Installation Engineering Handbook 30
Western Electric
Service Division

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ALIGNMENT OF FRAMES
COMMON REQUIREMENTS AND INFORMATION
(INCLUDING CABINETS AND CASINGS)

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1. GENERAL

1.1 Scope

1.11 This section contains the common requirements and information applicable to the procedures for leveling and aligning frames, bays and floor mounted cabinets and casings of all systems.

1.12 The operations covered in this section and in the associated aligning sections are normally performed after all the frames comprising a new lineup, or being added to an existing lineup, have been erected and, in so far as practical, all associated parts loosely assembled and the frameworks loosely fastened to the floor and to the top supporting details. The final tightening of the parts is made in conjunction with the aligning operations.

1.13 The information in this section supplements that contained in the associated sections covering the alignment of the various types of equipment.

1.14 The requirements covered in this section shall be followed except as modified by applicable specifications and drawings.

1.2 Associated Information

1.21 Refer to Table 1 for the location of information to which reference may be necessary when performing operations covered by this section.

ASSOCIATED HANDBOOK INFORMATION REFERENCE TABLE 1

Subject	Handbook	Section
General Requirements and Information	30	1B, 1C
Determining Level, and High and Low Spots in Floors	30	4
General Safety Precautions	30	1A
Precautions Against Personal Injury, Equipment Damage and Service Interruptions	0	

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1.3 Precautions

1.31 General safety precautions against personal injury and equipment damage are outlined in Handbook 0 and Section 1A in this handbook and are to be observed at all times as they apply to the operations being performed. Specific precautions to be taken are covered in this section.

1.4 Verification

1.41 Items for the verification of the equipment installed by the operations covered in each section are listed at the end of that particular section.

1.42 Where practicable, the essentials of the requirement are included in the verification item. Where this is not practicable, a brief statement of the requirement appears as one or more subparagraphs of the verification item. In each case, a reference is made to the complete requirement.

1.43 The verification items in each section may also be used as a self-check guide when performing operations covered by the section.

2. INSTALLING EQUIPMENT

2.1 Plumbing fixtures and other tools and materials required for the operations covered in this section are listed in the specific sections on Alignment of Frames.

3. PLUMBING OF EQUIPMENT

3.1 The vertical parts of framework should be plumb to within the allowable deviations shown below:

Height	Maximum Allowable Deviation from Plumb
Less than 4'-6"	1/16"
Over 4'-6" but less than 7'-0"	1/8"
7'-0" to 9'-0" incl.	3/16"
Over 9'-0"	1/4"

In this requirement the deviation should be measured at the top of the structure. Any acceptable deviation from straightness of the part should be ignored. An exception is made for panel system power-driven frames which are erected and aligned by approved gauges.

3.2 The plumbing and aligning requirements specified in Paragraphs 3.1, 5.12 and 5.13 do not necessarily apply to 355, 356 and similar Community Dial (CDO) equipments. Good alignments as judged by eye is all that is required. However, in no cases should the deviation from plumb exceed twice the limit specified in Paragraph 3.1.

3.3 Plumbing of uprights (except those of panel double sided frames) is performed with a plumb bob used either with or without a fixture. Suspend the plumb bob from either the frame top angle or from a wooden block clamped to the upright.

> CAUTION: WHERE A C CLAMP IS USED, GUARD AGAINST INJURY WHICH MIGHT RESULT IF JARRING OF THE UPRIGHT LOOSENED THE CLAMP SUFFICIENTLY TO ALLOW IT TO FALL. A CORD SHOULD BE TIED AROUND THE C CLAMP AT ONE END, AND TO THE CABLE RACK OR AUXILIARY FRAMING AT THE OTHER END, TO PREVENT THE CLAMP FROM FALLING.

3.31 The use of an R-2642 Plumbing Fixture for plumbing crossbar type frames is covered in the specific sections applying to the alignment of these frames.

4. LEVEL OF FRAMES

4.1 Job Assembled Frames

4.11 Distributing frames, step-by-step frames having angle bases and SxS frames with sheet metal bases, "I" beam relay racks and other frame structures of these general types in which the uprights are flexibly attached to long horizontal members, may follow the general contour of the floor.

4.2 Shop Welded Frames

4.21 Rigid frames, such as crossbar frames and channel and bulb angle relay racks, cable duct type carrier frames, other frames equipped with casings, and fuse and power board frameworks, should be as level as the plumbing tolerances and squareness of the structures permit. Except as otherwise specified below, adjacent frames in a lineup may step up or down to conform to the general contour of the floor provided the difference in the

level of the joined ends does not exceed 1/8" measured at the base.

4.211 The difference in level of frames connected by drive shafts less than 2'-0" in length shall not be greater than 1/16".

4.212 The difference in level of adjacent bays of power board framework shall not exceed 1/16" nor shall the total difference throughout the entire length of the board be greater than /2".

4.213 The difference in level of crossbar and other frames of sheet metal base design shall be gauged at the top surface of the sheet metal guard rail and shall not exceed 1/16".

4.214 Where a difference in level of adjacent top angles of cable duct type frames exists, a spacer, as shown in Figure 1, should be inserted as required between the junction pipe and the underside of the top angle before the V-bolt is securely fastened.

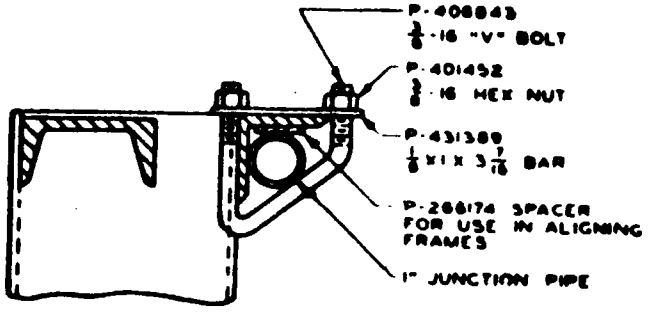

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FIG. 1 SECURING TOP ANGLE OF CABLE DUCT-TYPE FRAMES TO JUNCTION PIPE (PAR. 4.214) (Agrees with Fig. 1A of BSP 800-614-154)

4.3 Use of Shims

4.31 Standard shims (see Handbook 250) where necessary to meet the leveling requirements, may be placed permanently under the base angles of frames and under the base plates of floor mounted cabinets not equipped with leveling screws; that is, where cement grouting, to form a continuous support, is not required.

NOTE: Cement grouting is normally used only where accurate leveling is required such as under the floor angles of power driven panel frames and in some cases under motor generator sets, exhauster sets, etc. Requirements pertaining to this will be found in the handbook sections covering the frames or the equipment involved.

5. FRONT-TO-REAR ALIGNMENT

5.1 Joined Ends of Frames

5.11 Joined ends of frames of sheet metal base construction, including box type (No. 5 Crossbar) frameworks and SxS frames having sheet metal bases, should be as nearly flush as practicable.

5.12 Joined ends of frames other than those covered in Paragraph 5.11 should not be out of alignment (front-to-rear) more than 1/8" except as follows:

5.121 The ends of power board frameworks and frames connected by drive shafts less than 2'-0" length should not be out of alignment more than 1/16".

5.13 The junction in ladder guard rails on frames, racks and other equipment should be as nearly flush as practicable so as not to interfere with the easy operation of the ladder. Vertical misalignment should not exceed 1/16".

6. FULL LENGTH OF LINEUPS

6.1 A frame should not be out of its normal position (in or out from a straight line extending the full length of the lineup) more than 1/8".

7. FLOOR MOUNTED CABINETS AND CASINGS

7.1 Description

7.11 A cabinet is a sheet metal structure which supports the equipment it encloses while a casing is a sheet metal structure placed around a completely installed unit of equipment. All cabinets and casings are usually perforated for floor fastenings, but only those having channel base members have leveling screws.

7.2 Aligning

7.21 The vertical parts of cabinets and casings should be plumb to within the allowable deviation shown below:

Height	Maximum Allowable Deviation from Plumb
Less than 4'-6"	1/16"
Over 4'-6" but less than 7'-0"	1/8"
7'-0" to 9'-0" incl.	3/16"
Over 9'-0"	1/4"

7.22 The front surface at the joined ends of adjacent cabinets or casings in a lineup should be as nearly flush as practicable. The cabinets or casings should be as level as the plumbing tolerances and squareness of the structure permit. Adjacent cabinets or casings in a lineup may, in general, follow the contour of the floor, that is within the limits permitted by the plumbing requirements. The difference in level between adjacent cabinets or casings, measured at the top surfaces, should be as small as practicable. Shims should be used as required.

7.23 Hinged covers or doors on cabinets or casings should not bind with adjacent covers or doors to such an extent that any cover or door cannot be readily opened without causing an adjacent cover or door to move.

8. EXPOSED STUDS IN EXPANSION SHIELDS

8.1 The excess lengths of the studs in Loxin expansion shields securing open base members, such as step-by-step frames, panel frames, relay racks, distributing frames, etc., should be cut off approximately flush with the nut, after the frame aligning operations have been completed, using the R-1562 Bolt Cutter. Any burrs remaining after the cutting operations should be removed with a file. It is not necessary to cut off the excess lengths of the studs where they are not exposed such as in frames of sheet metal base construction.

9. VERIFICATION ITEMS

VERIFICATION ITEMS AND BRIEF STATEMENT OF REQUIREMENTS	REFERENCE	
	Par. No.	Fig. No.
9.1 BAYS AND FRAMES		
9.11 Bays, frames and other similar type structures should meet the following alignment requirements in so far as they apply to the particular type of framework.		
9.1101 Vertical parts plumb to within allowable tolerance.	3.1	
9.1102 Line-up of bays or frames not out of alignment (front-to-rear from a straight line) more than 1/8" in full length of line-up.	6.1	
9.1103 Bays and frames may follow the general contour of floor when flexibly attached to long horizontal members.	4.11	
9.1104 Rigid (welded) bays and frames as level as the plumbing tolerances and squareness of structures permit. Except as otherwise specified, adjacent frames in a line-up may step up or down to conform to the general contour of floor provided difference in level of joined ends does not exceed 1/8", measured at base.	4.21	
9.1105 Difference in level of frames connected by drive shafts less than 2'-0" in length not greater than 1/16".	4.211	
9.1106 Difference in level of adjacent bays of power board framework not more than 1/16" nor total difference throughout entire length greater than 1/2".	4.212	
9.1107 Excess length of floor bolts cut off when exposed.	8.1	
9.1108 Difference in level of crossbar and other frames of sheet metal base design not more than 1/16" gauged at the top surface of sheet metal guard rail.	4.213	

VERIFICATION ITEMS AND BRIEF STATEMENT OF REQUIREMENTS		REFERENCE Par. No.	REFERENCE Fig. No.
9.1109	Space due to difference in level of adjacent top angles of duct-type frames filled with spacer between junction pipe and under side of top angle (placed before V-bolt is tightened).	4.214	1
9.1110	Joined ends of frames of sheet metal, base construction, including box type (No. 5 crossbar) frameworks as nearly flush as practicable.	5.11	
9.1111	Joined ends of frames, other than sheet metal base construction type, not out of alignment more than 1/8" (except fuse boards and power boards).	5.12	
9.1112	Ends of fuse board and power board frameworks and frames connected by drive shaft less than 7'-0" in length not out of alignment more than 1/16".	5.121	
9.1113	Junctions in ladder guard rails approximately flush-vertical misalignment not more than 1/16".	5.13	
9.2	FLOOR MOUNTED CABINETS AND CASINGS		
9.21	Provided with leveling screws when cabinets and casings have channel base members.	7.11	
9.22	Vertical parts plumb to within the following allowable deviations.	7.21	
9.23	Front surface at joined ends of adjacent cabinets or casings in a lineup as nearly flush as practicable.	7.22	
9.24	Cabinets and casings level as plumbing tolerances and squareness of structure permit.	7.22	
9.25	Adjacent cabinets in a line-up may follow contour of floor within limits of plumbing requirement.	7.22	
9.26	Difference in level between adjacent cabinets or casings at top surfaces as small as practicable.	7.22	
9.27	Shims used as required.	7.22	
9.28	Hinged covers or doors on cabinets not binding with adjacent covers or doors.	7.23	

→ Indicates new or changed information.

[Vertical lines at side of paragraphs indicate requirements.

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Reason for Reissue:
To add paragraph 1.2, 1.4 and 9 and remove Fig. 1..