A. C. Halter

CTM-86

C STELLARATOR ASSOCIATES

INFORMAL TECHNICAL MEMORANDUM

RF GROUND PLANE DESIGN IN CS BUILDING

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August 12, 1958

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RF GROUND PLANE DESIGN IN CS BUILDING

I. General:

Complete RF shielding of the CS facility will not be performed initially, but FCC regulations and physiological hazards may require future shielding, particularly of a local nature around individual items of equipment.

In order to provide for such future shielding in the C building, it has been decided to establish an RF ground plane on initial construction, with provision to erect an RF tight shield in any desired location when, and if, necessary.

Preliminary studies (CTM-29) indicate that the most effective and practical shield should be formed of .030" copper sheet. This is particularly effective in the higher frequencies, although the band of operation is expected to be from 30KC to 40MC.

II. Specifications for the RF ground plane in the CS Building.

1. A ground plane of .030" copper will be applied over the concrete slab of the main floor of the CS building with the exception of the spectrographic area. A ground plane of .030" copper will also be applied over concrete floor in the master control room located above the spectrographic area, and on the first floor of the RF Building.
2. The separate sheets of copper forming the ground plane will be soldered together to provide continuous electrical joints.
3. The ground planes are not to be grounded to the building ground. 1000 V. rms high-pot tests are to be specified.

4. The main floor ground plane is to be covered with an electrical insulating traffic surface, which will withstand a loading of 4500 pounds per square foot.

5. Provision by removable plastic strips is to be made for the erection in the future, if necessary, of a complete RF shield over the C1 and the C2 Stellarators. The plastic strips, approximately 1" wide x 3/8" thick, are to be firmly positioned on, but removable from, the copper ground plane to form squares or rectangles around the bases of the Stellarators. Plastic strips are also to be provided around outer edge of entire ground planes adjacent to exterior walls. Future connection of shields to the copper ground plane may be either by a soldered joint or metallic gasket.

6. Bronze socket inserts are to be securely anchored in the concrete slab of the 75' x 100' Stellarator area and the 100 x 108 foot RF area. The inserts are to be of sufficient size and strength to accommodate 3/4" bolts to serve as anchors for tying platforms or elevated equipment firmly in place. Inserts are to be drilled and tapped to a depth of 2" to accept 3/4" diameter bolts, U. S. standard thread Inserts are to have a 1000 volt insulating coating except on the top surface. As inserts will also be used to serve as grounding connections, the inserts are to be soldered or fastened to the copper ground plane to make a solid electrical connection. Inserts are to be spaced on four foot centers throughout the 75' x 100' C1 and C2 area and on eight foot centers in the ground floor slab of the high bay section of the RF area.

7. All covers for openings in the Stellarator area ground plane are to be surfaced with the electrical insulating traffic surface.

8. Ground planes are to extend to 6" from all steel building columns, or 6" from column sole plates which are above 1st floor slab. Means is to be provided to permit making a soldered or metallic gasket connection to the ground plane at such openings for RF shield enclosures around the columns, if necessary. Socket inserts, as per #6, are to be provided in four equidistant locations 10" from the columns or sole plates. These inserts will serve to secure RF shield enclosures firmly in place.

III. Recommendations:

It is proposed that these specifications be adhered to by the following means:

1&2. 4' x 10' sheets of .030" copper will be used, with soldered joints as shown in SK-58217-3. These will be bonded to the concrete floor with a mastic.

3. Care must be taken upon installation to insure that no exposed re-enforcing steel comes into contact with the .030" Cu. This may be done by checking with a megger as each section is laid. The master control room floor shield will have an insulating layer between it and the false floor supports.

4. In order to insure an even floor over the soldered joints, a spread type surface of Neotex, or equal, will be used, except in those areas where the ground plane is to be accessible. This surface will be applied to a thickness of 3/8".

5. Extruded vinyl plastic strips will be used to surface the accessible strips of the ground plane. These will be fastened to the .030 sheet by double sided adhesive type tape. (See SK-58217-3) Layout of such strips is indicated on SK-58190-1.

6. The bronze socket inserts per SK-58198-7 will be located as indicated on SK-58190-1, and will have a coating of PVC to prevent metallic contact with any re-enforcing rods. SK-58217-2 indicates the method of fastening the inserts to the ground plane.

7. All floor openings for entry of such equipment as D. C. bus, vacuum piping, cooling water piping, power cables, etc. will be located as per SK-58190-1.

In order to preserve flexibility without interfering with the RF tight ground plane, all entries through the plane must be performed through removable floor slabs as shown on SK-58218-1, -58219-2, and SK-58220-1. RF tight entry will be maintained by flared .030" copper tubes soldered around the periphery of the entering device and to the ground plane or by a 360° solder joint to flanges. D.C. bus entries will be made through a bus section with a dummy filter -- to be replaced with a genuine filter at such a time as it is needed. Power cables will enter through Filtron type FSR-100, or similar, filters. All piping entries will have an insulating section, but metallic sections will be extended as far as practical below the ground plane, in order to act as wave traps.

The following floor openings have been considered:

D. C. bus

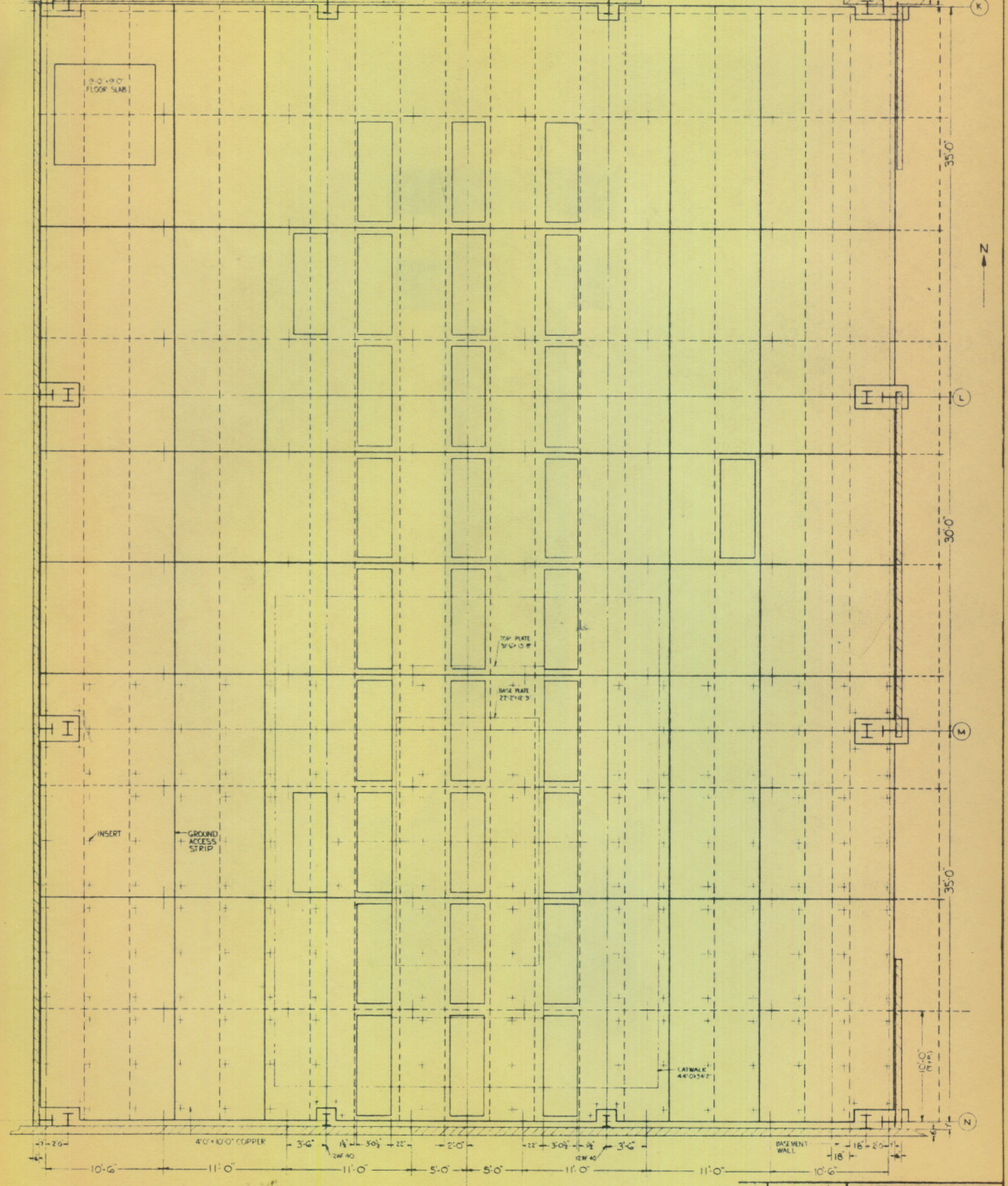
water piping - chilled and cooling tower

vacuum, nitrogen, exhaust, air, hydraulic

power 480/277 volt

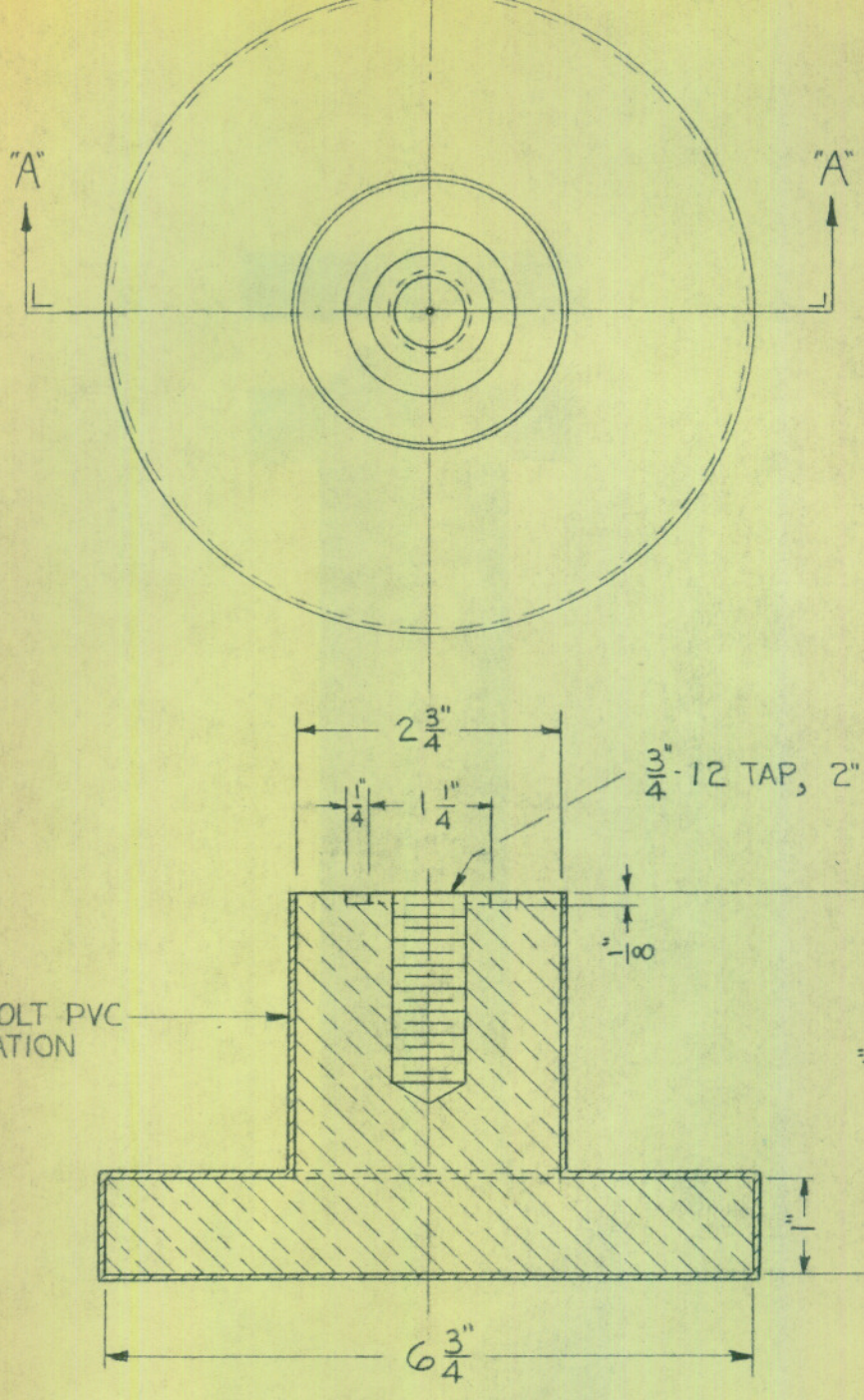
power 120 volt

The master control room and RF building ground planes will not involve floor openings, as entries to these areas will be made above the floor.



NOTE: ALL COLUMNS TO BE W14" 78 UNLESS OTHERWISE NOTED.

SCALE:		C-STELLARATOR ASSOCIATES
DRAWN:		JAMES FORRESTAL RESEARCH CENTER
CHECKED:		PRINCETON, N.J.
ENGR.		ALLIS-CHALMERS RADIO CORP. OF AMERICA
C.S.A.		TITLE: PROPOSED C.S. BLDG. FLOOR CUT-OUTS
C.S.A.		SK-58190-1 02



SECTION "A-A"

TYPE	DWG. NO. / USED ON	REQ.

SCALE: 1/2" = 12'

INITIALS — DATE

DRAWN: W.E.R 8-6-8

CHECKED:

ENG'R:

C.S.A.

C.S.A.

C-STELLARATOR ASSOCIATES

JAMES FORRESTAL RESEARCH CENTER

PRINCETON, N.J.

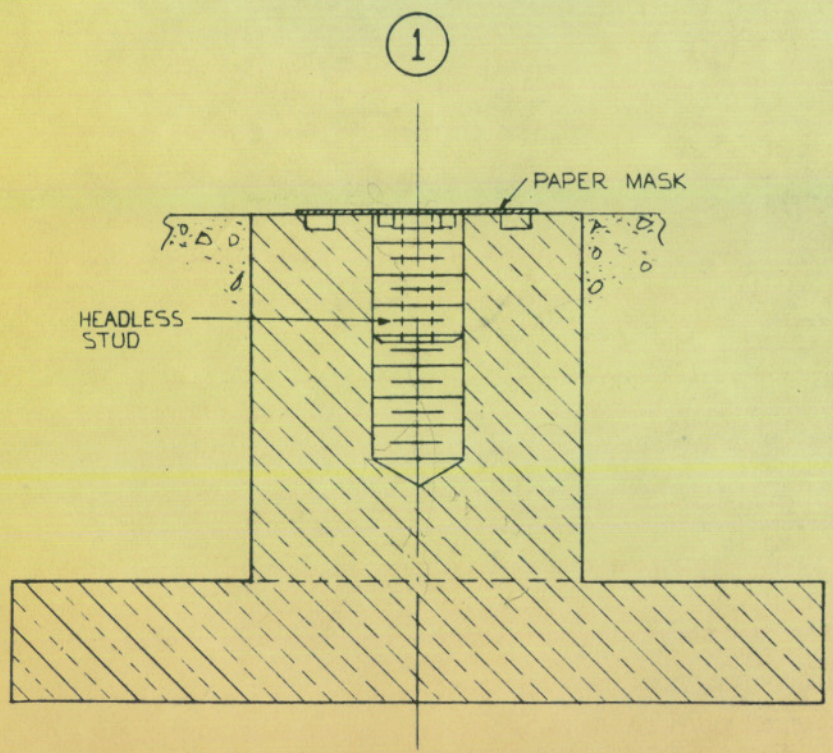
ALLIS-CHALMERS/RADIO CORP. OF AMERICA

TITLE: INSERT

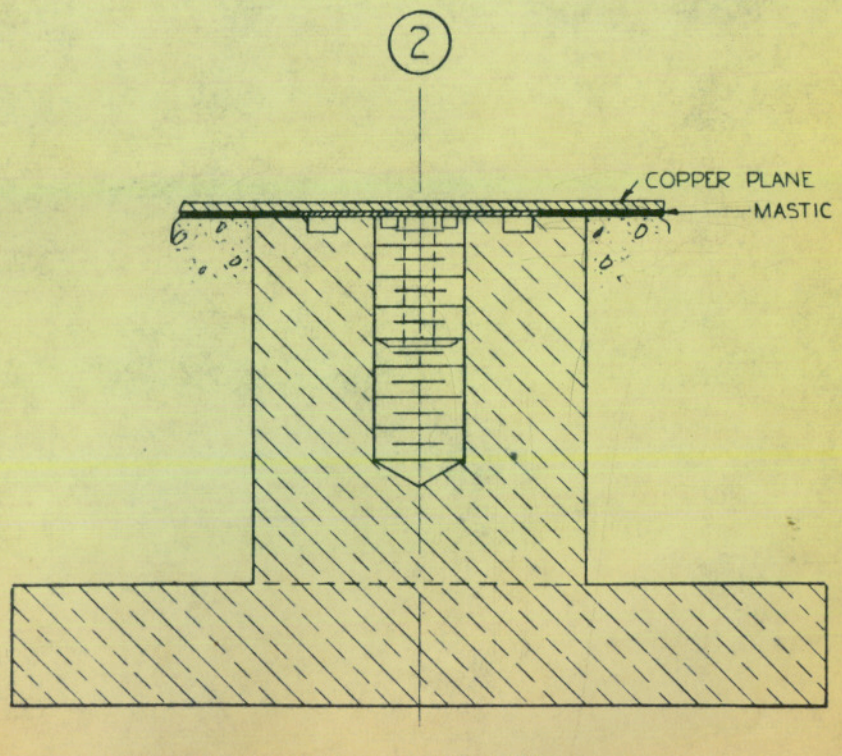
DWG. NO. 47-1 SK-58198-7

CSA—FORM No. 3-1

A B C

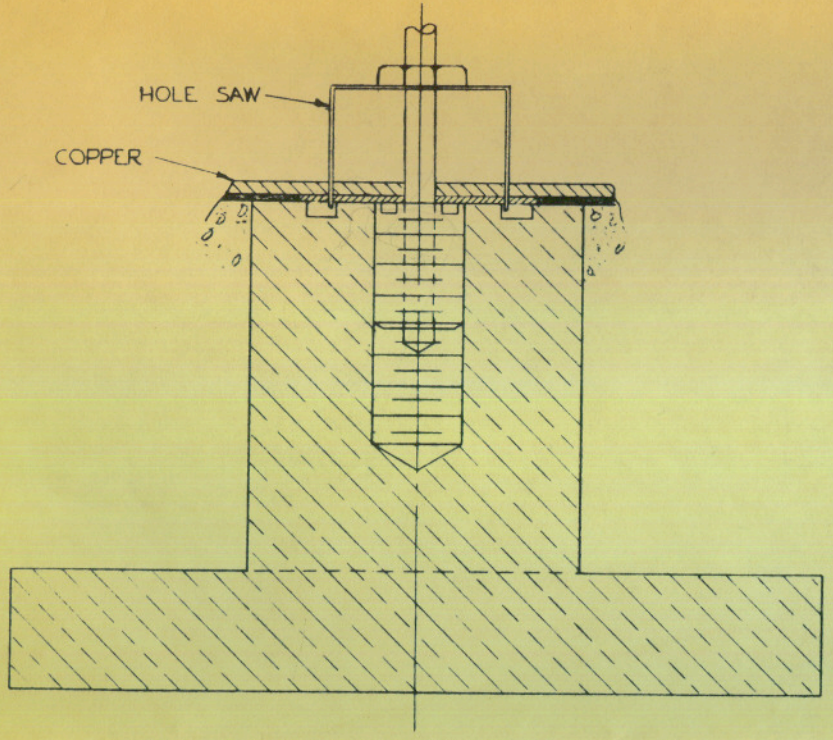


1. GROOVED BRONZE INSERT WITH 3/4" TAPPED HOLE.
2. SCREWED INTO HOLE IS HEADLESS STUD WITH SPANNER SOCKETS AND 1/4" LEAD IN HOLE.
3. 2" DIA. ADHESIVE PAPER MASK APPLIED ON TOP OF INSERT.



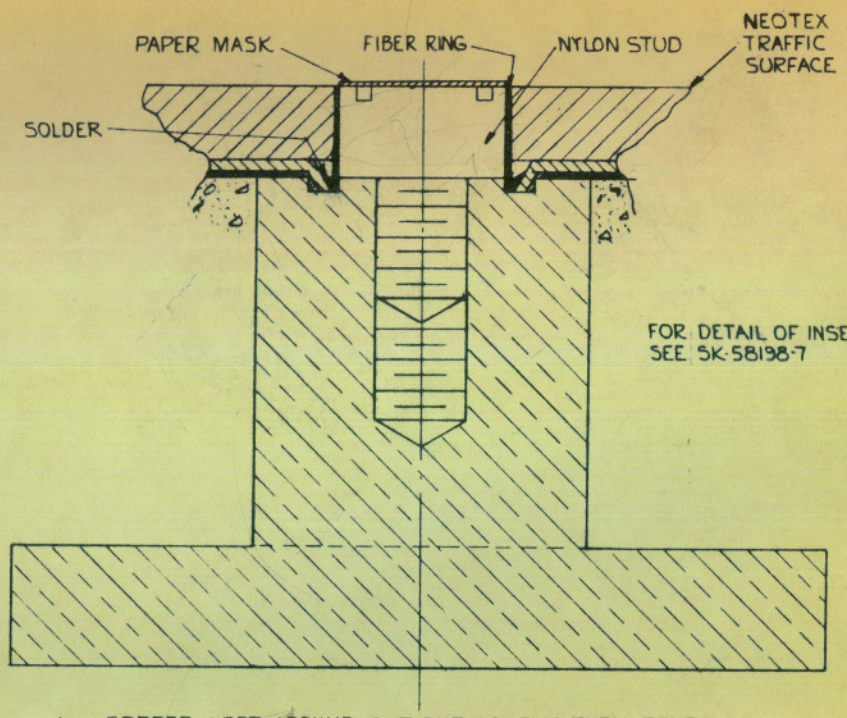
1. MASTIC APPLIED OVER CONCRETE FLOOR.
2. COPPER GROUND PLAIN LAID AND SOLDERED.

(3)



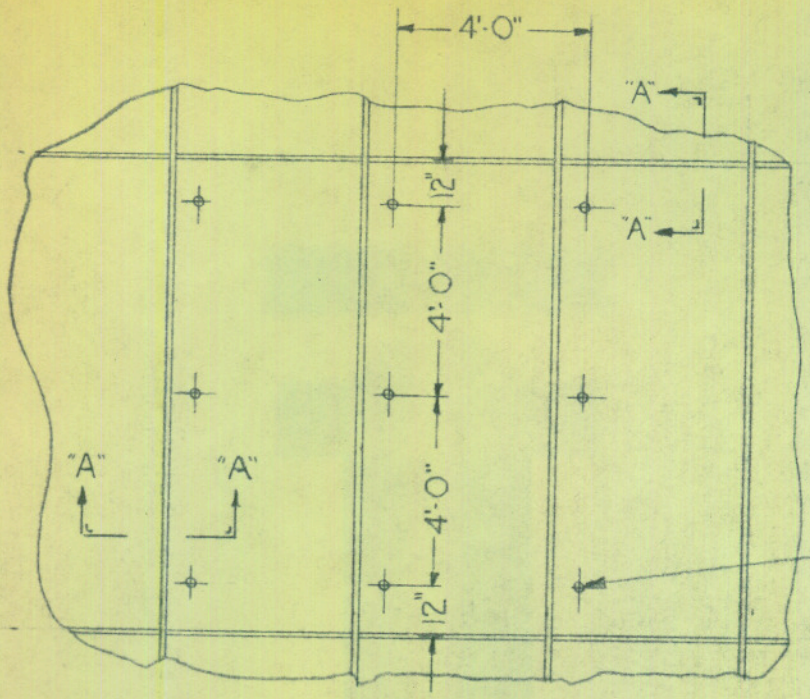
1. HEADLESS STUD IN INSERT IS LOCATED BY TAPPING ON COPPER GROUND PLANE.
2. NOTE. STUD CAN BE SCREWED INTO INSERT APPROX. 1/8" BELOW TOP SURFACE OF INSERT TO MAKE LOCATING EASIER.
3. HOLE SAW WITH 1/4" LEAD DRILL CUTS THRU COPPER INTO GROOVE IN INSERT.
4. HEADLESS STUD TOGETHER WITH COPPER DISC IS WITHDRAWN.

(4)

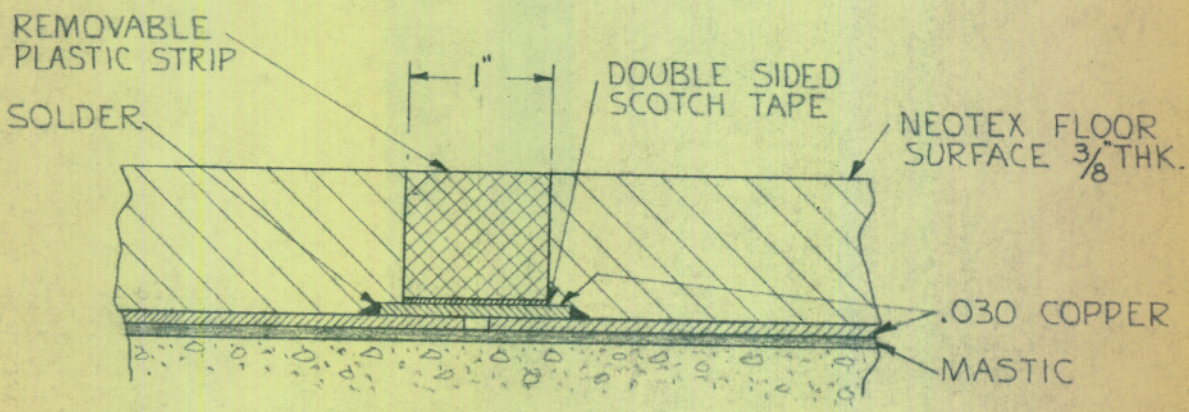


1. COPPER LEFT AROUND CUT OUT HOLE IS THEN BENT INTO GROOVE IN INSERT AND SOLDERED.
2. NYLON STUD IS SCREWED INTO INSERT AND FIBER RING PLACED AROUND HEAD.
3. INSULATING TRAFFIC SURFACE APPLIED OVER COPPER PLANE.
4. ADHESIVE PAPER DISC COVERING STUD PREVENTS STOPPING UP SPANNER SOCKETS DURING APPLICATION OF TRAFFIC SURFACE.

SCALE: NONE =12"	C-STELLARATOR ASSOCIATES
DRAWN: W.E.R 5-8-58 (INITIALS — DATE)	JAMES FORRESTAL RESEARCH CENTER
CHECKED:	PRINCETON, N.J.
ENG'R:	ALLIS-CHALMERS/RADIO CORP. OF AMERICA
C.S.A. ,	TITLE: FLOOR INSERT ASSEMBLY
C.S.A.	DWG. NO. SK-58217-2

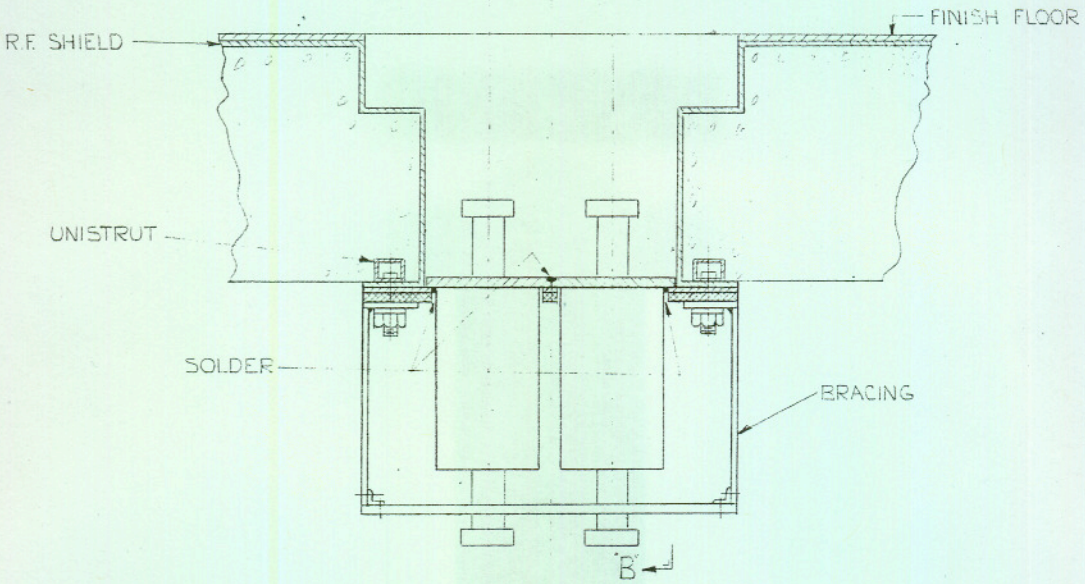


PLAN

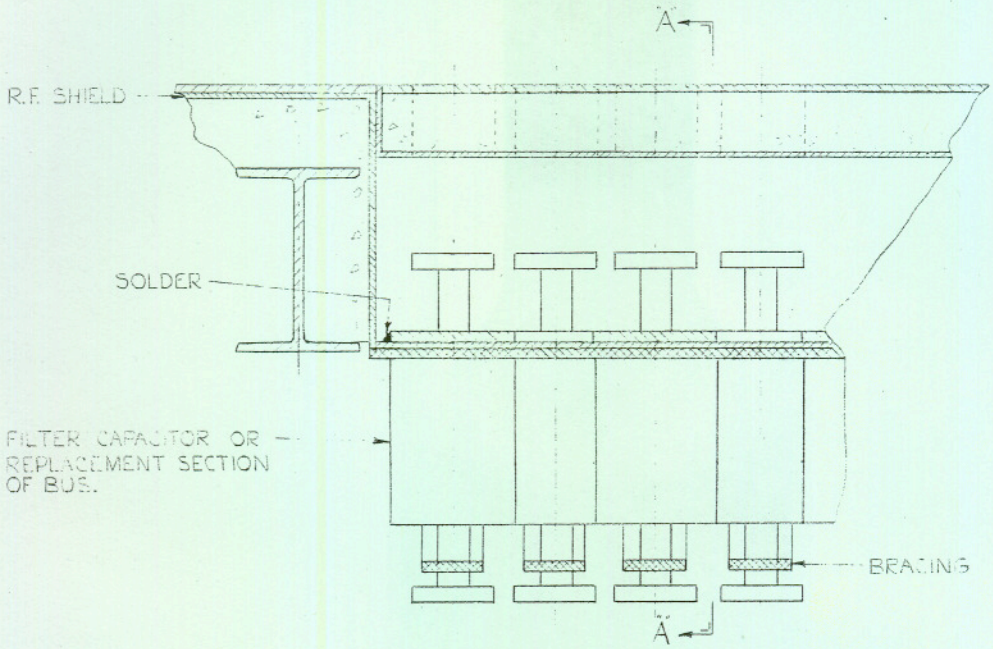


SECTION "A-A"

SCALE: NONE =12'	C-STELLARATOR ASSOCIATES
INITIALS — DATE	JAMES FORRESTAL RESEARCH CENTER
DRAWN: W.E.R 8-5-58	PRINCETON, N.J.
CHECKED:	ALLIS-CHALMERS/RADIO CORP. OF AMERICA
ENG'R:	TITLE: GROUND PLANE ASSEMBLY
C.S.A.	
C.S.A.	DWG. NO. SK-58217-3



SECTION "A-A"
(BUSBARS COVER OFF)



SECTION "B-B"
(SHOWING COVER ON)

47-2

TYPE	DWG. NO. / USED ON	REQ.

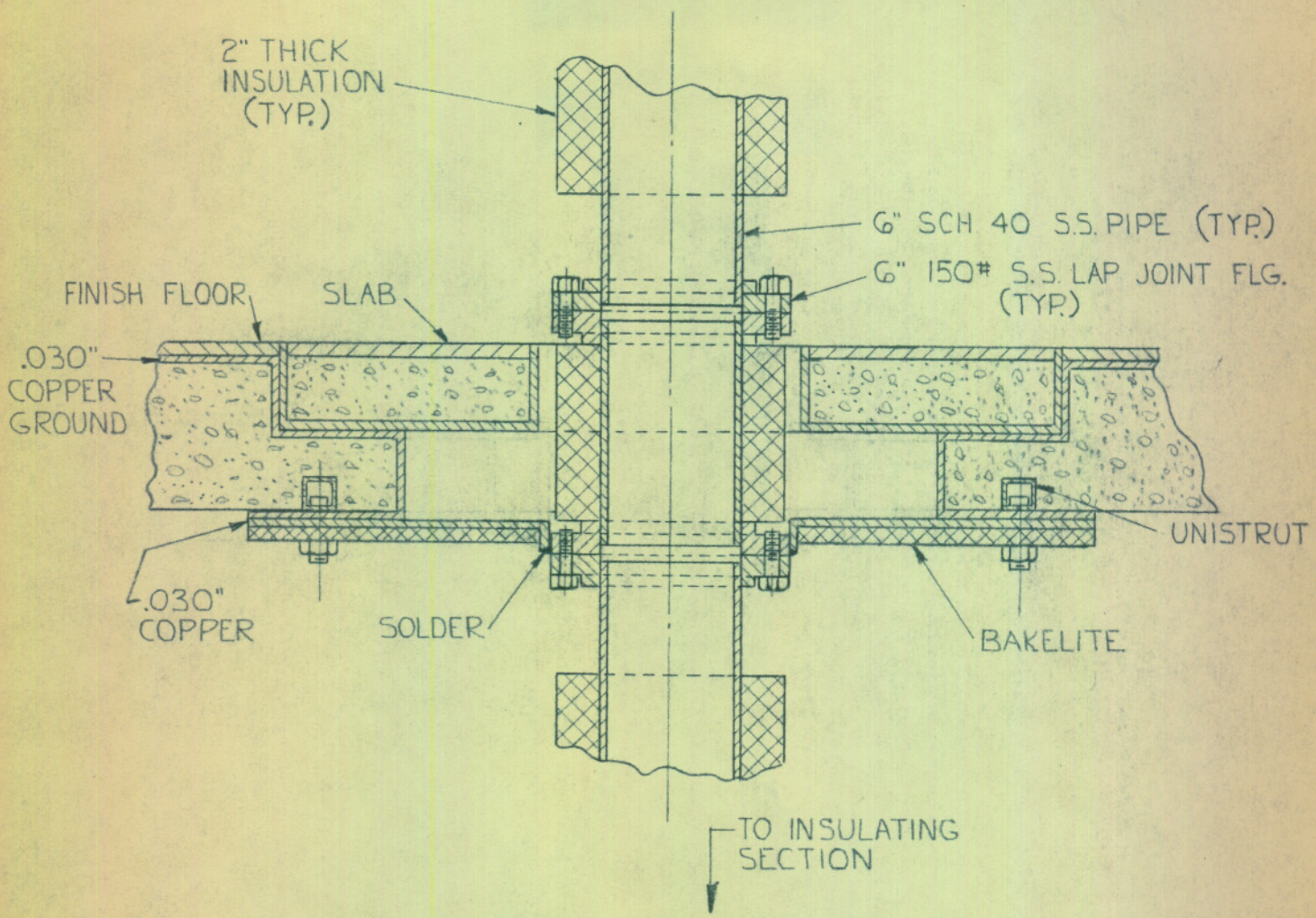
SCALE: 1" = 12'
INITIALS — DATE
DRAWN: W.E.R. 8 68
CHECKED:
ENG'R:
C.S.A.
C.S.A.

C-STELLARATOR ASSOCIATES
JAMES FORRESTAL RESEARCH CENTER
PRINCETON, N.J.
ALLIS-CHALMERS/RADIO CORP. OF AMERICA

TITLE: D.C. BUS OPENING IN C.S. BLDG. FLOOR

DWG. NO. [redacted] SK-58218-1

A B C D E



TYPE	DWG. NO. / USED ON	REQ.

SCALE: 1½" = 12'

DRAWN: W.E.R. 8-7-8 (INITIALS — DATE)

CHECKED: _____

ENG'R: _____

C.S.A. _____

C.S.A. _____

C-STELLARATOR ASSOCIATES

JAMES FORRESTAL RESEARCH CENTER

PRINCETON, N.J.

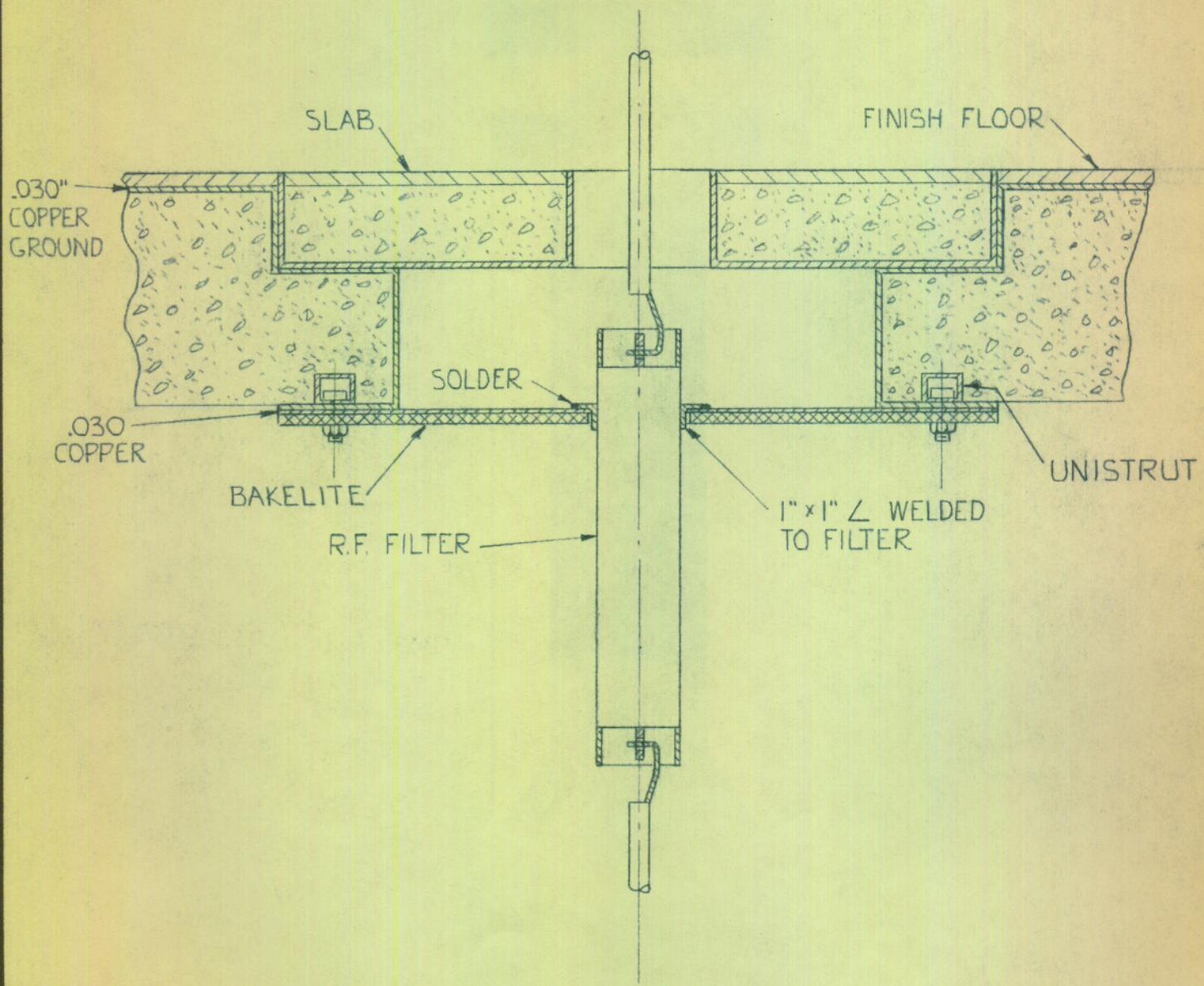
ALLIS-CHALMERS/RADIO CORP. OF AMERICA

TITLE: TYPICAL PIPE ENTRY

DWG. NO. [redacted] SK-58219-2

CSA—FORM No. 3-1

A B C



TYPE	DWG. NO. / USED ON	REQ.

SCALE: NONE =12'

INITIALS — DATE

DRAWN: W.E.R. 8-8-8

CHECKED: _____

ENG'R: _____

C.S.A. _____

C.S.A. _____

C-STELLARATOR ASSOCIATES

JAMES FORRESTAL RESEARCH CENTER

PRINCETON, N.J.

ALLIS-CHALMERS/RADIO CORP. OF AMERICA

TITLE: TYPICAL CABLE ENTRY

DWG. NO. 47-1 SK-58220-1

CSA—FORM No. 3-1

A B C