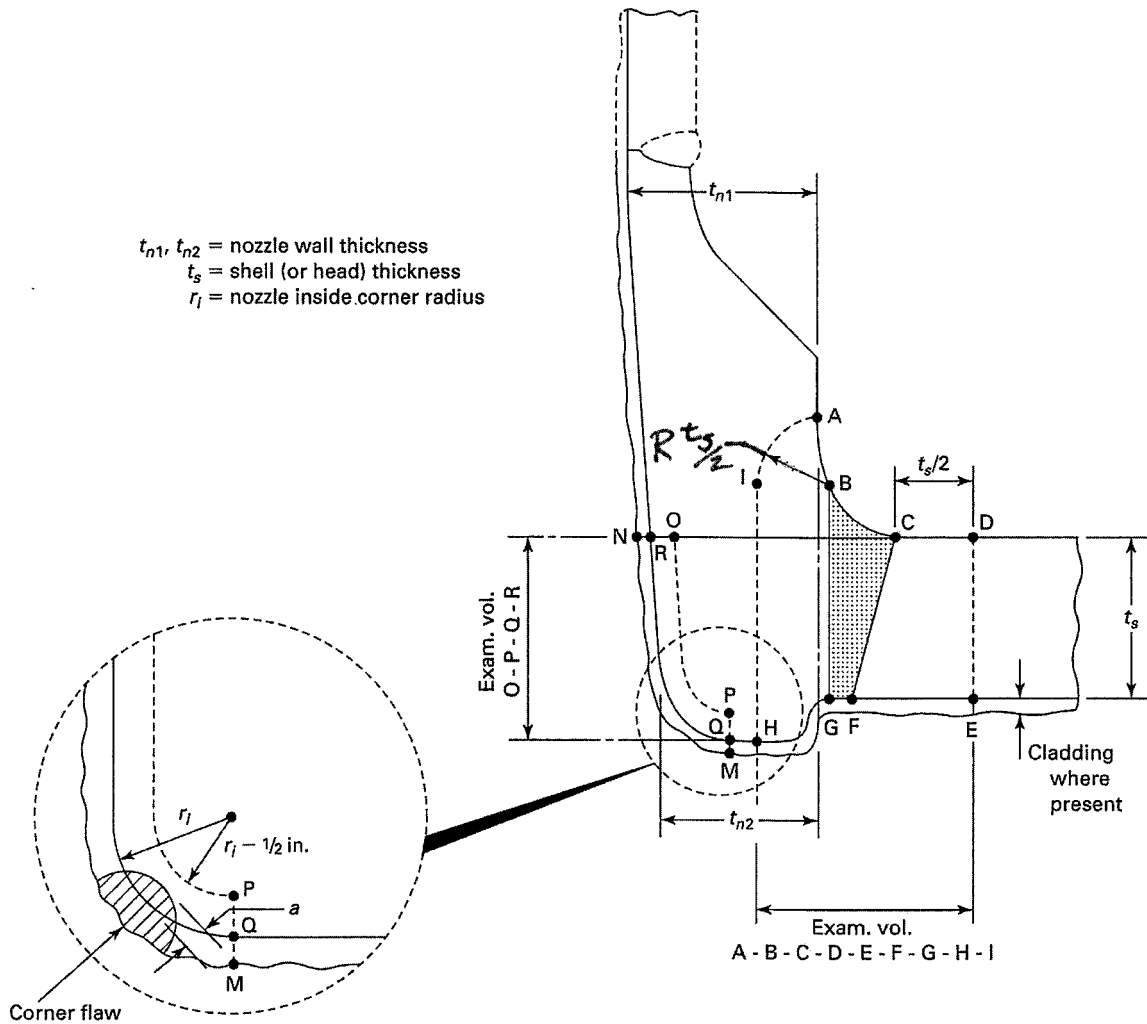


Figure IWB-2500-7(a)
Nozzle in Shell or Head
(Examination Zones in Barrel Type Nozzles Joined by Full Penetration Corner Welds)



EXAMINATION REGION [Note (1)]

- Shell (or head) adjoining region
- Attachment weld region
- Nozzle cylinder region
- Nozzle inside corner region

EXAMINATION VOLUME [Note (2)]

- C-D-E-F
- B-C-F-G
- A-B-G-H-I
- O-P-Q-R

GENERAL NOTE: $1/2 \text{ in.} = 13 \text{ mm}$

NOTES:

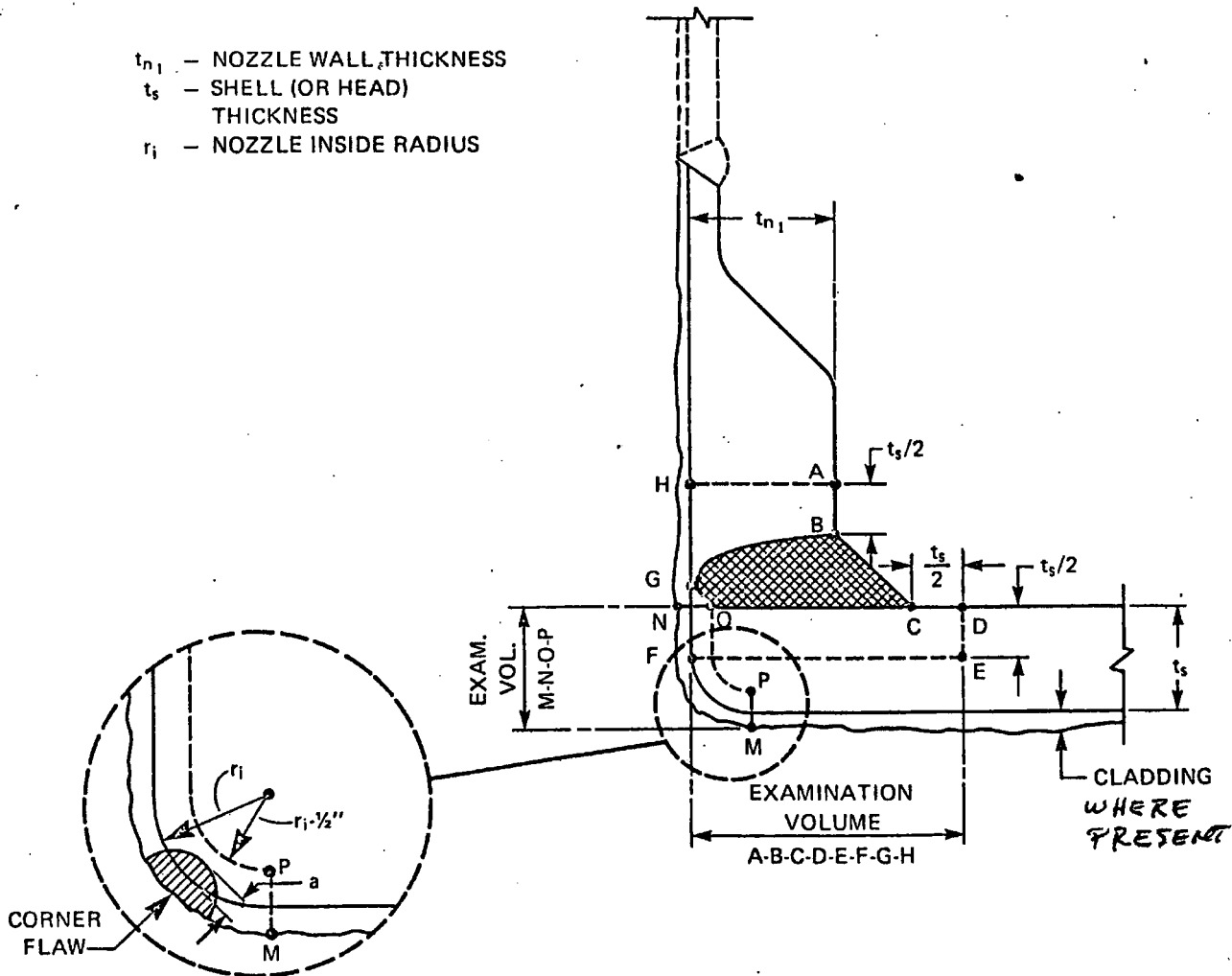
- (1) Examination regions are identified for the purpose of differentiating the acceptance standards in IWB-3512.
- (2) Examination volumes may be determined either by direct measurements on the component or by measurements based on design drawings.

Info only

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15180-17 (42)

t_{n1} - NOZZLE WALL THICKNESS
 t_s - SHELL (OR HEAD) THICKNESS
 r_i - NOZZLE INSIDE RADIUS



t_{n1} -
 t_s -
 r_i -

COR FL

EXAMINATION REGION ¹	EXAMINATION VOLUME ²
SHELL (OR HEAD) ADJOINING REGION	C-D-E-F-G
ATTACHMENT WELD REGION	B-C-G
NOZZLE CYLINDER REGION	A-B-G-H
NOZZLE INSIDE CORNER REGION	M-N-O-P

(1) |
 (2)

(1) EXAMINATION REGIONS ARE IDENTIFIED FOR THE PURPOSE OF DIFFERENTIATING THE ACCEPTANCE STANDARDS IN IWB-3512.

(2) EXAMINATION VOLUMES MAY BE DETERMINED EITHER BY DIRECT MEASUREMENTS ON THE COMPONENT OR BY MEASUREMENTS BASED ON DESIGN DRAWINGS.

FIG. IWB-2500-7(c) NOZZLE IN SHELL OR HEAD
 (Examination Zones In Set-On-Type Nozzles Joined By Full Penetration Corner Welds)

PROPOSED CODE CHANGE NEW APPENDIX X – NONMANDATORY BC03-242

FOR INFO ONLY

TABLE X-S1-1
 DEFINITION OF FAILURE PROBABILITY ESTIMATES FOR PIPE SEGMENTS

Definition	Failure Probability (per year)
An event that individually may be expected to occur more than once during the lifetime of the pipe segment.	10^{-1}
An event that individually may be expected to occur during the lifetime of the pipe segment.	10^{-2}
An event that individually is not expected to occur during the lifetime of the pipe segment; however, when considering all piping systems, an event in this category has the credibility of happening once.	10^{-4}
An event of such low probability that an event in this category is rarely expected to occur.	10^{-6}
An event of such extremely low probability that an event in this category is considered to be incredible.	10^{-8}

4.2.7 Process for Selecting Piping Structural Elements. The final list of HSS piping segments, as identified in 4.2.6 shall be selected for further evaluation at the piping structural elements level. The selection process is described in 4.2.8.

4.2.8 Piping Structural Element Selection.

(a) To complete the element selection process, a determination of segment high and low-failure-importance shall be used to rank failure potential for the elements in that segment. HSS segments shall be considered to have a high failure importance when a piping segment or its elements has either a degradation mechanism that is known to exist, which may be currently monitored as part of an existing Owner's augmented program, or is determined to be highly susceptible to a degradation mechanism that could lead to leakage or rupture. PFM calculation results may be used to determine this high failure importance if any location within which the segment exceeds the following indicator:

→ Probability of Large Leak > 10^{-4} per 40-years of operation.

(b) A set of inspection locations or elements shall be identified for which (1) failures will have the greatest potential impact on safety, and (2) there is a greater likelihood of detectable degradation and consequently a greater potential for identifying, through NDE, piping degradation prior to failure. The final list of structural elements and rationale for any decisions made in establishing this list shall be documented. The

following criteria shall be used to make this determination as shown in Figure X-S1-2:

(1) Region 1(A) includes all high-failure-importance locations in each HSS piping segment identified as likely to be susceptible to a known or postulated degradation mechanism and shall be examined. Exceptions include those locations already being examined under existing augmented programs. Region 1(B) includes other portions of these same HSS piping segments containing locations not affected by a known degradation mechanism and evaluated using a statistical evaluation such as the process described in (b)(2) below. At least one element in this portion of each HSS piping segment shall be examined.

(2) Region 2 includes all HSS piping segments with low-failure-importance locations. For these segments a statistical evaluation shall be used to define the number of random locations to be examined. A sampling plan shall be selected for each of these segments that achieves at least a 95% confidence (no more than 5% risk) of not exceeding an estimated leak (through wall crack) frequency defined from industry operating experience, based upon the estimates for piping leak frequencies in Table X-S1-2. In the statistical calculations, a leak is a visible leak that does not influence system operation. It shall be estimated as the frequency of a through-wall flaw. This estimate shall be obtained from a PFM model with suitable input and output parameters. In cases where a PFM model cannot be used due to model limitations such as application to socket welds or specific materials and to account for uncertainty and the possibility of unknown degradation mechanisms in these segments at

TABLE R-S1-2 ESTIMATES FOR PIPING LEAK FREQUENCIES

Material	Size		
	• NPS 1 (DN 25)	NPS 1 (DN 25) < Size < NPS 4 (DN 100)	• NPS 4 (DN 100)
Stainless steel	10 ⁻⁵	10 ⁻⁵	10 ⁻⁶
Ferritic steel	10 ⁻⁵	10 ⁻⁶	5 × 10 ⁻⁶

known to exist, which may be currently monitored as part of an existing Owner's augmented program, or is determined to be highly susceptible to a degradation mechanism that could lead to leakage or rupture. PFM calculation results may be used to determine this high failure importance if any location within which the segment exceeds the following indicator:

Probability of Large Leak $> 10^{-4}$ per 40 years of operation

(b) A set of inspection locations or elements shall be identified for which (1) failures will have the greatest potential impact on safety, and (2) there is a greater likelihood of detectable degradation and consequently a greater potential for identifying, through NDE, piping degradation prior to failure. The final list of structural elements and rationale for any decisions made in establishing this list shall be documented. The following criteria shall be used to make this determination as shown in Fig. R-S1-2:

(1) Region 1(A) includes all high-failure-importance locations in each HSS piping segment identified as likely to be susceptible to a known or postulated degradation mechanism and shall be examined. Exceptions include those locations already being examined under existing augmented programs. Region 1(B) includes other portions of these same HSS piping segments containing locations not affected by a known degradation mechanism and evaluated using a statistical evaluation such as the process described in para. 4.2.8(b)(2). At least one element in this portion of each HSS piping segment shall be examined.

(2) Region 2 includes all HSS piping segments with low-failure-importance locations. For these segments a statistical evaluation shall be used to define the number of random locations to be examined. A sampling plan shall be selected for each of these segments that achieves at least a 95% confidence (no more than 5% risk) of not exceeding an estimated leak (through wall crack) frequency defined from industry operating experience, based upon the estimates for piping leak frequencies in Table R-S1-2. In the statistical calculations, a leak is a visible leak that does not influence system operation. It shall be estimated as the frequency of a through-wall flaw. This estimate shall be obtained from a PFM model

with suitable input and output parameters. In cases where a PFM model cannot be used due to model limitations such as application to socket welds or specific materials and to account for uncertainty and the possibility of unknown degradation mechanisms in these segments at least one element in each HSS piping segment shall be examined.

(3) Region 3 includes all LSS piping segments that have a high failure-importance. Locations selected for examination should be based on Owner-defined programs.

(4) Region 4 includes all LSS segments and locations with low failure-importance.

(5) System pressure tests and VT-2 visual examinations are required for all Class 1, 2, and 3 piping, as applicable in Regions 1, 2, 3, and 4, in accordance with IWA-5000, IWB-5000, IWC-5000, or IWD-5000, as applicable, and R-2500.

4.2.9 Change-In-Risk Evaluation

(a) If a prior deterministic inservice inspection program has been used, change-in-risk evaluation shall be performed prior to the initial implementation of a risk-informed inspection program.

(b) Proposed inspection program changes shall be assessed to quantitatively determine if any adjustments or compensatory measures to the proposed risk-informed inspection program are necessary to provide assurance that the effect of the proposed change results in a risk decrease, risk neutrality, or acceptably small increase. The quantitative assessment shall consider CDF and LERF with and without operator action. Operator recovery action credited in the calculations shall assume perfect performance, which means no human error probabilities are required.

(c) The quantitative assessment shall modify the failure probability used [see para. 4.2.5(c)] in calculating change in CDF and LERF as follows:

(1) For piping segments that are part of augmented programs (such as erosion-corrosion and stress corrosion cracking), the failure probabilities with examinations credited are used.

(2) For piping segments that have NDE selections proposed or selected, the failure probabilities with examinations credited are used.

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