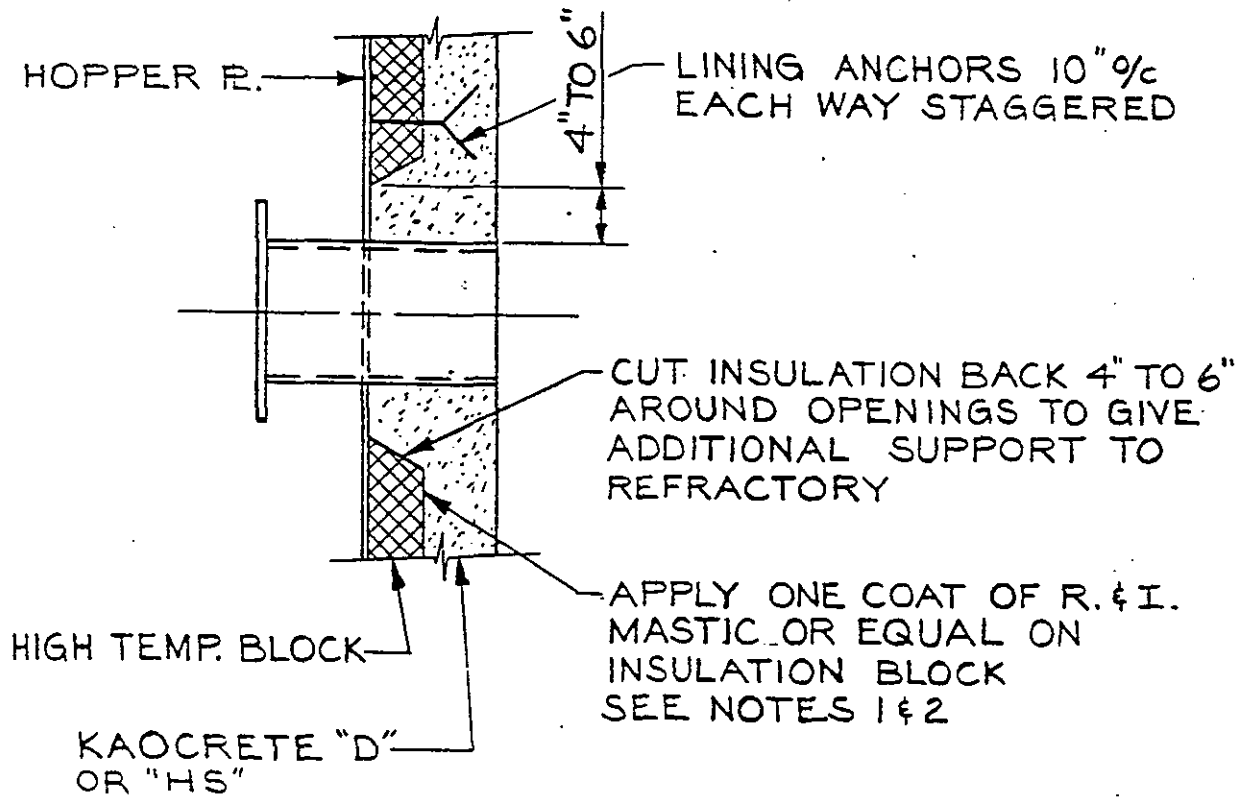
8/12-12-83

ASH HOPPER
DETAIL @ POKE HOLE

REVISIONS			MICRO-FILM
DASH NO.	DATE	DESCRIPTION	ORIG.

EFF. R - 5359

CONFIDENTIAL



FOR GENERAL NOTES
SEE DWG. 172958C.

SECTION-12G

DWN. BY T.W.H.	CHK'D JHP	INSULATION DETAILS	SCALE	DATE 6-30-77
DLFORST	<i>Almery</i>		DRWG. NO. 132670	A.O.

60 IPGD

FORM BDM 1087 A-4

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BRUNING 26346

THE BABCOCK & WILCOX COMPANY
POWER GENERATION GROUP

4Y (IPGD)

11U

9/12-83

ASH HOPPER
DETAIL @ ACCESS DOOR

REVISIONS			MICRO- FILM
DASH NO.	DATE	DESCRIPTION	ORIG.

5369

APPLY ONE COAT OF
R. & I. MASTIC OR EQUAL
ON INSULATION BLOCK
SEE NOTES 1 & 2

PACK WITH 4" KAOWOOL
& COVER WITH
KAOCRETE "D"
OR "HS"

HOPPER R.

REMOVABLE ACCESS
DOOR BOLTED TO
HOPPER

CUT INSULATION BACK
4" TO 6" AROUND DOOR

KAOCRETE "D"
OR "HS"

CONFIDENTIAL

HIGH TEMP. BLOCK

FOR GENERAL NOTES
SEE DWG. 172958C

SECTION-12H

OWN. BY T.W.H. CHK'D JHP
DLT PRST APP'D *Aimery*

INSULATION DETAILS

SCALE *1/2"* DATE 6-30-77
DRWG. NO. 132671 A.O.

LOCKED DRAWER DRAWING

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IPGD 172958C

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IRUNING 26946

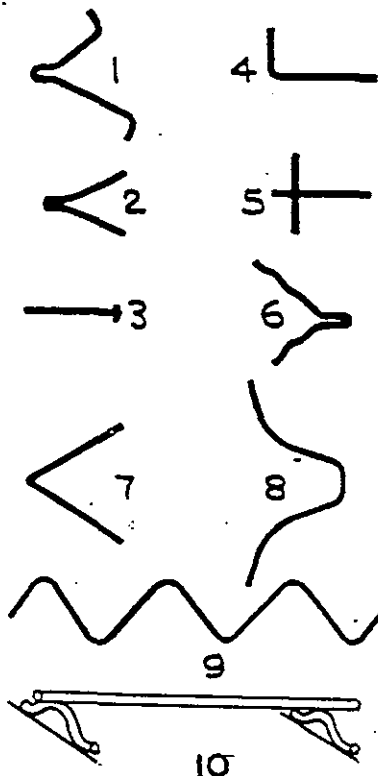
DATE 6-30-77

THE BABCOCK & WILCOX COMPANY
POWER GENERATION DIVISION

4 Y (IPGD)
5W
1/12/2-83

BRICKWORK - REFRACTORY
FASTENERS

REVISIONS			MICRO- FILM
DASH NO.	DATE	DESCRIPTION	ORIG.



EFF. R - 5350

CONFIDENTIAL

FIGURE - 1

STUD GUN ANCHORS

- | | |
|-------------------|---------------------|
| 1. DOUBLE HOOK | 4. RIGHT ANGLE BEND |
| 2. 2-PRONGED STUD | 5. "T" STUD |
| 3. HEADED STUD | 6. "Y" STUD |

MANUAL-WELD ANCHORS

- | | |
|-------------|---------------------|
| 7. "V" | 9. CHAIN-LINK FENCE |
| 8. LONGHORN | 10. SS SLAB SPACER |

LOCKED DRAWER DRAWING

IPGD DIV.

OWN. BY	CHK'D
PASSED BY	APP'D

REFRACTORY ANCHORS

SCALE	DATE
DRWG. NO.	A.

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BABCOCK & WILCOX
INDUSTRIAL POWER GENERATION DIVISION

REFRACTORIES
MATERIAL ORDERING

4Y(IPGD)
4Y2
4A2
1/12-12-83

When ordering material for use on boilers, use the tables for specific material found in this section. All quantities shown include the proper percentage extra for rebound or wastage.

To facilitate economical procurement by the Purchasing Department, each item of brick or tile except Insulating Firebrick on the shop orders should list the Pyrometric Cone Equivalent (PCE) necessary for that item. The term PCE is a test of refractory materials per ASTM designation C-24. Specifically it is a number, assigned to a refractory material which designates the temperature at which the tip of a cone of refractory material being tested will melt and touch the supporting base.

RECOMMENDED CASTABLE OVERAGES

TYPE OF INSTALLATION	OVERAGE - %
1. Casting and hand rodding involving minimum of waste	8 - 10
2. Vibrated installation - to allow for greater compaction	
Dense castables	15
Insulating castables	20
3. Slap troweling and plastering	10 - 15
4. Gunning	15 - 100

Gunning losses vary widely according to a number of variables. A floor may have less than 10% loss and a roof might have as much wasted as that which adheres, in other words, a 100% overage might be required. Losses run less on the inside of a stack than on the outside of a vertical cylinder or tank. Losses will also vary according to wall thickness, type of nozzle, air pressure, water pressure, prewetting of castable, rate of feed, experience of operators, stickiness of material, type of surface, etc.

For B&W gun mixes see 4Y(IPGD)-4Y2-4A2 page 8 showing various lightweight and dense castable rebound figures, material overages and necessary pounds required to place.

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BABCOCK & WILCOX
INDUSTRIAL POWER GENERATION DIVISION

4Y(IPGD)
4Y2
4A2
3/12-12-83

REFRACTORIES
MATERIAL ORDERING

Application	Tube O.D. Inches	Tube Centers Inches	Plastic Moldables or Castables Weight
Recovery Unit	2-31/32	4	21.3 #/sq. ft.
Furnace Bottom	2-31/32	5	25.5 #/sq. ft.
Cyclone Furnace	1-15/32	1-1/2	11.8 #/sq. ft.
	1-1/32	1-1/16	11.5 #/sq. ft.
Full Stud	2-31/32	3	17.2 #/sq. ft.
Furnace Walls	2-31/32	5	25.5 #/sq. ft.
	3-1/4	4-1/2	24.3 #/sq. ft.
	7/8	1-1/2	12.3 #/sq. ft.
Slag-Tap Furnace	2-31/32	3	17.2 #/sq. ft.
Floors (Full Stud	2-31/32	5	25.5 #/sq. ft.
tube flow without	3-1/4	4-1/2	24.3 #/sq. ft.
slag Monkey)			
Slag Tap Furnace			
Floors (Slag	--	--	245 #/cu. ft.
Monkey)			
Furnace Screen	2-31/32	--	8 #/ft. (length)
Tubes of Slag	3-1/4	--	9 #/ft. (length)
Tap Units (Full			
Stud and hand			
trowelled)			
Furnace Floor	7/8	1-1/2	23.4 #/sq. ft.
Full Stud Tubes	1-1/4	1-3/4	24.5 #/sq. ft.

Above quantities (except for screen tubes) include extra 40% for rebound losses. For screen tubes quantities include extra 20% for tube bends, wastage, etc.

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4Y(IPGD)
4Y2
4A2
4/12-12-83

BABCOCK & WILCOX
INDUSTRIAL POWER GENERATION DIVISION
REFRACTORIES
MATERIAL ORDERING

For additional material beyond the face of the tube add the following:

WEIGHT PER INCH OF THICKNESS PER SQ. FT. (HAND APPLIED), LB.	
B&W KAOLITE AGGREGATE	B&W KAOCRETE-B
4.11	9.44
(allowing 20% overage)	(allowing 10% overage)

Example:

For weight of refractory 1" beyond the face of the tubes using Kaocrete-B
for 2-31/32" tubes on 6" centers

From 4Y-4Y2-4A2	Flush with tubes	8.02 #/ft ²
	1" Additional	9.44 #/ft ²
	TOTAL	17.46 #/ft ²

NOTE:

For export jobs where B&W supplies the High Early Strength Portland Cement
for the Kaolite materials. Quantity of cement 0.52 x pounds of Kaolite
Aggregate.

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BABCOCK & WILCOX
INDUSTRIAL POWER GENERATION DIVISION

REFRACTORIES
MATERIAL ORDERING

4Y(IPGD)
4Y2
4A2
5/12-12-83

MATERIAL	DRY MAT'L. REQ'D/CU. FT. CAST IN PLACE (POUNDS) NO ALLOWANCES MADE FOR LOSSES	SHIPPING UNITS
Kaocrete-A	125#	100# Bags
Kaocrete-B	100#	100# Bags
Kaocrete-D	128#	100# Bags
Kaocrete-HS	123# (Cast) 125# (Gun)	100# Bags
Kaocrete-28 LI	126#	100# Bags
Kaocast	123#	100# Bags
Kaocrete-30	135#	100# Bags
Kaocrete-32C (Cast)	144#	100# Bags
Kaocrete-32G (Gun)	135#	100# Bags
Kao-Tab-93	150#	100# Bags
Kao-Tab-95 (Cast)	165#	100# Bags
Kao-Tab-95 (Gun)	165#	100# Bags
Kaogun-BF	126#	100# Bags
Kao-Phos-93 (Ram)	170#	50# Bags
Kao-Phos-93 RG (Gun)	168#	50# Bags
Kao-Tuff-C (Cast)	138#	100# Bags
Kao-Tuft-G (Gun)	130#	100# Bags
Kromalox-P (Ram)	175#	100# Boxes
Kromalox-G (Gun)	154#	100# Bags
Kaolite-2000 HS	58#	40# Bags
Kaolite-2200	58#	40# Bags
Kaolite-2200 HS	71# (Cast) 82# (Gun)	50# Bags
Kaolite-2300 LI	54#	40# Bags
Kaolite-2500 LI	74# (Cast) 60# (Gun)	50# Bags
Kaolite-2500 HS	78# (Cast) 85# (Gun)	75# Bags
Kaolite-2800	84# (Cast) 86# (Gun)	75# Bags
Kaolite-3300	68#	50# Bags
Plastic Chrome Ore	208#	200# Drums

For B&W gun mixes see 4Y(IPGD)-4Y2-4A2 page 8 for rebound loss and pounds required to place/per cu./ft.

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BABCOCK & WILCOX
INDUSTRIAL POWER GENERATION DIVISION

REFRACTORIES
MATERIAL ORDERING

4Y(IPGD)
4Y2
4A2
7/12-12-83

MORTAR	*QUANTITIES LBS./1000 BRICK	REQ'D LBS. BRUSH COAT/100 SQ. FT.	SHIPPING UNITS (CONTAINERS)
High Temp. (Heat Setting)	240-300	20	100# Bags
SR-90 (Dry) (Air Setting)	375-475	25-35	100# Bags
Mul-Set F (Wet) (Air Setting)	300-350	22	100# Drums
Mul-Set F (Dry) (Air Setting)	180-300	20	100# Bags
Air-Set (Wet) **(Air Setting)	360-400	22	100# Drums
Air-Set (Dry) **(Air Setting)	275-300	20	100# Bags
Smoothset (Wet) (Air Setting)	220-330	22	100# Drums
Smoothset (Dry) (Air Setting)	160-240	20	100# Bags
I.F.B. (Dry) (Air Setting)	220-330	22	100# Bags
I.F.B. (Wet) (Air Setting)	160-240	20	100# Drums

* Quantities vary according to type of brick laid up. Lower values are for dipped joints, higher values for trowelled joints.

**Order Air-Set Mortar (Dry) for all domestic applications.
Order Air-Set Mortar (Wet) for export jobs.

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4Y(IPGD)
4Y2
4A2
8/12-12-83

BABCOCK & WILCOX
INDUSTRIAL POWER GENERATION DIVISION

REFRACTORIES
MATERIAL ORDERING

B&W GUN MIXES

REBOUND PROPERTIES

The following is a table showing the various lightweight and dense rebound figures, material overages (attributed to rebound loss alone), and necessary pounds required/of to place:

<u>Lightweight</u>	<u>% Rebound</u>	<u>Resulting Overage Figure</u>	<u>Pounds Required/Of Gunned</u>
Kaolite 2000 HS	10-15	1.11 - 1.18	62
Kaolite 2200	10-15	1.11 - 1.18	62
Kaolite 2200 HS	15-20	1.18 - 1.25	85
Kaolite 2300 LI	10-15	1.11 - 1.18	57
Kaolite 2500 HS	5-10	1.05 - 1.11	84
Kaolite 2500 LI	10-15	1.11 - 1.18	70
Kaolite 2800	10-15	1.11 - 1.18	84
<u>Dense</u>			
Kaocast 4M	13	1.15	126
Kaocast 6M	16	1.19	126
Kaogun BF	10-15	1.11 - 1.18	128
Kao-Tuff G	12	1.14	138
Kao-Tab 95-G	18	1.22	165
Kaocrete 28-LI	13	1.15	134
Kaocrete 32 G	18	1.22	136
Kaocrete HS	10-15	1.18	124
Kaocrete A	23	1.30	132
Kaocrete D	28	1.39	133

NOTE: Gunned onto vertical wall by experienced operator under optimum conditions. Total overage figure should include a 10% contingency factor.

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BABCOCK & WILCOX
INDUSTRIAL POWER GENERATION DIVISION

4Y(IPGD)
4Y21
1/12-12-83

BRICKWORK - REFRACTORY
FIREBRICK

The industrial boilers of Babcock & Wilcox may require firebrick for the following applications:

1. Pulverized Coal Unit - Ash Hopper (4A-11U)

The standard refractory is Kaocrete D (trowelled) or Kaocrete HS (gunned). If customer specifies firebrick on the floor (or slope) of the hopper, B&W Firebrick 80 is recommended with B&W MUL-SET F (air-setting) mortar.

2. #1 Firebrick

Access door protection (4Y-6A-8U3)
Lower drum hopper (stoker fired unit) (1K2542-3Y)

3. #2 Firebrick

Ash hopper (stoker fired unit) (1K2542-3Y)

CONFIDENTIAL

4Y(IPGD)
4Y21
2/12-12-83

BABCOCK & WILCOX
INDUSTRIAL POWER GENERATION DIVISION

BRICKWORK - REFRACTORY
FIREBRICK
AVERAGE PROPERTIES OF B&W FIREBRICK

Firebrick series	Firebrick 80	Firebrick 80-0	Glass tank paver	Special refractory brick SR-90	SR-99
Melting point, F	3190	3190	3100	3480	3660
Density avg (ASTM C 134-70)					
Lb/9" straight	8.1	8.8	11.1	10.6	11.3
Lb/cu ft	189	151	190	183	193
Hot modulus of rupture, psi (ASTM C 583-76)					
@ Room temperature	1700	3500	3000	3600	3800
@ 2000F	-	-	1900	4500	2900
@ 2300F	-	-	1000	4200	1600
@ 2600F	-	-	800	2900	800
@ 2800F	-	-	700	2100	650
Cold crushing strength, psi (ASTM C 133-72)	4000	10,000	12,000	12,000	10,000
Permanent linear change, % (Per ASTM C 113-74)					
5 hr @ 2912F	-1.0	-0.8	+0.1	-	-
5 hr @ 3200F	-	-	-	+1.5	-
24 hr @ 3200F	-	-	-	-	+0.3
Thermal conductivity, Btu-in./h-ft ² -F (ASTM C 202-71)					
Mean temperature @ 500F	16.0	20.8	13.0	26.5	47.5
@ 1000F	16.0	20.6	12.3	22.8	31.5
@ 1500F	15.9	20.3	12.1	20.8	24.0
@ 2000F	15.6	19.9	11.9	19.5	20.5
@ 2500F	15.2	19.5	-	18.8	17.5
Deformation under hot load, % @ 25 psi (ASTM C 16-77)					
1 1/2 hr @ 2640F	-1.0	-0.5	-	-	-
1 1/2 hr @ 2900F	-	-	0.0	-	-0.3
1 1/2 hr @ 3000F	-	-	-	+0.1	-
1 1/2 hr @ 3200F	-	-	-	+0.1	-
150 hr @ 3200F	-	-	-	<0.25	-
Permeability ft ³ /hr ft ² in./psi	1000	100	13	35	30
Relative abrasion resistance vol loss when abraded cc's (ASTM C 704-76)	11.0	5.2	5.6	7.3	13.5
Porosity % (ASTM C 20-74)	17	8	16	18	17
Panel spall loss, % (Per ASTM C 122-76) 12 cycles @ 2550F					
24 hr preheat @ 3000F	3.0	NR*	-	-	-
24 hr preheat @ 3100F	-	-	-	0	2.6
Static corrosion resistance to molten glass, corrosion, % (ASTM C 621-68) soda, lime, silica cullet - one inch cylinder					
72 hrs @ 2250F	-	-	12	-	-
Chemical analysis, % (ASTM C 573-70)					
Alumina Al ₂ O ₃	45	45	57	90	99.4
Silica SiO ₂	52	52	14	10	0.4
Zirconia ZrO ₂	-	-	26	-	-
Ferric oxide Fe ₂ O ₃	1.4	1.4	0.3	0.1	0.1
Titanium oxide TiO ₂	1.7	1.7	0.2	Trace	Trace
Calcium oxide CaO	0.1	0.1	0.1	0.1	Trace
Magnesium oxide MgO	Trace	Trace	0.1	0.1	Trace
Alkalies as Na ₂ O	0.3	0.3	0.9	0.1	0.1

*Not recommended for severe spalling conditions

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BABCOCK & WILCOX
INDUSTRIAL POWER GENERATION DIVISION

BRICKWORK - REFRACTORY
FIREBRICK

4Y(IPGD)
4Y21
3/12-12-83

REV. 4-5369

RECOMMENDED INITIAL CURING AND FIRING SCHEDULES OF FIREBRICK

† 1. Firebrick Structures:

to 13-1/2" thickness, 75°F per hour to operating temperature

above 13-1/2" thickness, 50°F per hour to operating temperature

or: 75°F per hour to 1200 F

Hold 8 hours at 1200 F

75°F per hour to 1800 F

Hold 8 hours at 1800 F

75°F per hour to operating temperature

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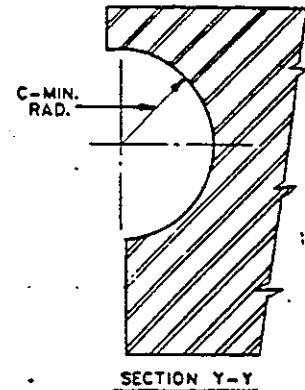
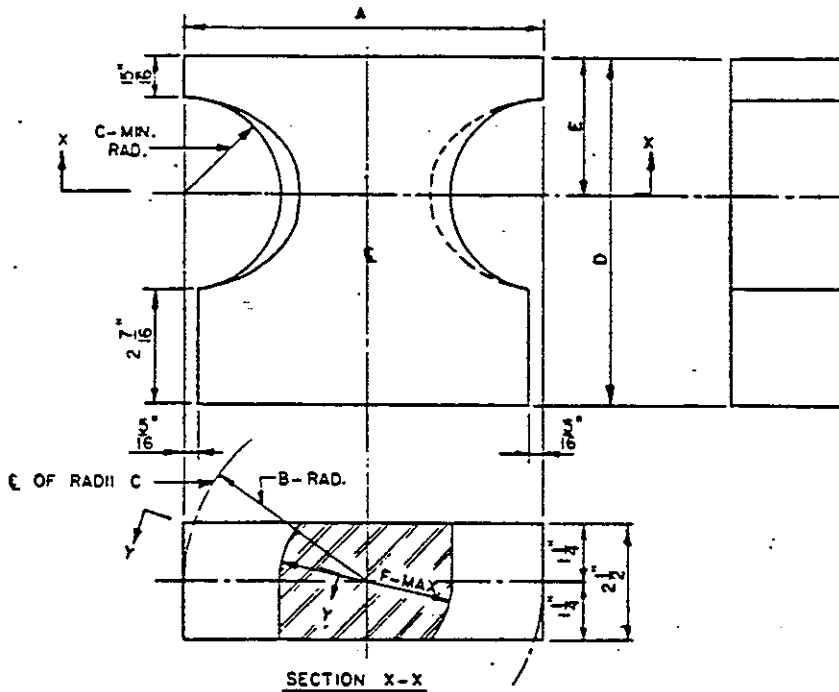
BOILER DIVISION

REFRACTORIES - TILES

4Y(IPGD)
4Y211
1/12-12-83

"C" TILES FOR 3", 4", & 4 1/2" WALL TUBES

REVISIONS		MICRO-FILM
DATE	DESCRIPTION	ORIG.



USED FOR TUBES		PATTERN NO.	A	B	C MIN.	D	E	F MAX.	VOLUME
DIA.	CTRS.								
3"	6"	45211	5 7/8"	2 5/16"	1 9/16"	6 1/2"	2 1/2"	2 3/4"	70 CU. IN.
4"	7"	45212	6 7/8"	3 7/16"	2 1/16"	7 1/2"	3"	2 3/4"	89 CU. IN.
4"	8"	45213	7 7/8"	3 5/16"	2 1/16"	7 1/2"	3"	3 3/4"	108 CU. IN.
4"	9"	45214	8 7/8"	4 1/16"	2 1/16"	7 1/2"	3"	4 3/4"	127 CU. IN.
4 1/2"	6"	45215	7 7/8"	3 5/16"	2 5/16"	8"	3 1/4"	3 1/4"	110 CU. IN.
4 1/2"	9"	45216	8 7/8"	4 7/16"	2 5/16"	8"	3 1/4"	4 1/4"	130 CU. IN.

CONFIDENTIAL

NOTE -

A TOLERANCE OF 2% PLUS OR MINUS WILL BE ALLOWED ON ALL DIMENSIONS OF 4" AND OVER, AND 3% PLUS OR MINUS ON ALL DIMENSIONS UNDER 4" UNLESS OTHERWISE NOTED.

DWN. BY JK	CHKD. EBS	INSULATION DETAILS	SCALE NTS	INCHES = 1 FOOT
DATE 3-26-59	APPD. REL		28426	A-0

IPGD DIV. - LOCKED DRAWER DRAWING

60 IPGD

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BOILER DIVISION

REFRACTORIES - TILES

4Y(IPGD)

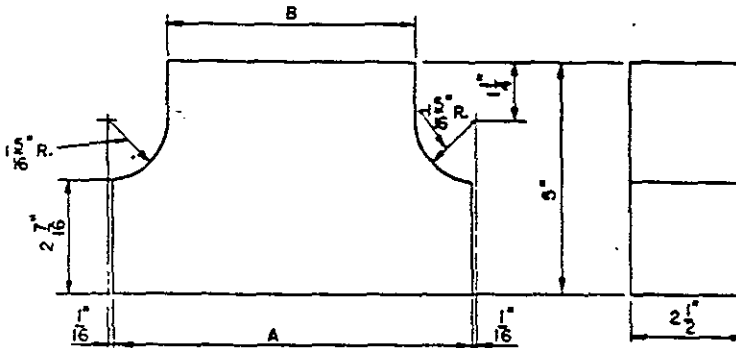
4Y211

2/12-12-83

EFF. R - 538

"T" TILES FOR 2 1/2" WALL TUBES

REVISIONS		MICRO-FILM
DASH	DESCRIPTION	DRG.



USED FOR TUBE CTRS.	PATTERN NO.	A	B	VOLUME
6"	45201	5 7/8"	3 1/2"	60 CU. IN.
7"	45202	6 7/8"	4 1/8"	72 CU. IN.
8"	45203	7 7/8"	5 3/8"	85 CU. IN.
9"	45204	8 7/8"	6 3/8"	97 CU. IN.

CONFIDENTIAL

NOTE -

A TOLERANCE OF 2% PLUS OR MINUS WILL BE ALLOWED ON ALL DIMENSIONS OF 4" AND OVER AND 3% PLUS OR MINUS ON ALL DIMENSIONS UNDER 4" UNLESS OTHERWISE NOTED.

DWN. BY JK	CHKD. EBS	INSULATION DETAILS	SCALE NTS	INCHES = 1 FOOT
DATE 3-30-59	APPR. REL		28427	A-0

FORM 808-8

LOUEN DRAWING - IEGD-DIV.

GO

IPGD

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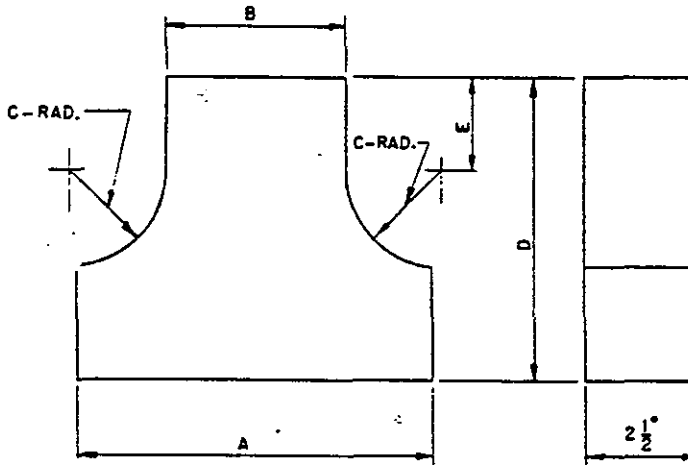
THE BABCOCK & WILCOX COMPANY
BOILER DIVISION

REFRACATORIES - TILES

4Y(EPGD)
AY211
3/12-12.83

"T" TILE

REVISIONS		MICRO-FILM
DATE	DESCRIPTION	ORIG.



CONFIDENTIAL

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USED FOR TUBES		PATTERN NO.	A	B	C	D	E	VOLUME
DIA.	CTRS.							
4"	7"	B-65100	6 1/4	2 7/8	2 1/8	6 1/2	2"	71 CU. IN.
4"	12"	B-65606	11 1/4	7 1/8	2 1/8	5"	2"	120 CU. IN.
3"	12"	B-65607	11 1/4	8 7/8	1 9/16	4 1/2	1 1/2	112 CU. IN.
3"	12"	B-65686	11 7/8	8 7/8	1 9/16	5 1/2	1 1/2	150 CU. IN.
3"	6"	B-65687	5 7/8	2 7/8	1 9/16	4"	0"	58 CU. IN.
4"	8"	B-65688	7 7/8	3 7/8	2 1/8	5"	2"	75 CU. IN.
2 1/2"	5"	4124 BA	4 7/8	2 3/8	1 5/16	3 3/4	0"	40 CU. IN.

NOTE -

A TOLERANCE OF 2% PLUS OR MINUS WILL BE ALLOWED ON ALL DIMENSIONS OF 4" & OVER, AND 3% PLUS OR MINUS ON ALL DIMENSIONS UNDER 4" UNLESS OTHERWISE NOTED.

DWN. BY JK	CHKD. EBS	INSULATION DETAILS	SCALE NTS	INCHES = 1 FOOT
DATE 3-30-59	APPD. REL		28428	A-0

LOCKED DRAWER DRAWING IPGD DIV. IPGD

THE BABCOCK & WILCOX COMPANY

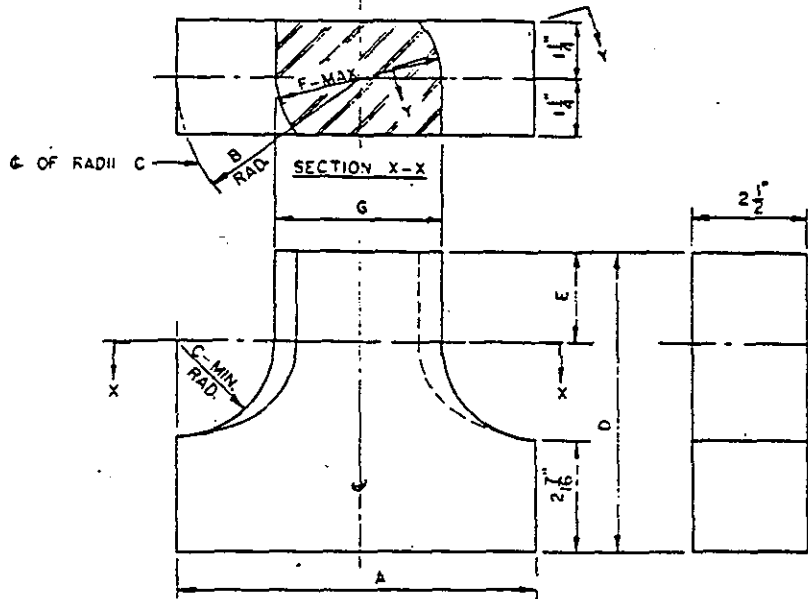
BOILER DIVISION

REFRATORIES - TILES

4Y(IPGD)
4Y211
4/12-12-83

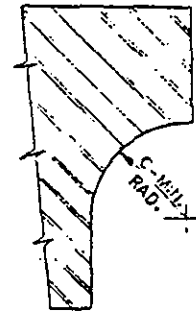
"T" TILES FOR 2 1/2", 3", 4", & 4 1/2" DOUBLE ROW WALL TUBES

REVISIONS		MICRO-FILM
DATE	DESCRIPTION	ORIG.



EFF. R-5339

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SECTION Y-Y

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DO NOT SCALE—USE DIMENSIONS ONLY

USED FOR TUBES		PATTERN NO.	A	B	C MIN.	D	E	F MAX.	G	VOLUME
DIA.	CTRS.									
3"	6"	45217	5 7/8"	2 5/16"	1 9/16"	5 1/2"	1 1/2"	2 3/4"	2 3/4"	58 CU. IN.
3"	8"	45224	7 7/8"	3 5/16"	1 9/16"	5 1/2"	1 1/2"	4 1/4"	4 1/4"	86 CU. IN.
4"	7"	45218	6 7/8"	3 7/16"	2 1/16"	6 1/2"	2"	2 3/4"	2 3/4"	73 CU. IN.
4"	8"	45219	7 7/8"	3 5/16"	2 1/16"	6 1/2"	2"	3 1/4"	3 1/4"	89 CU. IN.
4"	9"	45220	8 7/8"	4 7/16"	2 1/16"	6 1/2"	2"	4 1/4"	4 1/4"	105 CU. IN.
4 1/2"	8"	45221	7 7/8"	3 5/16"	2 1/16"	7"	2 1/4"	3 1/4"	3 1/4"	90 CU. IN.
4 1/2"	9"	45222	8 7/8"	4 7/16"	2 5/16"	7"	2 1/4"	4 1/4"	4 1/4"	107 CU. IN.
2 1/2"	8"	45225	7 7/8"	3 5/16"	1 5/16"	5"	1 1/4"	5 1/4"	5 1/4"	83 CU. IN.

NOTE -

A TOLERANCE OF 2% PLUS OR MINUS WILL BE ALLOWED ON ALL DIMENSIONS OF 4" AND OVER, AND 3% PLUS OR MINUS ON ALL DIMENSIONS UNDER 4" UNLESS OTHERWISE NOTED.

DWN. BY JK	CHK'D. EBS	INSULATION DETAILS	SCALE N.T.S.	INCHES = 1 FOOT
DATE 3-26-59	APPR. REL		28429	A-0

FORM 5000-27

LOCKED DRAWER DRAWING

60 IPGD ALPGD

THE BABCOCK & WILCOX COMPANY

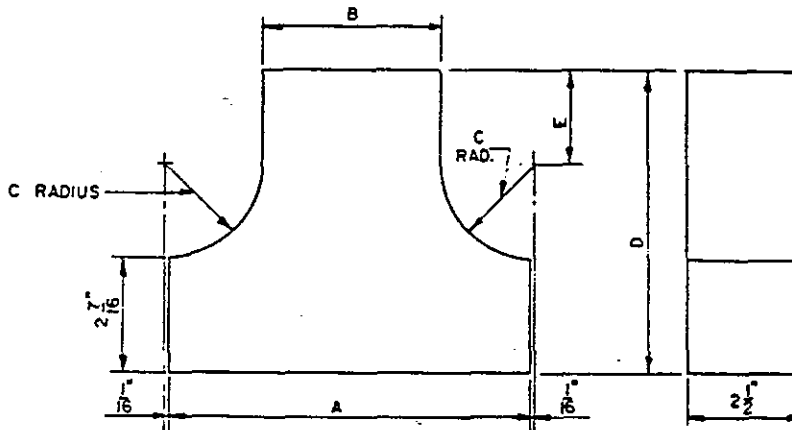
BOILER DIVISION

REFRACTORIES - TILES

4Y(IPGD)
4Y211
5/12-12-83

"T" TILES FOR 3", 4", & 4 1/2" WALL TUBES

REVISIONS		MICRO-FILM
DASH	DESCRIPTION	ORIG.



EFF. R - 5369

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DO NOT SCALE—USE DIMENSIONS ONLY

USED FOR TUBES		PATTERN NO.	A	B	C	D	E	VOLUME
DIA.	CTRS.							
3"	6"	45205	5 7/8"	2 1/8"	1 9/16"	5 1/2"	1 1/2"	60 CU. IN.
4"	7"	45206	6 7/8"	2 7/8"	2 1/16"	6 1/2"	2"	75 CU. IN.
4"	8"	45207	7 7/8"	3 7/8"	2 1/16"	6 1/2"	2"	91 CU. IN.
4"	9"	45208	8 7/8"	4 7/8"	2 1/16"	6 1/2"	2"	107 CU. IN.
4 1/2"	8"	45209	7 7/8"	3 3/8"	2 5/16"	7"	2 1/4"	92 CU. IN.
4 1/2"	9"	45210	8 7/8"	4 3/8"	2 5/16"	7"	2 1/4"	109 CU. IN.
3"	8"	45223	7 7/8"	1 7/8"	1 9/16"	5 1/2"	1 1/2"	88 CU. IN.

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LOCKED DRAWER DRAWING

NOTE -

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DWN. BY JK	CHKD. EBS	INSULATION DETAILS	SCALE NTS	INCHES = 1 FOOT
DATE 3-27-59	APPD. REL		28430	A-0

FORM 800-88

IPGD DIV.

60

IPGD

BABCOCK & WILCOX
INDUSTRIAL POWER GENERATION DIVISION

4Y(IPGD)
4Y22
1/12-12-S3

BRICKWORK - REFRACTORY
INSULATING FIREBRICK

The industrial boilers of Babcock & Wilcox may require insulating firebrick for the following applications:

1. Gas and Oil Fired Units - Ash Hopper

The ash hoppers of a gas and oil fired units are lined with 2 layers of insulating firebrick (B&W K20 or equivalent) which, in turn, are covered with 1 layer of #1 Firebrick (B&W Firebrick PCE 31-32 or equivalent).

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1/12-12-S3

4Y(IPGD)
4Y22
2/12-12-83-

BABCOCK & WILCOX
INDUSTRIAL POWER GENERATION DIVISION

BRICKWORK - REFRACTORY
INSULATING FIREBRICK

B&W insulating firebrick

Lightweight B&W insulating firebrick offer the low heat conductivity of efficient insulation plus the ability to withstand direct exposure to furnace heat. Seven types are available for service up to 3250F.

Insulating firebrick series	K*20	K*23	K*26 LI	K*28	K*30	K*3000	InsulCor*
Service temperatures, F							
Exposed	2000	2300	2600	2800	2900	3000	3250
Backup	2000	2300	2600	2800	2900	3000	3250
Density, avg (ASTM C 134-70)	1.7	1.8	2.8	3.0	3.0	3.4	4.8
Lb/9" straight	29	31	48	51	51	58	82
Lb/Cu ft	2750	2750	3190	3190	3190	3350	3350
Melting point, F	110	140	160	210	240	260	500
Modulus of rupture, psi (ASTM C 93-67)	110	145	170	220	295	275	1000
Cold crushing strength, psi (ASTM C 93-67)							
Permanent linear change, % (ASTM C 210-68)							
Fired @ 1950F	0	-	-	-	-	-	-
@ 2250F	-	0	-	-	-	-	-
@ 2450F	-	-	-0.1	-	-	-	-
@ 2750F	-	-	-	-0.6	-	-	-
@ 2800F	-	-	-	-	-0.5*	-	-
@ 2950F	-	-	-	-	-	-0.6	-
@ 3250F	-	-	-	-	-	-	+0.4
Thermal conductivity, BTU*in./hr*in. ² *F (ASTM C 182-72)							
Mean temperature @ 500F	0.8	0.9	1.7	1.7	2.0	2.1	6.0
@ 1000F	1.0	1.1	1.9	2.0	2.4	2.4	5.9
@ 1500F	1.2	1.3	2.2	2.3	3.0	2.8	6.3
@ 2000F	-	1.6	2.7	2.9	3.8	3.4	7.3
@ 2400F	-	-	-	-	-	4.0	8.4
Deformation under hot load, % @ 10 psi (per ASTM C 16-77)							
1 1/2 hr @ 2000F	0	-	-	-	-	-	-
1 1/2 hr @ 2200F	-	0.1	0.2	0.2	0.2	-	-
1 1/2 hr @ 2640F	-	-	-	-	-	0.5	-
12.5 psi 1 1/2 hr @ 2730F	-	-	-	-	-	-	0.1
Chemical analysis, % (ASTM C 573-70)							
Alumina Al ₂ O ₃	39	39	46	46	46	64	77
Silica SiO ₂	44	44	52	52	52	34	21
Ferric oxide Fe ₂ O ₃	0.7	0.6	1.0	1.0	0.9	0.6	0.4
Titanium oxide TiO ₂	1.1	1.1	1.4	1.4	1.4	0.7	0.6
Calcium oxide CaO	15.0	14.4	0.3	0.3	0.5	0.3	0.1
Magnesium oxide MgO	0.1	0.1	0.1	0.1	0.1	Trace	0.1
Alkalies, as Na ₂ O	0.3	0.4	0.3	0.3	0.4	0.4	0.3
Coefficient of reversible thermal expansion, in./in F	3.0x10 ⁻⁶	3.0x10 ⁻⁶	2.9x10 ⁻⁶	2.9x10 ⁻⁶	2.9x10 ⁻⁶	2.9x10 ⁻⁶	3.8x10 ⁻⁶
Color code	Green	Red	Brown	Orange	Black	Purple	(None)

Data are average results of tests conducted under standard procedures and are subject to variation. Results should not be used for specification purposes.

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BABCOCK & WILCOX
INDUSTRIAL POWER GENERATION DIVISION

4Y(IPGD)
4Y22
3/12-12-S3

BRICKWORK - REFRACTORY
INSULATING FIREBRICK

RECOMMENDED INITIAL CURING AND FIRING SCHEDULE OF INSULATION FIREBRICK

1. Insulating Firebrick Structures:

to 13-1/2" thickness, 75°F per hour to operating temperature

above 13-1/2" thickness, 50°F per hour to operating temperature

or: 75°F per hour to 1200 F

Hold 8 hours at 1200 F

75°F per hour to 1800 F

Hold 8 hours at 1800 F

75°F per hour to operating temperature

771-5849

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BABCOCK & WILCOX
INDUSTRIAL POWER GENERATION DIVISION

4Y(IPGD)
4Y23
1/12-12-83

BRICKWORK - REFRACTORY
INSULATING CASTABLES

Insulating castables may be used for special cases where insulating firebrick does not conform to the desired curvature or shape. Information is supplied to assist anyone considering a special application of these materials.

1. Kaolite 2200 HS & Kaolite 2200

Stoker extension (1K2542-3Y)
Protection for observation doors (4Y-6A-8U3)
A.H. at tube ferrules

2. Cease Fire 2000

CONFIDENTIAL

Normally used for replacement of block insulation or castable.

RAPID FIRE TECHNOLOGYTM

RFT can be incorporated in a number of insulation castables. See 4Y(IPGD)4Y26 for a brief description of RFT. Contact B&W Insulating Products Division for additional information.

See 4Y(IPGD)-4Y26 for recommended water additions, castable averages, and quantity of metal fibers (when used).

BRICKWORK - REFRACTORY
INSULATING CASTABLES

INSTRUCTIONS FOR USING B&W KAOLITE 2000-HS, KAOLITE 2200 & KAOLITE 2300-L1

These materials are recommended for casting, gunning and plastering.

Highest strength is obtained with refractory castables by using the least amount of mixing water which will allow thorough working of the material into place.

CONFIDENTIAL

1. Hand Rodding, Tamping and Casting

Best results will be obtained by using a mechanical mixer. When machine mixed (paddle type mixer best suited), add one-half recommended amount of water to mixer before adding dry material. Place contents of bag (40 lbs.) directly in mixer and add remaining water immediately and mix 6 minutes. When hand mixed, contents of bag should be dry mixed on a clean dry surface before adding water. Place material within 30 minutes after mixing. Forms may be removed eight hours after placement.

Additional water will be required to achieve satisfactory consistencies with shorter mixing times, and correspondingly lower strengths can be expected. No more than 12 U.S. quarts of clean water should be used under any conditions. Strengths will be reduced substantially if 13 U.S. quarts of mix water are used.

The following amount of clean water is recommended for this method of placement:

HAND RODDING, TAMPING
AND CASTING: 11.5 to 12 U.S. qts./bag (40 lbs.)

INTERNAL VIBRATION: 11.5 to 12 U.S. qts./bag (40 lbs.)

2. Gunning

Follow regular approved methods. To reduce rebound and dust, castable should be dampened uniformly with not more than 4 U.S. quarts of clean water per bag (40 lbs.) by machine mixing (paddle type mixer best suited) or by hand before placing in gun. Add required water at nozzle for effective placement. Suggested air pressure at nozzle should be 15 to 20 psi.

3. Plastering

Add sufficient amount of water for proper consistency. Follow recommended mixing instructions.

Use watertight forms. When placing against porous surfaces, waterproof the surface.

For maximum strength, allow 24 hours curing in damper atmosphere before first heat up. Heat slowing the first time.

BRICKWORK - REFRACTORY
INSULATING CASTABLES

INSTRUCTIONS FOR USING B&W KAOLITE 2200-HS (CONT'D)

3. Plastering

Add sufficient amount of water for proper consistency. Follow recommended mixing instructions.

Use watertight forms. When placing against porous surfaces, waterproof the surfaces.

For maximum strength, allow 24 hours curing in damp atmosphere before first heat-up. Heat slowly the first time.

CONFIDENTIAL

4. Caution

Store in warm, dry place. Keep freshly placed castable warm during cold weather.

For details on temperature requirements and on other questions related to placement, contact the B&W Insulating Products Division.

INSTRUCTIONS FOR USING B&W KAOLITE 2500-LI

B&W Kaolite 2500-LI is a 2500°F, low iron, insulating castable recommended for casting, gunning and plastering.

Highest strength is obtained with refractory castables by using the least amount of mixing water which will allow thorough working of the material into place.

1. Hand Rodding, Tamping and Casting

Best results will be obtained by using a mechanical mixer such as a mortar mixer. When machine mixed (paddle type mixer best suited), add one-half recommended amount of water to mixer before adding dry material. Place contents of bag (50 lbs.) directly in mixer and add remaining water immediately and mix for 6 minutes. When hand mixed, contents of bag should be dry mixed on a clean dry surface before adding water. Place material within 30 minutes after mixing. Forms may be removed eight hours after placement.

Additional water will be required to achieve satisfactory consistencies with shorter mixing times, and correspondingly lower strengths can be expected. No more than 12 U.S. quarts of clean water should be used under any conditions. Strengths will be reduced substantially if 13 U.S. quarts of mix water are used.

BABCOCK & WILCOX
INDUSTRIAL POWER GENERATION DIVISION

4Y(IPGD)
4Y23
7/12-12-83

BRICKWORK - REFRACTORY
INSULATING CASTABLES

INSTRUCTIONS FOR USING B&W KAOLITE 2500-HS (CONT'D)

1. Hand Rodding, Tamping and Casting

Best results will be obtained by using a mechanical mixer such as a mortar mixer. When machine mixed (paddle type mixer best suited), add one-half recommended amount of water to mixer before adding dry material. Place contents of bag (75 lbs.) directly in mixer and add remaining water immediately and mix for 6 minutes. When hand mixed, contents of bag should be dry mixed on a clean dry surface before adding water. Place material within 30 minutes after mixing. Forms may be removed eight hours after placement.

Additional water will be required to achieve satisfactory consistencies with shorter mixing times, and correspondingly lower strengths can be expected. No more than 14 U.S. quarts of clean water should be used under any conditions. Strengths will be reduced substantially if 15 U.S. quarts of mix water are used.

The following amount of clean water is recommended for this method of placement:

HAND RODDING, TAMPING AND
CASTING:

13 to 14 U.S. qts./bag (75 lbs.)

INTERNAL VIBRATION:

13 to 14 U.S. qts./bag (75 lbs.)

2. Gunning

Follow regular approved methods. To reduce rebound and dust, the castable should be dampened uniformly with not more than 3 U.S. quarts of clean water per bag (75 lbs.) by machine mixing (paddle type mixer best suited) or by hand before placing in gun. Add required water at nozzle for effective placement. Suggested air pressure should be 15 to 20 psi.

3. Plastering

Add sufficient amount of water for proper consistency. Follow recommended mixing instructions.

Use watertight forms. When placing against porous surfaces, waterproof the surfaces.

For maximum strength, allow 24 hours curing in a damper atmosphere before the first heat up. Heat slowly the first time.

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BABCOCK & WILCOX
INDUSTRIAL POWER GENERATION DIVISION

4Y(IPGD)
4Y23
9/12-12-83

BRICKWORK - REFRACTORY
INSULATING CASTABLES

INSTRUCTIONS FOR USING B&W KAOLITE 2800 (CONT'D)

CONFIDENTIAL

3. Plastering

Add sufficient amount of water for proper consistency. Follow recommended mixing instructions.

Use watertight forms. When placing against porous surfaces, waterproof the surfaces.

For maximum strength, allow 24 hours curing in damp atmosphere before first heat up. Heat slowly the first time.

4. Caution

Store in warm, dry place. Keep freshly placed castable warm during cold weather.

For details on temperature requirements and on other questions related to placement, contact the B&W Insulating Products Division.

INSTRUCTIONS FOR USING B&W KAOLITE 3300

B&W Kaolite 3300 is recommended for casting and plastering only. It is not recommended for gunning.

Highest strength is obtained with refractory castables by using the least amount of mixing water which will allow thorough working of the material into place.

1. Hand Rodding and Tamping

Best results will be obtained by using a mechanical mixer such as a mortar mixer. When machine mixed (paddle type mixer best suited), add one-half recommended amount of water to mixer before adding dry material. Place contents of bag directly in mixer and add remaining water immediately and mix for 3 minutes. When hand mixed, contents of bag should be dry mixed on a clean dry surface before adding water. Place material within 30 minutes after mixing. Forms may be removed eight hours after placing.

Additional water will be required to achieve satisfactory consistencies with shorter mixing times, and correspondingly lower strengths can be expected. No more than 5 U.S. quarts of water should be used under any conditions. Strengths will be reduced substantially if 6 U.S. quarts of mix water are used.

BABCOCK & WILCOX
INDUSTRIAL POWER GENERATION DIVISION

4Y(IPGD)
4Y23
11/12-12-83

BRICKWORK - REFRACTORY
INSULATING CASTABLES

B&W CEASE-FIRE 2000 (CONT'D)

Chemical Analysis

Alumina	Al_2O_3	31.0
Silica	SiO_2	31.0
Ferric Oxide	Fe_2O_3	0.8
Titanium Oxide	TiO_2	1.2
Magnesium Oxide	MgO	0.2
Calcium Oxide	CaO	11.0
Alkalies, As	$Na_2O + K_2O$	0.1
Phosphorous Pentaoxide	P_2O_5	14.7
Loss in Ignition	L.O.I.	10.0

Average Foam Characteristics

Rise Time, Seconds	30 - 90
Set Time, Seconds	30 - 120
Volumetric Expansion, %	125 - 150

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B&W Cease Fire 2000 is a unique two component inorganic refractory foam that permits repair or replacement of backup insulation while a unit is still operating, thus reducing downtime and saving energy. In one of the components a dry powder is mixed with water to form a slurry mixture which when mixed with mild phosphoric acid reacts and forms an insulation inorganic foam.

The foam rise time is 30 to 90 seconds, and sets between 30 and 120 seconds, while expanding to more than twice its original volume. There is no need to allow for drying or curing time. Should forms be required, they can be removed almost immediately because Cease Fire sets so quickly.

The structure of Cease Fire results in low thermal conductivity. And its inherent semi-resilience lets it "give" as temperature fluctuate, instead of cracking.

It is pumped from a specially designed placing machine through nipples located on the furnace casing, filling all cavities.

Although Cease Fire was introduced for replacement of damaged refractory or insulation, it can also be used on new units in hard to get at areas which require an insulating protection.

B&W CEASE-FIRETM FAST AIDE KIT

The Cease-Fire Fast Aide Kit is a quick fix inorganic foam designed for small industrial hot spot repair. The Cease-Fire Fast Aide Kit is a two component product consisting of enough material to place approximately 1.3 cubic feet of Cease-Fire 2000. The product comes packaged in 6 gallon

4Y(IPGD)
4Y23
12/12-12-83-

BABCOCK & WILCOX
INDUSTRIAL POWER GENERATION DIVISION

BRICKWORK - REFRACTORY
INSULATING CASTABLES

B&W CEASE-FIRETM FAST AIDE KIT (CONT'D)

mortar drums, the two components are first removed from the drum which then acts as the mixing vessel. Water is added to the appropriate level and then the dry component is mixed to form a slurry. The second component, 75% phosphoric acid, is packaged in a one gallon cube.

The components are then automatically metered in the appropriate ratios through a specially designed peristaltic pump, the Cease-Fire Fast Aide Pump. This pump weights only 42 pounds allowing for easy transport from location to location. The Cease-Fire Fast Aide Pump comes with a standard "hand crank" drive. An optional bolt on motor assembly is also available. This pump is capable of delivering up to 1/2 gallon of foam per minute. A mixing blade suitable for use with an electric drill as well as all hoses and nozzles come complete with the Fast Aide Pump. The Cease-Fire Fast Aide Pump is sold as a separate item which is capable of delivering several of the Fast Aide Kits.

The Cease-Fire Fast Aide System is designed for those jobs where material requirements are low and it becomes cost prohibitive to bring in a contractor or dealer with larger scale placement capabilities. Areas such as burner block repair, door leaks, or other small hot spots in industrial furnaces are ideal for the Fast Aide Kit. This produce fits best the jobs in 1 to 30 cubic foot range.

CONFIDENTIAL

4Y(IPGD)
4Y24
2/12-12-83

BABCOCK & WILCOX
INDUSTRIAL POWER GENERATION DIVISION

BRICKWORK - REFRACTORY
MORTARS

AVERAGE PROPERTIES OF MORTARS

Mortars are used to bond firebrick into place or to patch.

An acceptable mortar for boilers is B&W Mulset-F (wet & dry).

Recommended Use Limit, °F 3200

Quantities Required

Lbs. per 1000 Brick

180 - 350

Lbs. Required to Brush Coat 100 Sq. Ft.

20 - 22

Type of Brick

Heavy Firebrick

Refractoriness, ASTM C-199

Fired @ 3200°F instead of the
2910°F specified, 5 hrs., soak

No fusion, bloating, or
cracking

Modulus of Rupture, psi (ASTM C-198)
Using B&W Allmul Brick

Dried @ 230°F

+ 1000 psi

Fired @ 1000°F, 5 hrs.

at all temperatures

Fired @ 2000°F, 5 hrs.

up to 3200°F

Resistance to Slag Attack
(USS ARL 1 S 64)

Excellent

Typical Chemical Analysis, % (Fired Basis)

Al ₂ O ₃	70.8
SiO ₂	23.4
Fe ₂ O ₃	1.7
TiO ₂	3.0
Alkalies	1.1

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Data are average results of control tests conducted under standard procedures and are subject to normal variations. Results should not be used for specification purposes.

AVERAGE PROPERTIES OF B&W MULSET-F MORTARS (WET & DRY)

B&W MULSET-F MORTAR is an airsetting mortar mix designed for use at temperatures up to 3200°F. It has, in addition to this unusually high use limit, excellent troweling characteristics, exhibiting a "buttery" workability. Even at consistencies considered to be at the upper limit for troweling, it will not drip or run off until the trowel is turned. Despite this characteristic, however, Mulset-F spreads easily with a minimum of loss due to run down the side of the brick. Cleaning up, or pointing time, is thus minimized.

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BRICKWORK - REFRACTORY
MORTARS

REF. 5330

AVERAGE PROPERTIES OF B&W MULSET-F MORTARS (WET & DRY) (CONT'D)

Mulset-F has shown superior resistance to attack by slag (U.S. Steel Tests) ranking above all competitive mortars tested in this respect.

Mulset-F Mortar (Wet) is furnished at a consistence suitable for troweling. Additional water, to give a dipping consistency, can be easily worked into the mortar.

Mulset-F Mortar (Dry) is supplied in bags for those who prefer the material in this form. The desired consistency can be attained by hand or machine mixing with clean water. It is not necessary to use hot or heated water for this purpose, and strength properties are developed without the necessity of having the tempered mortar stand over-night before using.

B&W SMOOTHSET MORTAR (WET & DRY)

This mortar is recommended for field mortaring of insulating firebrick suspended roofs because the very nature of this operation calls for a material which will be workable for several minutes after it is buttered on the side of the brick. Actual observation of a number of field installations, both with B&W Air-Set Mortar and with B&W Smoothset Mortar, has indicated that the Smoothset is definitely superior to the Air-Set from the standpoint of permitting an easier and better job to be performed.

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4Y(IPGD)
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BRICKWORK - REFRACTORY
PLASTIC MOLDABLES

PREFERRED PLASTIC MOLDABLES*

B&W Kromalox P (rammed)
B&W Plastic Chrome Ore (rammed)
Kaiser Kromight Gun (gunned)

APPLICATION OF PLASTIC MOLDABLES

B&W Kromalox P - General patching material
- Chemical recovery boiler walls and floor
- Water cooled burner throat
- Industrial and marine boiler studed tube walls

B&W Plastic Chrome Ore - Water cooled burner throat
- General patching material

Kaiser Kromight Gun - Chemical recovery boiler walls & floor

*ACCEPTABLE REPLACEMENT:

3000° 60% Alumina plastic (air setting)
- H-W Apache plastic CS (Harbison Walker)
- Plibrico 60° AB (Plibrico)
- Mono-60 Airset (Kaiser Refractories)
- Pyramid 60 (Interface Corporation)

Diamond Shamrock (Didier-Taylor)
Jade Plastic (A. P. Green)

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B&W KROMALOX P

3200°F Chrome alumina phosphate bonded plastic

Recommended Use Limit	3200°F
Lbs. required to place one cu. ft.	175
Density, Lb/cu. ft. (fired 2700°F)	160

<u>Condition</u> <u>(Treatment)</u>	<u>Module of</u> <u>Rupture, Psi</u> <u>(ASTM C268-70)</u>	<u>Permanent Linear</u> <u>Change, %</u> <u>(ASTM C269-70)</u>
Fired 5 Hours @ 600°F	1480 - 2160	+ 0.3
@ 1000°F	2240 - 3360	+ 0.5
@ 1800°F	2640 - 3960	+ 0.7
@ 2400°F	3280 - 4920	+ 0.9
@ 2700°F	3840 - 5760	+ 1.2

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BRICKWORK - REFRACTORIES
PLASTIC MOLDABLES

B&W KROMALOX P (CONT'D)

Chemical Analysis, % (Fired Basis) (ASTM C 573-70)	Abrasion Loss, C.C.'s (ASTM C 704) 5.5 - 7.0
---	---

Alumina	Al_2O_3	83.4
Chrome Oxide	Cr_2O_3	9.8
Silica	SiO_2	2.3
Ferric Oxide	Fe_2O_3	0.3

Phosphorous		
Penta-Oxide	P_2O_5	3.7
Alkalies, as	Na_2O	0.5

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1. Instructions for Using:

B&W Kromalox P is a high alumina refractory plastic combined with high purity chrome oxide. Kromalox P is designed for areas of excessive erosion and slag attach in the high temperature areas of cyclone fired boilers and chemical recovery boilers.

2. Application:

B&W Kromalox P is suitable for pneumatic ram placement. The ideal temperature range to place Kromalox P is above 70°F with ventilation for moisture removal. Store in a cool, dry location. Keep from freezing. Storage over 6 months is not recommended in order to maintain optimum workability characteristics.

3. Warning:

B&W Kromalox P contains polyphosphoric acid which can cause irritation to skin and severe burns to the eyes upon contact. Avoid direct contact with skin and eyes. If the content does come in contact with the skin or eyes, flush with water for 15 minutes and consult a physician for eye care at once.

4. Heat Up Rate:

For specific heat up rate or additional information consult B&W Insulating Products Division.

AVERAGE PROPERTIES OF B&W PLASTIC CHROME ORE

Recommended Use Limit, °F	3200
Bulk Density (Rammed)	
Lbs./Cu. Ft.	205 - 210
Water Content, %	7

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BRICKWORK - REFRACTORY
PLASTIC MOLDABLES

AVERAGE PROPERTIES OF B&W PLASTIC CHROME ORE (CONT'D)

Modulus of Rupture, PSI	
Fired 5 Hours @ 1500F	708
2500F	1600
Permanent Linear Shrinkage, %	
After Firing @ 1500F	1.1
2550F	1.5

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1. Composition

B&W Plastic Chrome Ore is composed primarily of high grade refractory chrome ore which is especially selected for its outstanding chemical stability and refractory properties. During processing, certain additions are made to the chrome ore to provide the proper workability and plasticity required for good ramming properties and maximum density. The additions also impart a high air-setting strength and provide strong heat-setting ability. Proper installation is essential in order to obtain best service results.

2. Packaging

B&W Plastic Chrome Ore is shipped in either 100 pound or 200 pound airtight steel drums to preserve the plasticity which is developed during manufacture.

3. Setting Characteristics

B&W Plastic Chrome Ore contains air-setting bonds that function as the product is dried. These bonds retain their strength throughout the lower temperature range until ceramic bonds begin to form.

B&W Plastic Chrome Ore develops strong ceramic bonds at temperatures above 2400°F. These ceramic bonds give B&W Plastic Chrome Ore a strong monolithic structure which is permanently retained through all subsequent temperature fluctuations.

4. Shrinkage and Expansion

B&W Plastic Chrome Ore shrinks during drying and expands during firing. The drying shrinkage and firing expansion compensate each other making it unnecessary to provide expansion joints during installation. This feature of the Plastic Chrome Ore makes possible the installation of large or small areas which will retain truly monolithic surfaces.

5. Slag Resistance

B&W Plastic Chrome Ore, which is properly installed and burned-in, is highly impervious to slag penetration and erosion. Its chemically neutral character retards reaction with all types of acid or basic slags under oxidizing or reducing conditions.

BRICKWORK - REFRACTORY
PLASTIC MOLDABLES

AVERAGE PROPERTIES OF B&W PLASTIC CHROME ORE (CONT'D)

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15. Furnace Walls of Stud Tube Construction (Cont'd)

the Plastic Chrome Ore be applied in such a way as to grip the studs and tubes tightly and also that it is thoroughly bonded together. This means that the material must be densely packed down between and behind the tubes. After B&W Plastic Chrome Ore is applied, the venting may be done with a stiff wire brush. It is to be noted that the ends of the studs are visible when the job is completed.

16. Patching

Floors should preferably be allowed to wear thin and be replaced altogether. However, should a floor of sufficient original depth wear down, it may be rebuilt if it is possible to add 3" to 4" of material to the entire surface. All slag and spalled or cracked portions should be cut away and removed to a point where the material is in sound condition. Before installing a patch, a coating of a chrome bonding mortar with good air setting qualities should be applied to the old Plastic Chrome Ore.

AVERAGE PROPERTIES OF K/R (EX B&W) - KROMIGHT-GUN (TEMPERATURE LIMITE 3100°F)

Kromight-Gun is a dry plastic similar to Plastic Chrome Ore in its air setting properties. Its chemical composition is chromium oxide. It is black in color and has sodium silicate additive for air-setting. Kromight-Gun is especially designed to cover irregular surfaces. In most instances it will be used in place of Plastic Chrome Ore on furnace walls, screens, floors, seals, and cyclones. Its adhesive power is not quite as great as that of Plastic Chrome Ore when hand applied. However, when properly mixed with the correct amount of water, it may be pounded into place with the same application rules as with Plastic Chrome Ore. It also permits substantially reduced installation costs.

1. Instructions for Using Kromight-Gun

Kromight-Gun is normally applied by means of a gun or by slap trowelling in a manner similar to a castable. When gunning this material, it should be placed with as much water as the material will absorb without slumping with the use of an extended water-Kromight-Gun mixing period as provided by the 1-1/4" nominal pipe extension detailed on B&W drawing RR4146. This way severe dusting problems will be avoided. Also, for a slap trowelling mixture, it is desirable to have it on the wet side rather than the dry side.

BRICKWORK - REFRACTORY
PLASTIC MOLDABLES

AVERAGE PROPERTIES OF K/R (EX B&W) - KROMIGHT-GUN (TEMPERATURE LIMIT
3100F) (CONT'D)

1. Instructions for Using Kromight-Gun (Cont'd) **CONFIDENTIAL**

A furnace lined with Kromight-Gun must be protected before firing as follows:

K/R Kromight-Gun will air set and the top surface will dry in a comparatively short time after installation but the portion beneath the surface will remain plastic for quite some time. Under normal conditions the material should crust up and be relatively firm in 12 hours; however, it is not unusual to take longer. Walking or resting tools, ladders, etc., on the dried surface while in this condition will produce cracks and depressions in the upper surface which will permit slag penetration, shorten the life of the installation, and close off the vent holes causing the surface to peel upon heating. Even placing boards on the floor will not protect it if traffic over the floor is permitted before it has deeply air set.

Firing a furnace with a Kromight-Gun lining should be as follows:

Provided that a refractory has been thorough vented, the best installation will result if heat is applied immediately upon completion. Since on most jobs this is impossible and the refractory is allowed to stand for a considerable length of time, shrinkage cracks will develop. If these cracks are large (over 1/8"), it is necessary to fill them before applying heat with a chrome bonding mortar having good air-setting qualities. Smaller cracks (under 1/8") may be neglected since they will close up when heat is applied.

The furnace temperature should not be increased too rapidly. If the moisture in the refractory changes into steam too rapidly, it will not be able to escape through the vent holes quickly enough, resulting in a blistered or bloated surface. For the average furnace, the refractory should be thoroughly dried out if the temperature is brought up to about 500F and held there for 6 to 8 hours and then raised to about 1200F and held there for 3 to 4 hours. After drying out by the above procedure the refractory must be "burned-in" at the final operating temperature of the furnace.

The period of the "burning-in" process should be a minimum of 5 hours. The Kromight-Gun cannot be overfired by increasing the "burning-in" temperature. Actually the structure of the refractory is improved if "burned-in" at temperatures somewhat above the maximum operating temperature of the furnace provided other components and material in the boiler will permit this overfiring.

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BRICKWORK - REFRACTORY
PLASTIC MOLDABLES

AVERAGE PROPERTIES OF K/R (EX B&W) - KROMIGHT-GUN (TEMPERATURE LIMIT
3100°F) (CONT'D)

2. Gunning

Follow regular approved methods. To reduce rebound and dust, castable may be dampened uniformly with not more than 1/2 quart of water per bag by hand or machine mixing before placing in gun. Add required water at nozzle for effective placement.

3. Patching or Slap Trowelling

Add approximately 3 U.S. quarts of water per 100 lbs. A machine mixer should be used, mixing only enough material for work immediately at hand.

This is an air setting material.

When applying by hand, avoid slicked surface. Stipple with stiff wire brush to leave rough surface.

CAUTION

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Store only in dry place.

During cold weather, keep installed material from freezing until thoroughly dried out.

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BRICKWORK - REFRACTORY
CASTABLES

Refractory castables are used on industrial boilers to serve as a seal where gas flow is not desired or to serve as an insulator where high heat absorption may overheat metals. The following areas may require refractories as noted:

1. Kaocrete B - Behind flat stud tube walls (4Y-2R01)
 - Thermal barriers on flat stud tube wall or membrane walls (4Y-2R03) (4Y-6A-3Y1)
 - Seal between roof and S.H. tubes (4Y-2R06)
 - Burner seals (4Y-5R) (4Y-5R-4Y2)
 - Access doors (4Y-6A-8U3)
 - Vestibule seals
 - Furnace arch seals (4Y-2R03)
 - Seal between furnace S.W. and roof (1J21-3Y)
 - Wall boxes - access doors - soot blowers (4Y-6A-8U) (4Y-6A-8U3) (4Y-6A-12R1)
2. Kaocrete D - Ash hopper lining (4Y-11U) (Also see 4Y-4Y21, Page 1)
 - (Trowelled - Penthouse roof seals
 - or - Furnace roof seals
 - casting) - Stoker front (1K2542-3-3Y)
3. Kaocrete HS - Ash hopper lining (4Y-11U) (Also see 4Y-4Y21, Page 1)
 - (Gunned or - Furnace roof seals
 - casting) - Stack lining (low acid) (4Y-13R)
 - Flue and duct lining (4Y-11R)
4. Kaocast - Burner throat in refractory wall

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RAPID FIRE TECHNOLOGYTM

Allows refractory castables to be heated safely from the cured state to operating temperatures without the risk of explosive spalling. This allows boilers to be brought on line much quicker.

RFT is available in most B&W dense castables and a number of insulating castable for both casting and gunning, and is installed as ordinary castables. Those formulated for casting normally have a slightly lower placed density than that of ordinary castables, while the density of those for gunning is slightly higher. RFT has a maximum temperature of 3300°F.

Contact B&W Insulating Products Division for additional information.

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INDUSTRIAL POWER GENERATION DIVISION
BRICKWORK - REFRACTORY
B&W DENSE CASTABLES
AVERAGE PROPERTIES

Revised
RS447
RS490

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SEE 3Y-4Y26 PAGES 3, 4, & 5
B&W KROMACOX C RPT

Material	A.I.A.P.	B	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR	CS	CT	CU	CV	CW	CX	CY	CZ	DA	DB	DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR	DS	DT	DU	DV	DW	DX	DY	DZ	EA	EB	EC	ED	EE	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP	EQ	ER	ES	ET	EU	EV	EW	EX	EY	EZ	FA	FB	FC	FD	FE	FF	FG	FH	FI	FJ	FK	FL	FM	FN	FO	FP	FQ	FR	FS	FT	FU	FV	FW	FX	FY	FZ	GA	GB	GC	GD	GE	GF	GG	GH	GI	GJ	GK	GL	GM	GN	GO	GP	GQ	GR	GS	GT	GU	GV	GW	GX	GY	GZ	HA	HB	HC	HD	HE	HF	HG	HH	HI	HJ	HK	HL	HM	HN	HO	HP	HQ	HR	HS	HT	HU	HV	HW	HX	HY	HZ	IA	IB	IC	ID	IE	IF	IG	IH	II	IJ	IK	IL	IM	IN	IO	IP	IQ	IR
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Water requirements indicate are given as a guide. Actual water required may be higher in dry conditions. Contact your BAWA representative for assistance.

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BRICKWORK - REFRACTORY
CASTABLES

B&W KAOCRETE B

B&W Kaocrete B is a 2300°F castable suitable for casting, gunning or plastering.

1. Instructions for Using Casting

Highest strength is obtained with castable refractory by using the least amount of clean mixing water which will allow thorough working of material into place with a vibrator or by rodding. A mechanical mixer is required for proper placement (paddle type mortar mixer best suited). After adding the recommended amount of water to achieve a ball-in-hand consistency, mix for 3 minutes. Place material within 30 minutes after mixing.

2. Gunning

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Use suitable gunite equipment. To reduce rebound and dust, material should be predampened uniformly with approximately 2 U.S. quarts of clean water per 100# bag in a mechanical mixer before placing into gun. Add required water at nozzle for effective placement.

3. Precautions

Use watertight forms. Waterproof porous surfaces.

For maximum strength, cure 24 hours under damp conditions before initial heat-up. Keep freshly placed castable warm during cold weather, ideally between 70°F and 80°F.

For standard castables, heat slowly the first time. RFT™ castables can be heated initially at much faster rates than standard castables. Consult B&W Insulating Products Division for any specific heat-up schedule. Store bagged castables in a warm, dry place.

B&W KAOCRETE D

B&W Kaocrete D is a 2500°F castable suitable for casting only.

1. Instructions for Using Casting

Highest strength is obtained with castable refractory by using the least amount of clean mixing water which will allow thorough working of material into place with a vibrator or by rodding. A mechanical mixer is required for proper placement (paddle type mortar mixer best suited). After adding the recommended amount of water to achieve a ball-in-hand consistency, mix for 3 minutes. Place material within 30 minutes after mixing.

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BRICKWORK - REFRACTORY
CASTABLES

B&W KAOCRETE D (CONT'D)

2. Other

Material can be rammed into place by adding a sufficient amount of water for proper consistency.

3. Precautions

Use watertight forms. Waterproof porous surfaces.

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For maximum strength, cure 24 hours under damp conditions before initial heat-up. Keep freshly placed castable warm during cold weather, ideally between 70°F and 80°F.

For standard castables, heat slowly the first time. RFTTM castables can be heated initially at much faster rates than standard castables. Consult B&W Insulating Products Division for any specific heat-up schedule. Store bagged castables in a warm, dry place.

B&W KAOCRETE HS

B&W Kaocrete HS is 2600°F castable suitable for casting and gunning

1. Instructions for Using Casting

Highest strength is obtained with castable refractory by using the least amount of clean mixing water which will allow thorough working of material into place with a vibrator or by rodding. A mechanical mixer is required for proper placement (paddle type mortar mixer best suited). After adding the recommended amount of water to achieve a ball-in-hand consistency, mix for 3 minutes. Place material within 30 minutes after mixing.

2. Gunning

Use suitable gunite equipment. To reduce rebound and dust, material should be predampened uniformly with approximately 1 U.S. quart of clean water per 100# bag in a mechanical mixer before placing into gun. Add required water at nozzle for effective placement.

3. Other

Material can be rammed or plastered into place by adding a sufficient amount of water for proper consistency.

BRICKWORK - REFRACTORY
CASTABLES

B&W KAOCRETE HS (CONT'D)

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4. Precautions

Use watertight forms. Waterproof porous surfaces.

For maximum strength, cure 24 hours under damp conditions before initial heat-up. Keep freshly placed castable warm during cold weather, ideally between 70°F and 80°F.

For standard castables, heat slowly the first time. RFT™ castables can be heated initially at much faster rates than standard castables. Consult B&W Insulating Products Division for any specific heat-up schedule. Store bagged castables in a warm, dry place.

B&W KAOCAST

B&W Kaocast is a 3000°F castable suitable for casting and gunning.

1. Instructions for Using Casting

Highest strength is obtained with castable refractory by using the least amount of clean mixing water which will allow thorough working of material into place with a vibrator or by rodding. A mechanical mixer is required for proper placement (paddle type mortar mixer best suited). After adding the recommended amount of water to achieve a ball-in-hand consistency, mix for 3 minutes. Place material within 30 minutes after mixing.

2. Gunning

Use suitable gunite equipment. To reduce rebound and dust, material should be predampened uniformly with approximately 1 U.S. quart of clean water per 100# bag in a mechanical mixer before placing into gun. Add required water at nozzle for effective placement.

3. Other

Material can be rammed into place by adding a sufficient amount of water for proper consistency.

4. Precautions

Use watertight forms. Waterproof porous surfaces.

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BRICKWORK - REFRACTORY
CASTABLES

B&W KAOGUN - BF (CONT'D)

4. Curing - For maximum strength, material should be cured for 18 - 24 hours in a damp atmosphere.
5. Heating - Heat slowing the first time.
6. Caution

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Store in warm, dry place.

During cold weather keep wet castable warm.

FACTORS AFFECTING THE USE OF CASTABLE REFRACTORIES

This Product Information Sheet has been prepared in order to cover in one place for ready reference the majority of information affecting the proper use of castable refractories.

Failure to understand some of the fundamental facts about castable refractories has led to installations in which the material has failed to perform as expected because basic considerations were ignored or violated.

Those factors which are considered to be of prime importance are covered in this Product Information Sheet.

1. Water Content

Of all the variable factors involved in the placement of castables, proper control of water content with prompt thorough working into place is probably of greatest importance. Appendix A gives recommended water additions for our complete line of castables.

2. Forms

Watertight forms, suitably braced, should be used whenever it is desired to contain the refractory castable until it take its hydraulic set. Either metal or wood may be used for the forms. The forms should be lubricated with a form-oil developed for use with wood or metal forms.

Because of ease of installation it is suggested that sectionalized forms be used of type which will permit the height to be built up in successive convenient increments as the work proceeds.

Particular care should be taken during the placement behind forms to insure that all irregular sections or corners are completely filled. by adding all fresh material from one side of an obstacle and working under and around it the tendency towards forming air pockets under the obstacle is reduced.

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BRICKWORK - REFRACTORY
CASTABLES

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FACTORS AFFECTING THE USE OF CASTABLE REFRACTORIES (CONT'D)

3. Anchors and Reinforcement

Various methods and arrangements of anchors are used with castable constructions. These may consist of fired refractory anchor tile, various designs of straight or bent studs and rods and internal reinforcing such as chickenwire, woven wire mesh or metal fibers.

Fired refractory anchor tile should be held firmly in place during placement of the castable refractory. This may be done by means of wooden wedges or by clamping the holders to the tile with a light hammer blow. Anchor tiles are placed vertically with castables to minimize the tendency towards air pocket formation under the tile.

When metallic anchors are used they should be coated with a high melt roofing asphalt or paraffin. The purpose of this coating is to prevent bonding of the castable to the metal anchor and to provide a space for differential expansion since the coating will volatilize or melt when the anchors get hot. If a coating material is not available the metal anchors may be wrapped with a few turns of oiled paper, waterproof paper, polyethylene sheets or a cellophane type tape. It is particularly important to coat the ends of the anchors to provide expansion space.

Studs on boiler tubes should not be coated in this manner.

The use of internal metallic reinforcing such as expanded metal lath and welded wire road mesh is often undesirable. There is no cooling of this reinforcing material and it achieves the same temperature as the surrounding castable. Since the expansion coefficient of the metal is normally at least twice, and in case of stainless steels, perhaps four times as great as that of the castable its expansion builds up stresses which tend to form cleavage planes. As the service temperature increases the differential expansion becomes greater. A preferred method is to carry anchors from the furnace casing (or equivalent) into the castable. The castable is then tied to a metallic surface exposed to cooling air having a total expansion comparable to that of the main portion of the castable itself. If an internal mesh is required for a specific reason, such as a thin duct or stack lining, chickenwire or woven wire mesh is recommended with a 1-1/2 inch - 2 inch mesh of approximately 18 gauge. Such a mesh is so formed that it is not able to exert the same type of positive expansion stresses as expanded metal lath or welded road mesh and therefore does not have a pronounced tendency to form a cleavage plane. When metal fibers are used refer to Appendix E.

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BRICKWORK - REFRACTORY
CASTABLES

FACTORS AFFECTING THE USE OF CASTABLE REFRACTORIES (CONT'D)

4. Mixing

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4.4 Hand Mixing (Cont'd)

done in a wheelbarrow or on a clean flat surface. The dry castable should first be dry mixed before water is added to overcome the effects of segregation which may have taken place in handling and storage. After thoroughly dry mixing the water should be slowly added and the material should be mixed sufficiently to obtain a uniform consistency.

4.5 General

Required water quantities for the various B&W castables are printed on the bags. Some variation may be observed from batch to batch because of variations in fineness. This affects total surface which in turn affects total water requirements. A good guide to follow is the "ball in hand" test. Make a small ball of castable and toss it 12 inches into the air several times, catching it on the flat palm of the hand. If it breaks apart when it hits the palm, it is too dry. If it flattens out it is too wet for a dense castable but satisfactory for an insulating castable. If it flows between the fingers it is too wet for either. For a dense castable the ball should retain its size and approximate shape.

To avoid affecting the set and strength of the castable use clean potable water.

Mixing should be from 3 to 6 minutes after all water is added. Longer mixing tends to speed up setting and reduce the final strength. Mixing insulating castables for 6 minutes yields the best consistency for casting and the best strengths.

Under normal temperature conditions water temperature should be on the order of 60°F to 70°F. For cold weather precautions see the TEMPERATURE SECTION.

Do not mix more material than can be placed in 20 minutes. In hot weather it should be placed in 10 minutes. Longer delays result in reduced strength of the castable. If longer working times are required check your local B&W representatives for suitable retarders..

Do not resume mixing action after it has once been stopped. This adversely affects strength.

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FACTORS AFFECTING THE USE OF CASTABLE REFRACTORIES (CONT'D)

5. Casting

All the castable should be thoroughly worked into place and internal air bubbles removed by rodding.

5.1 Casting by Vibrating Means

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An effective method of placement is by vibrating, either internal or external. The action of vibration sets the particles of the fresh castable in motion reducing friction between the particles and thus giving the mixture the mobile qualities of a thick fluid which flows easily into place. The vibratory action permits placement of a thick heavy mixture which is not practical with hand placement and rodding. It insures filling of all irregularities, corners and voids.

5.1.1 Internal Vibrating

The efficiency of an internal vibrator is a function of diameter and vibrating speed. They may be obtained in sizes from 1 inch up. For the smallest size the speed should be 12,000 - 15,000 VPM. For a 2-3/4 inch vibrator the speed should be a minimum of 9000 VPM. Intermediate sizes should have proportionate speeds. A vibrator cannot be considered satisfactory which will not efficiently place a castable with the recommended water contents.

A vibrator with a 1-3/4 inch diameter is the most common size used for placing 3-4 tons an hour. A 2-3/4 inch diameter vibrator will about double this rate where sections are 6 inches or more thick.

When vibrating around cores, anchors or other obstructions add all fresh material from one side and vibrate the castable under and around the obstacle to avoid air pockets.

Continue vibrating until the mass has settled into place and the surface gives an appearance of "wetness". If water collects on surface reduce the amount of water.

An internal vibrator should be moved about 1-2 inches per second. When removed from the mass the speed should be reduced to avoid formation of holes. Vibration should not be continued longer than necessary.

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FACTORS AFFECTING THE USE OF CASTABLE REFRACTORIES (CONT'D)

5. Casting

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5.1.2 External Vibrating

External vibration will produce the benefits of internal vibration. The simplest method is to tap the outside of the form with a hammer. The efficiency is improved by an external vibrator. External vibration can be improvised by using a chipping hammer, air rammer to any pneumatic tool which produces a vibrating action. Merely place the tool against the outside form and move the tool to get a uniform setting. To get rid of air bubbles, augment with internal rodding particularly along the forms.

6. Placement by Pneumatic Methods

Applying castables by means of pneumatic guns is widely practiced.

This method offers particular advantages when it is necessary to handle large quantities of material through a small access area. In an ash hopper, for example, the physical problem of handling the castable through small doors poses many problems under conventional mixing techniques and can be expensive in terms of manpower. If a gun is used for material can be charged at a convenient location a hundred feet or more from the point of placement and carried there through a hose by air pressure.

Pneumatic placement guns are generally classed as a dry run or a wet gun depending upon the manner in which water is added to the dry castable.

6.1 Dry Gun

The dry gun operates on the principle of pressure forcing the dry material from the charging chamber through a hose to the point of placement. Water is added at the discharge nozzle.

Prewetting of castables is recommended to reduce rebound losses and dusting. Instructions for suitable amounts of water for prewetting are shown on the bags of B&W castable refractories.

Experience has shown that dense castables are best placed using a nozzle pressure of 25 - 40 psi. Insulating castables should be placed at 20 - 30 psi.

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FACTORS AFFECTING THE USE OF CASTABLE REFRACTORIES (CONT'D)

6. Placement by Pneumatic Methods (Cont'd)

6.1 Dry Gun (Cont'd)

The water pressure at the nozzle should be about 10 psi higher than the air pressure. Allow a pressure drop between chamber and nozzle at 5 psi for each 50 foot length of material hose and an additional 5 psi for every 50 foot elevation of the nozzle above the machine.

Also see Item 9, (Hand Rodding).

6.2 Wet Gun

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These guns mix the castable in the charging chamber to the desired consistency. The wet mix is then forced through the material hose by air pressure. An additional jet of air is introduced at the nozzle to impart greater velocity to the wet castable.

Wet type cement guns may also be used for mixing and transporting castable with the placement behind forms accomplished by conventional methods.

Also see Item 9, (Hand Rodding).

7. Ramming

Castable refractories may also be rammed effectively. Under such circumstances less water is used than for the other means described. The amount required is printed on the bags of the various B&W castables. Ramming should be accomplished by means of pneumatic ramming tools.

To reduce the tendency towards laminations a ramming head not over 2 inches in diameter should be used. Equally suitable are rectangular heads of not more than 4 square inches impact surface with a rough face. The action of such a head produces a rough surface when ramming the castable into place. Fresh material then has something to which it can knit without forming a smooth cleavage plane.

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8. Slap Trowelling

This method is particularly effective for thin lining or for places not readily accessible for ramming or gun application. It does not result in high rebound losses usually associated with the use of a gun. For this reason this method is preferred by some contractors over the use of a gun. When applying a castable in this manner small portions are picked up on the trowel and are then thrown against the surface being covered. Excess amounts are trimmed immediately.

The amount of water required for mixing a castable to a consistency suitable for slap trowelling is best determined on the job.

9. Hand Rodding

Probably the majority of small and medium sized installations are made without special vibrating or pneumatic equipment. Under such circumstances it is necessary to thoroughly work the material into place by hand whether it is a flat surface or vertical surface behind forms.

The water contents should be as specified in 4Y-4Y24. After the wet castable is placed in position, it should be rodded or tamped into place. Tools for such purpose may be any suitable implement. The foregoing will work well with a mixture which has fairly free flowing characteristics. For a stiff mix, it is necessary to use a tool with a large surface, which will permit the material to be pushed and tamped into place.

Refractories may be hand applied or gunned on the walls. For either method the refractory should be packed behind tie bars and similar structural attachments before the major portion of the wall is done. It is advantageous to install refractory behind these attachments before the metal lath is applied.

When hand applied, the refractory should be thrown through the lath with enough force to fill all the voids behind the lath, the material being built out until the lath is covered and the desired thickness is reached. If block insulation is to be applied to this surface, the refractory should be trowelled to a smooth straight surface. If plastic insulation is to be applied, the surface should be straight but left somewhat roughened.

Around doors and soot blower openings on inner cased jobs, the refractory should be packed in the metal seal box taking care to fill all voids. This is essential to prevent gas bypassing.

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FACTORS AFFECTING THE USE OF CASTABLE REFRACTORIES (CONT'D)

9. Hand Rodding (Cont'd)

At the junction of walls at some locations on boilers a mound of refractory is used to seal against gas bypassing. This seal is applied in two layers. The first layer at these locations should be installed before the remainder of the area is covered. After the first layer is thoroughly dry, the second layer should be installed; making this second layer a part of the refractory covering the remaining portion of the surface to be covered. Special care should be exercised to insure that these seals are installed exactly as the drawing as they prevent gas bypassing and flyash leakage.

10. Temperature

10.1 Cold Weather

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It is of more than casual interest that complaints on castable refractories seem to be more numerous for material placed in the winter and early spring when the weather is cold than is the case during the summer and early fall.

In cold weather the strength of a castable will be adversely affected if the dry material used is in the freezing range of temperatures and if mixed with cold water. It is desirable that both the dry material and the water be in a temperature range of 60-70°F if maximum strength is a consideration.

Provisions should be made to maintain a minimum ambient air temperature of 50°F when placing castable refractories. At the same time any steel that will come into contact with the refractory should be maintained at a temperature not lower than 50°F. The freshly poured castable refractory should be protected against freezing for a minimum of 48 hours or until thoroughly dried.

When the temperature is below 50 degrees the maximum strength of the material can be improved by heating the mixing water. The following formula may be used for estimating the temperature of fresh concrete:

$$X = \frac{Wt. + .22 W't'}{W + .22 W'}$$

where W = Weight of water
W' = Weight of dry castable
t = Temperature of water
t' = Temperature of Solids
X = Temperature of mixed castables

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FACTORS AFFECTING THE USE OF CASTABLE REFRACTORIES (CONT'D)

10. Temperature (Cont'd)

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10.1 Cold Weather (Cont'd)

For example, assume that B&W Kaocast at a temperature of 45°F is to be mixed with seven quarts of water per bag. A desirable mix temperature would be 70°F.

$$\text{then } 70 = \frac{7 \times 2.08t + .22 \times 100 \times 45}{7 \times 2.08 + .22 \times 100}$$

$$70 = \frac{14.56t + 990}{14.56 + 22}$$

$$t = 108 \text{ (temperature of water)}$$

For maximum strength development the dry castable should be heated if below 50°F. To eliminate this necessity it is suggested that the material be stored in a heated enclosure several days before use. After placement maintain ambient temperature at 50°F minimum.

10.2 Hot Weather

It is desirable to protect the freshly placed castable against excessive temperatures just as it is desirable to protect against freezing temperatures. In the event of excessive heat the strength will be improved by cooling the material by water or other means during the first 24 hours after it is placed. The water should not be applied until the material has set.

11. Finishing

When finishing off a castable lining or trimming excess material as gunned or slap trowelled care should be taken to avoid overtrowelling the finished surface. Normally it is preferred to leave a slightly rough surface. Where a smooth surface is necessary it should be given only sufficient trowelling to make it smooth without slicking. Use a wooden float rather than a steel trowel. If overtrowelled, excess cement is brought to the surface. This has the effect of sealing it thus restricting the escape of water vapor during drying or initial firing-in of the lining. It can also have the effect of creating a thin crust of pure cement which is readily dislodged under alternate heating and cooling.

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FACTORS AFFECTING THE USE OF CASTABLE REFRACTORIES (CONT'D)

11. Finishing (Cont'd)

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The possibility of bringing water and fines to the surface is reduced by waiting for the material to initiate a set before trowelling is commenced. Too long a delay will result in a surface that is too hard to finish with a trowel. The tendency in a great majority of cases is to trowel while the material is too soft and plastic.

12. Curing

The term "curing" as applied to a castable refractory, means keeping the material wet or the surrounding atmosphere humid. The primary purpose is to create the most favorable conditions for the completion of the chemical reactions of the cement. Curing results in improved strength. Normally a period of 24 hours is suggested to permit strength development before starting air drying or application of heat. There are certain instances where the realities of the situation prevents taking this much time and where achievement of the last degree of strength is unimportant. Under such circumstances the curing period can be abbreviated.

Good judgement must be exercised in such decisions. The basic consideration being whether the last degree of ultimate strength is essential for proper performance in service.

During the curing period the primary object is to prevent the loss of moisture from the castable. Three methods are in common use:

12.1 Cover surface with polyethylene or damp sacks. In this case do not place covering directly on the castable until the initial set has taken place. Block up the covering to avoid contact. Sacks should be kept wet for 24 hours.

12.2 Spray or paint with concrete curing compounds. A list of resin base compounds (Appendix C) is attached which have been tested for castable refractories and found to be satisfactory. Other resin base compounds as well as compounds of asphalt are equally suitable. Their use insures proper curing without 24 hour supervision.

12.3 Spray with water either continuously or frequently enough to prevent drying of exposed surface.

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12. Curing (Cont'd)

According to Wygant* and Crowley, a rise in internal temperature of the castable during curing is not harmful so long as the moisture is not lost from the mass.

Air drying will not take place until the impermeable barrier formed by the curing compound is burned off. For a structure subject to long slow heating this will take place at lower temperatures and the moisture can then leave the mass on further heating. For a thick mass subject to fairly fast heating the barrier can be burned off with a torch prior to being heated to permit normal air drying.

13. Air Drying

Following the curing the castable may be exposed immediately to heat or it can be air dried indefinitely. The longer it air dries before exposure to temperature the more strength it will develop, however, the increase in strength is negligible after several days. As soon as heat is applied further development of strength ceases.

14. Heating

In applying heat to a standard castable it is desirable to first subject it to a period of a few hours at temperatures of 250 - 350°F. Following this it can be raised gradually. Generally an effort is made to alternate periods of rising temperature with periods of maintaining a constant temperature. This permits the temperature gradient in the wall to establish itself and avoids undue extremes of temperature between the hot face and the interior.

Refinery vessels normally are subjected to slower heating rates.

15. Storage

When our refractory castables are stored under dry, well ventilated conditions, the loss of strength over a period of a year is very low, on the order of 10%.

If the material is stored where the bags can become wet or exposed to dampness for extended periods, a certain amount of moisture may get into the material and cause a partial setting up with loss of strength.

*"Curing Refractory Castables: It isn't the Heat, It's the Humidity,
"J. F. Wygant and M. S. Crowley, ACS Bulletin, Vo. 43, No. 1 (1964)

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APPENDIX B
RECOMMENDED CASTABLE AVERAGES

<u>B&W Castable</u>	<u>Lb/Std. Bag</u>	<u>Lbs. Required to Place One Cu. Ft.</u>	<u>Recommended Prewet U.S. Qts/Bag</u>	<u>Typical Rebound %</u>	<u>Recom'd Overages</u>
<u>Dense</u>					
Kaocrete A & A-BF	100	125	1.0	23	1.30
Kaocrete B	100	100	1.0	10-15	1.11-1.18
Kaocrete 28-LI	100	126	--	13	1.15
Kaocast	100	123	1.0	15-20	1.18-1.20
Kaocrete 32-G	100	135	1.0-2.0	18	1.22
Kao-Tab 93	100	150	1.0	15-20	1.15-1.25
Kao-Tab 95-Gun	100	165	2-3	18	1.22
Kaocrete HS	100	125	1.0	10-15	1.11-1.18
Kaogun BF	100	128	2.0	10-15	1.11-1.18
Kao-Tuff G	100	130	1.0-2.0	12	1.14
Kao-Phos 93	100	170	0	30-40	1.33-1.45
Kaogun pH	100	126	1.25-1.5	10-15	1.11-1.18
<u>Insulating</u>					
Kaolite 2000-HS	40	56	4	10-15	1.11-1.18
Kaolite 2200	40	56	4	10-15	1.11-1.18
Kaolite 2200-HS	50	82	4	15-20	1.18-1.25
Kaolite 2300-LI	40	54	4	10-15	1.11-1.18
Kaolite 2500-LI	50	60	2	10-15	1.11-1.18
Kaolite 2500-HS	75	85	3	5-10	1.05-1.11
Kaolite 2800	75	86	2.5	10-15	1.11-1.18

NOTE

Gunned onto vertical wall by experienced operator under optimum conditions.
Total overage figure should include a 10% contingency factor.

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APPENDIX C
MANUFACTURERS OF ORGANIC CURING COMPOUNDS

Nox Crete Chemicals
20th and Williams Sts.
Omaha, Nebraska, 68108
Telephone (402) 341-2080

ABCO Cure and Seal - horizontal surfaces

NATRASTON - verticle surfaces

Master Builders
23700 Shagrin Blvd.
Cleveland, Ohio 44122
Telephone (216) 831-5500

MB-429 - horizontal surfaces

Master Cure - horizontal and verticle
surfaces

ECO Industries
99 Madison Avenue
New York, New York 10016
Telephone (212) 889-0749

Eco-Seal - both horizontal and
verticle surfaces

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APPENDIX D
MANUFACTURERS OF CONCRETE VIBRATORS

WYCO Tool Company
4601 West Addison
Chicago, Illinois
Telephone (312) 282-3411

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Cleveland Vibrator Company
2827 Clinton Avenue
Cleveland, Ohio 44113
Telephone (216) 241-7157

FMC Corporation
Material Handling Equipment Division
3400 Walnut Street
Homer City, Pennsylvania 15748
Telephone (412) 479-8011

Flexible Shaft Corporation
217 Eagle Street
Brooklyn, New York 11222
Telephone (212) 383-6597

Homelite
Division of Textron, Inc.
14401 Carowinds Blvd.
Charlotte, North Carolina 28217
Telephone (704) 588-3200

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APPENDIX E
BABCOCK & WILCOX, INSULATING PRODUCTS DIVISION
SPECIFICATION FOR METAL FIBER ADDITIONS TO CASTABLE

Metal fiber additions to castables have demonstrated improvement in various castable properties - those of thermal shock, mechanical shock, and abrasion resistance.

Scope: This specification shall describe:

1. Fiber Type
2. Fiber Quantity
3. Field Mixed Material
4. Pre-Mixed Material

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1. Fiber Type

Fiber reinforcement is available from the following sources:

The National Standard Co.
1618 Terminal Road
Niles, Michigan 49120
(Meltex Fibers)

Ribbon Technology
6270 Bowen Road
Canal Winchester, Ohio 43110
(Ribtec Fibers)

The fiber type required is a function of process temperature and atmospheric conditions. Below is a chart showing which fiber type to use:

FIBER RECOMMENDATIONS*

<u>Conditions</u>	<u>Best</u>	<u>Next Best</u>
Hydrogen	446 Under 1000°F	430
Hydrogen Sulphide	310 Over 1000°F	304
Carburization	446	309
	310	
	330	302 B
Nitrogen	330	309
		304

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APPENDIX E (CONT'D)

FIBER RECOMMENDATIONS* (CONT'D)

<u>Conditions</u>	<u>Best</u>	<u>Next Best</u>
Coke Oven Gas	446	
Sulphur		
Carbon Compounds	310	309
Chlorine	330	310
Oxidation		
1600°F	430	304
1900°F	304	446
2100°F	310	446-330
2200°F	446-330	

*Taken From Ribbon Technology Published Literature.

The Individual fibers are to be 1" x (.016-.020) when field mixing
and 3/4" x (.020 - .025) when pre-mixed by Babcock & Wilcox, IPD.

2. Quantity of Metal Fibers

Approximately 1% of volume of fibers (@ 500#/CF) gives optimum reinforcement to refractory castables. The following table correlates the 1 volume % to weight % for castables of various densities.

METAL FIBER ADDITION

<u>B&W Castables</u>	<u>Castable Density</u>	<u>Volume %</u>	<u>Weight %</u>
Dense:			
Kao-Tab 95	165#	1	≈ 3
Kaocrete HS	123#	1	≈ 4
Insulating:			
Kaolite 2200	56#	1	≈ 8
Kaolite 2200 HS	71#	1	≈ 6

3. Field Mixed Material

Attention must be given to the even distribution of metal fibers throughout the castable to avoid fiber "clumping" or "balling". These fiber clumps if introduced in the mix can lead to voids and weak spots. The following procedure should be followed:

- a. Using a paddle-type mixer, pour in the dry castable and mix.

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APPENDIX E (CONT'D)

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3. Field Mixed Material (Cont'd)

- b. For casting applications, introduce the measured fibers into the operating mixer by means of shaking through a wire basket fashioned from poultry netting or welded wire mesh 1/2" - 1" openings. Half of the necessary water should be added before fiber addition and half after.
- c. For gunning applications, introduce the measured fibers into the operating mixer by means of shaking through a wire basket fashioned from poultry netting or welded wire mesh with 1/2" - 1" openings. This should be done immediately after the pre-wetting water has been added to the castable.

4. Premixed Material

Babcock & Wilcox can supply castables with metal fiber additions on request. Contact B&W Insulating Products Division for prices and availability.

Premixed fiber reinforced castables are used in the same manner as plain castables with regards to mixing and placement. It should be noted, however, that the castable water demand is slightly higher when metal fibers are added.