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Roofing Maintenance Management System

Membrane and Flashing Condition Indexes for Built-Up Roofs
Volume II: Inspection and Distress Manual

Because no systematic procedure exists to determine priorities and select repair strategies for low-slope roofs, the U.S. Army Construction Engineering Research Laboratory (USA-CERL) is developing a roof maintenance management system that will provide a practical decisionmaking procedure to identify cost-effective repairs.

As part of the system for built-up roofs, this volume presents the standardized information needed to conduct the visual inspection survey, including names, descriptions, severity levels, measurement criteria, causes, and photographs of membrane and flashing distresses. Procedures for distress density calculations are also provided. Roof inspectors can use this information to objectively determine the indexes that reflect the (1) ability of the membrane and flashing to perform their functions, (2) needed level of maintenance, and (3) waterproof integrity.

Volume I describes the development and verification of the indexes.

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MEMBRANE AND FLASHING CONDITION INDEXES FOR BUILT-UP ROOFS VOLUME II: INSPECTION AND DISTRESS MANUAL

1 INTRODUCTION

Background

Each of the U.S. armed services branches has a very large inventory of low-slope roofs. Roof repairs and reconstruction work are steadily increasing as the roofs approach the end of their service lives, making it increasingly important to better manage maintenance funds. To ensure the optimum use of these funds, the U.S. Army Construction Engineering Research Laboratory (USA-CERL) is developing a roofing maintenance management system for low-slope roofs. This work is being performed with the coordination and assistance of the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) and the U.S. Army Facilities Engineering Support Agency (FESA).

The system will be developed initially for built-up roofs and will include other roofing systems in the future. The system will be based on a roof condition evaluation procedure which includes a visual inspection survey and nondestructive testing of the roof insulation. The visual inspection will provide a membrane condition index (MCI) and flashing condition index (FCI) which are numerical indicators that reflect the condition of each component in terms of its ability to perform its function, needed level of maintenance and repair, and waterproof integrity.

The two condition indexes are calculated based on the type, severity, and density of distress as determined from the visual roof inspection. To obtain repeatable and meaningful condition index values, distress identification and measurement must be standardized.

Objective

The objective of this work effort was to develop a roof condition index procedure for built-up roofs determined from a visual inspection. This volume provides roof inspectors with a standardized reference for distress identification for both the membrane and flashing. The distress information is to be used in conjunction with the procedures presented in Chapter 2 to determine the MCI and FCI.

Approach

The existing U.S. Air Force roof condition index (RCI) procedure[1] was modified to improve its accuracy, reduce field effort, and increase its usefulness. The modifications and improvements were field tested and revised based on results obtained at seven military installations located in different climates. Guidelines for performing roof inspections and procedures for computing the MCI and FCI were developed.

[1] *Built-Up Roof Management Programs*, Air Force Manual, AFM 91-36, 3 September 1980.

Using the Manual

Chapter 2 contains the inspection procedures. Distresses for the flashing and membrane are presented in Chapters 3 and 4, respectively. Names, descriptions, severity levels, photographs, measurement criteria, and causes are presented for each distress.

It is very important that the inspector be able to identify all distress types and their severity levels and specific defects. The inspector should study this manual and carry a copy for reference during the inspection.

The results of the roof inspection are to be used in conjunction with procedures in Chapter 2 to determine the MCI and FCI and their respective ratings (Figure 1). Deduct value curves are in Appendix A. A sample of the sheets to be used by the roof inspectors is provided in Appendix B.

It should be emphasized that inspectors must follow the distress descriptions in this manual to arrive at meaningful and consistent values for the condition indexes.

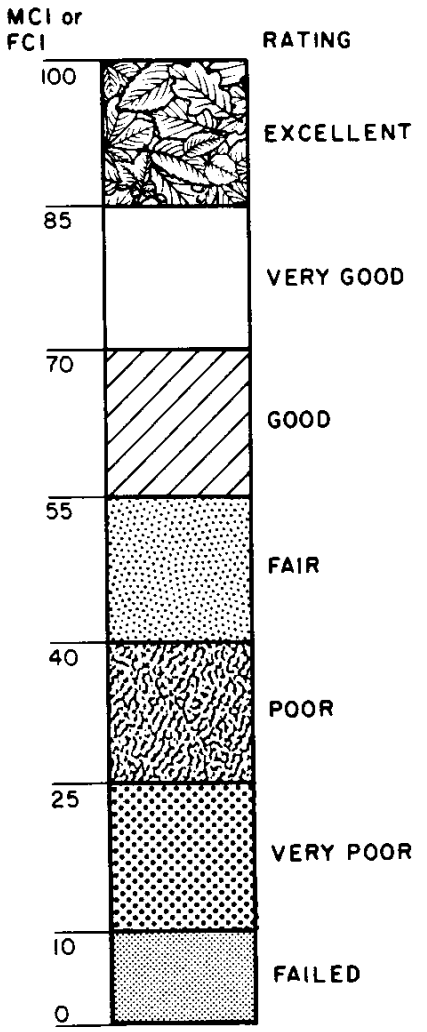

Figure 1. Membrane and Flashing Conditition Indexes (MCI and FCI) and ratings.

2 PROCEDURES FOR ROOF INSPECTION AND CALCULATION OF INDEXES

Introduction

Determining the condition indexes requires measurement of all the existing roof membrane and flashing distresses. A thorough roof inspection must be made to determine the types, severity, specific defects, and amounts (density) of each distress present. This inspection must be carefully organized and planned to provide the necessary information for determining the membrane and flashing conditions.

This chapter presents the procedures for visually inspecting built-up roofs and computing the membrane and flashing condition indexes.

Roof Sections

Dividing a building's roof into sections and rating each separately provides a better evaluation of the overall roof condition because (1) a roof section that is in poor condition would not detract from the condition index of a good roof section on the same building, and (2) a condition index indicating that replacement of the section is necessary would not signal replacement of the roof on the entire building.

A section is generally delineated by:

- expansion joints or area dividers
- different roof elevations
- areas of major repair or replacement
- areas that were built at different times
- areas having different roof systems, different amounts of roof traffic and/or rooftop equipment, or radically different occupancies below the roof
- areas having particularly sensitive occupancies below, such as computer centers, operating rooms or command centers.

Some judgment is necessary in cases where the roof is segmented into very small areas or if there are no identifiable delineations on large roofs. Small sections may be combined where practical. However, if areas have distinct differences in characteristics such as different structural systems, roof systems, or environments below the roof structure (i.e., canopies, freezers, unheated warehouses), they should be treated as individual sections. Large areas without delineations can be divided into sections with areas of 25,000 to 40,000 sq ft.

Roof Plans

Each roof section should have a roof plan which is drawn to a scale (approximately 1" = 30') that fits on the Roof Inspection Worksheet (Figure 2). The plan should show all physical roof features, including perimeter conditions (roof edge, expansion joint, penthouse, etc.), rooftop equipment, projections through the roof, roof drains, walkways, sign supports, piping, etc. Standard symbols should be used to identify these items whenever possible (Figure 3).

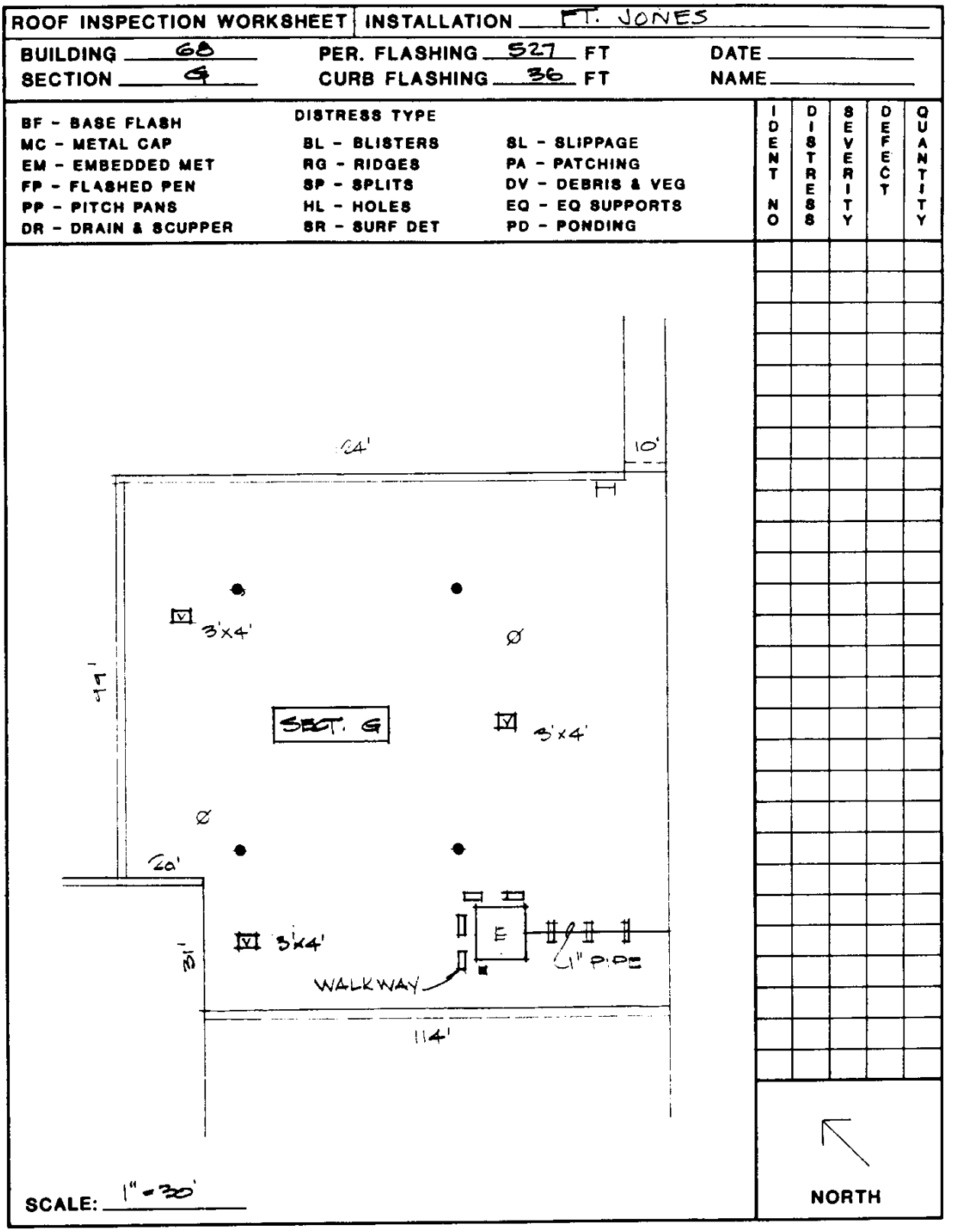

Figure 2. Roof inspection worksheet. (This form has been reduced in size.)

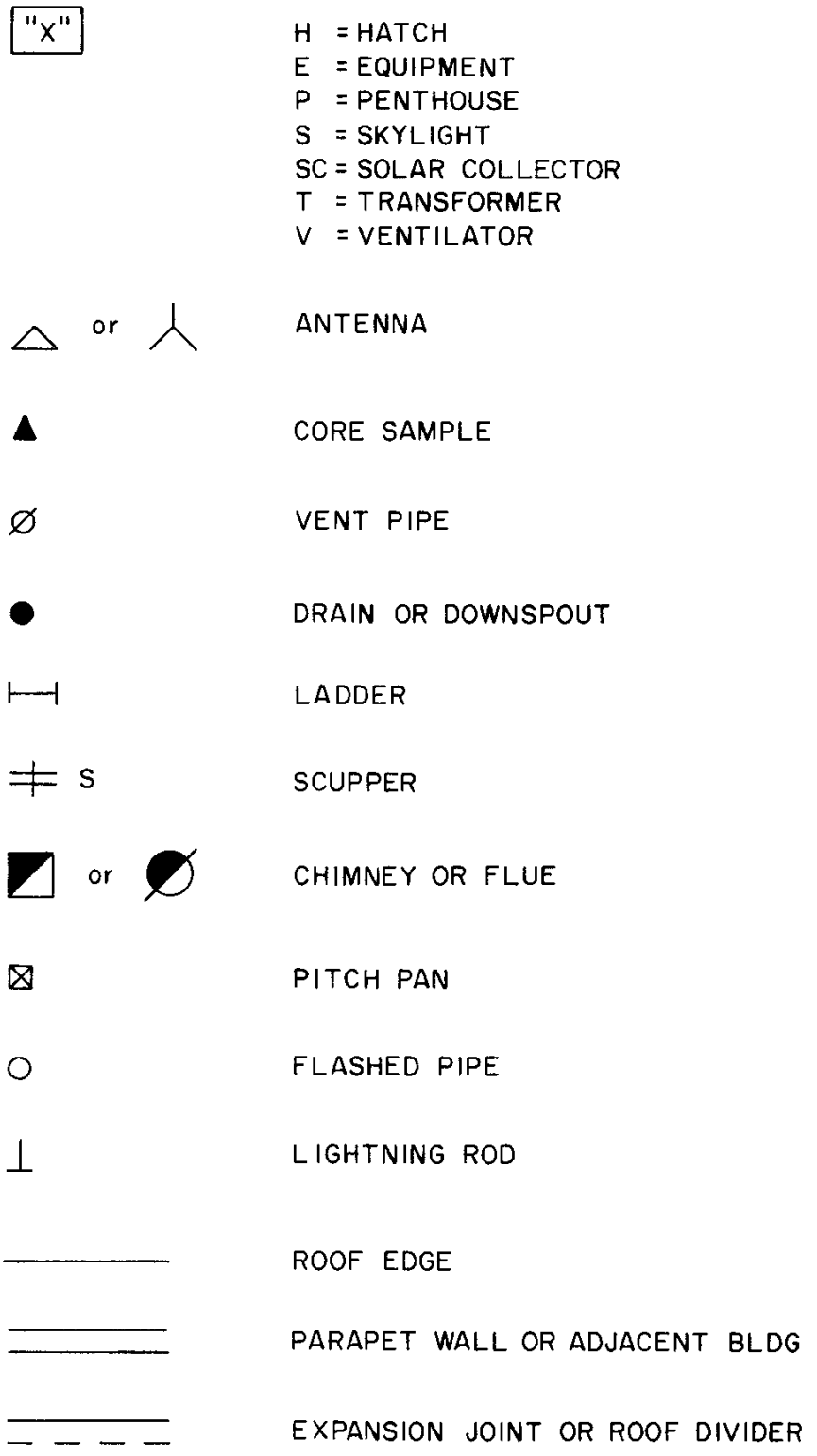

Figure 3. Legend to be used on roof section plans.

Inspection Procedure

Survey Team

The roof inspection should be performed by a team of at least two people: an inspector and a recorder. The inspector surveys the roof, identifying distresses and determining severity levels, specific defects, and quantities. The recorder records the data on the Roof Inspection Worksheet and assists in measuring distress quantities when required. The recorder must also serve as the safety observer for the team.

Supplies

The following supplies are required for performing the inspection:

Inspection and Distress Manual
Pencil and clipboard
Roof Inspection Worksheets
Small 3 in. pointing trowel (to scrape gravel)
Can of spray paint
Stiff bristle whisk broom
Pocket knife
12-ft and 100-ft measuring tapes
Large plastic bag (to collect rooftop debris)
Satchel (for carrying tools and materials)

Survey Preparation

The survey team should complete the general information section at the top of the Roof Inspection Worksheet (Figure 2) and gain access to the roof section. Contact the building superintendent or custodian for assistance. Develop or verify the roof plan before the survey begins. All penetrations, projections, and rooftop equipment should be shown and located correctly. Check plan dimensions against actual field dimensions.

Distress Survey

Perform the distress survey using the following steps:

1. Inspect the perimeter flashing. Establish a starting point at one corner of the roof section. Walk the entire perimeter, examining the base flashing, embedded edge metal flashing, and metal cap flashing.

2. Identify all distresses and specific defects according to the distress manual. Mark each medium and high severity distress with spray paint.* Enter each identified distress by type, severity level, specific defect (specific defects are listed numerically for each distress [see Chapters 3 and 4]), and quantity on the Roof Inspection Worksheet. Note the location of each distress on the roof plan using an identification number (Figure 4). Determine the distress quantities using the measurement criteria described in Chapters 3 and 4.

3. After inspecting the perimeter, work across the roof area inspecting all other flashings: curbed penetrations, flashed penetrations, pitch pans, drains, etc. Record data as in step 2.

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*To be used by maintenance personnel for locating necessary work.

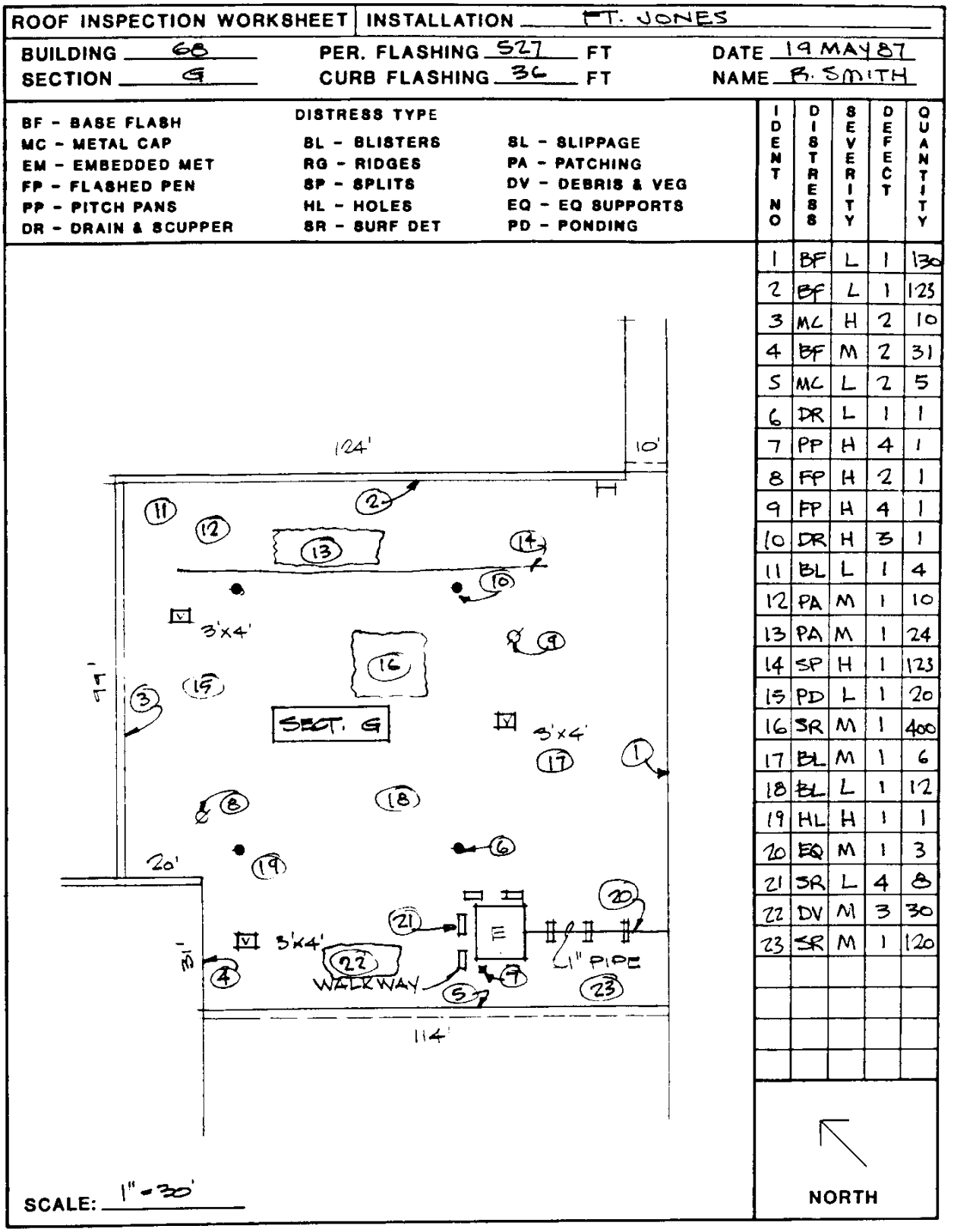


Figure 4. Completed roof inspection worksheet. (This form has been reduced in size.)

4. Inspect the roof membrane. Establish a starting point at one corner of the roof section. Using 10- to 15-ft wide strips, sweep back and forth across the roof section surveying the entire membrane. Record data as in step 2.

5. Complete the "Remarks" section on the back of the Roof Inspection Worksheet.

It is imperative to use the distress definitions listed in this distress manual when performing roof inspections. If these definitions are not followed, accurate indexes cannot be determined. Use a second Roof Inspection Worksheet if the first one becomes filled.

Inspection Guidelines

The guidelines below should be followed when performing the visual inspection and distress survey.

Base Flashing

Measure height of top termination of base flashing above the roof surface (Figure 5). To establish the height, run fingers up behind the counterflashing. If the base flashing height cannot be determined, assume it is adequate (Figure 6).

Metal Cap Flashing

Check for looseness of metal cap flashing by attempting to lift it by hand at several locations.

Embedded Edge Metal

Determine the total number of joints by dividing the total length of embedded edge metal flashing by the length of the edge metal sections (normally 10 ft). Inspect every fourth joint for splits in the stripping felts, removing any loose gravel or dirt from the joint using the small whisk broom and pointing trowel (Figure 7). Determine the number of inspected joints that are high severity (have splits in the stripping felts [Figure 8]) and multiply by 4 to get the total number of high severity joints (one joint equals 1 ft). All other joints are considered medium severity. Multiply the number of inspected joints not counted as high severity by 4 to obtain the total number of medium severity joints. Check that the embedded edge metal flashing is secure by attempting to lift the outside edge.

Flashed Penetrations

Check the height of the flashing sleeve above the roof surface. Use a whisk broom and trowel to examine stripping felts.

Interior Drains and Roof Level Scuppers

Check all drains and scuppers and remove debris whenever possible (Figures 9 and 10). When inspecting drains, make sure the clamping ring is tight. Stripping felts around scuppers should be inspected for holes at corners.

Figure 5. Check height of base flashing above deck.

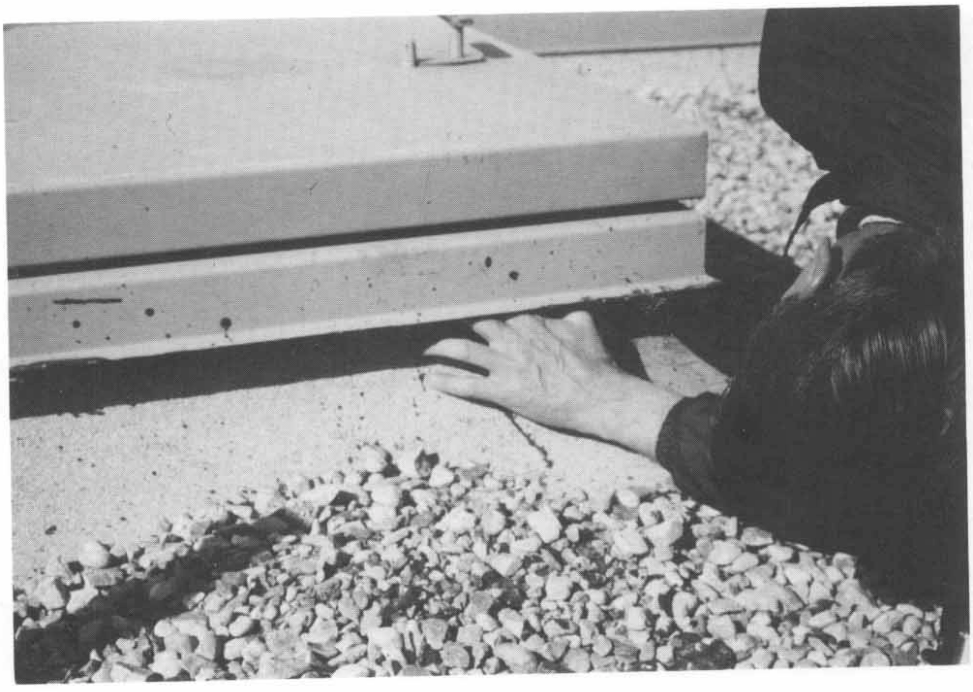


Figure 6. Check base flashing height by running fingers behind counterflashing.

Figure 7. Sweep gravel back from embedded edge metal to expose joints.

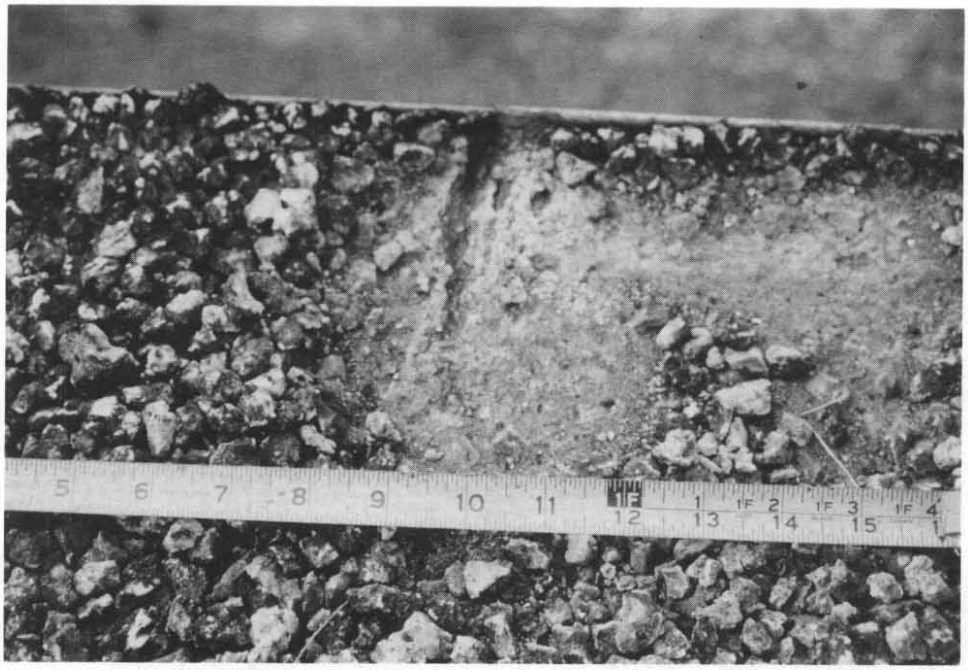


Figure 8. Tear in stripping felts exposed by sweeping gravel away at joints.

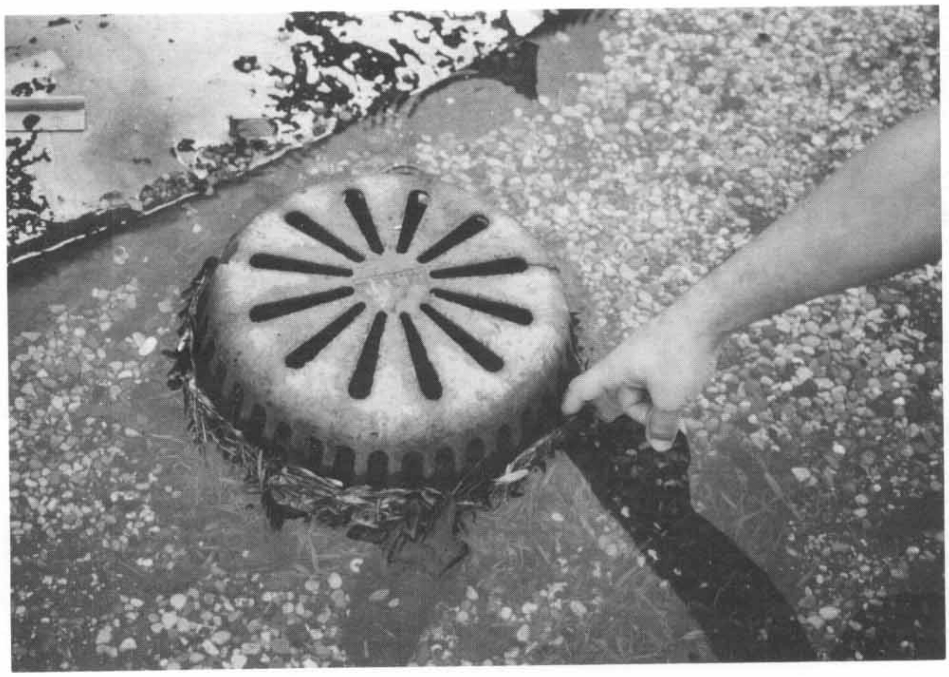


Figure 9. Roof drain clogged by debris.

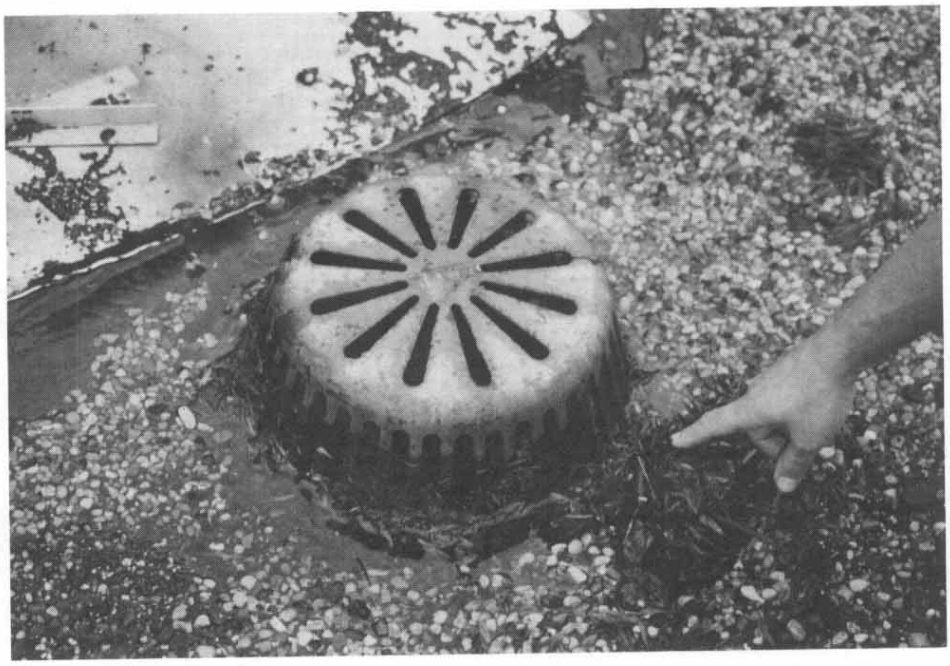


Figure 10. Removing debris frees the drain.

Membrane

Membrane inspection requires surveying the entire roof area. However, when large areas of a particular distress and severity level are present (especially on large roofs), the representative sampling technique can be used. Select a portion of the roof (approximately 1000 sq ft) which appears to be typical of the entire roof area. Measure the quantity of distress in the sample area and by extrapolation, calculate the quantity for the entire roof area. An area that differs greatly from the majority of the roof should be surveyed separately.

General

The following is a list of general guidelines for the roof inspection:

- Be careful not to damage the roof. Do not step on blisters, kick base flashing or step on edge flashing.

- Note existing problems that are not included in the lists of flashing and membrane distresses in the "remarks" section on the back of the worksheet. Figures 11 and 12 show examples of these problems. Walk the outside of the building and look for water stains, efflorescence, missing mortar, spalled brick, and gutter and drainage problems.

- Walk the interior of the building and examine the ceiling below the roof deck for water marks. Note rusting or other signs of water penetration or leaks in the "remarks" section on the back of the worksheet.

- If there is snow or a large area of ponding on the roof, postpone the inspection until the roof is clear.

- Wherever possible, use a measuring tape to determine roofing distress quantities. Estimating is acceptable when necessary; however, the rating accuracy will be only as good as the estimating accuracy. Pacing to find lengths, or some other quantifying estimating method, is preferable to an "eyeball" estimate.

- If more than one severity level of a distress exists in a localized area, count the entire area at the highest severity level.

Calculating the Indexes

Once the condition survey is completed, determine the FCI and MCI for the roof section. Calculating the condition indexes is a simple procedure which involves five steps (Figure 13).

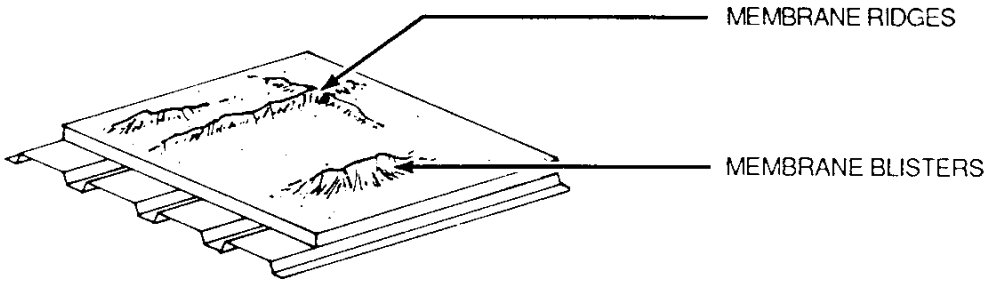
1. For each combination of distress and severity level, transfer the quantities from the Roof Inspection Worksheet to the Roof Section Rating Form (Figure 14).

2. Total the quantities for each combination, calculate their corresponding densities, and determine the deduct values from the deduct value curves (Appendix A) for each distress type and severity.

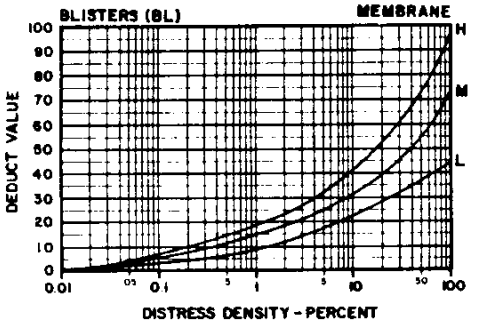
Figure 11. Scupper opening is too small and easily clogged. Report in the "Remarks" section on the back of the Roof Inspection Worksheet.

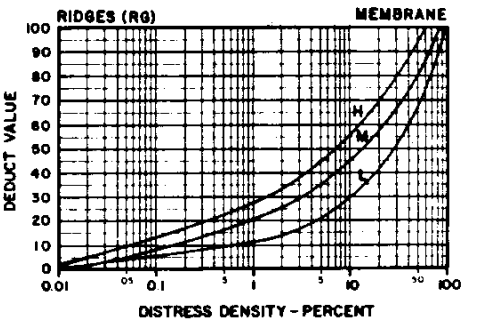
Figure 12. Metal curb around scuttle is corroded and needs paint. Report in the "Remarks" section.

STEP 1. INSPECT ROOF. DETERMINE DISTRESS TYPES AND SEVERITY LEVELS; DETERMINE QUANTITIES AND CALCULATE DENSITIES.



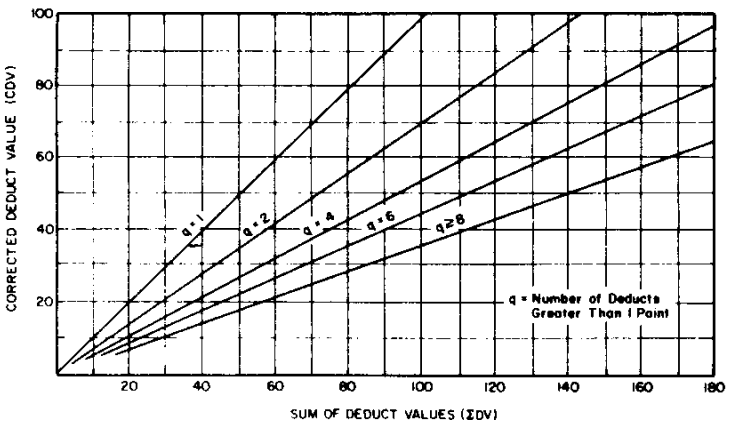
STEP 2. DETERMINE DEDUCT VALUES.

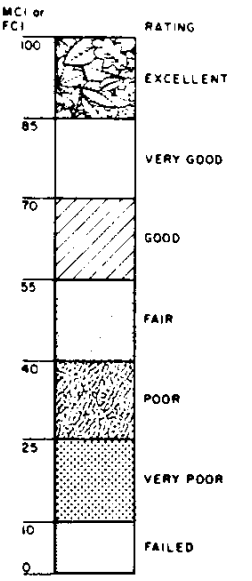




STEP 5. DETERMINE MEMBRANE CONDITION RATING.

STEP 3. COMPUTE CORRECTED DEDUCT VALUE.





STEP 4. COMPUTE MEMBRANE CONDITION INDEX (MCI) = 100-CDV

Figure 13. Steps for determining roof membrane condition rating.

ROOF SECTION RATING FORM

BUILDING 68 | SECTION 6 | DATE 21 MAY 87 | CALC BY DB

PER. FLASHING 527 FT | CURB FLASHING 36 FT | FLASHING TOTAL 563 FT | AREA 16,800 SQFT | CHKD BY BD

FLASHING

DISTRESS TYPE

BF - BASE FLASH
MC - METAL CAP
EM - EMBEDDED MET
FP - FLASHED PEN
PP - PITCH PANS
DR - DRAIN & SCUPPER

TYPE	SEV	QUANTITIES	TOT.	DEN.	DV
BF	L	130 + 123	253	45	17
MC	H	10	10	1.8	13
BF	M	31	31	5.5	13
MC	L	5	5	.89	2
DR	L	1	1	.18	1
PP	H	1	1	.18	9
FP	H	1 + 1	2	.36	11
DR	H	1	1	.18	21

CORRECTED DEDUCT VALUE (CDV) 33

FCI = 100 - CDV = 67

FLASHING RATING = GOOD

MEMBRANE

DISTRESS TYPE

BL - BLISTERS
RG - RIDGES
SP - SPLITS
HL - HOLES
SR - SURF DET
SL - SLIPPAGE
PA - PATCHING
DV - DEBRIS & VEG
EQ - EQU SUPPORTS
PD - PONDING

TYPE	SEV	QUANTITIES	TOT.	DEN.	DV
BL	L	4 + 12	16	.10	3
PA	M	10 + 24	34	.20	7
SP	H	123	123	.73	65
PD	L	20	20	.12	3
SR	H	400 + 120	520	3.1	14
BL	H	6	6	.036	2
HL	H	1	1	.006	5
EQ	M	3	3	.018	3
SR	L	8	8	.048	2
DV	M	30	30	.18	2

CORRECTED DEDUCT VALUE (CDV) 65

MCI = 100 - CDV = 35

MEMBRANE RATING = POOR

Figure 14. **Roof section rating form.** (This form has been reduced in size.)

3. For each component (flashing and membrane), list the individual deduct values in descending order and compute the sum of the deduct values (ΣDV) and q (# of DV's > 1) as shown below. Determine the corresponding corrected deduct values (CDVs) from the Corrected Deduct Value Curves (Appendix A). The CDV of maximum value should be used to compute the condition index.

Flashing (distress data from Figure 14)

DV	ΣDV	q	CDV
21	21	1	21
17	38	2	24
13	51	3	28
13	64	4	32
11	75	5	(33)
9	84	6	33
2	86	7	32
1	87	7	31

Maximum $CDV_{flashing} = 33$

Membrane (distress data from Figure 14)

DV	ΣDV	q	CDV
65	65	1	(65)
14	79	2	55
7	86	3	53
5	91	4	48
3	94	5	47
3	97	6	43
3	100	7	40
2	102	8	37
2	104	9	38
2	106	10	38

Maximum $CDV_{membrane} = 65$

4. Compute the condition indexes using the following equations:

$$FCI = 100 - \text{Max. } CDV_{flashing} \quad \text{[Eq 1]}$$

$$MCI = 100 - \text{Max. } CDV_{membrane} \quad \text{[Eq 2]}$$

5. Determine the condition ratings from Figure 1.

3 FLASHING DISTRESSES

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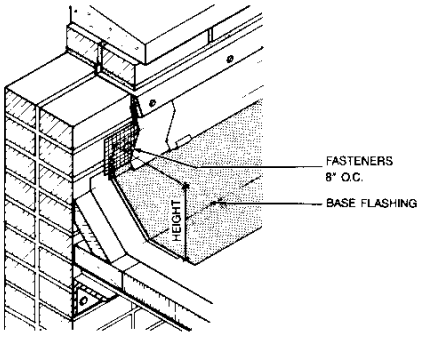
BASE FLASHING

Description: Base flashing is one or more plies of material which extend from the roof surface up onto a vertical or inclined surface providing a watertight termination of the membrane.



BASE FLASHING-PARAPET

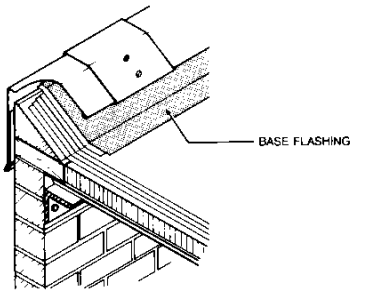
Severity Levels:

Low: Any of the following conditions:

1. Loss of surfacing on mineral-surfaced sheets or other poor appearance (including patching) but no apparent deterioration of felts.
2. Top of base flashing is less than 6 in. above the roof surface.
3. Flashing has permanent repairs.

Medium: Any of the following conditions:

1. Slippage, wrinkling, blistering, or pulling of base flashing material.
2. Loss of surfacing with some deterioration of felts but no holes, splits, or tears.
3. Grease, solvent, or oil drippings on the base flashing but no deterioration of felts.
4. Flashing has temporary repairs.



BASE FLASHING-ROOF EDGE

High: Any of the following conditions:

1. Holes, splits, or tears in flashing caused by deterioration or physical damage.
2. Exposed gaps at the top of the base flashing which are not covered by counter-flashing or open side laps in the flashing which allow water to channel behind them.
3. Grease, solvent, or oil drippings on the base flashing with deterioration of the felts.

Measurement: Measure lineal feet of base flashing having the above conditions. Holes, open side laps, and seams count as 1 ft each. If an area of the base flashing is at medium severity and holes are closer than 6 in., count that entire length of distressed base flashing as high severity.

Density:

$$\frac{A}{B} \times 100 = \text{Problem Density}$$

where A = length of base flashing defects (ft)
B = total length of flashed perimeter of roof section being rated (including flashings for penthouses, courtyards, and curbed projections)

Note: The problem density is calculated for each existing severity level.

Causes:

1. Flashing splits or tears can result from mechanical damage, material shrinkage, unattached membrane pulling the flashing, or differential movement between the wall and the deck.
2. Delamination and sliding result from weak or no attachment between the flashing plies or between the flashing and the substrate. This can result from any of the following conditions:

   - When first installed, the flashing piles were not firmly pressed into the bitumen to form a solid, continuous laminate.
   - No primer was used on the wall.
   - The wrong bitumen was used to attach the flashing plies to the wall.
   - The flashing cement was improper or of poor quality.
   - The hot-mopped bitumen was allowed to cool before the flashing plies were applied.
   - Fasteners were improper type or too few to hold flashing to substrate.

BF1 Base Flashing
<Low Severity>
Curb is not high enough--
6 in. minimum

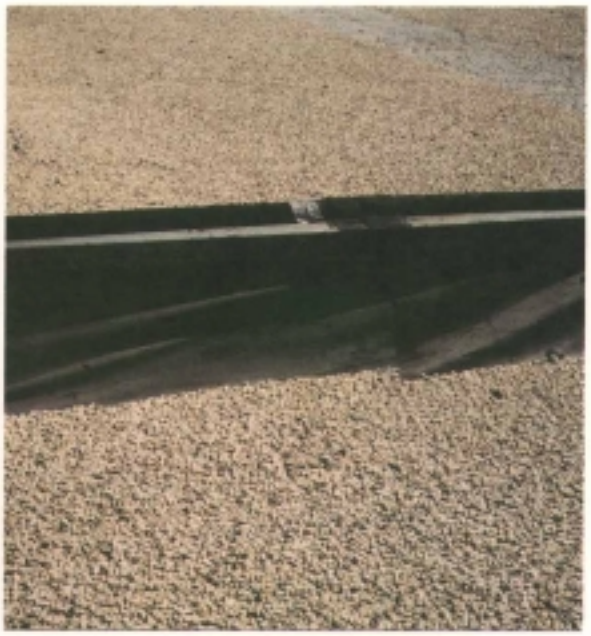
BF2 Base Flashing
<Low Severity>
Surface looks poor but there are
no areas that are worn through

BF3 Base Flashing
<Low Severity>
Poor appearance of coating but coating
is not worn through. Also, counter-
flashing is displaced <High Severity>

BF4 Base Flashing
<Low Severity>
Mineral surfacing is worn but
surface is still intact

Base Flashing (BF)

BF5 Base Flashing
<Medium Severity>
Surfacing is worn but hole is not all the way through the flashing

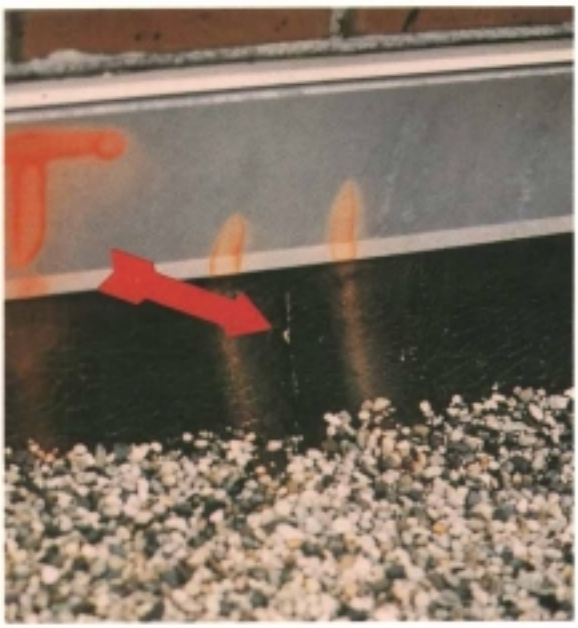


BF6 Base Flashing
<Medium Severity>
Base flashing is pulled and not firmly bonded to the curb

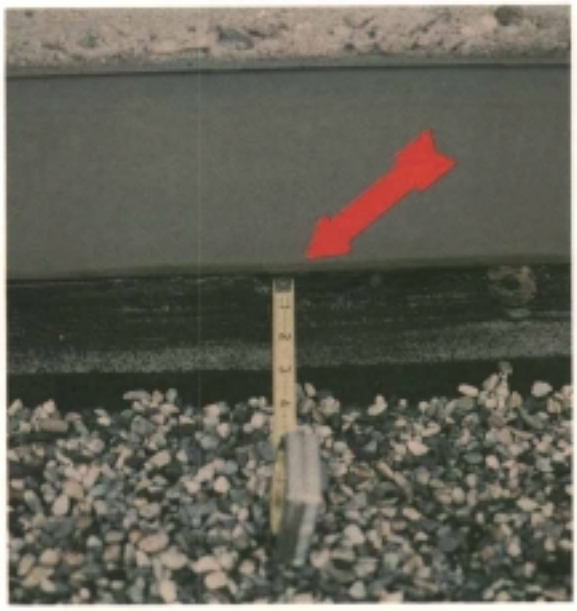
BF7 Base Flashing
<Medium Severity>
Flashing material has sagged

BF8 Base Flashing
<High Severity>
Deteriorated flashing material; there are holes through all piles of the flashing

BF9 Base Flashing
<High Severity>
There is an open seam and the material has sagged



BF10 Base Flashing
<High Severity>
There is an open seam in the flashing



BF11 Base Flashing
<High Severity>
Flashing has sagged; top is open

BF12 Base Flashing
<High Severity>
There is a hole through the flashing material

BF13 Base Flashing
<High Severity>
There is an open seam in the flashing

BF14 Base Flashing
<High Severity>
There is a hole in the flashing material

METAL CAP FLASHING

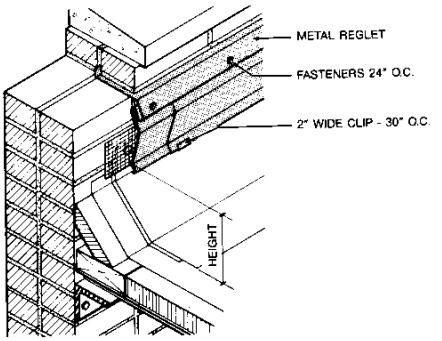
Description: Metal cap flashing includes counterflashing and any sheet metal coping cap which serves as part of the counterflashing or the cover over a detail such as a roof area divider, equipment curb, raised roof edge, or an expansion joint (including the rubber bellows of an expansion joint).

Counterflashing is the material, usually sheet metal, which protects the top termination of base flashing and sheds water away from it. Counterflashing should be free to expand and contract.

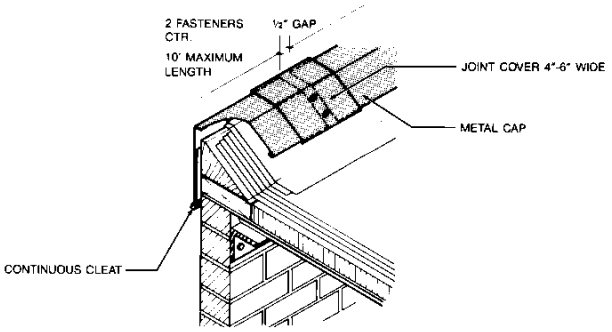
Severity Levels:

Low: Any of the following conditions:

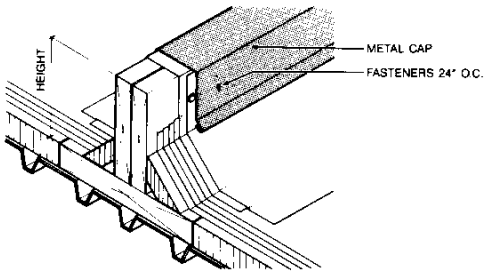
1. Loss of paint or protective coating or start of metal corrosion.
2. Metal coping cap is deformed and allows water to pond on the top.
3. Counterflashing is deformed but still performing its function.
4. Counterflashing has been sealed to the base flashing.



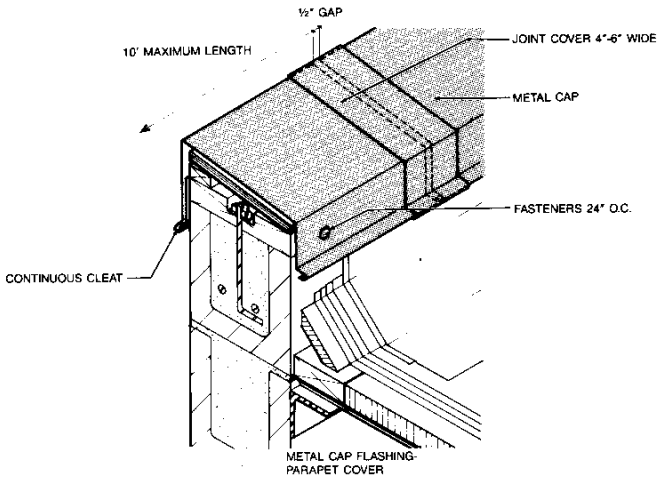
METAL CAP FLASHING-
COUNTER FLASHING



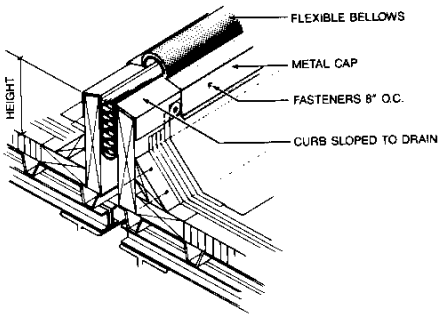
METAL CAP FLASHING -
ROOF EDGE



METAL CAP FLASHING-
AREA DIVIDER



METAL CAP FLASHING-
PARAPET COVER



METAL CAP FLASHING-
EXPANSION JOINT

Metal Cap Flashing (MC)

Medium: Any of the following conditions:

1. Corrosion holes have occurred through the metal on a vertical surface.
2. Metal coping cap has loose fasteners, failure of soldered or sealed joints, open joints, or loss of attachment.
3. Sealant at reglet or top of counterflashing is missing or no longer functioning, allowing water to channel behind counterflashing.
4. Counterflashing is loose at the top, allowing water to channel behind it.
5. Counterflashing does not extend over top of base flashing.

High: Any of the following conditions:

1. Metal coping cap or counterflashing is missing or displaced from its original position.
2. Corrosion holes have occurred through the metal on a horizontal surface.
3. Metal coping cap has missing joint covers where joint covers were originally installed.

Measurement: Measure lineal feet of metal cap flashing having the above conditions. Individual defects (i.e., joints, holes) count as one foot minimum.

Density:

$$\frac{A}{B} \times 100 = \text{Problem Density}$$

where A = length of metal cap flashing defects (ft)
B = total length of flashed perimeter of roof section being rated (including flashings for penthouses, courtyards, and curbed projections)

Note: The problem density is calculated for each existing severity level.

MC1 Metal Cap Flashing
<Low Severity>
The metal has begun to corrode but no holes are evident

MC2 Metal Cap Flashing
<Low Severity>
The metal is bent but still functions; there is some corrosion

MC3 Metal Cap Flashing
<Low Severity>
The metal is bent but still is able to function

MC4 Metal Cap Flashing
<Low Severity>
The counterflashing has been sealed to the base flashing

Metal Cap Flashing (MC)

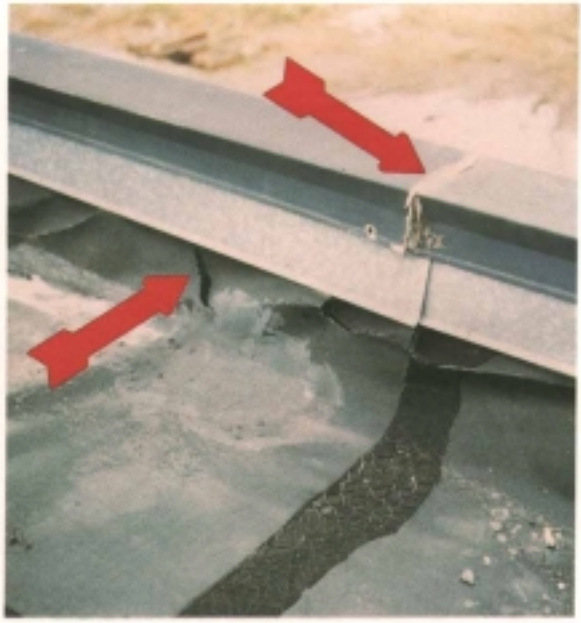
MC5 Metal Cap Flashing
<Low Severity>
Metal or accessories have been deformed or damaged

MC6 Metal Cap Flashing
<Low Severity>
Water can accumulate on top of the cap

MC7 Metal Cap Flashing
<Medium Severity>
The metal has been bent so that water can accumulate on the joint in the masonry

MC8 Metal Cap Flashing
<Medium Severity>
The top of the counterflashing holds water

MC9 Metal Cap Flashing
<Medium Severity>
The top of the counterflashing is loose



MC10 Metal Cap Flashing
<Medium Severity>
Joint in cap has failed; caulking has not corrected the problem. Also, Base Flashing has holes
<High Severity>

MC11 Metal Cap Flashing
<Medium Severity>
Neoprene cover at joint has failed

MC12 Metal Cap Flashing
<High Severity>
The metal counterflashing has fallen off of the wall

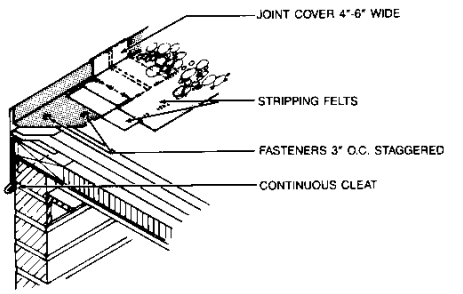
MC13 Metal Cap Flashing
<High Severity>
The metal has corroded so that there are holes in the metal

MC14 Metal Cap Flashing
<High Severity>
Joint covers are missing

MC15 Metal Cap Flashing
<No Severity level--report in remarks>
The reglet has been cut into the top of the parapet wall; the caulking has failed

MC16 Metal Cap Flashing
<No Severity level--report in remarks> There is no cap flashing; water has penetrated the masonry and deterioration has occurred due to freeze-thaw action

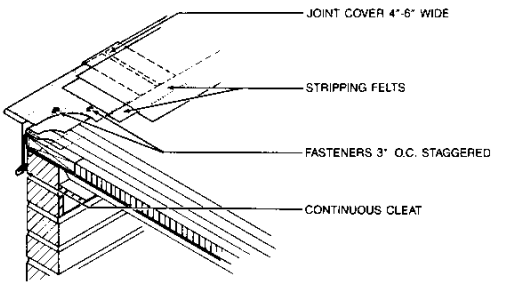
EMBEDDED EDGE METAL



EMBEDDED EDGE METAL

Description: Formed strip of metal at the roof edge which continues down the vertical part of the wall to form a fascia or drip. This stripped-in flashing provides a finished termination for the roofing membrane. A formed vertical projection (gravel stop) may be incorporated to prevent loose aggregate from rolling or washing off the roof. Exterior and interior gutters, which are embedded into the membrane, are considered as embedded edge metal. (An interior gutter is a built-in trough of metal or other material which collects water from the roof and carries it to a downspout.)

Note: A raised roof edge which is not stripped in, is rated as metal cap flashing and not as embedded edge metal.



EMBEDDED EDGE METAL

Severity Levels:

Low:

1. The entire length of embedded edge metal flashings is rated low severity as a minimum due to the maintenance problems associated with it.

Medium: Any of the following conditions:

1. The joints in embedded edge metal flashings are rated medium severity as a minimum due to the maintenance problems associated with them.
2. Nails under the stripping felts are backing out.
3. Corrosion of the metal.
4. Loose or lifted metal flange without deterioration of the stripping felts.
5. The entire length of interior gutter is rated medium severity as a minimum due to the maintenance problems and high potential for leak damage associated with its presence.

High: Any of the following conditions:

1. Stripping felts are missing or loose.
2. Splits in the stripping felts above the metal joints.
3. Holes have occurred through the metal.
4. Loose or lifted metal flange with deterioration of the stripping felts.
5. Holes or joint movement are present in the interior gutter.

Measurement: Measure lineal feet of embedded edge metal flashing having the above conditions. Each split above a joint is counted as one foot. As a method of sampling the joints, determine the total number of joints by dividing the total length of embedded edge metal flashing by the length of edge metal sections (normally 10 ft). Every fourth

joint should be inspected for splits in the stripping felts. Count the number of inspected joints that are high severity and multiply by 4 to determine the total lineal feet of high severity joints. All other joints are rated medium severity. Multiply the number of inspected joints not rated high severity by 4 to determine the total lineal feet of medium severity joints.

Density:

$$\frac{A}{B} \times 100 = \text{Problem Density}$$

where A = length of embedded edge metal flashing defects (ft)
B = total length of flashed perimeter of roof section being rated (including flashings for penthouses, courtyards and curbed projections)

Note: The problem density is calculated for each existing severity level.

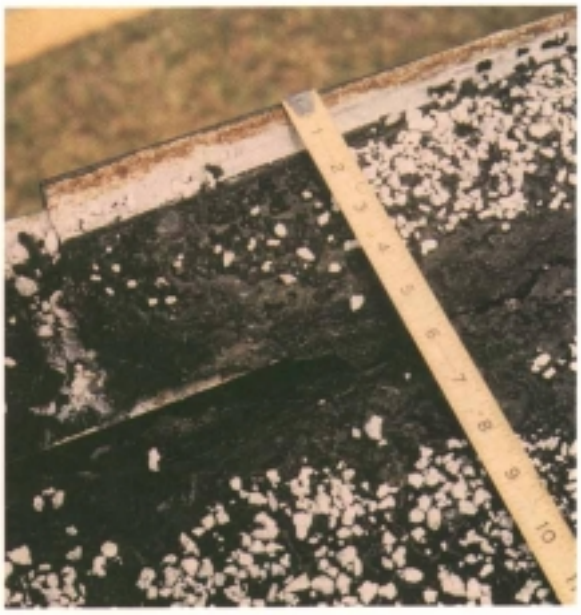
Causes:

1. Splits in the stripping felts and loose stripping felts are caused by:
   - Insufficient or improper nailing of the metal flange allowing it to move.
   - Insufficient or no priming of the metal flange (top and bottom) before installation. This prevents bonding of the bitumen to the metal.
   - The widely different expansion coefficients of the metal and bituminous components.
2. Exposed metal flanges can result from stripping felt deterioration or the flange may never have been stripped-in.
3. Loose or lifted metal edge is caused by insufficient fastening, rotting, or lack of a wood perimeter nailer.

EM1 Embedded Edge Metal
<Low Severity>
Tapered edge metal is raised but strip-in still presents a potential hazard

EM2 Embedded Edge Metal
<Medium Severity>
There are interior gutters

EM3 Embedded Edge Metal
<High Severity>
The stripping shows the beginning of a tear or break



EM4 Embedded Edge Metal
<High Severity>
The metal is loose or lifted

Embedded Edge Metal (EM)

EM5 Embedded Edge Metal
<Medium Severity>
Stripping felts are missing

EM6 Embedded Edge Metal
<High Severity>
The stripping is torn or broken

EM7 Embedded Edge Metal
<High Severity>
The metal movement has torn the stripping

EM8 Embedded Edge Metal
<High Severity>
The stripping felts are torn

EM9 Embedded Edge Metal
<High Severity>
The stripping felt is torn along the back edge of the embedded metal

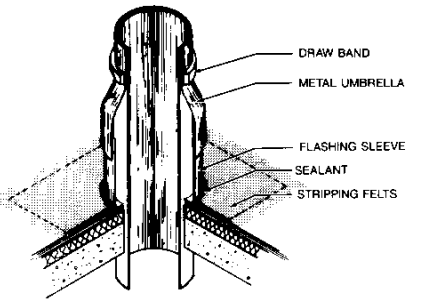
EM10 Embedded Edge Metal
<High Severity>
The edge metal is bent or deformed; the stripping is torn

EM11 Embedded Edge Metal
<High Severity>
The stripping is torn

Embedded Edge Metal

FLASHED PENETRATIONS

Description: Open pipes, plumbing vent stacks, flues, ducts, continuous pipes, guy wires, drain sumps, and other penetrations through the roof membrane (excluding pitch pans but including metal curbing for hatches and ventilators, where the flange is stripped into the membrane).



FLASHED PENETRATION

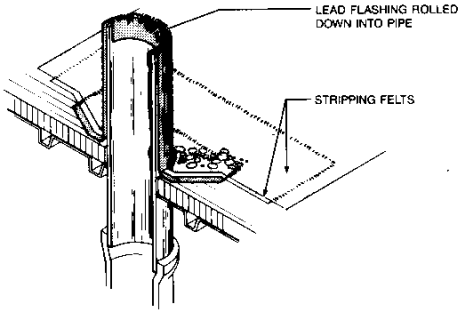
Severity Levels:

Low: Either of the following conditions:

1. Flashing sleeve is deformed.
2. Opening in the penetration or flashing is less than 6 in. above the roof surface.

Medium: Any of the following conditions:

1. Edge of stripping felts is exposed but there is no apparent felt deterioration.
2. Top of flashing sleeve is not sealed or has not been rolled down into an existing plumbing vent stack.
3. The sleeve or umbrella is open or no umbrella is present (where required).
4. Metal is corroded.



FLASHED PENETRATION
PLUMBING VENT STACK

High: Any of the following conditions:

1. Flashing sleeve or metal curb has been installed with no stripping felts.
2. Flashing sleeve or metal curb is cracked, broken, or corroded through.
3. No flashing sleeve is present.
4. Penetration is not sealed at the membrane level.

Measurement: Count each distressed flashed penetration as one linear ft at the highest severity level which exists. For metal curbs and ducts with greater than 1 ft of perimeter, count the actual length (in feet) of distressed perimeter.

Density:

$$\frac{A}{B} \times 100 = \text{Problem Density}$$

where A = lineal feet of distressed flashed penetrations
B = total length of flashed perimeter of roof section being rated (including flashings for penthouses, courtyards and curbed projections)

Note: The problem density is calculated for each existing severity level.

FP1 Flashed Penetration
<Low Severity>
The vent stack is distorted due to movement of the membrane

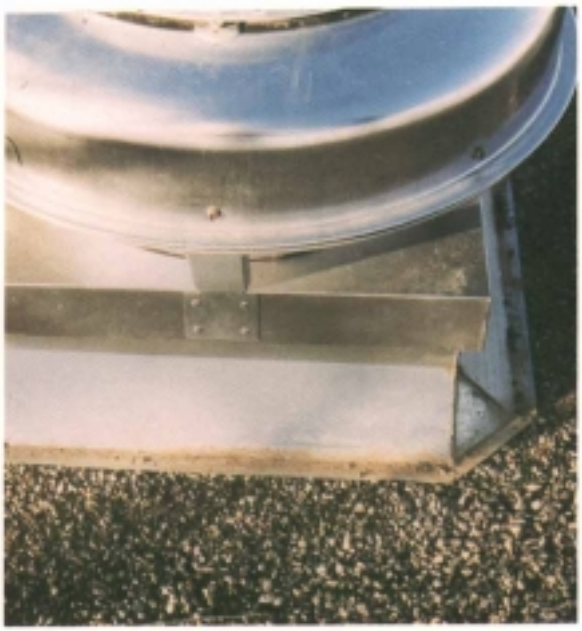
FP2 Flashed Penetration
<Low Severity>
The top of the flashing is less than 6 in. above the finished roof

FP3 Flashed Penetration
<Low Severity>
The top of flashing sleeve is not sealed

FP4 Flashed Penetration
<Medium Severity>
The lead had not been rolled down into the vent

Flashed Penetrations (FP)

FP5 Flashed Penetration
<Medium Severity>
The seal at the umbrella is broken



FP6 Flashed Penetration
<Medium Severity>
The flashing curb has not been stripped-in

FP7 Flashed Penetration
<Medium Severity>
The flashing sleeve is cracked or broken

FP8 Flashed Penetration
<Medium Severity>
The flashing umbrella is missing

FP9 Flashed Penetration
<High Severity>
The lead flashing is broken

FP10 Flashed Penetration
<High Severity>
The joint in the metal sleeve has failed

FP11 Flashed Penetration
<High Severity>
The metal has corroded and holes are evident

FP12 Flashed Penetration
<High Severity>
The metal flashing has been left out

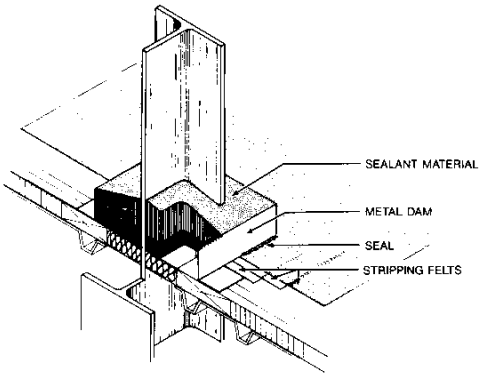
FP13 Flashed Penetration
<High Severity>
Unflashed pipe penetration sealed with roofing cement

FP14 Flashed Penetration
<High Severity>
Guy wire anchor has not been flashed

FP15 Flashed Penetration
<High Severity>
The sleeve around the penetration is missing; the conduit is lying on the roof without supports

PITCH PANS

Description: A pitch pan is a flanged metal sleeve placed around a roof-penetrating element and filled with a sealer.



PITCH PAN

Severity Levels:

Low:

1. Pitch pans are rated low severity as a minimum due to the maintenance problems associated with them.

High: Any of the following conditions:

1. Metal corrosion.
2. Sealing material is below metal rim.
3. Stripping felts are exposed or deteriorated.
4. Sealing material has cracked or separated from pan or penetration.

Measurement: Each distressed pitch pan should be counted once at the highest severity level which exists.

Density:

$$\frac{A}{B} \times 100 = \text{Problem Density}$$

where A = number of distressed pitch pans
B = total length of flashed perimeter of roof section being rated (including flashings for penthouses, courtyards, and curbed projections)

Note: The problem density is calculated for each existing severity level.

PP1 Pitch Pans
<Low Severity>
Pitch pan installed and maintained correctly but presents a hazard

PP2 Pitch Pans
<High Severity>
Metal shows light corrosion

PP3 Pitch Pans
<High Severity>
Water standing in pitch pan; fill material not complete

PP4 Pitch Pans
<High Severity>
Fill material is low; water standing in pan

PP5 Pitch Pans
<High Severity>
Sides of pan are distorted; fill material is low

PP6 Pitch Pans
<High Severity>
Pipe sleeve used as pitch pan has not been filled

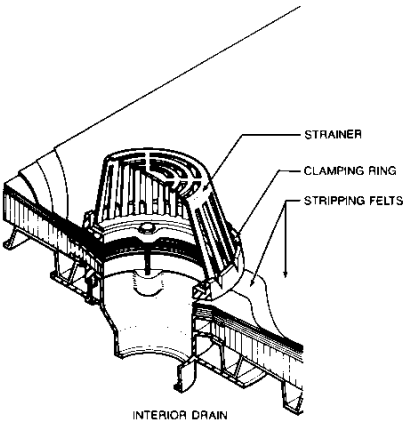
PP7 Pitch Pans
<High Severity>
Fill material has pulled away from the sides of the pan

PP8 Pitch Pans
<High Severity>
Material has pulled away; water can penetrate pan

PP9 Pitch Pans
<High Severity>
Pan not full

INTERIOR DRAINS AND ROOF LEVEL SCUPPERS

Description: A drain is a penetration at the roof membrane which allows water to flow from the roof surface into a piped drainage system. The drain fixture at the roof has a flange and/or clamping arrangement to which the roofing membrane is attached. A roof level scupper is a channel through a parapet or raised roof edge which is designed for peripheral drainage of the roof.



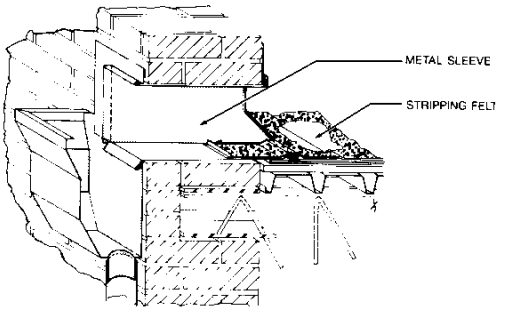
INTERIOR DRAIN

Note: Stripping felts around scuppers should be carefully inspected for holes at corners.

Severity Levels:

Low:

1. Bitumen has flowed into the drain leader but the drain is not clogged.



SCUPPER

Medium: Any of the following conditions:

1. Stripping felts are exposed but there is no apparent deterioration of felts.
2. Strainer is broken or missing.
3. Scupper shows loss of paint or protective coating or start of metal corrosion.

High: Any of the following conditions:

1. Stripping felts have holes or are deteriorated.
2. Clamping ring is loose or missing from drain body or bolts are missing.
3. Drain is clogged.
4. Scupper metal is broken or holes have occurred through the metal.

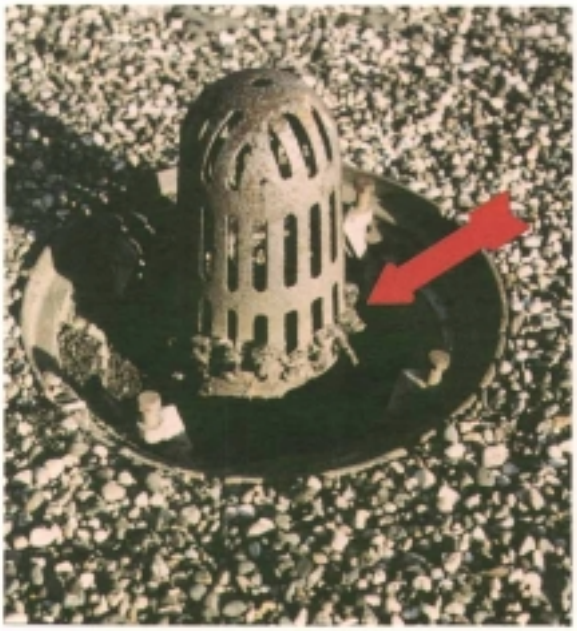
Measurement: Each distressed drain and scupper should be counted once at the highest severity level which exists.

Density:

$$\frac{A}{B} \times 100 = \text{Problem Density}$$

where A = number of distressed interior drains and roof level scuppers
B = total length of flashed perimeter of roof section being rated (including flashings for penthouses, courtyards and curbed projections)

Note: The problem density is calculated for each existing severity level.



DR1 Drains and Scuppers
<Low Severity>
Bituminous material has flowed into the drain

DR2 Drains and Scuppers
<Medium Severity>
The felts around the drain are exposed

DR3 Drains and Scuppers
<Medium Severity>
The strainer is broken

DR4 Drains and Scuppers
<High Severity>
The clamping ring is loose. Bolts are lying next to the ring

DR5 Drains and Scuppers
<High Severity>
The clamping ring is missing; also, the strainer is broken and the drain is clogged with bitumen

DR6 Drains and Scuppers
<High Severity>
The drain is clogged

DR7 Drains and Scuppers
<High Severity>
The drain is clogged, the clamping ring is missing, and the strainer is broken

DR8 Drains and Scuppers
<High Severity>
The drain is clogged

4 MEMBRANE DISTRESSES

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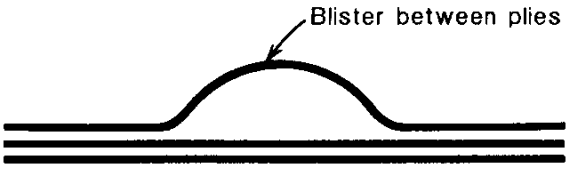
BLISTERS

Description: Blisters are round or elongated raised areas of the membrane which are filled with air.



Graphic Representation of Blister

Note: Blisters and ridges are difficult to differentiate at the low and medium severity levels. The rating error will be insignificant because of the similarity in the deduct curves. At high severity, however, it is important to distinguish between the two distresses due to their different leak potentials.

Severity Levels:

Low:

1. The raised areas are noticeable by vision or feel. The surfacing is still in place and the felts are not exposed.

Medium:

1. The felts are exposed or show deterioration.

High:

1. The blisters are broken.

Measurement:

1. Measure the length and width of the blister in lineal feet and calculate the area (length times width). If the distance between individual blisters is less than 5 ft, measure the entire affected area in sq ft.
2. When large quantities of this problem are present (especially on large roofs), the representative sampling technique can be used.

Density:

$$\frac{A}{B} \times 100 = \text{Problem Density}$$

where A = total area of membrane blisters (sq ft)
B = total area of roof section being rated (sq ft)

Note: The problem density is calculated for each existing severity level.

Causes: Blisters are caused by voids or lack of attachment within the membrane. Moisture and gasses within the void greatly increases the potential for growth.

BL1 Blisters
<Low Severity>
Low severity blisters.
The surface is still in place

BL2 Blisters
<Low Severity>
Large blister but still low severity level

BL3 Blisters
<Low Severity>
Blisters in walk-pad application

BL4 Blisters
<Low Severity>
Blisters in gravel surfaced membrane

BL5 Blisters
<Low Severity>
General blistering over all of roof surface

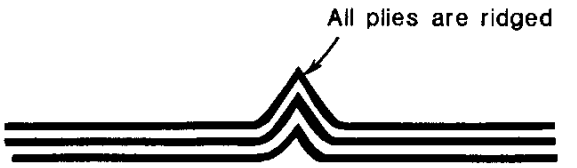
BL6 Blisters
<Low Severity>
Blisters in cap sheet

BL7 Blisters
<Medium Severity>
Blister is bare and felts are starting to show wear

BL8 Blisters
<High Severity>
Blister has broken

RIDGES

Description: Ridges are long, narrow (usually less than 3 in.), raised portions of the roof membrane. Their maximum height is about 2 in. Usually ridges occur directly above the insulation board joints and run perpendicular or parallel to the felts. They include all the plies and therefore are generally stiffer than blisters.



Graphic Representation of Ridge

Note: Blisters and ridges are difficult to differentiate at the low and medium severity. The rating error will be insignificant because of the similarity in the deduct curves. However at the high severity, it is important to distinguish between the two distresses due to their different leak potentials.

Severity Levels:

Low:

1. The ridges are noticeable but the felts are not exposed.

Medium:

1. The ridges are raised and clearly visible. The surfacing on the ridge is gone and the top felt is exposed.

High: Either of the following conditions:

1. Open breaks have developed in the ridge.
2. Felt deterioration has progressed through the top ply, exposing underlying plies.

Measurement: Measure lineal feet of ridges running in all directions.

Density:

$$\frac{A}{B} \times 100 = \text{Problem Density}$$

where A = total length of membrane ridges (ft)
B = total area of roof section being rated (sq ft)

Note: The problem density is calculated for each existing severity level.

Causes: Ridging can be the result of internally generated moisture vapor collecting at insulation joints and affecting the membrane or of movement of the substrate.

RG1 Ridges
<Low Severity>
Beginnings of ridges evident in surface; some picture framing evident

RG2 Ridges
<Medium Severity>
Closeup of medium severity ridging condition

RG3 Ridges
<Low Severity>
Ridges in a smooth surface membrane

RG4 Ridges
<Medium Severity>
Bare felt showing; some slippage of felt at lap is evident

RG5 Ridges
<Medium Severity>
Smooth surface membrane

RG6 Ridges
<High Severity>
Felts are distorted; felt lap is opening up; first felt shows deterioration

RG7 Ridges
<High Severity>
Ridge has collapsed; felt is broken or torn

SPLITS

Description: Splits are tears that extend through all membrane felts. They vary in length from a few feet to the length of the roof and in width from a hair-line crack to more than 1 in. Splits generally occur directly above the joints between the long sides of insulation boards and run in the direction the felts were installed.

Graphic Representation of Split

Severity Levels:

High:

1. An unrepaired split or a repaired split which has started to re-open.

Measurement: Measure lineal feet of split.

Density:

$$\frac{A}{B} \times 100 = \text{Problem Density}$$

where A = total length of membrane splits (ft)
B = total area of roof section being rated (sq ft)

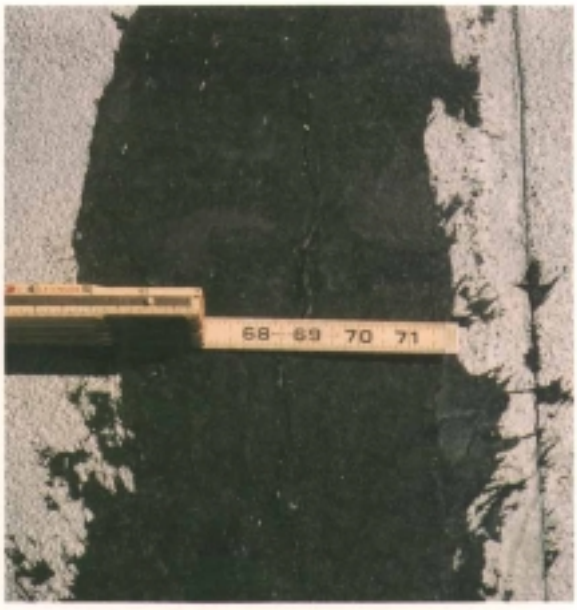
Causes:

1. The membrane is too weak.
2. There is little or no attachment between any of the following: membrane, insulation, vapor retarder (if any), and deck.
3. Areas of the membrane have missed headlaps.
4. Differential movement at deck joints.
5. Structural movement within the roof system.
6. Stress concentration due to shrinkage cracking of a poured deck.

SP1 Splits
<High Severity>
Long split over structural member; yellow markings indicate water penetration determined by infrared (IR) scanning

SP2 Splits
<High Severity>
Closeup of split in gravel surface; repair attempt made using mastic without reinforcing fabric

SP3 Splits
<High Severity>
Large split in gravel surface roof



SP4 Splits
<High Severity>
Split in mineral cap sheet

HOLES

Description: A membrane hole is any visible opening which extends through all membrane layers. Holes can be of various sizes and shapes, and can be located anywhere on the roof surface.

Severity Levels:

High:

1. All holes in the membrane are considered high severity due to their high leak potential.

Measurement: Count the total number of holes in the membrane. If the distance between two holes is less than 1 ft, count them as one hole.

Density:

$$\frac{A}{B} \times 100 = \text{Problem Density}$$

where A = number of membrane holes
B = total area of roof section being rated (sq ft)

HL1 Holes
<High Severity>
Membrane below gravel surface has been penetrated by a sharp object

HL2 Holes
<High Severity>
Holes in smooth surfaced roof

SURFACE DETERIORATION

Description: A built-up roofing membrane will generally have one of the following types of surfacing: aggregate surface, mineral surface-cap or smooth surface-coated. The membrane surface may show any of the following distressed conditions:

1. Lack of top surface or coating.
2. Alligatoring (interconnected hairline cracks that resemble alligator hide).
3. Lack of adhesion between the membrane plies.

Note: Walkways are treated as part of the membrane surfacing.

Severity Levels:

Low: Any of the following conditions:

1. On aggregate surfaced roofs, the aggregate is not embedded or is poorly embedded but the felts remain covered with aggregate.
2. Open edge laps or fishmouths.
3. On smooth surfaced roofs, there is evidence of crazing of top surface with hairline cracks (alligatoring).
4. Walkway shows loss of surfacing, loss of adhesion, cracks, blistering or cracked coating.

Medium: Any of the following conditions:

1. On aggregate surfaced roofs, the aggregate is displaced and the top coat of bitumen is exposed.
2. On mineral surfaced-cap sheet roofs, the mineral granules have come off the cap sheet, exposing the underlying felt.
3. On smooth surfaced roofs, no surface coating exists or there is a loss of surface coating.
4. On smooth surfaced roofs, alligator cracks extend down through the bitumen to the top felt.

High: Any of the following conditions:

1. On aggregate surfaced roofs, the aggregate cover has been displaced and the bitumen pour coat is deteriorated, leaving the underlying felts exposed. The felts may be deteriorated.
2. On mineral surfaced-cap sheet roofs, the cap sheet felt is deteriorated.
3. On smooth surfaced roofs, alligator cracks extend down through one or more plies.
4. Shrinking of the walkway has torn the membrane below it.

Measurement:

1. Measure square feet of each affected area and rate at highest severity level which exists.
2. When large quantities of this problem are present (especially on large roofs), the representative sampling technique can be used.

Density:

$$\frac{A}{B} \times 100 = \text{Problem Density}$$

where A = total area of surface deterioration (sq ft)
B = total area of roof section being rated (sq ft)

Note: The problem density is calculated for each existing severity level.

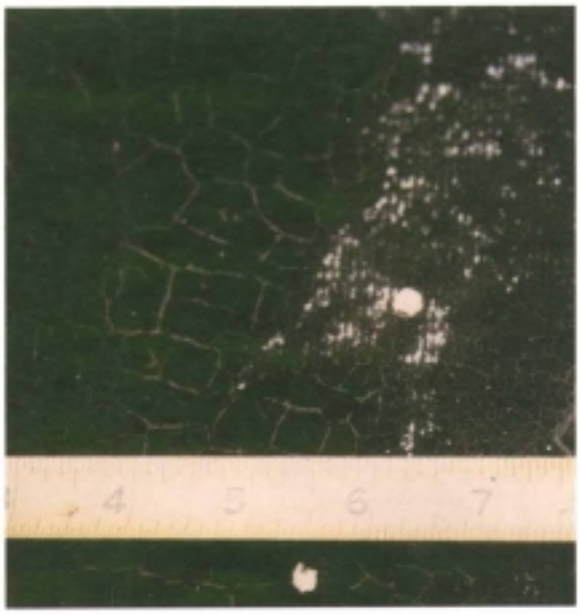
Causes:

1. Inadequate top pour coat.
2. Little or no embedment of aggregate.
3. Wind erosion such as occurs at roof corners and water erosion such as occurs when downspouts empty directly onto the membrane.
4. Use of bitumen on a slope that is greater than proper for that bitumen. The bitumen and gravel run off, leaving the felts exposed. This can affect localized areas or the entire roof.
5. Alligatoring results from overapplication of bitumen or aging bitumen, combined with weathering and temperature cycling. The bitumen gradually loses the ability to flow back together and alligatoring is enhanced.

SR1 Surface Deterioration
<Low Severity>
Gravel is loose and easily displaced by wind; imbedment of gravel is minimal
<Medium Severity>
Bare areas

SR2 Surface Deterioration
<Low Severity>
There are open edge laps or fishmouths

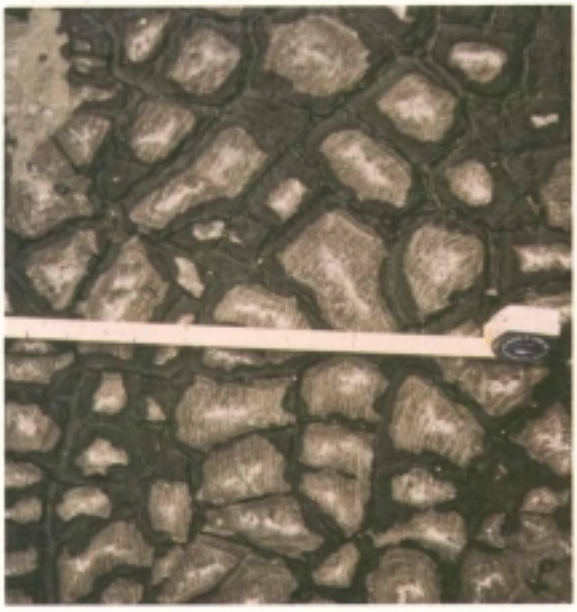
SR3 Surface Deterioration
<Low Severity>
Walkways are cracked or blistered



SR4 Surface Deterioration
<Low Severity>
Hairline alligator cracking of the surface is evident

SR5 Surface Deterioration
<Medium Severity>
Granule surface on cap sheet is eroded

SR6 Surface Deterioration
<Medium Severity>
Loss of surface coating on smooth surface roof



SR7 Surface Deterioration
<Medium Severity>
Alligator cracking of the surface extends down to the felt

SR8 Surface Deterioration
<Medium Severity>
Alligator cracking of the surface extends down to the felt

SR9 Surface Deterioration
<Medium Severity>
Gravel surfacing shows erosion from wind coming over corner of building

SR10 Surface Deterioration
<High Severity>
Gravel surfacing is gone and felts are starting to show wear

SR11 Surface Deterioration
<High Severity>
Smooth surface membrane is deteriorated

SR12 Surface Deterioration
<High Severity>
Cap sheet is completely worn and felt is torn or broken

SLIPPAGE

Description: Slippage is a downslope lateral movement of felt plies. Slippage usually occurs on roofs with slopes greater than 1/4 in./ft.

Severity Levels:

Low:

1. Less than 2 in. of slippage has occurred, evidenced by the presence of narrow bare strips perpendicular to the slope.

Note: Low severity slippage requires inspection at 6 month intervals.

High:

1. More than 2 in. of slippage has occurred. There is evidence of humping and wrinkling.

Measurement: Measure square feet of affected roof area. The affected area extends from the high point on the slope where bare felts are noticeable, down to the low point of the slope or the area where humping and wrinkling are noticeable.

Density:

$$\frac{A}{B} \times 100 = \text{Problem Density}$$

where A = total affected area of roof (sq ft)
B = total area of roof section being rated (sq ft)

Note: The problem density is calculated for each existing severity level.

Causes:

1. Inadequate fastening of felts for the amount of roof slope present.
2. Use of improper bitumen.
3. Thickness of asphalt interply moppings is too great, reducing horizontal shear resistance between felt plies.
4. Phased construction, where the base sheet is glazed and felts applied at a later date.

SL1 Slippage
<Low Severity>
Slippage lines can be seen in the roof surface

SL2 Slippage
<High Severity>
Slippage is greater than 2 in.

SL3 Slippage
<High Severity>
Slippage is evident in surface and is greater than 2 in.

PATCHING

Description: A localized repair of the membrane done with cold-applied roofing cement with fabric or felt embedded in it, with hot bitumen and felts, or with a modified bitumen system. It should be obvious that the work is not part of the original roof construction.

Severity Levels:

Low:

1. All patches are rated low severity as a minimum.

Medium:

1. The materials and workmanship of the patch are not equal to or better than the existing membrane.

High:

1. Ruptures or other membrane distresses of at least medium severity are present within the patched area (count as patching distress only).

Measurement:

1. Measure square feet of each patch having the above conditions.
2. When large quantities of this problem are present (especially on large roofs), the representative sampling technique can be used.

Density:

$$\frac{A}{B} \times 100 = \text{Problem Density}$$

where A = total area of patching (sq ft)
B = total area of roof section being rated (sq ft)

Note: The problem density is calculated for each existing severity level.

PA1 Patching
<Low Severity>
Patching is evident in smooth surfaced roof.

PA2 Patching
<Low Severity>
Patching is evident in gravel surfaced roof

PA3 Patching
<Medium Severity>
Patching material is not the same as the original roof

PA4 Patching
<High Severity>
Patched area has a high severity blister

PA5 Patching
<High Severity>
Patched area has a split

DEBRIS AND VEGETATION

Description:

1. Foreign objects on the roof which could damage or puncture the membrane.
2. The growth of vegetation on the roof.
3. Accumulation of solvent and oil drippings on the roof.

Severity Levels:

Medium: Any of the following conditions:

1. The collection of foreign objects which are not removed from the roof during the inspection.
2. Grease, solvent, or oil drippings on the roof which show no degradation of the roof membrane.
3. Evidence of vegetation, but not penetrating the felts.

High: Any of the following conditions:

1. Grease, solvent, or oil drippings on the roof which is causing degradation to the roofing system.
2. Vegetation roots that have penetrated the felts.

Measurement: Measure square feet of affected area. Each isolated case of debris and vegetation of less than 1 sq ft in area should be counted as 1 sq ft.

Density:

$$\frac{A}{B} \times 100 = \text{Problem Density}$$

where A = total area of debris and vegetation (sq ft)
B = total area of roof section being rated (sq ft)

Note: The problem density is calculated for each existing severity level.

DV1 Debris and Vegetation
Freon container left on roof;
inspector should remove

DV2 Debris and Vegetation
<Medium Severity>
Accumulation of tree needles
on roof

DV3 Debris and Vegetation
<Medium Severity>
Boxes of roof insulation left on roof

DV4 Debris and Vegetation
<Medium Severity>
Conduit and piping left on roof

Debris and Vegetation (DV)

DV5 Debris and Vegetation
<Medium Severity>
Grass growing on roof

DV6 Debris and Vegetation
<Medium Severity>
Vegetation growing on roof

DV7 Debris and Vegetation
<Medium Severity>
Lawn growing on roof

DV8 Debris and Vegetation
<High Severity>
Degradation of membrane due to
oil or solvent drippage

IMPROPER EQUIPMENT SUPPORTS

Description: Pipe, conduit, and mechanical equipment supports (wood sleepers, channels, etc.) which are placed directly on the roof surface with no protective pad or placed at insufficient height to allow for maintaining the membrane below the equipment. Repairing this distress may require replacing the surrounding insulation and membrane.

Note: Terminations for guy wires are to be rated as flashed penetrations distresses.

Severity Levels:

Low:

1. All improper equipment supports are rated low severity as a minimum due to the maintenance problems associated with them.

Medium: Either of the following conditions:

1. Movement of the support has caused displacement of the roof surfacing but has not damaged the membrane.
2. The equipment is bolted through the membrane but the bolts appear to be sealed.

High: Either of the following conditions:

1. The support has caused damage to the roof membrane.
2. The equipment is bolted through the membrane and the bolts appear not to be sealed.

Measurement: Measure square feet of each improper equipment support. The minimum dimension for length and width of a support shall be 1 ft.

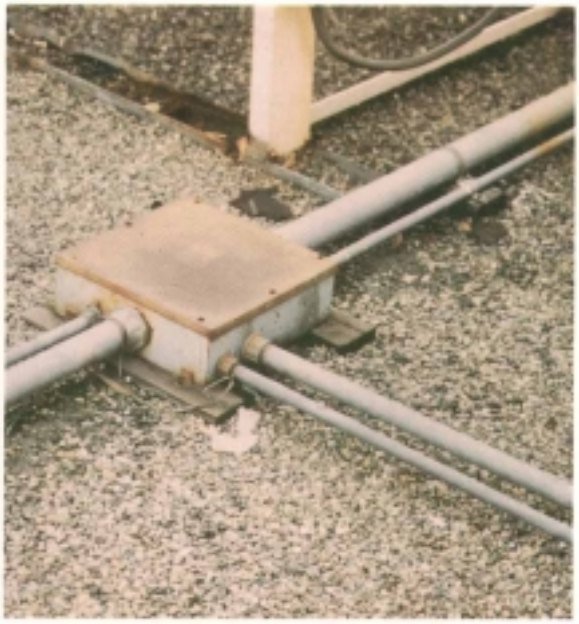
Density:

$$\frac{A}{B} \times 100 = \text{Problem Density}$$

where A = total area of improper equipment supports (sq ft)
B = total area of roof section being rated (sq ft)

Note: The problem density is calculated for each existing severity level.

EQ1 Improper Equipment Supports
<Low Severity>
Pipe supported by wood block



EQ2 Improper Equipment Supports
<Low Severity>
Conduit supported by wood blocks

EQ3 Improper Equipment Supports
<Low Severity>
Ductwork supported on steel channels
which rest on the membrane, unflashed

EQ4 Improper Equipment Supports
<Low Severity>
Large air-conditioning unit
supported on unflashed steel

EQ5 Improper Equipment Supports
<Medium Severity>
Air handling equipment installed directly on the roof surface

EQ6 Improper Equipment Supports
<High Severity>
Blocks supporting piping have moved, tearing the roof membrane

EQ7 Improper Equipment Supports
<High Severity>
Angle leg set on roof without flashing

EQ8 Improper Equipment Supports
<High Severity>
Equipment support has damaged membrane

Improper Equipment Supports (EQ)

EQ9 Improper Equipment Supports
<High Severity>
Improper A/C support and pipe penetration

EQ10 Improper Equipment Supports
<High Severity>
Base for antenna has not been placed on a flashed curb.
Bolts penetrate membrane

EQ11 Improper Equipment Supports
<High Severity>
Antenna base is nailed to roof

PONDING

Description: Standing water is present or there is evidence of ponding by the presence of staining. Water which remains after 48 hr. is considered ponded water.

Severity Levels:

Low:

1. Ponding is rated low severity due to the maintenance problems associated with it.

Measurement: Measure square feet of affected area.

Density:

$$\frac{A}{B} \times 100 = \text{Problem Density}$$

where: A = total area of ponding (sq ft)
B = total area of roof section being rated (sq ft)

Causes:

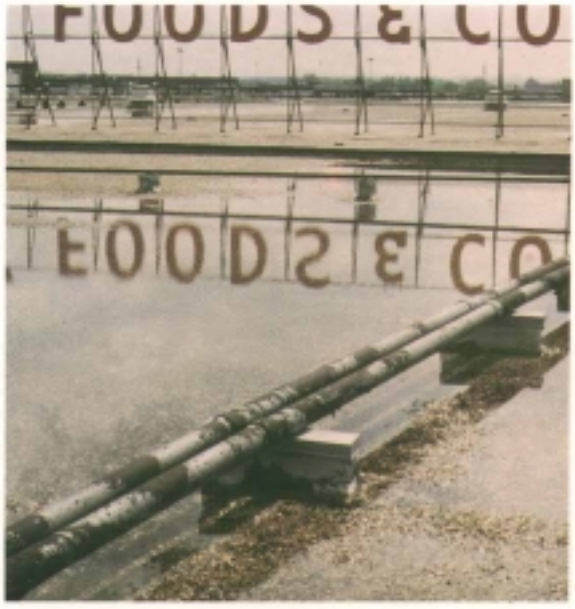
1. Improper design of roof drainage system.
2. Irregularities of membrane surface.
3. Clogged roof drains and scuppers or obstructions.

PD1 Ponding
<Low Severity>
Ponding is occurring between drains

PD2 Ponding
<Low Severity>
Ponding on "dead-flat" roof

PD3 Ponding
<Low Severity>
Drain is blocked. Clearing of drain by the inspector will eliminate the distress

PD4 Ponding
<Low Severity>
Scupper edge is too high and blocks drainage



PD5 Ponding
<Low Severity>
General ponding due to poor drain locations

PD6 Ponding
<Low Severity>
Dirt accumulation on roof indicating that water ponds near the drain

PD7 Ponding
<Low Severity>
Debris--indication of ponding

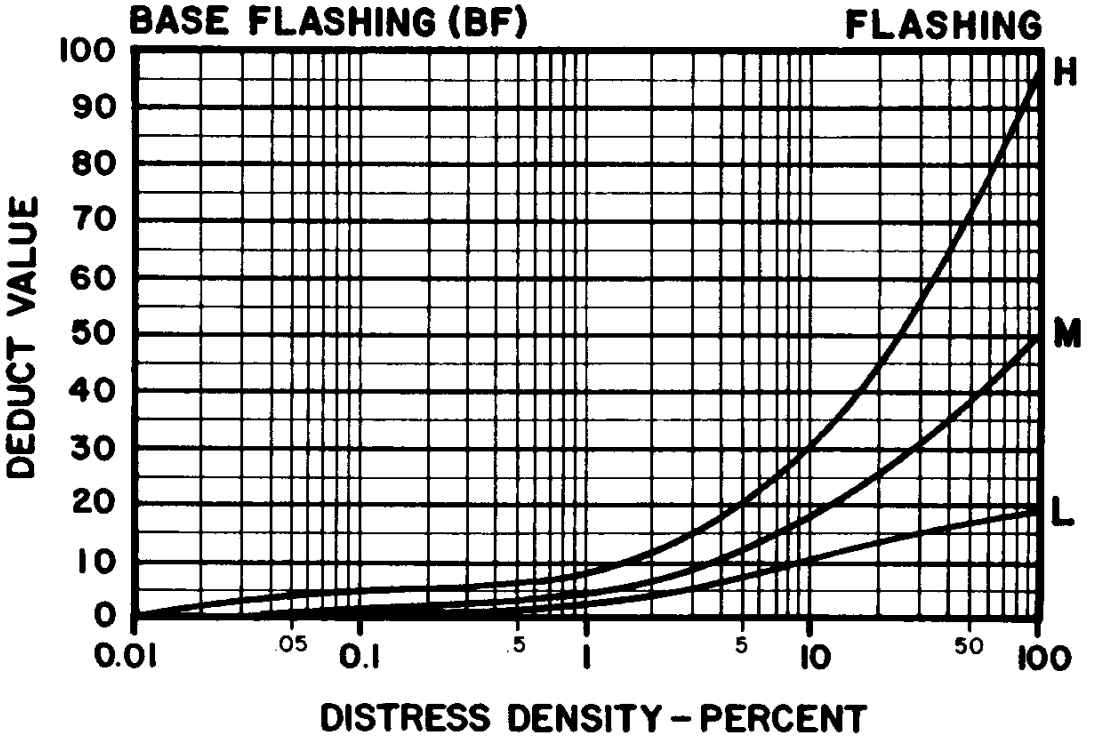
PD8 Ponding
<Low Severity>
Drain is placed too high

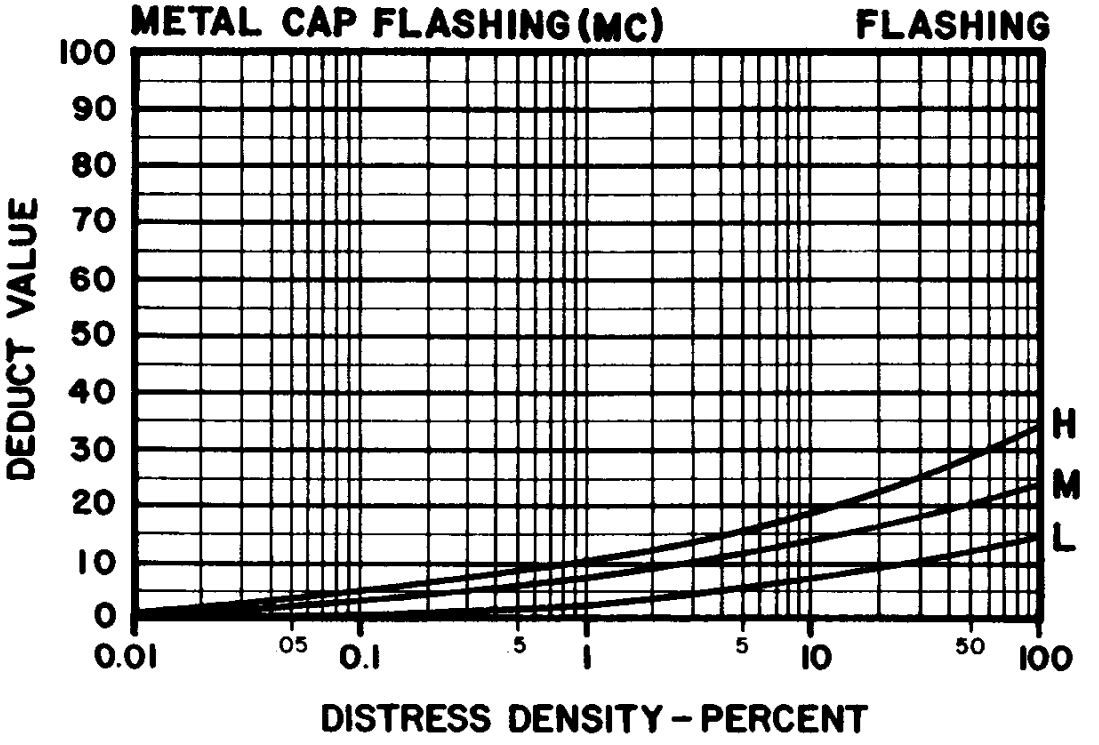
PD9 Ponding
<Low Severity>
Ponding on roof

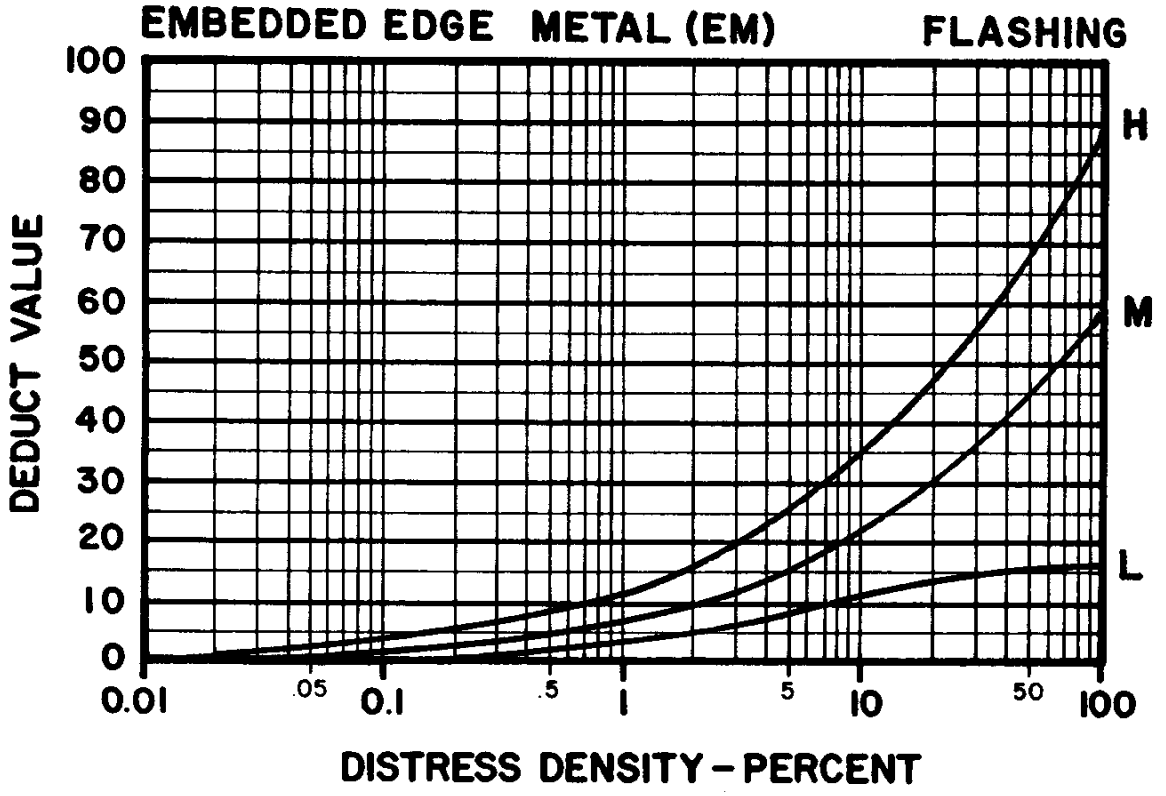
PD10 Ponding
<Low Severity>
Evidence of ponding shown in PD9

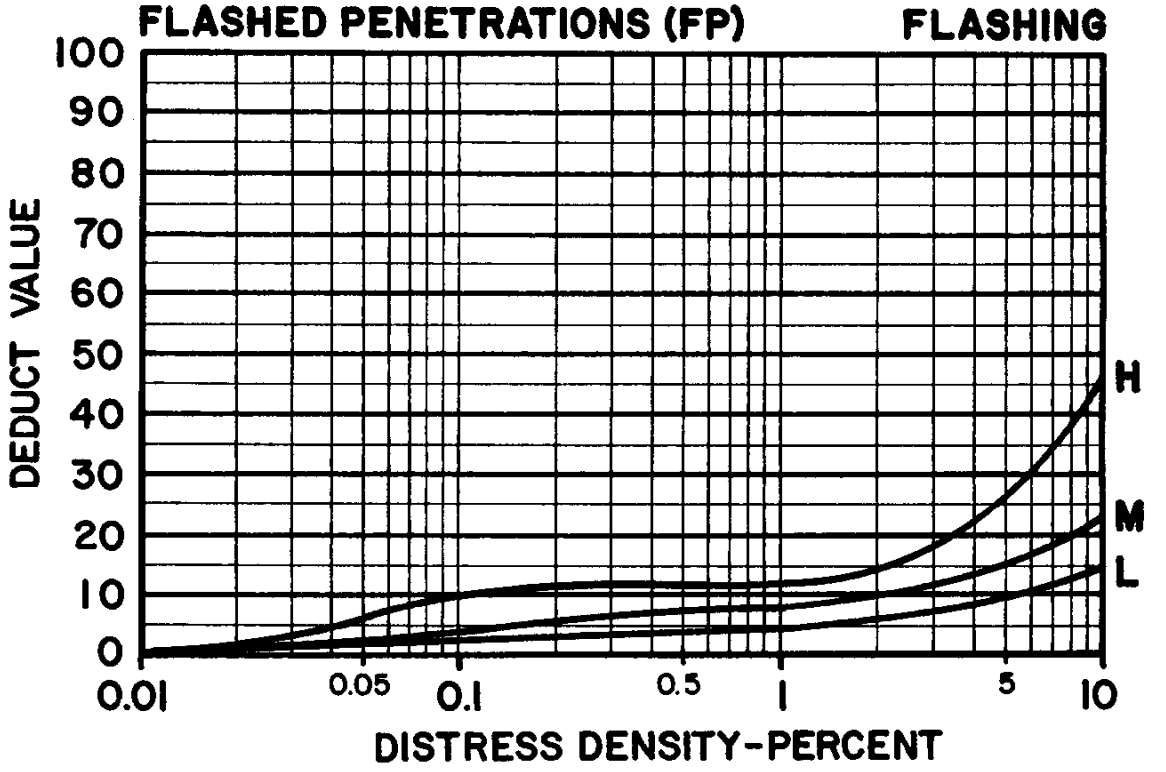
APPENDIX A:

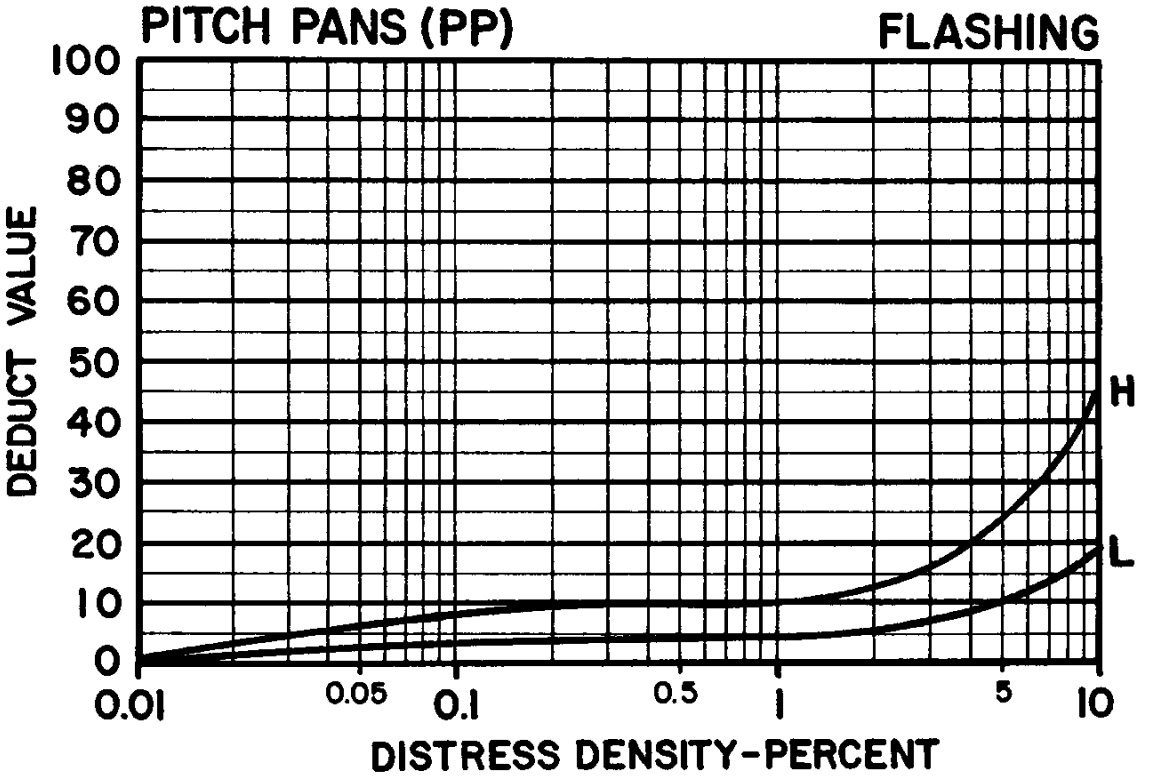
DEDUCT VALUE CURVES

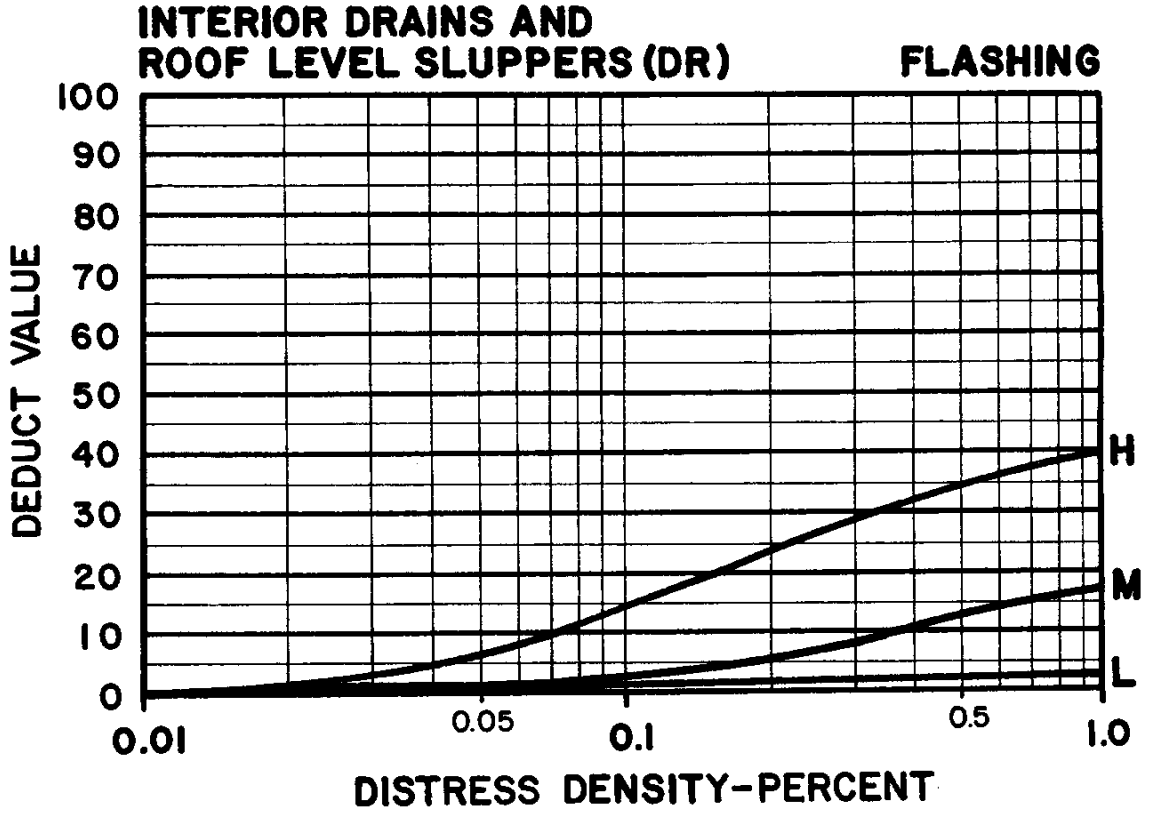


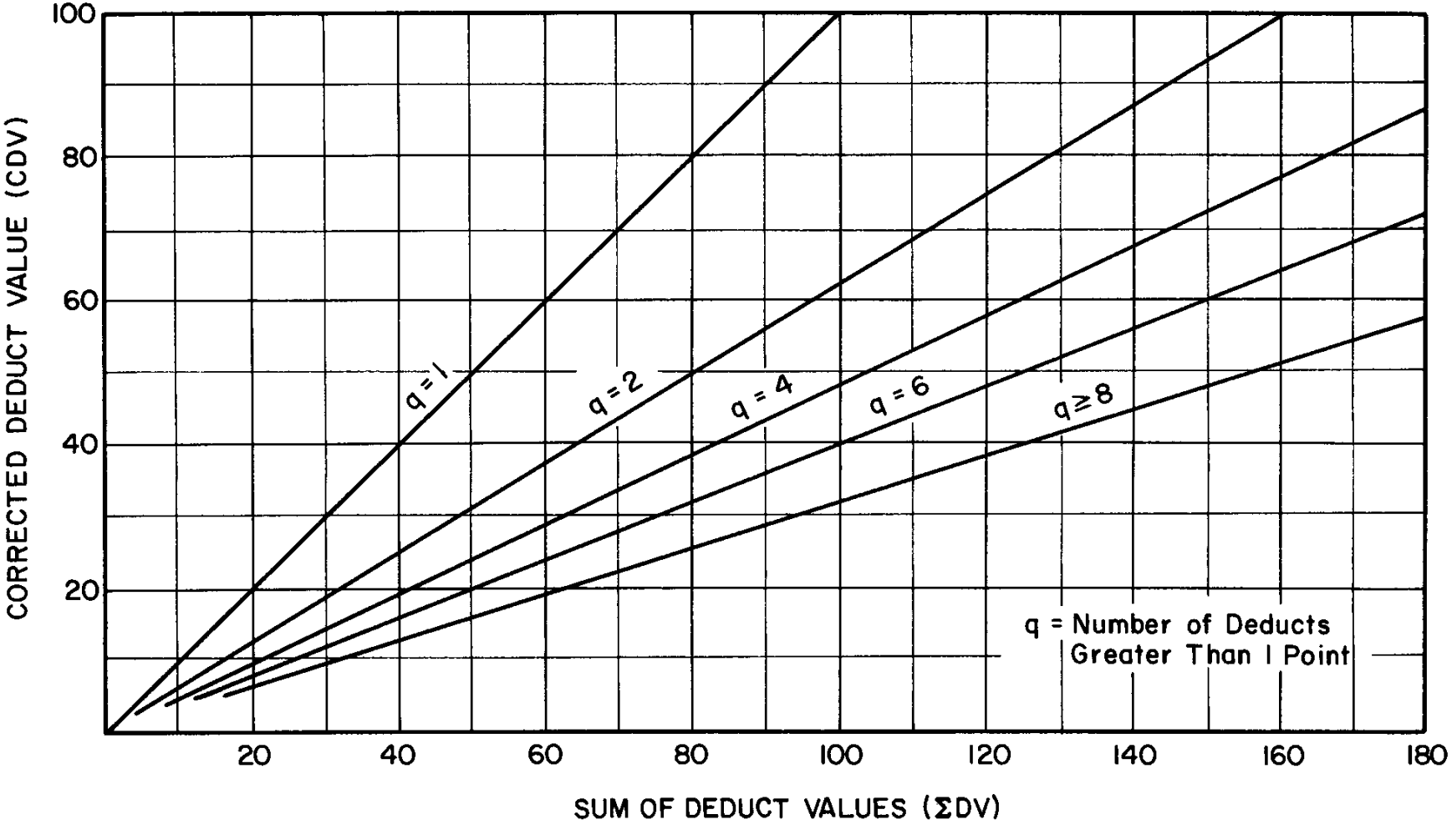



EMBEDDED EDGE METAL (EM)
FLASHING
DEDUCT VALUE
100
90
80
70
60
50
40
30
20
10
0
H
M
L
0.01
.05
0.1
.5
1
5
10
50
100
DISTRESS DENSITY - PERCENT

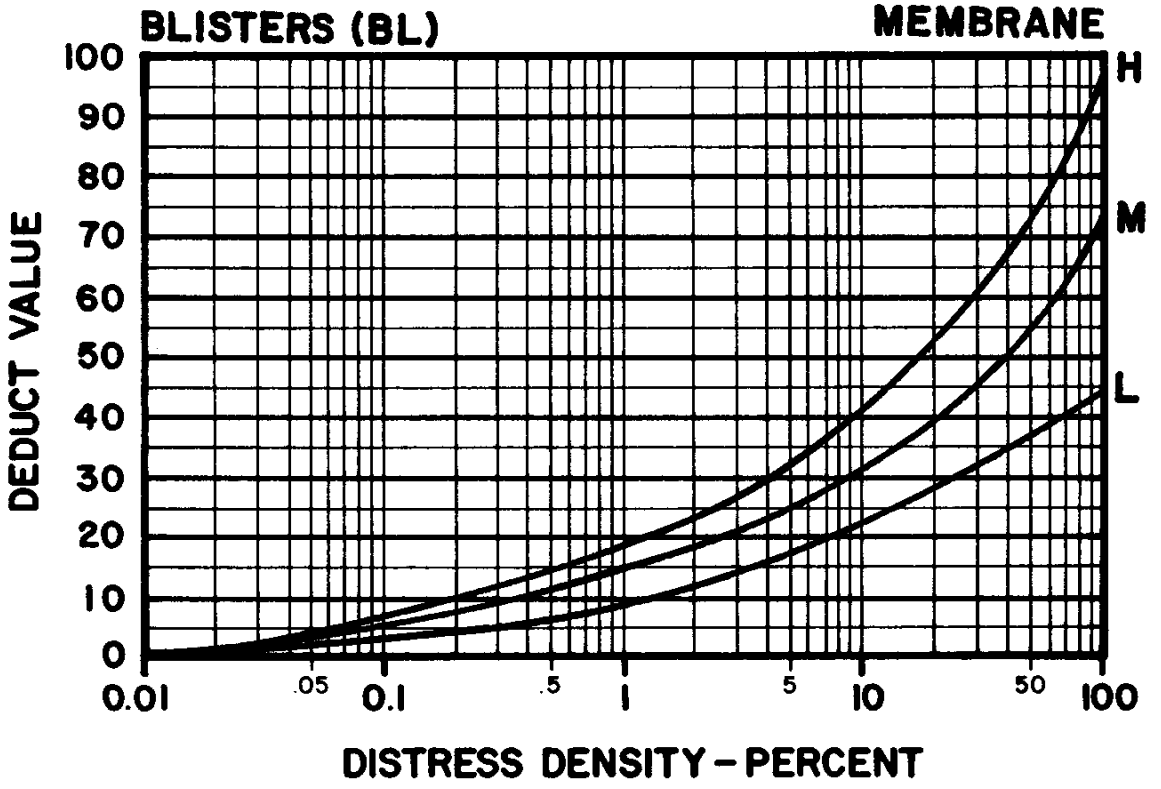

FLASHED PENETRATIONS (FP)
FLASHING
DEDUCT VALUE
100
90
80
70
60
50
40
30
20
10
0
H
M
L
0.01
0.05
0.1
0.5
1
5
10
DISTRESS DENSITY-PERCENT

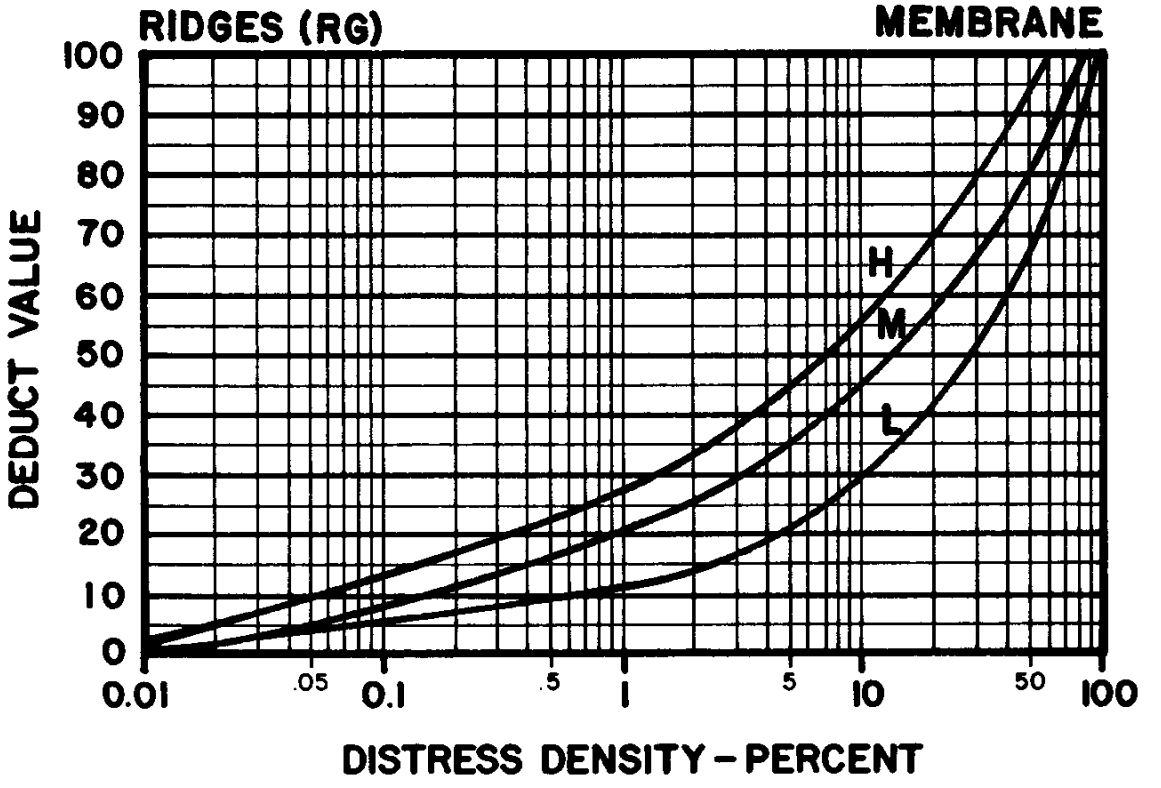

PITCH PANS (PP)
FLASHING
DEDUCT VALUE
100
90
80
70
60
50
40
30
20
10
0
0.01
0.05
0.1
0.5
1
5
10
H
L
DISTRESS DENSITY-PERCENT

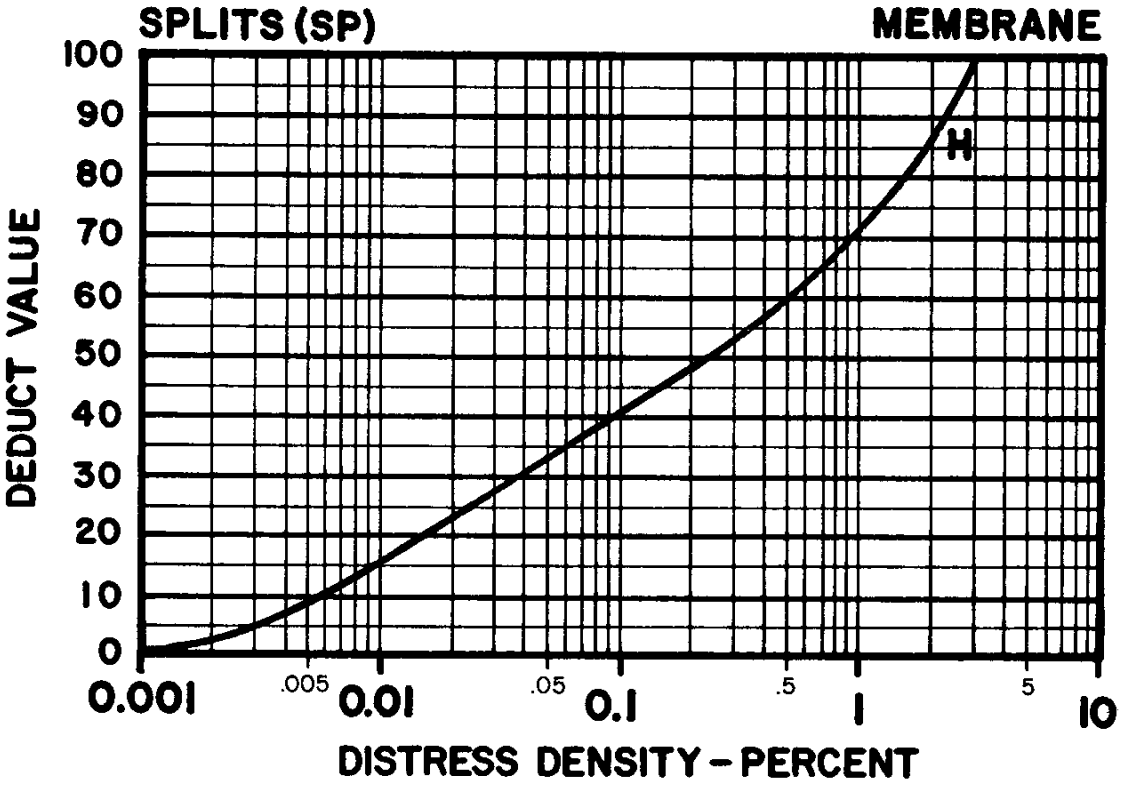

INTERIOR DRAINS AND
ROOF LEVEL SLUPPERS (DR)
FLASHING
DEDUCT VALUE
100
90
80
70
60
50
40
30
20
10
0
0.01
0.05
0.1
0.5
1.0
H
M
L
DISTRESS DENSITY-PERCENT

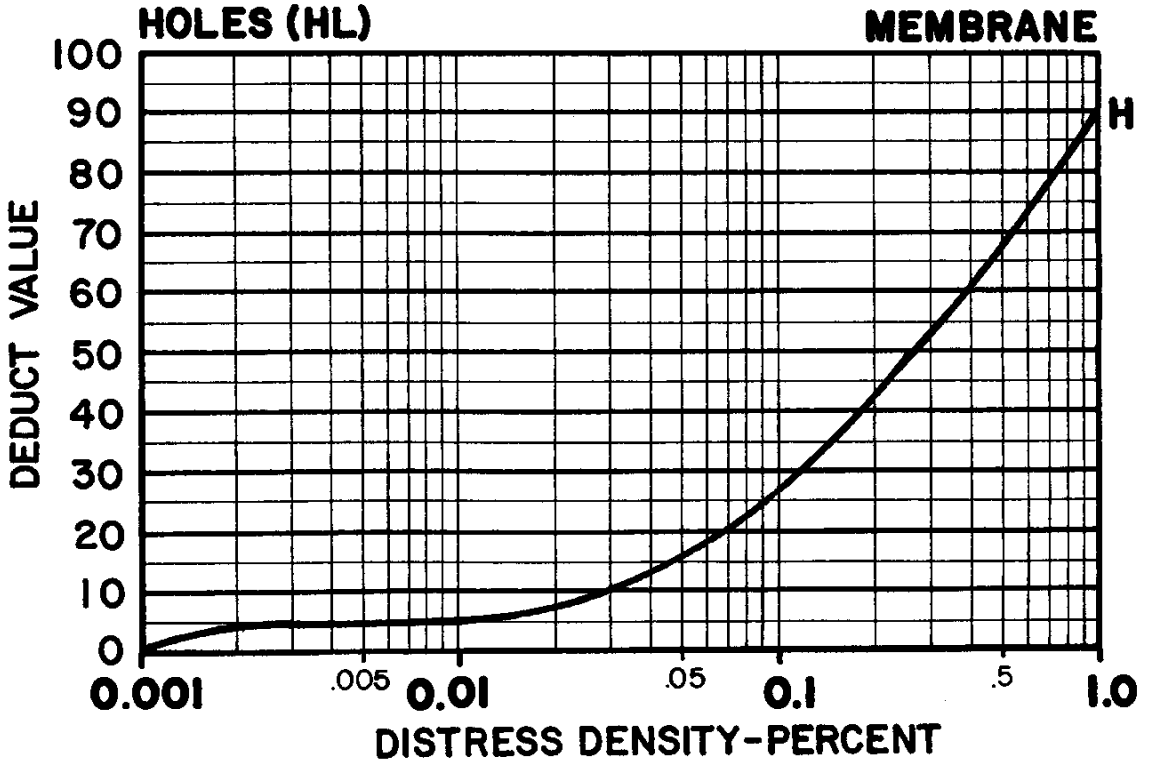


Corrected deduct values for flashing.


BLISTERS (BL)
MEMBRANE
DEDUCT VALUE
100
90
80
70
60
50
40
30
20
10
0
H
M
L
0.01
.05
0.1
.5
1
5
10
50
100
DISTRESS DENSITY – PERCENT


RIDGES (RG)
MEMBRANE
DEDUCT VALUE
100
90
80
70
60
50
40
30
20
10
0
H
M
L
0.01
.05
0.1
.5
1
5
10
50
100
DISTRESS DENSITY – PERCENT


SPLITS (SP)
MEMBRANE
DEDUCT VALUE
100
90
80
70
60
50
40
30
20
10
0
H
0.001
.005
0.01
.05
0.1
.5
1
5
10
DISTRESS DENSITY - PERCENT


HOLES (HL)
MEMBRANE
DEDUCT VALUE
100
90
80
70
60
50
40
30
20
10
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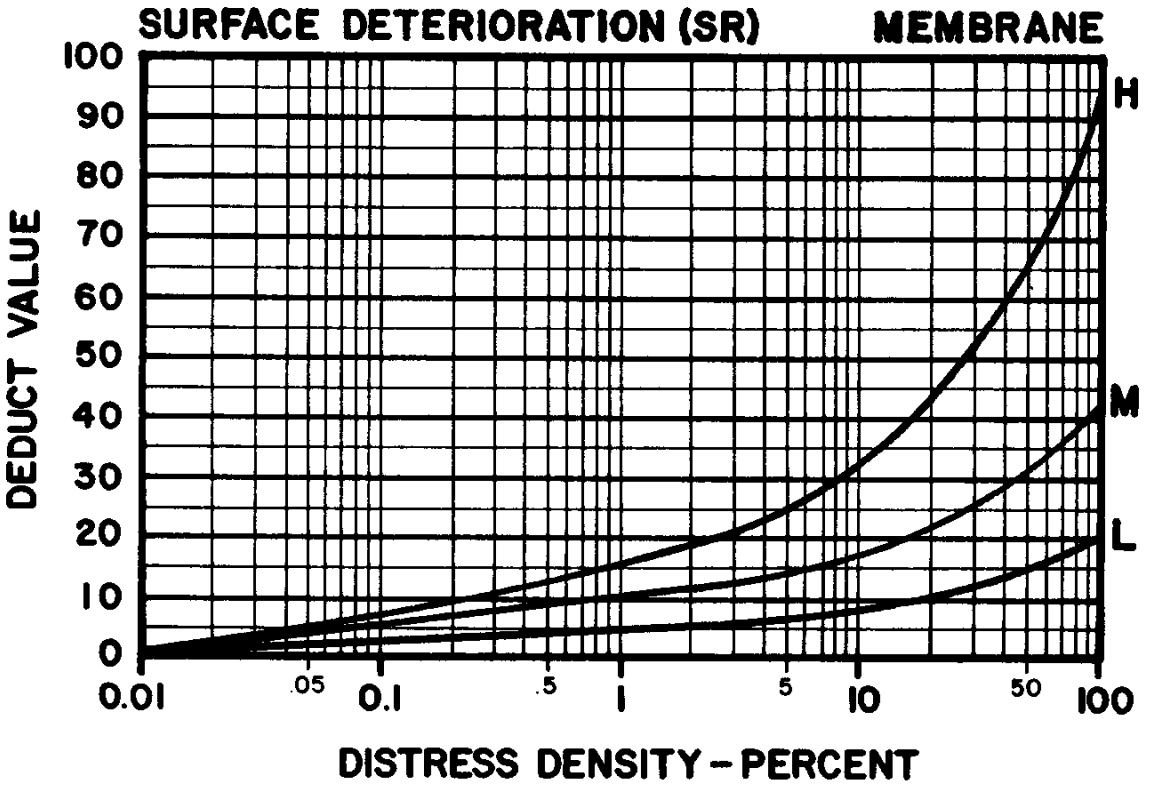
0.001
.005
0.01
.05
0.1
.5
1.0
DISTRESS DENSITY-PERCENT


SURFACE DETERIORATION (SR)
MEMBRANE
DEDUCT VALUE
100
90
80
70
60
50
40
30
20
10
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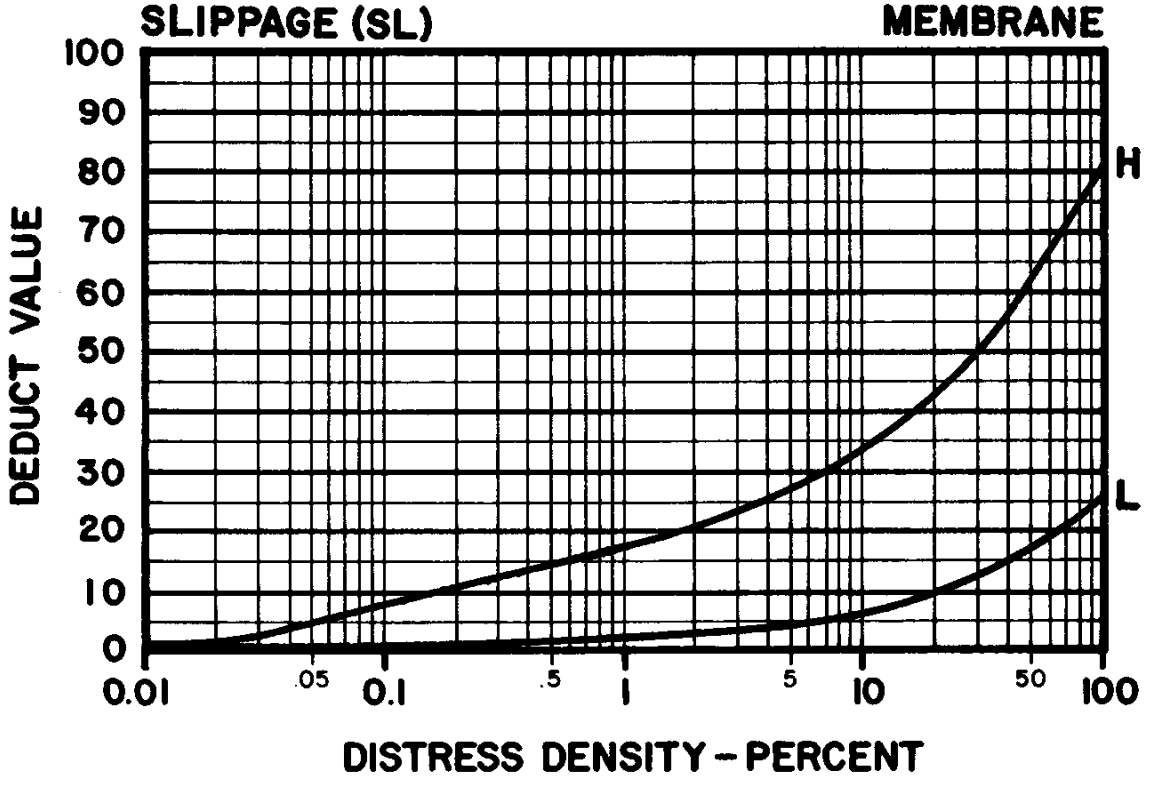
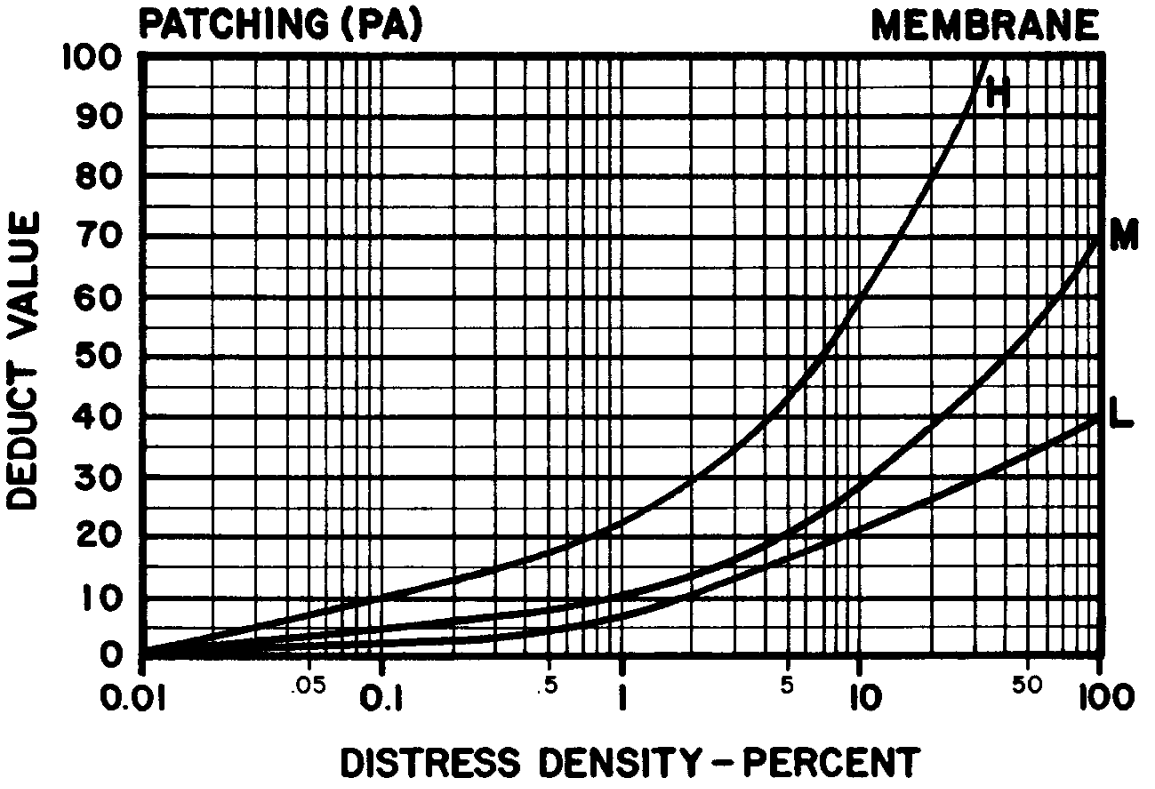
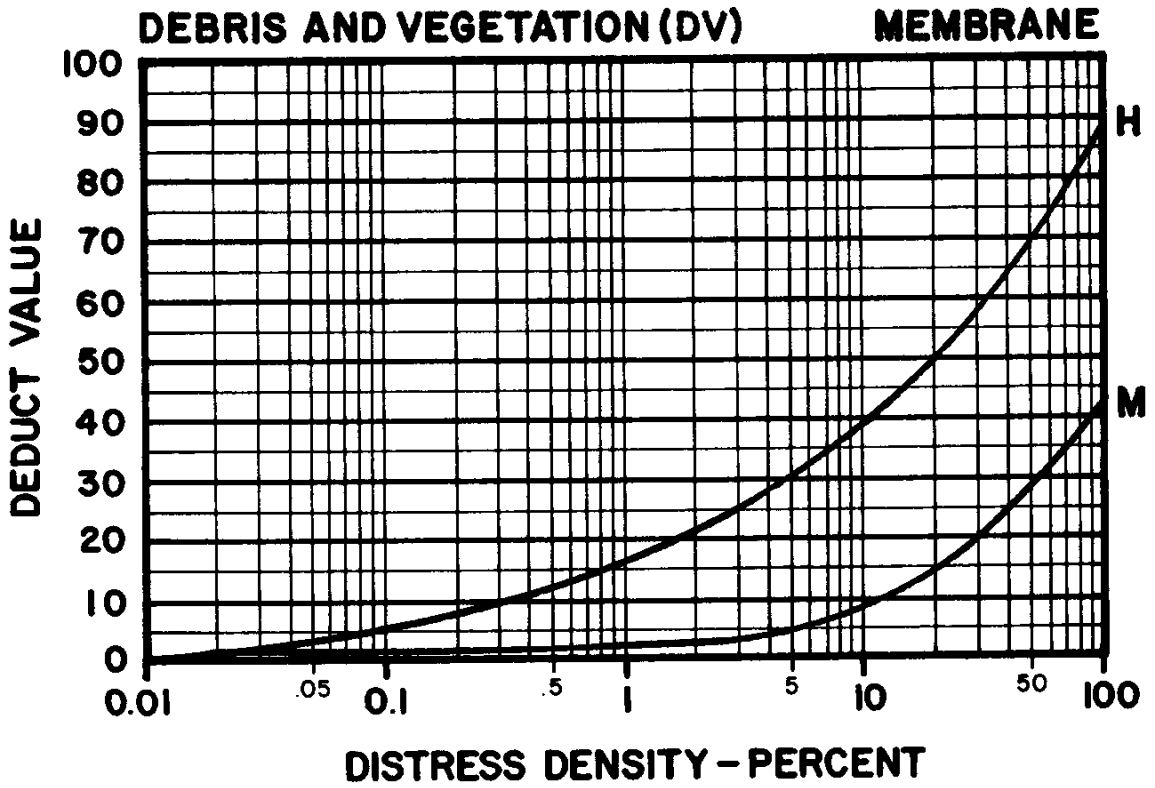
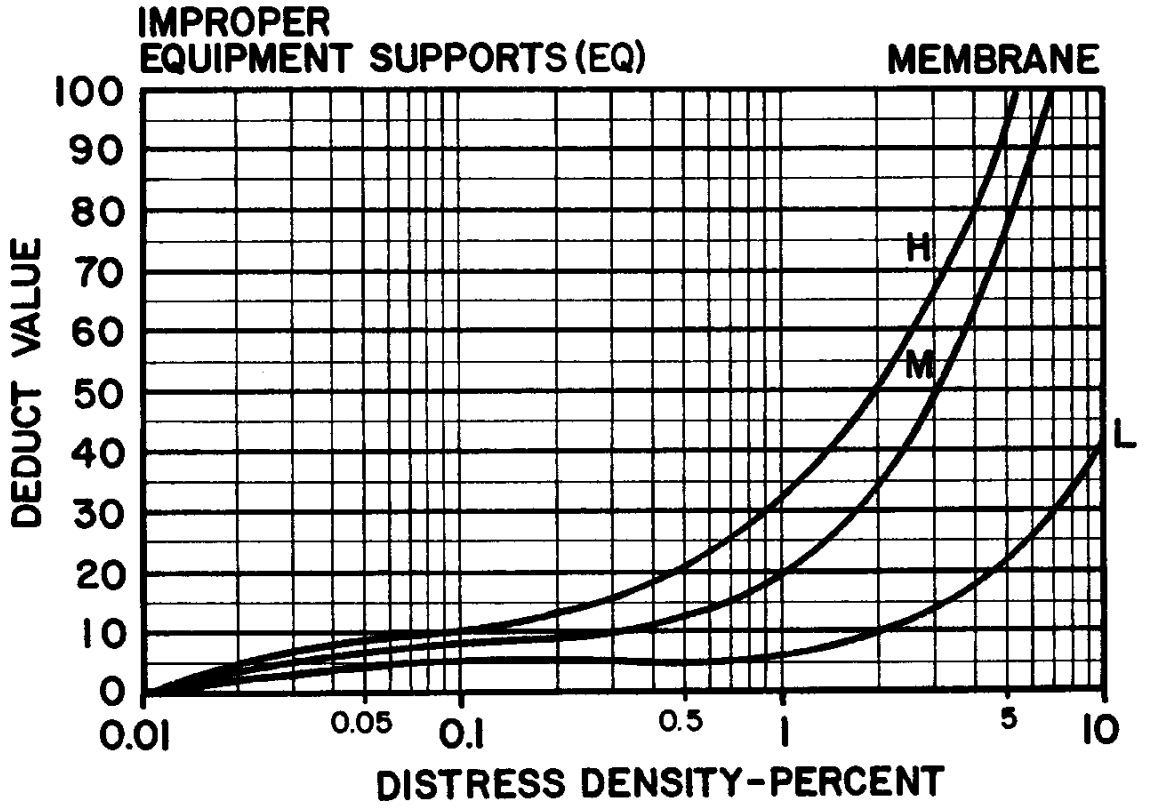
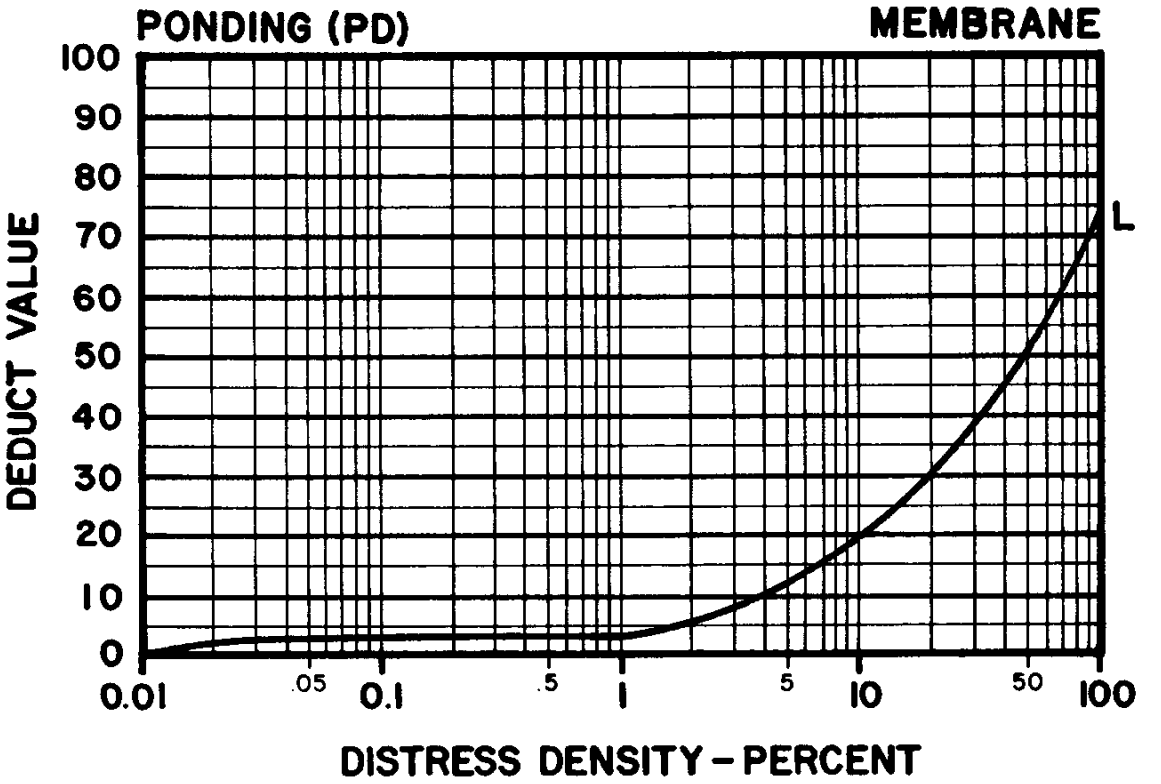
H
M
L
0.01
.05
0.1
.5
1
5
10
50
100
DISTRESS DENSITY - PERCENT

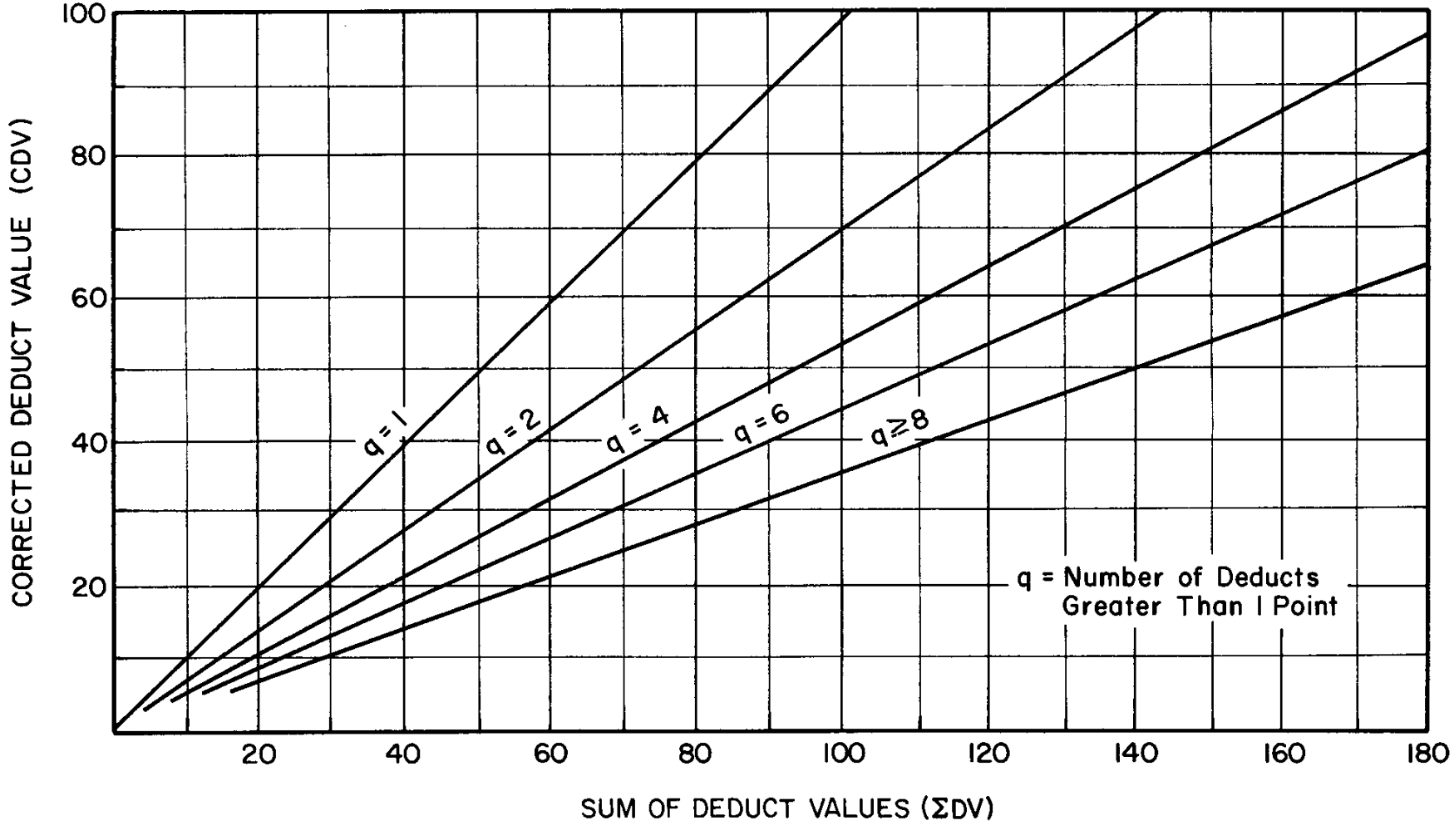

SLIPPAGE (SL)
MEMBRANE
DEDUCT VALUE
100
90
80
70
60
50
40
30
20
10
0
H
L
0.01
.05
0.1
.5
1
5
10
50
100
DISTRESS DENSITY - PERCENT


PATCHING (PA)
MEMBRANE
DEDUCT VALUE
100
90
80
70
60
50
40
30
20
10
0
H
M
L
0.01
.05
0.1
.5
1
5
10
50
100
DISTRESS DENSITY – PERCENT


DEBRIS AND VEGETATION (DV)
MEMBRANE
DEDUCT VALUE
100
90
80
70
60
50
40
30
20
10
0
H
M
0.01
.05
0.1
.5
1
5
10
50
100
DISTRESS DENSITY – PERCENT


IMPROPER
EQUIPMENT SUPPORTS (EQ)
MEMBRANE
DEDUCT VALUE
100
90
80
70
60
50
40
30
20
10
0
H
M
L
0.01
0.05
0.1
0.5
1
5
10
DISTRESS DENSITY-PERCENT


PONDING (PD)
MEMBRANE
DEDUCT VALUE
100
90
80
70
60
50
40
30
20
10
0
L
0.01
.05
0.1
.5
1
5
10
50
100
DISTRESS DENSITY - PERCENT



Corrected deduct values for membrane.

APPENDIX B:

INSPECTION AND RATING FORMS

On the following pages are a Roof Inspection Worksheet (front and back) and a Roof Section Rating Form that may be photocopied for use.

ROOF INSPECTION WORKSHEET	INSTALLATION _____

BUILDING _____ PER. FLASHING _____ FT DATE _____

SECTION _____ CURB FLASHING _____ FT NAME _____

BF - BASE FLASH
MC - METAL CAP
EM - EMBEDDED MET
FP - FLASHED PEN
PP - PITCH PANS
DR - DRAIN & SCUPPER

DISTRESS TYPE

BL - BLISTERS
RG - RIDGES
SP - SPLITS
HL - HOLES
SR - SURF DET
SL - SLIPPAGE
PA - PATCHING
DV - DEBRIS & VEG
EQ - EQ SUPPORTS
PD - PONDING

IDENT NO	DISTRESS	SEVERITY	DEFECT	QUANTITY

SCALE: _____

NORTH

REMARKS:

ROOF SECTION RATING FORM

BUILDING ____________	SECTION ____________	DATE ____________	CALC. BY ________
PER. FLASHING ________ FT CURB FLASHING ________ FT	FLASHING TOTAL ____________ FT	AREA ____________ SQFT	CHKD. BY ________

FLASHING

DISTRESS TYPE

- BF - BASE FLASH
- MC - METAL CAP
- EM - EMBEDDED MET
- FP - FLASHED PEN
- PP - PITCH PANS
- DR - DRAIN & SCUPPER

TYPE	SEV	QUANTITIES	TOT.	DEN.	DV
CORRECTED DEDUCT VALUE (CDV)					

FCI = 100 - CDV = ____________

FLASHING RATING = ____________

MEMBRANE

DISTRESS TYPE

- BL - BLISTERS
- RG - RIDGES
- SP - SPLITS
- HL - HOLES
- SR - SURF DET
- SL - SLIPPAGE
- PA - PATCHING
- DV - DEBRIS & VEG
- EQ - EQU SUPPORTS
- PD - PONDING

TYPE	SEV	QUANTITIES	TOT.	DEN.	DV
CORRECTED DEDUCT VALUE (CDV)					

MCI = 100 - CDV = ____________

MEMBRANE RATING = ____________

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DLA ATTN: DLA-WI 22314

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ATTN: DEH (23)

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