NDE PROCEDURE With NDE MAP

CLIENT : **PT. CITRA PALU MINERALS (CPM)**

PROJECT NAME : **POBOYA 2000 TPD EXPANSION PROJECT**

LOCATION : **PALU, SULAWESI**

CONSULTANT : **PT. COMO ENGINEERS (PT. CE)**

VENDOR : **PT. HANAZONO ENGINEERING INDONESIA**

DOCUMENT NO. : **E2502-000-PRC-007**

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Revision History

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CONTENTS

1. LIQUID PENETRANT EXAMINATION PROCEDURE

LIQUID PENETRANT EXAMINATION PROCEDURE ASME BPV Code

DOCUMENT : TLA-PT-ASME-02
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SUMMARY OF REVISION SHEET

This page is a record of all revisions of the procedure and the following revision (s) has (have) been made to this procedure.

REV.	DATE	PAGE	BRIEF OF REVISION
00	07 October, 2021	All pages	First Issue
			-

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Daftar Isi / Table of Content

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1 Tujuan

1.1 Untuk meyediakan petunjuk dan standar penerimaan pelaksanaan pengujian dengan color contrast visible dye penetrant untuk lasan, stainless steel, carbon and low alloy steel materials.

1.2 Procedure ini terdiri dari versi Inggris dan Indonesia, jika ada konflik antara keduanya maka versi Inggris yang dipakai.

1 Purpose

1.1 This procedure provides guidance and acceptance standards for color contrast (visible) dye penetrant examination of weldments, stainless steel, carbon and low alloy steel materials.

1.2 This procedure consists of English and Indonesian versions, shall there is conflict between these versions the English version shall govern.

2 Ruang Lingkup

2.1 Prosedur ini berlaku untuk sistem penetrant solvent removable.

2.2 Pengujian Liquid penetrant digunakan untuk mendeteksi cacat terbuka dipermukaan material pada logam tidak berpori.

2.3 Pengujian Liquid penetrant harus dilaksanakan pada langkah-langkah fabrikasi sesuai persyaratan dari routing sheet, spesifikasi proses atau oleh persyaratan kontrak pelanggan.

2.4 Procedure harus demonstrasikan ke Authorized Inspector Client, jika ada perubahan dari persyratan di **Table T-621.1 dan Table T-621.3** diketahui sebagai essential variable harus didemonstrasikan ulang. Perubahan dari persyaratan diketahui sebagai nonessential variable tidak diperlukan demonstrasi. Semua perubahan dari essential atau non essential variable dari yang disebut dalam prosedur ini harus diperlukan revisi dari atau dengan addendum ke procedure.

2.5 Persyaratan Demonstrasi :

a. Demonstrasi harus dilaksanakan untuk mendapatkan kepuasan Authorized Inspector, dibawah control dan pengawasan dari Level III penguji yang qualified dan certified untuk melaksanakan ujian method dan teknik.

2 Scope

2.1 This procedure is applicable to the solvent removable penetrant systems.

2.2 Liquid penetrant examination is used to detect discontinuities that are opened to the surface of nonporous metals.

2.3 Liquid penetrant examination shall be performed at the various stages of production that are required by the applicable routing sheets, process specifications or by customer contract requirements.

2.4 Procedure shall be demonstrated to Client's Authorized Inspector, when a change of requirement in **Table T-621.1 and Table T-621.3** identified as an essential variable shall require redemonstration. A change of a requirement identified as a nonessential variable does not require re-demonstration. All changes of essential or nonessential variable from those specified by this procedure shall require revision of or an addendum to the procedure.

2.5 Demonstration requirements :

a. The demostration shall be performed to the satisfaction of the Authorized Inspector, under the control and supervision of a Level III examiner who is qualified and certfied for performing the examination method and technique.

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b. Demonstrasi harus pada minimum satu test spesimen yang mempunyai cacat dimana ukuran, lokasi, orientasi, jumlah, dan karakterisasi telah ditentukan sebelum demonstrasi dan diketahui hanya oleh pengawas Level III penguji.

b. The demonstration shall be on minimum one test specimen having flaws whose size, location, orientation, quantity, and characterization have been determined prior to demonstration and are known only by the supervising Level III examiner.

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c. Procedure dianggap qualified jika pengawas Level III penguji dan Authorized Inspector telah puas dengan indikasi yang didapat dengan procedure yang demonstrasikan efective menampakkan ukuran, lokasi, orientasi, jumlah, dan karakterisasi dari cacat yang diketahui didapatkan pada specimen test yang diuji.

d. Nama dan / atau identifikasi dan tanda tangan dari pengawas Level III penguji dan Authorized Inspector yang menyaksikan harus ditambahkan untuk menyatakan penerimaan menyatakan qualifikasi procedure.

c. The procedure shall be considered qualified when the supervising Level III and the Authorized Inspector are satisfied that indications produced by the demonstrated procedure effectively reveal the size, location, orientation, quantity, and characterization of the flaws known to be present in the examination test specimen.

d. The name and/or identity and signature of the supervising Level III and the witnessing Authorized Inspector shall be added to indicate their acceptance of the procedure indicate qualification.

3 Persyaratan Keselamatan

3.1 Safety regulasi dari PT. TITIAN LANCAR ABADI harus diikuti selama pengujian.

3.2 **SAFETY (S.H.E INSTRUCTION)**

- Selalu menggunakan PPE such as Safety shoes, hand glove, safety glass, and helmet.
- Waspada tempat yang licin dan benda jatuh
- Waspada benda berbahaya sekitar tempat kerja
- Berhenti kerja dan lapor ke client an supervisor untuk tempat kerja yang tidak aman
- Pakai alat pengaman ketinggian jika kerja diatas 2 m
- Pungut sampah dan buang ditempat yang tersedia
- Jangan membuang pelumas, oli atau cairan bekas test ke lantai

3 Safety Requirements

3.1 PT. TITIAN LANCAR ABADI's safety regulation shall be followed during examination.

3.2 **SAFETY (S.H.E INSTRUCTION)**

- Always use PPE such as Safety shoes, hand glove, safety glass, and helmet.
- Watch out for slippery and falling object
- Watch out for the hazard around the areas.
- Stop the activities and report to client and supervisor for unsafe working condition.
- Use fall protection equipment if working above 2 m.
- Collect all waste and put it in agreed place.
- Do not expose any lubricant, oil or test fluid to the ground.

4 Referensi

4.1 PT. TITIAN LANCAR ABADI Written Practice

4.2 ASME BPVC Code Sect. I, V, VIII Div. 1, VIII Div. 2, IX, 2019 Edition

4.3 ASME / ANSI B31.1, 2020 Edition.

4.4 SE – 165, Standard Guide for Liquid Penetrant Examination.

4 Reference

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5	**Definisi – Definisi**	**5**	**Definitions**
5.1	Developer: material yang diaplikasikan ke permukaan tes untuk mempercepat keluarnya dan mempertajam kontras dari indikasi.	**5.1**	Developer: a material that is applied to the test surface to accelerate bleed out and enhance the contrast of the indications.
5.2	Penetrant: cairan campuran dari pewarna.	**5.2**	Penetrant: a solution or suspension of dye.
5.3	Footcandle (fc): pencahayaan pada permukaan, di area 1 ft2, didistribusikan merata dengan kekuatan 1 lm (lumen).	**5.3**	Foot candle (fc): the illumination on surface, 1 ft2 in area, on which is uniformly distributed a flux of 1 lm (lumen).
5.4	Pra pembersihan : pembersihan permukaan dari kontaminasi pada bagian yang di tes sehingga tidak akan menggangu proses pemeriksaan	**5.4**	Pre cleaning : the removal of surface contaminants from the test part so that they will not interfere with the examination process.
5.5	Contaminant: semua barang asing yang berada pada permukaan yang diuji atau pada material inspeksi yang akan berpengaruh buruk dari performance liquid penetrant material.	**5.5**	Contaminant: any foreign substance present on the test surface or in the inspection materials which will adversely affect the performance of liquid penetrant materials.
5.6	Bleedout: aksi dari liquid penetrant yang terjebak dari cacat untuk membentuk indikasi - indikasi	**5.6**	Bleedout: the action of an entrapped liquid penetrant in surfacing from discontinuities to form indications.
5.7	Post cleaning: penghilangan sisa material pengujian cairan penetrant dari bagian tes setelah pengujian penetrant dilaksanakan.	**5.7**	Post cleaning: the removal of residual liquid penetrant examination materials from the test part after the penetrant examination has been employed.
6	**Kwalifikasi dan Tanggung Jawab**	**6**	**Qualification and Responsibility**
6.1	Personel yang melakukan pengujian untuk persyaratan procedure ini harus di qualifikasi sesuai dengan prosedure dari PT. TITIAN LANCAR ABADI Written Practice sesuai dengan SNT-TC-1A, CP - 189 atau ISO 9712:2012	**6.1**	Personnel performing examinations to the requirements of this specification shall be qualified in accordance with PT. TITIAN LANCAR ABADI's Written Practice in accordance wtith SNT-TC-1A, CP - 189 or ISO 9712:2012
6.2	Personel yang menentukan keberterimaan sesuai syarat–syarat dari prosedur ini harus Level II atau Level III.	**6.2**	Personnel determining the acceptability to the requirements of this procedure shall be Level II or Level III.
7	**Material penetrant**	**7**	**Penetrant Material**

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7.1 Semua material penetrant (cleaning agents, penetrant, solvents, developer, dll.) sebelum digunakan pada nickel base alloys, austenitic or duplex stainless steel and titanium harus dianalisa kandungan kontaminan sesuai dengan persyaratan T-641, Mandatory Appendix II, SE-165, Annex 4. Kandungan total chlorine and fluorine tidak boleh lebih 0.1 % dari berat

7.1 All penetrant material (cleaning agents, penetrant, solvents, developer, etc.) prior to their use on nickel base alloys, austenitic or duplex stainless steel and titanium shall have their contaminant contents analyzed in accordance with the requirements of T-641, SE-165, Annex 4. The total chlorine and fluorine content shall not exceed 0.1% by weight.

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7.2 Pencampuran material penetrant dari grup yang berbeda dari supplier yang berbeda tidak diperbolehkan.

7.3 Merk dan produk lain dari yang disebut di prosedur ini bisa digunakan asalkan demonstrasi untuk bisa memuaskan Authorized Inspector harus dilaksanakan.

7.4 Daftar material dibawah ini boleh digunakan untuk pengujian dari liquid penetrant:

Group II – method C – Visible Solvent Removable

Supplier	Material	Type
Magnaflux	Penetrant	SKL- SP 1
Magnaflux	Solvent / Remover	SKC-S
Magnaflux	Developer	SKD-S2
Oikosh	Penetrant	H - 41
Oikosh	Solvent / Remover	C - 36
Oikosh	Developer	D - 78

7.2 Intermixing of penetrant materials from different groups or from different suppliers within a group is not permitted.

7.3 Brand name or products other than specified in this procedure may be used provided demonstration to the satisfaction of the Authorized Inspector to be performed.

7.4 The following list of materials may be used for liquid penetrant examination:

Group II – method C – Visible Solvent Removable

Supplier	Material	Type
Magnaflux	Penetrant	SKL- SP 1
Magnaflux	Solvent / Remover	SKC-S
Magnaflux	Developer	SKD-S2
Oikosh	Penetrant	H - 41
Oikosh	Solvent / Remover	C - 36
Oikosh	Developer	D - 78

8 Procedure

8.1 Persiapan Permukaan

8.1.1 Sebelum dilaksanakan pengujian Penetrant, permukaan yang akan di uji dan area dengan jarak minimal 1" (25 mm) setiap sisinya area tersebut, harus kering, bebas dari semua kotoran, grease, oli, pasir, loose, rust, scale, atau material lainnya yang akan menggangu pada saat pengujian.

8.1.2 Grit atau shot blasting tidak di ijinkan sebagai metode persiapan permukaan. Persiapan permukaan dengan mein gerinda, mesin, atau metode lain mungkin diperlukan

8.2 Pembersihan awal

8.2.1 Precleaning: penghilangan kontaminasi permukaan dari bagian tes sehingga mereka tidak mengganggu proses pengujian.

8.2.2 Metode dari pra pembersihan dengan langsung menyemprotkan pelarut pembersih di permukaan yang di uji.

8 Procedure

8.1 Surface Preparation

8.1.1 Prior to Liquid Penetrant examination , the Surface to be examined and any adjacent area within at least 1" (25 mm) of the surface to be examined, shall be dry and free of any dirt, grease, oil, sand, loose rust, scale or any other foreign material which would interfere with examination.

8.1.2 Grit or shot blasting is prohibited as a method of surface preparation. The surface preparation by grinding, machining, or other methods may be necessary.

8.2 Pre Cleaning

8.2.1 Precleaning: the removal of surface contaminants from the test part so that they will not interfere with the examination process.

8.2.2 The metods of pre cleaning by **directly spray solvent** to the surface being examined.

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8.2.3 Pengeringan permukaan untuk pengujian setelah dibersihkan dilakukan dengan penguapan normal. Periode waktu minimum 1 menit harus ditunggu untuk memastikan bahwa larutan pemebersih sudah menguap sebelum penerapan penetrant.

8.2.3 Drying of the surfaces to be examined after cleaning shall be accomplished by normal evaporation. A period of time minimum 1 **minutes** shall be established to ensure that the cleaning solution has evaporated prior to the application of penetrant.

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8.3 Aplikasi Penetrant

8.3.1 Suhu

8.3.1.1 Pada semua hal rekomendasi dari pabrik pembuat harus dikuti.

8.3.1.2 Teknik standar, suhu dari penetrant dan permukaan benda uji tidak boleh dibawah 50ºF (10ºC) atau diatas 125ºF (52ºC) saat periode pengujian. Pemanasan atau pendinginan lokal diperbolehkan asalkan selama pengujian suhu tetap dalam range dari 50ºF sampai 125ºF (10ºC sampai 52ºC).

8.3.1.3 Apabila tidak bisa di aplikasikan sesuai dengan pembatasan suhu, suhu dan waktu yang lain boleh digunakan, harus di lakukan kualifikasi pada prosedur yang di gunakan.

8.3.2 Metode

Penetrant bisa diaplikasikan dengan dikuas.

8.3.3 Dwell Time Penetran

Dwell Time Penetran adalah sangat kritis dan harus dilakukan **10 ~ 30 menit.** Area yang akan di lakukan pengujian harus tetap di basahi oleh penetrant selama waktu penetrasi (dwell).

8.4 Penghilangan Kelebihan Penetrant

8.4.1 Setelah waktu penetrasi terlewati, cairan penetran yang berada dipermukaan benda uji harus dihilangkan, dilaksanakan dengan hati-hati untuk menghindari penghilangan cairan tersebut dari cacat yang akan diuji.

8.4.2 Kelebihan Solvent removable penetrants dibuang dengan mengelapnya dengan kain yang kering atau kertas serap air, lakukan berulang sampai sisa penetran dipermukaan benda uji hilang.

8.4.3 Sisa yang lain dihilangkan dengan mengusap ringan permukaan benda dengan kain bersih atau kertas serap air yang telah diberi solvent.

8.3 Penetrant Application

8.3.1 Temperature

8.3.1.1 In all cases manufacturer's recommendation shall be followed.

8.3.1.2 As a standard technique, the temperature of the penetrant and the surface of the part to be examined shall not be below 50ºF (10ºC) nor above 125ºF (52ºC) throughout the examination period. Local heating or cooling is permitted provided the part temperature remains in the range of 50ºF to 125ºF (10ºC to 52ºC) during the examination.

8.3.1.3 Where it is not practical to comply with this temperature limitation, other temperatures and dwell times may be used, provided the qualification of procedure shall be performed.

8.3.2 Methods

The penetrant shall be applied by brushing.

8.3.3 Penetrant (Dwell) Time

Penetrant (dwell) time is critical and shall be **10 ~ 30 minutes**. The area to be examined shall remain wetted by the penetrant throughout the entire penetration (dwell) time.

8.4 Excess Penetrant Removal

8.4.1 After the specified penetration (dwell) time has elapsed, any penetrant remaining on the surface shall be removed, taking care to minimize removal of penetrant from discontinuities.

8.4.2 Excess solvent removable penetrants shall be removed by wiping with a dry clean cloth or absorbent paper, repeating the operation until most traces of penetrant have been removed.

8.4.3 The remaining traces shall be removed by lightly wiping the surface with a clean cloth or absorbent paper moistened with solvent.

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8.4.4 Untuk meminimasi penghilangan penetran dari cacat, pemakaian solvent harus sehati-hati mungkin. Tidak diperbolehkan untuk menyemprotkan solvent, setelah selesainya aplikasi penetran dan sebelum waktu developing.

8.4.4 To minimize removal of penetrant from discontinuities, care shall be taken to avoid the use of excess solvent. Flushing the surface with solvent, following the application of the penetrant and prior to developing, is prohibited.

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8.5 Pengeringan Setelah Penghilangan Penetrant

Pengeringan pada bagian pembersihan penetrant yang dengan penguapan normal, waktu penguapan setelah pembersihan penetrant harus maximum **5** menit.

8.5 Drying After Penetrant Removal

Drying of part after removal of excess solvent removable penetrant shall be carried out by normal evaporation, the drying after removal excess penetrant shall be maximum **5** minutes.

8.6 Pengaplikasian Developer

8.6.1 Developer harus diaplikasikan dengan disemprotkan segera setelah penghilangan penetrant sesuai **par.8.5,** maximum **5** menit.

8.6.2 Sebelum developer diaplikasikan pada permukaan, developer harus dikocok terlebih dahulu supaya partikel bercampur secara merata.

8.6.3 Developer harus diaplikasikan sehingga tebal lapisannya cukup untuk menarik cairan dari cacat ke permukaan tetapi tidak boleh berlebihan yang bisa menutupi indikasi dari cacat tersebut.

8.6.4 Developing time untuk interpretasi akhir adalah **10** menit tetapi tidak lebih dari **30** menit.

8.6 Application of Developer

8.6.1 The developer shall be applied by spraying after the penetrant removal as stated in **par. 8.5**, shall be maximum **5** minutes.

8.6.2 Prior to applying the developer to the surface, the developer must be thoroughly agitated to ensure adequate dispersion of suspended particles.

8.6.3 The developer shall be applied so that the coating thickness is sufficient enough to draw the penetrant out of discontinuities, but not too excessive which could cause the masking of indications.

8.6.4 The minimum developing times for final interpretation is **10** minutes but no longer than **30** minutes.

8.7 Pencahayaan.

8.7.1 Pengujian menggunakan color contrast visible dye penetrant harus dilaksanakan dengan cahaya natural atau lampu sinar putih. Light meter sinar putih harus dikalibrasi **paling sedikit setahun sekali** atau jika meter telah direpair. Jika meter tidak dipakai setahun atau lebih kalibrasi harus dilakukan sebelum digunakan.

8.7.2 Pencahayaan (natural atau tambahan lampu putih) pada permukaan benda uji adalah diperlukan untuk evaluasi indikasi. Minimum intensitas lampu harus 100 fc (1 076 lx).

8.7 Illumination.

8.7.1 Examination using colour contrast visible dye penetrant shall be performed under natural or supplemental white light source. White Light meter shall be calibrated **at least once a year** or whenever the meter has been repaired. If meters has not been in use for one year or more, calibration shall be done before being used.

8.7.2 Illumination (natural or supplemental white light) of the examination surface is required for the evaluation of indications. The minimum light intensity shall be 100 fc (1 076 lx).

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8.7.3 Intensitas lampu natural atau tambahan lampu putih, harus diukur dengan meter lampu putih sebelum evaluasi dari indikasi atau verifikasi sumber cahaya harus digunakan. Verifikasi dari sumber lampu harus didemonstrasikan hanya sekali saja, didokumenasikan, dan disimpan dalam file,

8.7.3 The light intensity, natural or supplemental white light source, shall be measured with a white light meter prior to the evaluation of indications or a verified light source shall be used. Verification of light sources is required to be demonstrated only one time, documented, and maintained on file.

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9 Penginterprestasian Indikasi

9.1 Pengamatan untuk informasi indikasi dimulai segera setelah aplikasi dari pengeringan developer atau segera saat masih basah lapisan developer mengering.

9.2 Interpretasi akhir indikasi harus dilakukan setelah penetarnt tampak selama minimal 10 menit, tetapi tidak boleh lebih dari 30 menit.

9.3 Indikasi yang relevan adalah indikasi yang di sebabkan oleh diskontinuitas yang terbuka ke permukaan pengujian dan dengan dimensi besarnya dari 1/16 inchi (1.5 mm), dimensi kurang dari 1/16 inchi (1.5 mm) disebut indikasi tidak relevan dan bisa di abaikan.

9.4 Indikasi yang meragukan adalah indikasi yang disebabkan oleh kondisi diskontinuitas. Permukaan yang tidak rata disebabkan oleh proses mesin, gerinda, atau kondisi pengelasan yang menyebabkan indikasi meragukan.

9.5 Indikasi yang meragukan yang bisa menutupi indikasi tidak bisa diterima dan harus di uji ulang.

Kondisi permukaan harus dilakukan untuk pengujian yang di ulang

9.6 Area pigmentasi yang dapat menutupi indikasi relevan tidak bias diterima dan harus dibersihkan dan di uji ulang

9.7 Indikasi yang memanjang adalah indikasi yang memiliki panjang lebih besar dari tiga kali lebar

9.8 Indikasi bulat adalah indikasi bulat atau bentuk ellip dengan panjang sama dengan atau kurang dari tiga kali lebar

10 Evaluasi indikasi

a. Sebuah indikasi dari cacat mungkin lebih besar dari cacat yang menyebabkannya; namun , ukuran dari indikasi adalah yang menjadi dasar evaluasi penerimaan.

9 Interpretation of Indication

9.1 **Observation** of the information of indications begin immediately after the application of a dry developer or as soon as wet developer coating is dry.

9.2 Final interpretation of indications shall be made after allowing the penetrant to bleed-out for at least 10 minutes, but no longer than 30 minutes.

9.3 **Relevant indications** are those indications caused by discontinuities that are opened to the examination surface and with major dimension grater than 1/16 inch (1.5 mm), should the dimension less than 1/16 inch (1.5 mm) then it is called no relevant indication; it may be ignored.

9.4 **False indications** are indications caused by conditions other than discontinuities. Surface irregularities due to machining, grinding, or welding are conditions that may cause false indications.

9.5 **False indications** that could mask indications are unacceptable and shall be reexamined.

Surface conditioning shall proceed the reexamination.

9.6 Broad areas of pigmentation which could mask relevant indications are unacceptable and shall be cleaned and reexamined.

9.7 **Linear indications** are indications having a length greater than three times a width

9.8 **Rounded indications** are circular or elliptical shapes with a length equal to or less than three times its width.

10 Evaluation of Indication

a. An indication of an imperfection may be larger than the imperfection that cause it; however the size of the indication is the basic for acceptance evaluation.

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b. Standar penerimaan ini harus diterapkan kecuali ada standar penerimaan yang lebih ketat lainya dan ditetapkan untuk bahan tertentu atau aplikasinya.

b. The acceptance standard shall apply unless other more restrictive standards are specified for specific material or application.

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10.1 Standar Penerimaan

10.1.1 ASME BPV Code Section I, Appendix A, Para A-270

a. Hanya indikasi dengan dimensi utama yang lebih besar dari 1.5 mm (1/16 in) harus dianggap relevan,

b. Semua permukaan yang akan di uji harus bebas dari:

1. Indikasi relevan yang memanjang.
2. Indikasi relevan yang bulat lebih besar dari 5mm (3/16 in).
3. Empat atau lebih indikasi yang bulat dalam satu garis dipisahkan 1.5 mm (1/16 in.) atau kurang , tepi ke tepi

10.1.2 ASME BPV Code Sect. VIII Div.1, Appendix 8 Para 8.3 & 8.4

a. Hanya indikasi dengan dimensi utama yang lebih besar dari 1.5 mm (1/16 in) harus dianggap relevan,

b. Semua permukaan yang akan di uji harus bebas dari:

1. Indikasi relevan yang memanjang.
2. Indikasi relevan yang bulat lebih besar dari 5mm (3/16 in).
3. Empat atau lebih indikasi yang bulat dalam satu garis dipisahkan 1.5 mm (1/16 in.) atau kurang , tepi ke tepi

10.1.3 ASME B31.1 Power Piping, Para 146.4.4:

a. Hanya indikasi dengan dimensi utama yang lebih besar dari 2 mm (1/16 in) harus dianggap relevan,

b. Semua permukaan yang akan di uji harus bebas dari:

1. Semua crack atau indikasi linear
2. Indikasi relevan yang bulat lebih besar dari 5mm (3/16 in).
3. Empat atau lebih indikasi yang bulat dalam satu garis dipisahkan 2 mm (1/16 in.) atau kurang , tepi ke tepi
4. Sepuluh atau lebih indikasi bulat dalam 3870 mm^2 (6 in^2.) di permukaan dengan ukuran utama pada suatu area tidak melebihi dari 150 mm (6 in) dengan luasan diambil di lokasi yang paling relatif tidak menguntung kan untuk indikasi di evaluasi.

10.1 Acceptance Standard

10.1.1 ASME BPV Code Section I, Appendix A, Para A-270

a. Only indications with major dimensions greater than 1.5 mm (1/16 in) shall be considered relevant.

b. All surfaces to be examined shall be free of:

1. Relevant linear Indications.
2. Relevant rounded indications greater than 5mm (3/16 in).
3. Four or more rounded indications in a line separated by 1.5 mm (1/16 in.) or less, edge to edge

10.1.2 ASME BPV Code Sect. VIII Div.1, Appendix 8 Para 8.3 & 8.4

a. Only indications with major dimensions greater than 1.5 mm (1/16 in.) shall be considered relevant,

b. All surfaces to be examined shall be free of:

1. Relevant linear indications
2. Relevant rounded indications greater than 5 mm (3/16 in.)
3. Four or more rounded indications in a line separated by 1.5 mm (1/16 in.) or less, edge to edge

10.1.3 ASME B31.1 Power Piping, Para 146.4.4:

a. Only indications with major dimensions greater than 2 mm (1/16 in.) shall be considered relevant,

b. All surfaces to be examined shall be free of:

1. Any crack or linear indications.
2. Relevant rounded indications greater than 5.0 mm (3/16 in.)
3. Four or more relevant rounded indications in a line separated by 2 mm (1/16 in.) or less, edge to edge
4. Ten or more rounded indications in any 6 in^2. (3870 mm^2) of surface with the major dimension of this area not to exceed 150 mm (6 in.) with the area taken in the most unfavorable location relative to the indications being evaluated.

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10.1.4 ASME BPV Code Sect. IX, Part 195.2.2

a. Hanya indikasi dengan dimensi utama yang lebih besar dari 1.5 mm (1/16 in) harus dianggap relevan,

b. Semua permukaan yang akan di uji harus bebas dari:

1. Indikasi relevan yang memanjang. Indikasi relevan yang bulat lebih besar dari 5mm (3/16 in).
2. Empat atau lebih indikasi yang bulat dalam satu garis dipisahkan 1.5 mm (1/16 in.) atau kurang , tepi ke tepi .

10.1.5 ASME BPV Code Sect. VIII Div. 2, Part 7.5.7.1 (d) and 7.5.7.2

a. Hanya indikasi dengan dimensi utama yang lebih besar dari 1.5 mm (1/16 in) harus dianggap relevan,

b. Semua permukaan yang akan di uji harus bebas dari:

1. Indikasi relevan yang memanjang.
2. Indikasi relevan yang bulat lebih besar dari 5mm (3/16 in).
3. Empat atau lebih indikasi yang bulat dalam satu garis dipisahkan dengan 1.5 mm (1/16 in.) atau kurang , tepi ke tepi
4. Indikasi terdeteksi seperti Crack, terlepas dari kondisi permukaan, tidak bisa di terima.

11 Pembersihan Akhir

11.1 Pembersihan akhir pengujian hanya dilakukan bila bahan penetrant yang digunakan akan merusak bagian yang di uji karena mengoktaminasinya. Bahan pembersih atau bahan pelarut sesuai persyaratan di procedure ini dan harus digunakan untuk menghilangkan sisa bahan penetrant pasca pengujian .

11.2 Menghilangkan developer dan bekas material penetran harus dengan mengelap dengan kain bersih, kemudian di semprot dengan solvent remover.

12 Dokumentasi

Hasil dar pengujian harus dicatat pada Penetrant Examination Report (Exhibit 1).

13 Perbaikan

10.1.4 ASME BPV Code Sect. IX, Part 195.2.2

a. Only indications with major dimensions greater than 1.5 mm (1/16 in.) shall be considered relevant,

b. All surfaces to be examined shall be free of:

1. Relevant linear indications.
2. Relevant rounded indications greater than 5 mm (3/16 in.)
3. Four or more relevant rounded indications in a line separated by 1.5 mm (1/16 in) or less, edge to edge.

10.1.5 ASME BPV Code Sect. VIII Div. 2, Part 7.5.7.1 (d) and 7.5.7.2

a. Only indications with major dimensions greater than 1.5 mm (1/16 in.) shall be considered relevant,

b. All surfaces to be examined shall be free of:

1. Relevant linear indications
2. Relevant rounded indications greater than 5 mm (3/16 in.)
3. Four or more relevant rounded indications in a line separated by 1.5 mm (1/16 in) or less, edge to edge
4. Crack like indications detected, irrespective of surface conditions, are unacceptable.

11 Post – Examination Cleaning

11.1 Post – Examination Cleaning is required only when penetratnt materials will affect the use of the parts being tested by their contaminant. The cleaning agents, or solvents meeting the requirements of this procedure shall be used for the post-examination removal of penetrant materials.

11.2 Removing of developer and tracing penetrant shall be by wiping with dry cloth, followed by spraying with solvent remover.

12 Documentation

Examination results shall be recorded on the Penetrant Examination Report (Exhibit 1).

13 Repair

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Indikasi yang tidak diterima harus dibuang dan diuji kembali untuk meyakinkan cacat sudah hilang atau ukuran yang diterima

Unacceptable indications shall be removed and re-examined to assure complete removal of defects or to acceptable size before re-

Kp.Gunung Buntu RT005/RW003 Desa,Banyuwangi,Kec.Pulo Ampel Kota Serang/42455
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sebelum di las lagi.
Jika cacat direpair dengan chipping atau grinding dan urutan repair tidak memerlukan welding, area yang di keruk harus di haluskan terhadap permukaan sekitarnya sehingga terhindar daro takikan, lubang, atau pojokan. Jika welding diperlukan setelah repair cacat, area harus dibersihkan dan di welding sesuai dengan welding procedure yang qualified.

welding.
Whenever an imperfection is repaired by chipping or grinding and subsequent repair by welding is not required, the excavated area shall be blended into the surrounding surface so as to avoid sharp notches, crevices, or corners. Where welding is required after repair of an imperfection, the area shall be cleaned and welding performed in accordance with a qualified welding procedure.

a. Perlakuan indikasi yang Nonrelevant.
Setiap indikasi yang diyakini sebagai Nonrelevant harus dianggap sebagai cacat kecali ditunjukkan dengan pengujian denga method yang sama atau dengan method lainnya dan/atau dengan perbaikkan permukaan sehingga tidak ada cacat yang tidak diterima

a. Treatment of Indications Believed Nonrelevant.
Any indication which is believed to be nonrelevant shall be regarded as an imperfection unless it is shown by re-examination by the same method or by the use of other nondestructive methods and/or by surface conditioning that no unacceptable imperfection is present.

b. Pengujian pada area yang cacatnya sudah di hilangkan.
Setelah cacat yakin sudah hilang dan sebelum repair pengelasan, area harus di uji ulamg dengan method yang cocok untuk meyakinkan bahwa cacat telah hilang atau telah berkurang sampai ukuran diterima

b. Examination of Areas From Which Defects Have Been Removed.
After a defect is thought to have been re-moved and prior to making weld repairs, the area shall be examined by suitable methods to ensure it has been re-moved or reduced to an acceptably sized imperfection.

c. Pengujian pada area repair.
Setelah repair telah dilakukan, area repai harus disamarkan dengan permukaan sekelilingnya sehingga terhindar dari lekukan tajam, atau pojok dan di uij ulang dengan method liquid penetrant dan dengan method pengujian lainnya yang diperlukan untuk area yang terkena, kecuali yang jika kedalaman repair kurang dari yang diperlukan sensitivitas radiography, maka radiography bias tidat diperlukan

c. Reexamination of Repair Areas.
After repairs have been made, the repaired area shall be blended into the surrounding surface so as to avoid sharp notch crevices, or corners and reexamined by the liquid penetrant method and by all other methods of examination that were originally required for the affected area, except that, when the depth of repair is less than the radiographic sensitivity required, re-radiography may be omitted.

Kp.Gunung Buntu RT005/RW003 Desa,Banyuwangi,Kec.Pulo Ampel Kota Serang/42455
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Exhibit 1
PENETRANT TEST REPORT

Customer :	Drawing No. : ..... Rev.	Report No : ... - PT-.....
Project Name :	Procedure No. : ..... Rev.	
Unit No :	Applicable COI E :	NCR Ref No :
Material Spec. :	Welding Process :	

Penetrant Type / Method : ☐ Visible ☐ Solvent Removable ☐ Other

Brand's Name/Type : ..... Penetrant : ..... Cleaner: ..... Developer: .....

Method pre-cleaning : ☐ Solvent spray Drying after pre-cleaning :

Penetrant Application : ☐ Brush ☐ Spray Dwell Time : ..... Temperature :.....

Light Intensity : ..... Light Source : .....

Method removing excess penetrant .....

Drying after remove excess penetrant : ..... Developer App. ..... Developing Time : .....

Batch No. of Penetrant : Cleaner : Developer :

Surface Preparation / : ☐ As Welded ☐ Machining ☐ Grinding ☐ Solvent spray

Time of Examination : ☐ After Welding ☐ After Hydro-test ☐ After PWHT ☐ Others

Scope of Examination : ☐ Base Metal ☐ Edge Prep ☐ Back Chipping

: ☐ Weld Part ☐ Repair Weld ☐ Others

Part Name	Weld No.	Thickness (mm)	Result		Types Of Discontinuities	Remarks
			Accepted	Rejected		

Sketch (Identify discontinuities listed above) if necessary :

Examined by :	Reviewed / witnessed by :	Reviewed / witnessed by :
Name :		
NDE Level :		
Date :	Date :	Date :

Kp.Gunung Buntu RT005/RW003 Desa,Banyuwangi,Kec.Pulo Ampel Kota Serang/42455
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Table T – 621.1
Requirements of a Liquid Penetrant Examination Procedure

Requirement	Essential Variable	Non essential Variable	Par. reference	Qualified range
Identification of and any change in type or family group of penetrant materials including developers, emulsifiers, etc.	X		1/7.3 / 7.4	Visible dye, Magnaflux SKC-S, SKL-SP 1/2, SKD – S2
Surface preparation (finishing and cleaning, including type of cleaning solvent remover)	X		8.1 / 8.2	Machining, grinding, cleaning by wire brush, spray with solvent / remover Magnaflux – SKC – S
Method of applying penetrant	X		8.3.2	brush
Method of removing excess surface penetrant	X		8.4	Wiping with dry cloth, moistened cloth with solvent / remover Magnaflux – SKC – S
Method of applying developer	X		8.6.1	Spray
Minimum and maximum time periods between steps and drying aids	X		8.2.3/8.5	Drying after pre-cleaning minimum 1 mnt., after penetrant removal maximum 5 mnt.
Decrease in penetrant dwell time	X		8.3.3	10 ~ 30 mnt.
Increase in developer dwell time (interpretation time)	X		8.6.4	10 ~ 30 mnt.
Minimum light intensity 1000 Lux.	X		9.2	min. 1050 lux
Surface temperature outside 40 to 125^0 F (5 to 52^0 C) or as previous qualified	X		8.3.1	10 ~ 52 ^{0} C
Performance demonstration, when required	X		2.4	ASME V, T150
Personnel qualification requirements		X	6	SNT-TC-1A, 2006 Edition and 2016 Edition.
Materials, shapes, or sizes to be examined and the extent of examination		X	1	Carbon Steel Butt, T , corner, lap joint, examination based on NDE request
Post examination cleaning technique		X	12	Wiping dry cloth, spray with solvent, wiping dry cloth

Table T – 621.3
Minimum and maximum Time Limits for Steps in Penetrant Examination Procedures

Requirement	Minimum	Maximum	Par. reference	Qualified range
Drying after preparation (T-643)	1		8.2.3	Minimum 1 minute
Penetrant dwell (T-672)	10	30	8.3.3	10 ~ 30 minutes.
Drying after penetrant removal (T-674)		5	8.5	Maximum 5 minutes
Developer application (T-675)		5	8.6.1	Maximum 5 minutes
Developing and interpretation time (T-675.3 and T-676)	10	30	8.6.4	10 ~ 30 minutes.

Kp.Gunung Buntu RT005/RW003 Desa,Banyuwangi,Kec.Pulo Ampel Kota Serang/42455
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APPENDIX 1

TECHNIQUE SHEET NO. PTS-01

Component	:	weldments and materials of stainless steel, titanium, carbon and low alloy steel.
Method	:	Visible, Solvent – Removable and Water Wsahable
Penetrant Solvent – Removable	:	Magnaflux SKL – SP1
Cleaner / Remover	:	Magnaflux SKC – S
Developer	:	Magnaflux SKD – S2
Acceptance Criteria	:	As per Section **10.1** of this procedure.

Sequence of Examination

No.	Paragraph	Activity	Remark
1	8.1	Surface preparation	- adjacent areas within at least 25.4 mm from welds - Clean of all foreign particles, dressed smooth as necessary (grit/shot blasting is prohibited)
2	8.2	Pre-cleaning	- adjacent areas within at least 25.4 mm, **directly spray solvent** to the surface being examined. - drying .minimum 1 minutes, by normal evaporation or forced warm air
3	8.3	Apply penetrant	- temperature $10^0 – 52^0$C - by brushing
4	8.3.3	Allowed dwell time	- 10 ~ 30 minutes - remain wet
5	8.4.1	Removal of excess penetrant (solvent removable)	- flushing is prohibited - by dry clean cloth or absorbent paper - lightly wiping clean cloth moistened with solvent - drying after remove excess penetrant max. 5 minutes
6	8.5	Drying	- by normal evaporation, blotting, wiping or forced air - after remove excess penetrant max. 5 minutes
7	8.6	Apply developer	- coating thickness is sufficient enough, not too excessive - developing time 10 ~ 30 minutes
8	9	Interpretation of indications	- minimum light intensity of 105 fc (1050 Lx) at the work surface - observation started at the beginning of developing - final interpretation, 10 – 30 minutes (developing time) - non-relevant indications and broad areas are unacceptable and re-examined
9	11	Post cleaning	- use cleaning agents or solvent
10	12	Documentation	- All blank item shall be filled out

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2. MAGNETIC PARTICLE EXAMINATION PROCEDURE

MAGNETIC PARTICLE EXAMINATION PROCEDURE ASME BPV Code

DOCUMENT : TLA-MT-ASME-01
REVISION NO. : 00

Prepared by	Reviewed by	Reviewed and Approved by
Name : NOVAN NUGRAHA	Name : AGUS RIYANTO	Name : ADI PADMO
Position : NDE LEVEL II	Position : Director Utama	Position : NDE LEVEL III ASNT. No. : 126596
Date : 07 October, 2021	Date : 07 October, 2021	Date : 07 October, 2021

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SUMMARY OF REVISION SHEET

This page is a record of all revisions of the procedure and the following revision (s) has (have) been made to this procedure.

REV.	DATE	PAGE	BRIEF OF REVISION
00	07 October, 2021	All pages	First Issue
			-
			-

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Daftar Isi / Table of Content

Kp.Gunung Buntu RT005/RW003 Desa,Banyuwangi,Kec.Pulo Ampel Kota Serang/42455
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1 Tujuan

1.1 Untuk meyediakan petunjuk dan standar penerimaan pelaksanaan pengujian dengan magnetic particle material ferromagnetic dengan menggunakan AC-Yoke dengan metode kontinyu.

1.2 Procedure ini terdiri dari versi Enggris dan Indonesia, jika ada konflik antara keduanya maka versi Enggris yang dipakai.

1 Purpose

1.1 This procedure provides guidance and acceptance standards during the conduct of magnetic particle examination of **visible wet** ferromagnetic materials using AC-Yoke with continuous method.

1.2 This procedure consists of English and Indonesian versions, shall there is conflict between these versions the English version shall govern.

2 Ruang Lingkup

2.1 Prosedur ini berlaku untuk pelaksanaan MT yang dilakukan pada permukaan dimana suhunya tidak melebihi 135 °F (57 °C). Instruksi dari pembuat partikel harus di ikuti.

2.2 Pengujian Lasan dengan Partikel Magnetik harus termasuk base metal setidaknya 1" (25 mm) tiap sisi lasan bila dimungkinkan.

2.3 Procedure harus demonstrasikan ke Authorized Inspector Client, jika ada perubahan dari persyratan di Table T-721 diketahui sebagai essential variable harus didemonstrasikan ulang. Perubahan dari persyaratan diketahui sebagai nonessential variable tidak diperlukan demonstrasi. Semua perubahan dari essential atau non essential variable dari yang disebut dalam prosedur ini harus diperlukan revisi dari atau dengan addendum ke procedure.

2.4 Persyaratan Demonstrasi :

a. Demonstrasi harus dilaksanakan untuk mendapatkan kepuasan Authorized Inspector, dibawah control dan pengawasan dari Level III penguji yang qualified dan certified untuk melaksanakan ujian method dan teknik.

b. Demonstrasi harus pada minimum satu test spesimen yang mempunyai cacat dimana ukuran, lokasi, orientasi, jumlah, dan karakterisasi telah ditentukan sebelum demonstrasi dan diketahui hanya oleh pengawas Level III penguji.

2 Scope

2.1 This procedure is applicable for MT performed on surfaces which the temperature does not exceed 135 °F (57 °C). The instruction of the particle manufacturer shall be followed.

2.2 Magnetic particles examination of welds shall include base metal for at least 1" (25 mm) on each side of the weld where possible.

2.3 Procedure shall be demonstrated to Client's Authorized Inspector, when a change of requirement in Table T-721 identified as an essential variable shall require redemonstration. A change of a requirement identified as a nonessential variable does not require re-demonstration. All changes of essential or nonessential variable from those specified by this procedure shall require revision of or an addendum to the procedure.

2.4 Demonstration requirements :

a. The demostration shall be performed to the satisfaction of the Authorized Inspector, under the control and supervision of a Level III examiner who is qualified and certfied for performing the examination method and technique.

b. The demonstration shall be on minimum one test specimen having flaws whose size, location, orientation, quantity, and characterization have been determined prior to demonstration and are known only by the supervising Level III examiner.

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c. Procedure dianggap qualified jika pengawas Level III penguji dan	**c.** The procedure shall be considered qualified when the supervising Level III

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Handphone. 085218282807; 089697533762
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Authorized Inspector telah puas dengan indikasi yang didapat dengan procedure yang demonstrasikan efective menampakkan ukuran, lokasi, orientasi, jumlah, dan karakterisasi dari cacat yang diketahui didapatkan pada specimen test yang diuji.

d. Nama dan / atau identifikasi dan tanda tangan dari pengawas Level III penguji dan Authorized Inspector yang menyaksikan harus ditambahkan untuk menyatakan penerimaan menyatakan qualifikasi procedure.

3 Persyaratan Keselamatan

3.1 Safety regulasi dari PT. TITIAN LANCAR ABADI harus diikuti selama pengujian.

3.2 SAFETY (S.H.E INSTRUCTION)

- Selalu menggunakan PPE seperti Safety shoes, hand glove, safety glass, dan helmet.
- Waspada tempat yang licin dan benda jatuh
- Waspada benda berbahaya sekitar tempat kerja
- Berhenti kerja dan lapor ke client supervisor untuk tempat kerja yang tidak aman
- Pakai alat pengaman ketinggian jika kerja diatas 2 m
- Pungut sampah dan buang ditempat yang tersedia
- Jangan membuang pelumas, oli atau cairan bekas test ke lantai

4 Referensi

4.1 PT. TITIAN LANCAR ABADI Written Practice

4.2 ASME BPVC Code Sect. I, V, VIII Div. 1, VIII Div. 2, 2019 Edition

4.3 ASME / ANSI B31.1, 2020 Edition.

4.4 SE – 709, Standard Guide for Magnetic Particle Testing

5 Definisi – Definisi

5.1 MT: Pengetesan dengan magnetic particle.

5.2 NDE: Pengujian tanpa merusak.

and the Authorized Inspector are satisfied that indications produced by the demonstrated procedure effectively reveal the size, location, orientation, quantity, and characterization of the flaws known to be present in the examination test specimen.

d. The name and/or identity and signature of the supervising Level III and the witnessing Authorized Inspector shall be added to indicate their acceptance of the procedure indicate qualification.

3 Safety Requirements

3.1 PT. TITIAN LANCAR ABADI's safety regulation shall be followed during examination.

3.2 SAFETY (S.H.E INSTRUCTION)

- Always use PPE such as Safety shoes, hand glove, safety glass, and helmet.
- Watch out for slippery and falling object
- Watch out for the hazard around the areas.
- Stop the activities and report to client and supervisor for unsafe working condition.
- Use fall protection equipment if working above 2 m.
- Collect all waste and put it in agreed place.
- Do not expose any lubricant, oil or test fluid to the ground.

4 References

4.1 PT. TITIAN LANCAR ABADI's Written Practice

4.2 ASME BPVC Code Sect. I, V, VIII Div. 1, VIII Div. 2, 2019 Edition

4.3 ASME / ANSI B31.1, 2020 Edition.

4.4 SE – 709, Standard Guide for Magnetic Particle Testing

5 Definitions

5.1 MT: Magnetic particle Examination.

5.2 NDE: Non Destructive Examination.

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5.3	Metode Kontinue adalah metode dimana arus magnetizing tetap ada pada saat media	**5.3**	Continous method : that is, the magnetizing current remains on while the examination

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pengujian sedang diterapkan.

medium is being applied.

6 Qualifikasi dan Tanggung Jawab

6.1 Personel yang melakukan pengujian untuk persyaratan procedure ini harus di qualifikasi sesuai dengan prosedure dari PT. TITIAN LANCAR ABADI Written Practice sesuai dengan SNT-TC-1A, CP - 189 atau ISO 9712:2012

6.2 Personel yang menentukan keberterimaan sesuai syarat–syarat dari prosedur ini harus Level II atau Level III.

6 Qualification and Responsibility

6.1 Personnel performing examinations to the requirements of this specification shall be qualified in accordance with PT. TITIAN LANCAR ABADI's Written Practice in accordance wtith SNT-TC-1A, CP - 189 or ISO 9712:2012

6.2 Personnel determining the acceptability to the requirements of this procedure shall be NDE Level II or NDE Level III.

7 Perlengkapan

7.1 Manufaktur dan model dari peralatan MT Yoke dipakai tapi tak terbatas termasuk:

Magnaflux, Model Y-6, Parker (AC),

Handymagna, Keiyu

7.2 Pie–Shaped Magnetic Particle Field Indicator

Pie-Indicator harus diposisikan pada permukaan benda yang akan di uji, dimana sisi yang ada tembaganya jauh dari permukaan yang di uji.

Indikasi tepat dari field strength, bila tampak jelas garis (garis-grasi) dari magnetic particle form melintasi permukaan copper dari indicator saat pengaplikasian magnetic partikel dengan medan magnit secara serempak. Bila garis (garis-garis) dari partikel form tidak tampak, Teknik magnetisasi harus di rubah sesuai kebutuhan. Pie–Type Indicator sangat baik di gunakan pada dry particle procedure.

7.3 Artificial Flaw Shims.

7 Equipment(s)

7.1 Manufacturer and model of MT Yoke equipment used but not limitted includes:

Magnaflux, Model Y-6, Parker (AC),

Handymagna, Keiyu

7.2 Pie–Shaped Magnetic Particle Field Indicator.

The Pie-indicator shall be positioned on the surface to be examined, such that the copper plate side is away from the inspected surface.

A suitable field strength is indicated when a clearly defined line (or lines) of magnetic particles form(s) a cross the copper face of indicator when the magnetic particles are applied simultaneously with the magnetizing force. When a clearly defined line (or lines) of particles is not formed. The magnetizing technique shall be changed as needed. Pie-type indicators are best used with dry particle procedures.

7.3 Artificial Flaw Shims.

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Shims dengan takik garis harus di orientasikan paling sedikit satu takikan tegak lurus dengan medan magnit yang di aplikasikan.

Shims dengan takik lingkaran dapat digunakan pada beberapa orientasi.

Shims harus di letakan pada permukaan benda yang akan di uji, dengan sisi cacat buatan pada shims mengarah pada permukaan uji.

Medan Magnit dikatak tepat, bila tampak jelas garis (garis-garis) dari magnetic particle form mewakili 30 % kedalam cacat nampak pada permukaan shims saat

Shims with linear notches shall be oriented so that at least one notch is perpendicular to the applied magnetic field.

Shims with only circular notches may used in any orientation.

Shims shall be attached to the surface to be examined, such that the artificial flaw side of the shims is toward the inspected surface.

A suitable field strength is indicated when a clearly defined line (or lines of magnetic particles, representing the 30% depth flaw, appear(s) on the shims face when magnetic particles are applied

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pengaplikasian magnetic partikel dengan medan magnit secara serempak. Bila garis (garis-garis) dari partikel form tidak tampak, Teknik magnetisasi harus di rubah sesuai kebutuhan. Shims–Type Indicator sangat baik di gunakan pada wet particle procedure.

simultaneously with the magnetizing force. When a clearly defined line of particles is not formed. The magnetizing technique shall be changed as needed. Shim Type Indicators are best used with wet particles procedures.

8 Media Pengujian

8.1 Partikel basah, visible hitam particles harus digunakan sebagai media pengujian, sesuai dengan kebutuhan.

8.2 Merk dan produk lain dari yang disebut di prosedur ini bisa digunakan asalkan demonstrasi untuk bisa memuaskan AI harus dilaksanakan.

8.3 Pada semua hal recomendasi dari pabrik pembuat harus dikuti.

8.4 Partikel basah, warnanya harus memenuhi kecukupan beda kontras dengan permukaan yang diuji. Partikel ini harus dicampur dalam cairan medium yang sesuai dengan konsentrasi yang disyaratkan pabrik pembuat.

Partikel basah dan campurannya harus sesuai dengan sepesifikasi yang sesuai dengan yang di daftar SE-709, para. 2.2.

Ukuran particle : minimum pass 98% melalui 45 mesh (4 ~ 8 μm).

Supplier	Material	Type
Magnaflux	White contrast	WCP - 2
Magnaflux	Solvent / Remover	SKC-S
Magnaflux	Particle	7 HF
Oikosh	White contrast	M – 47
Oikosh	Particle	I – 72
Oikosh	Solvent	C - 36

8 Examination Medium

8.1 Wet particles, black visible particles shall be used as the examination medium, as applicable.

8.2 Brand name or products other than specified in this procedure may be used provided demonstration to the satisfaction of the Authorized Inspector to be performed.

8.3 In all cases manufacturer's recommendation shall be followed.

8.4 Wet particles, the colour of the particle shall provide adequate contrast with the surface being examined. The particle shall be suspended in a suitable liquid medium in the concentration recommended by the manufacturer.

Wet particles and suspension vehicles shall be in accordance with the applicable specifications listed in SE-709, para. 2.2.

Particle size : minimum pass 98% through 45 mesh (4 ~ 8 μm).

Supplier	Material	Type
Magnaflux	White contrast	WCP - 2
Magnaflux	Solvent / Remover	SKC-S
Magnaflux	Particle	7 HF
Oikosh	White contrast	M – 47
Oikosh	Particle	I – 72
Oikosh	Solvent	C - 36

9 Procedure

9.1 Verifikasi dan Kalibrasi

9.1.1 Kekuatan angkat magnet dari Arus bolak balik (AC) Yoke harus diverifikasi sebelum digunakan setiap hari. Kekuatan angkat magnet Yoke harus diverifikasi jika yoke rusak atau setelah di repair.

9.1.2 a. Arus bolak balik (AC) Yoke harus mempunyai kemampuan angkat paling sedikit 10 lb (4.5 kg) pada maximum jarak pole, dengan kontak menyerupai [illegible] digunakan

9 Procedure

9.1 Verification and Calibration

9.1.1 The magnetizing power of the alternating current electromagnetic (AC) Yokes shall be verified prior to use each day the yoke is used. The magnetizing power of yokes shall be verified whenever the yoke has been damaged or repaired.

9.1.2 a. The alternating current electromagnetic yoke shall have a lifting power of at least 10 lb (4.5 kg) at the maximum pole spacing, with contact similar to what will be used during the

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dalam pengujian..

b. Setiap pemberat harus ditimbang dengan timbangan dari pabrik yang terpercaya dan ditulis stencil berat nominalnya sebelum pertama dipakai

c. Penimbangan perlu diverifikasi lagi jika rusak yang menyebabkan potensi kehilangan beratnya

9.1.3 Light meter Putih,

Light meter Putih harus dikalibrasi paling sedikit setahun sekali atau jika meter telah direpair. Jika meter tidak dipakai setahun atau lebih kalibrasi harus dilakukan sebelum digunakan.

9.2 Persiapan Pengujian

9.2.1 Sebelum pengujian magnetic particle dilaksanakan, check permukaan uji harus dilaksanakan untuk megetahui jika cacat permukaan yang terbuka yang mungkin tidak bisa menarik dan menahan magnetic particle karena lebarnya.

9.2.2 Sebelum pengujian magnetic particle dilaksanakan, permukaan yang akan diuji dan area dengan jarak setidaknya 1" (25 mm) setiap sisinya area tersebut, harus kering, bebas dari semua kotoran, grease, oli, pasir, loose, rust, scale, atau material lainnya yang akan mengganggu pada saat pengujian, metode untuk pembersihan dengan dengan kain yang dibasahi solvent remover.

9.2.3 Jika menguji lasan, minimum satu inch dari kedua sisi lasan harus diikutkan kedalam area yang diamati, jika bisa.

9.2.4 Persiapan material dengan menggunakan gerinda atau mesin disyaratkan apabila terdapat ketidakteraturan permukaan yang menutupi indikasi dari kemungkinan cacat.

examination.

b. Each weight shall be weighed with a scale from a reputable manufacturer and stenciled with the applicable nominal weight prior to first use

c. A weight need only be verified again if damaged in a manner that could have caused potential loss of material

9.1.3 White Light meter,

White Light meter shall be calibrated at least once a year or whenever the meter has been repaired. If meters has not been in use for one year or more, calibration shall be done before being used.

9.2 Preliminary Examination

9.2.1 Before the magnetic particle examination is conducted a check of examination surface shall be conducted to locate any surface discontinuity openings which may not attract and hold magnetic particles because of their width

9.2.2 Before the magnetic particle examination is conducted, the surface to be examined and any adjacent area within at least 1" (25 mm) of the surface to be examined, shall be dry and free of any dirt, grease, oil, sand, loose, rust, scale, or any other foreign material which would interfere with examination, method for cleaning by wiping with the wetted cloth with solvent remover.

9.2.3 When examine the welds, at least one inch both side of the weld shall be included in area of interest, if practicable.

9.2.4 Preparation of the materials by grinding or machining may be required where surface irregularities could mask indications due to discontinuities.

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9.2.5 Nonmagnetic Surface Contrast Enhancement (WCP) harus diaplikasikan pada lasan dan harus termasuk base metal setidaknya 1" (25 mm) tiap sisi lasan bila mungkin, hanya dalam jumlah yang cukup untuk memberi contrast particle. Pengukuran ketebalan nonmagnetic surface contrast enhancement ini tidak perlu.

9.2.5 Nonmagnetic Surface Contrast Enhancement (WCP) shall be applied on welds and shall include base metal for at least 1" (25 mm) on each side of the weld where possible, only in amounts sufficient to enhance particle contrast.

The thickness measurement of this nonmagnetic surface contrast enhancement is not required

9.3 Teknik Pemagnetan

9.3 Magnetizing Technique

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9.3.1 Kekuatan medan magnet harus diverifikasi sebelum pengujian dengan menggunakan Pie–Shaped Magnetic Particle Field Indicator

9.3.1 Field strength shall be verified prior to examination using Pie–Shaped Magnetic Particle Field Indicator.

9.3.2 Observasi indikasi harus dilaksanakan setelah aliran listrik hidup dan magnetic particles di aplikasikan (metode continue)

9.3.2 Observation of indications shall be performed upon the magnetizing current on and magnetic particles being applied.(continuous method)

9.3.3 Final interpretasi untuk AC Yoke harus dilaksanakan setelah aliran listrik tetap hidup minimum selama 5 (lima) detik.

9.3.3 Final interpretation for AC Yoke shall be performed after the magnetizing current remain on at least 5 (five) second.

9.4 Aplikasi Magnetic Particle

Letakan Yoke di area yang akan di uji, tekan tombol hidup dan aplikasikan Partikel basah secara merata dengan menyemprot. Indikasi harus diamati selama aplikasi dari partikel magnetic.

9.4 Magnetic Particle Applications

Place yoke in the area to be examined, turn on current and uniformly applied wet particles by **spray**. Formation of indications shall be observed during application of the magnetic particles.

9.5 Cakupan Pengujian

9.5.1 Setidaknya dua pengujian terpisah dilakukan pada setiap area. Pengujian kedua dengan fluks magnetic harus dilakukan dengan arah tegak lurus terhadap hasil dari arah pengujian yang pertama.

9.5.2 Semua pengujian harus dilakukan dengan overlap yang cukup untuk menjamin cakupan 100% sensitifitas testnya.

9.5.3 Untuk metode yoke, pengujian secara menyamping dibatasi, sampai jarak maximum ¼ dari jarak kontaknya pada masing–masing sisi dari garis terpendek dari jarak kontak untuk meyakinkan area dibawahnya teruji.

9.5.4 Untuk inspeksi las, lasan dan sekurangnya jarak 1" (25 mm) dari base metal setiap sisinya harus diperhatikan sebisa mungkin.

9.5 Examination Coverage

9.5.1 At least two separate examinations shall be carried out on each area. The second examination shall be with the magnetic flux approximately perpendicular to that used in the first examination.

9.5.2 All examination shall be conducted with sufficient overlap to assure 100% coverage at established test sensitivity.

9.5.3 For the yoke method, lateral examination area shall be limited, to a maximum distance of ¼ of the contact spacing on either side of the shortest line between the contact spacing to ensure the area under the contact is examined.

9.5.4 For welding inspections, the weld and at least 1" (25 mm) of base material on each side of the weld shall be examined where possible.

9.6 Penginterprestasian Indikasi

9.6 Interpretation of Indications

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9.6.1 Pengujian magnetic Particle harus dilaksanakan dengan cahaya natural atau lampu sinar putih. Light meter sinar putih harus dikalibrasi **paling sedikit setahun sekali** atau jika meter telah direpair. Jika meter tidak dipakai setahun atau lebih kalibrasi harus dilakukan sebelum digunakan.

Pencahayaan (natural atau tambahan

9.6.1 Magnetic Particle examination shall be performed under natural or supplemental white light source. White Light meter shall be calibrated **at least once a year** or whenever the meter has been repaired. If meters has not been in use for one year or more, calibration shall be done before being used.

Illumination (natural or supplemental

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lampu putih) pada permukaan benda uji adalah diperlukan untuk evaluasi indikasi. Minimum intensitas lampu harus 100 fc (1 076 lx).

Intensitas lampu natural atau tambahan lampu putih, harus diukur dengan meter lampu putih sebelum evaluasi dari indikasi atau verifikasi sumber cahaya harus digunakan. Verifikasi dari sumber lampu harus didemonstrasikan hanya sekali saja, didokumenasikan, dan disimpan dalam file,

9.6.2 Kemampuan operator sangat berperan dalam menginterprestasi pola indikasi dari serbuk terutama pada saat mengevaluasi cacat bawah permukaan dan pada akar las pada lasan parsial penetrasi. Hasil terbaik bisa didapatkan dengan pengamatan dan menggali lebih dalam untuk menampakkan indikasi. Gambar ditail dari sambungan parsial penetrasi akan membantu operator untuk mengevalusi pola dari serbuk.

9.6.3 Area pada toe of fillet welds dapat juga menyebabkan indikasi yang non relevan ketika terdapat bagian yang kasar. Uji ulang setelah penggerindaan dan penghalusan pada fillet weld menghasilkan transisi yang lebih halus dari lasan ke base metal akan menunjukan apakah indikasi tersebut non relevan.

9.6.4 Kondisi ini dapat diminimalkan dengan penyemprotan tipis, merata dari partikel magnetis.

9.7 Pengevaluasian Indikasi

9.7.1 Indikasi adalah retensi dari partikel magnetic pada diskontinuitas. Kekasaran permukaan, kotoran, minyak, dan grease dapat menyebabkan indikasi yang meragukan.

9.7.2 Indikasi yang benar adalah disebabkan oleh ketidaksempurnaan mekanik dalam bahan lasan dan di daerah yang berdekatan.

white light) of the examination surface is required for the evaluation of indications. The minimum light intensity shall be 100 fc (1 076 lx).

The light intensity, natural or supplemental white light source, shall be measured with a white light meter prior to the evaluation of indications or a verified light source shall be used. Verification of light sources is required to be demonstrated only one time, documented, and maintained on file.

9.6.2 Operator skill must be developed in the interpretation of indication patterns especially in the evaluation of sub-surface defect and un-fused roots on partial penetration welds. The best results may be achieved by observation and excavations made to explore indications. Drawings that show the details of partial penetration joints will help the operator evaluate the particle pattern.

9.6.3 The area at the toe of fillet welds can also cause non-relevant indications when an abrupt section change is present. Re–examination after grinding and blending the edge of the fillet weld to provide a smooth transition from weld to base metal will determine whether indication is non- relevant.

9.6.4 This condition can be minimized by applying a light and uniform coating of magnetic particles.

9.7 Evaluation of Indications

9.7.1 **Indications** are revealed by retention of magnetic particles on the discontinuities. Surface roughness, dirt, oils and grease can cause false indication.

9.7.2 True indications are caused by mechanical imperfections in the weld material and in the adjacent area.

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9.7.3	Indikasi yang memanjang adalah indikasi yang memiliki panjang lebih besar dari tiga kali lebar.	**9.7.3**	**A linear** indications is one having a length greater than 3 times its width.
9.7.4	Indikasi bulat adalah indikasi bulat atau	**9.7.4**	A rounded indication is one of circular or

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bentuk ellip dengan panjang sama dengan atau kurang dari tiga kali lebar.

10 Dokumentasi

Hasil dar pengujian harus dicatat pada Magnetic Particle Examination Report (Exhibit 1).

12 Demagnetisasi

Jika sisa magnet di benda uji dapat mengganggu pada proses berikutnya atau penggunaannya, maka benda uji harus didemagnetisasi sewaktu waktu setelah selesai pengujian. Demagnitization dapat menggunakan alat MT dimana procedure magnetik fluks dengan membungkus benda uji dengan kabel dan secara bertahap mengurangi ampere atau dengan mengangkat Yoke di atas area pengujian, daya ON, di putar dan di jauh kan perlahan.

Setelah proses demagnetization selesai residual fields harus tidak lebih dari 3G (240 Am-1) di semua bagian.

13 Pembersihan Akhir

Pembersihan akhir harus dilaksanakan jika material test magnetic particle yang diaplikasikan pada benda uji dapat mengganggu proses berikutnya dan dengan menggunakan alat yang cocok, bisa mengelap dengan kain dan di sikat baja.

13 Standar Penerimaan

13.1 <u>ASME BPV Code Section I, Appendix A, Para A-260</u>

a. Hanya indikasi dengan dimensi utama yang lebih besar dari 1.5 mm (1/16 in) harus dianggap relevan,

elliptical shape with a length equal to or less than three times its width.

10 Documentation

Examination results shall be recorded on the Magnetic Particle Examination Report (Exhibit 1).

11 Demagnetization

When residual magnetism in part could interfere with subsequent processing or usage, the part shall be demagnetized any time after completion of the examination. The demagnetization may use the MT machine which procedure sufficient magnetic flux by wrapping the part with cable and gradually decrease the amperes at the following decrease the amperes at the following step or lifting the yoke above the part; power on, rotate and pull away.

After demagnetization residual fields should not exceed 3G (240 Am-1) anywhere in the piece.

12 Post Cleaning

The post cleaning shall be performed only when magnetic particle test materials applied on the part could interfere with subsequent processing and using the suitable means, it may be by wipping with dry cloth and wire brushing

13 Acceptance Standard

13.1 <u>ASME BPV Code Section I, Appendix A, Para A-260</u>

a. Only indications with major dimensions greater than 1.5 mm (1/16 in) shall be considered relevant.

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b. Semua permukaan yang akan di uji harus bebas dari:

1. Indikasi relevan yang memanjang.
2. Indikasi relevan yang bulat lebih besar dari 5 mm (3/16 in).
3. Empat atau lebih indikasi relevan yang bulat dalam satu garis dipisahkan dengan 1.5 mm (1/16 in.) atau kurang , tepi ke tepi

b. All surfaces to be examined shall be free of:

1. Relevant linear Indications.
2. Relevant rounded indications greater than 5 mm (3/16 in).
3. Four or more relevant rounded indications in a line separated by 1.5 mm (1/16 in.) or less, (edge to edge)

Kp.Gunung Buntu RT005/RW003 Desa,Banyuwangi,Kec.Pulo Ampel Kota Serang/42455
Handphone. 085218282807; 089697533762
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13.2 ASME BPV Code Sect. VIII Div.1, Appendix 6, Para 6.3 & 6.4

a. Hanya indikasi dengan dimensi utama yang lebih besar dari 1.5 mm (1/16 in) harus dianggap relevan,

b. Semua permukaan yang akan di uji harus bebas dari:

1. Indikasi relevan yang memanjang.
2. Indikasi relevan yang bulat lebih besar dari 5 mm (3/16 in).
3. Empat atau lebih indikasi yang bulat dalam satu garis dipisahkan d 1.5 mm (1/16 in.) atau kurang , tepi ke tepi

13.2 ASME BPV Code Sect. VIII Div.1, Appendix 6, Para 6.3 & 6.4

a. Only indications with major dimensions greater than 1.5 mm (1/16 in.) shall be considered relevant,

b. All surfaces to be examined shall be free of:

1. Relevant linear indications.
2. Relevant rounded indications greater than 5 mm (3/16 in.)
3. Four or more relevant rounded indications in a line separated by 1.5 mm (1/16 in.) or less, edge to edge

13.3 ASME B31.1 Power Piping, Chapter IV, Para 136.4.3

a. Hanya indikasi dengan dimensi utama yang lebih besar dari 2 mm (1/16 in) harus dianggap relevan,

b. Semua permukaan yang akan di uji harus bebas dari:

1. Semua crack atau indikasi linear
2. Indikasi relevan yang bulat lebih besar dari 5mm (3/16 in).
3. Empat atau lebih indikasi yang bulat dalam satu garis dipisahkan 2 mm (1/16 in.) atau kurang , tepi ke tepi
4. Sepuluh atau lebih indikasi bulat dalam 3870 mm^2 (6 in^2.) di permukaan dengan ukuran utama pada suatu area tidak melebihi dari 150 mm (6 in) dengan luasan diambil di lokasi yang paling relatif tidak menguntung kan untuk indikasi di evaluasi.

13.3 ASME B31.1 Power Piping, Chapter IV, Para 136.4.3

a. Only indications with major dimensions greater than 2 mm (1/16 in.) shall be considered relevant,

b. All surfaces to be examined shall be free of:

1. Any crack or linear indications.
2. Relevant rounded indications greater than 5.0 mm (3/16 in.)
3. Four or more relevant rounded indications in a line separated by 2 mm (1/16 in.) or less, edge to edge
4. Ten or more rounded indications in any 6 in^2. (3870 mm^2) of surface with the major dimension of this area not to exceed 150 mm (6 in.) with the area taken in the most unfavorable location relative to the indications being evaluated.

13.4 ASME BPV Code Sect. VIII Div. 2, Part 7.5.6.1 (d) and 7.5.6.2

a. Hanya indikasi dengan dimensi utama yang lebih besar dari 1.5 mm (1/16 in) harus dianggap relevan,

13.4 ASME BPV Code Sect. VIII Div. 2, Part 7.5.6.1 (d) and 7.5.6.2

a. Only indications with major dimensions greater than 1.5 mm (1/16 in.) shall be considered relevant,

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b. Semua permukaan yang akan di uji harus bebas dari:

1. Indikasi relevan yang memanjang.
2. Indikasi relevan yang bulat lebih besar dari 5mm (3/16 in).
3. Empat atau lebih indikasi yang bulat dalam satu garis dipisahkan 1.5 mm (1/16 in.) atau kurang , tepi ke tepi

b. All surfaces to be examined shall be free of:

1. Relevant linear indications.
2. Relevant rounded indications greater than 5.0 mm (3/16 in.)
3. Four or more relevant rounded indications in a line separated by 1.5 mm (1/16 ins.) or less, edge to edge

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Handphone. 085218282807; 089697533762
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4. Indikasi terdeteksi seperti Crack, terlepas dari kondisi permukaan, tidak bisa di terima.

4. Crack like indications detected, irrespective of surface conditions, are unacceptable.

14 Perbaikan

Indikasi yang tidak diterima harus dibuang dan diuji kembali untuk meyakinkan cacat sudah hilang atau ukuran yang diterima sebelum di las lagi.

Jika cacat direpair dengan chipping atau grinding dan urutan repair tidak memerlukan welding, area yang di keruk harus di haluskan terhadap permukaan sekitarnya sehingga terhindar daro takikan, lubang, atau pojokan. Jika welding diperlukan setelah repair cacat, area harus dibersihkan dan di welding sesuai dengan welding procedure yang qualified.

a. Perlakuan indikasi yang Nonrelevant.

Setiap indikasi yang diyakini sebagai Nonrelevant harus dianggap sebagai cacat kecali ditunjukkan dengan pengujian denga method yang sama atau dengan method lainnya dan/atau dengan perbaikkan permukaan sehingga tidak ada cacat yang tidak diterima

b. Pengujian pada area yang cacatnya sudah di hilangkan.

Setelah cacat yakin sudah hilang dan sebelum repair pengelasan, area harus di uji ulamg dengan method yang cocok untuk meyakinkan bahwa cacat telah hilang atau telah berkurang sampai ukuran diterima

c. Pengujian pada area repair.

Setelah repair telah dilakukan, area repai harus disamarkan dengan permukaan sekelilingnya sehingga terhindar dari lekukan tajam, atau pojok dan di uij ulang dengan method magnetic particle dan dengan method pengujian lainnya yang diperlukan untuk area yang terkena, kecuali yang jika kedalaman repair kurang dari yang diperlukan sensitivitas radiography, maka radiography bias tidat diperlukan

14 Repair

Unacceptable indications shall be removed and re-examined to assure complete removal of defects or to acceptable size before re-welding.

Whenever an imperfection is repaired by chipping or grinding and subsequent repair by welding is not required, the excavated area shall be blended into the surrounding surface so as to avoid sharp notches, crevices, or corners. Where welding is required after repair of an imperfection, the area shall be cleaned and welding performed in accordance with a qualified welding procedure.

a. Treatment of Indications Believed Nonrelevant.

Any indication which is believed to be nonrelevant shall be regarded as an imperfection unless it is shown by re-examination by the same method or by the use of other nondestructive methods and/or by surface conditioning that no unacceptable imperfection is present.

b. Examination of Areas From Which Defects Have Been Removed.

After a defect is thought to have been re-moved and prior to making weld repairs, the area shall be examined by suitable methods to ensure it has been re-moved or reduced to an acceptably sized imperfection.

c. Reexamination of Repair Areas.

After repairs have been made, the repaired area shall be blended into the surrounding surface so as to avoid sharp notch crevices, or corners and reexamined by the magnetic particle method and by all other methods of examination that were originally required for the affected area, except that, when the depth of repair is less than the radiographic sensitivity required, re-radiography may be omitted.

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Exhibit 1:
MAGNETIC PARTICLE TEST REPORT

Customer :	Drawing No. : ..... Rev.	Report No :.....- MT.....
Project Name :	Procedure No. : ..... Rev.	
Unit No :	Applicable CODE :	NCR Ref No :

Material Spec. :	Welding Process :

MT Equipment	: ☐ Yoke	☐ Other	
Current Type	: ☐ AC	☐ Other	Serial No. : .....
Light Intensity	:	Light Source :	
Particle	: ☐ Visible	☐ Wet	
Temperature	:	Particle application	☐ Spray ☐ Other
Brand's Name/Types	:	Particle :	White Contrast : ..... Cleaner :
Batch no. of	Particle :	White Contrast :	Cleaner : .....
Examination Method	: ☐ Continuous	Magnetizing technique	☐ Minimum twice in each area, right angle each other
Surface Prep. / cleaning	: ☐ As welded	☐ As machined	☐ As ground ☐ Solvent Wipe
Time of Examination	: ☐ After Welding	☐ After Hydro-test	☐ After PWHT ☐ Others
Scope of Examination	: ☐ Base Metal	☐ Edge Prep	☐ Back Chipping
	: ☐ Weld Part	☐ Repair Weld	☐ Others

Part Name	Weld No.	Thickness (mm)	Result		Types of Discontinuities	Remarks
			Accepted	Rejected		

Sketch (Identify discontinuities listed above) if necessary :

Examined by : Name : NDE Level :	Reviewed / witnessed by :	Reviewed / witnessed by :
Date :	Date :	Date :

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Table T – 721

Requirements of a Magnetic Particle Examination Procedure

Requirement	Essential Variable	Non essential Variable	Par. reference	Range qualified
Magnetizing technique	X		9.3	Yoke
Magnetizing current type or amperage outside range specified by this article or as previous qualified	X		NA	AC (Alternating Current)
Surface preparation	X		9.2	Machining, grinding, wire brush, wipe with wetted cloth with solvent/remover Magnaflux SKC-S
Magnetic particles (fluorescent / visible, color, particle size, wet / dry)	X		8.1 / 8.4	Wet visible black, particle size 4 ~ 8 µm, Magnaflux – 7 HF
Method of particle application	X		9.4	Spray
Method of excess particle removal	X		NA	NA, for Wet
Minimum light intensity	X		9.6 (a)	min. 1050 lux
Existing Coating thickness greater than the thickness demonstrated	X		NA	NA
Nonmagnetic surface contrast enhancement, ***when utilized***	X		8.4 / 9.2.4	White contrast Magnaflux WCP - 2
Performance demonstration, when required	X		2.3	ASME V, T 150
Examination part surface temperature outside of the temperature range recommended by the manufacturer of the particles or as previous qualified	X		2.1	Max. 57^0 C
Shape or size of the examination object		X	1	Butt, T , corner, lap joint, thick. max. 75 mm.
Equipment of the same type		X	7	Yoke AC only
Temperature (within those specified by manufacturer or as previously qualified)		X	2.1	Max. 57^0 C
Demagnetizing technique		X	12	Lift yoke above the part, power on, twisting and pull away
Post-examination cleaning technique		X	13	Wiping with cloth , wire brush
Personnel qualification requirements		X	6	SNT-TC-1A, 2006 Edition and 2016 Edition.

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AC – YOKE MAGNETIZING POWER VEIFICATION LOG

(by lifting the Test block 10 pounds(4.5 kgs)

Month	Date	Time	Yoke Serial no.	Test block Serial no.	Pole Spacing (mm)	Result	Verified by (Initial / Name)
	1						
	2						
	3						
	4						
	5						
	6						
	7						
	8						
	9						
	10						
	11						
	12						
	13						
	14						
	15						
	16						
	17						
	18						
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	22						
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	24						
	25						
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	27						
	28						
	29						
	30						

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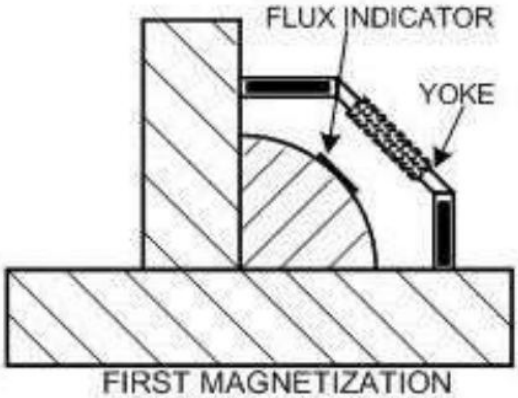
APPENDIX 1

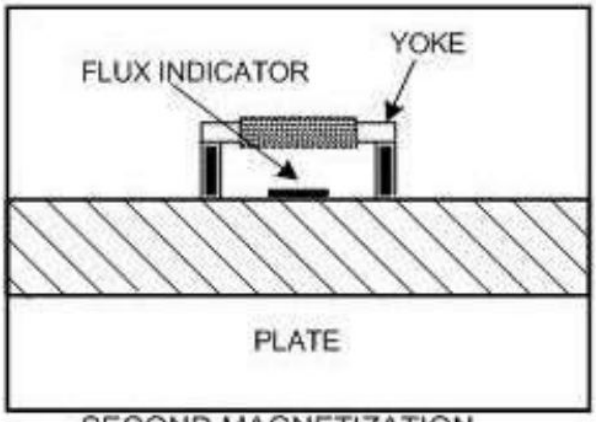
1 TECHNIQUE SHEET No : MTS –01

COMPONENT : Filet welds (full or partial penetration, node and nozzle welds)
TECHNICAL : Continuous magnetization, color contrast wet method
MATERIAL : Carbon Steel
MAGNETIC SOURCE : Electro magnetic, Yoke
CURRENT : AC
FLUX INDICATOR : Pie Type
POLE SPACING : As Required
BACKGROUND :Cleaned, spray with white contrast paint Magnaflux WCP-2 or Oikosh M 47
MAGNETIC PARTICLES : Magnaflux 7HF or Oikosh I 72
ACCEPTANCE CRITERIA : See paragraph 14 of this procedure

SKETCH



FIRST MAGNETIZATION
CROSS-SECTION VIEW
(STEP 3)



SECOND MAGNETIZATION
SIDE VIEW
(STEP 6)

INSPECTION SEQUENCE:

1. Remove slag, weld spatters, debris and other contaminant from weld surface and adjacent 1 inch
2. Spray white paint on test surface (weld). Wait till it dries.
3. Place the magnetic Yoke across the weld with pole spacing as required
4. Apply the magnetic ink between the poles and magnetic short shot the weld while the ink is flowing away from the surface, visually inspect for indication.
5. To determine if there is sufficient magnetic force, see Section 11 of this procedure.
6. Reposition the magnetic Yoke so that the magnetic field is perpendicular to that of step 3 above Repeat step 3 above
7. If indication is observed, determined whether the indication caused by discontinuity or false /irrelevant indication.
8. This can be done by removing the indication, visually examine the surface and re-MT
9. Indication can be removed.
10. Indication can be removed by light grinding. If indication still appear after grinding
11. Inspection shall be carried out with sufficient lighting.
12. Demagnetization not required
13. During a subsequent magnetization an overlap of least one inch over the previous step is necessary to ensure complete coverage.

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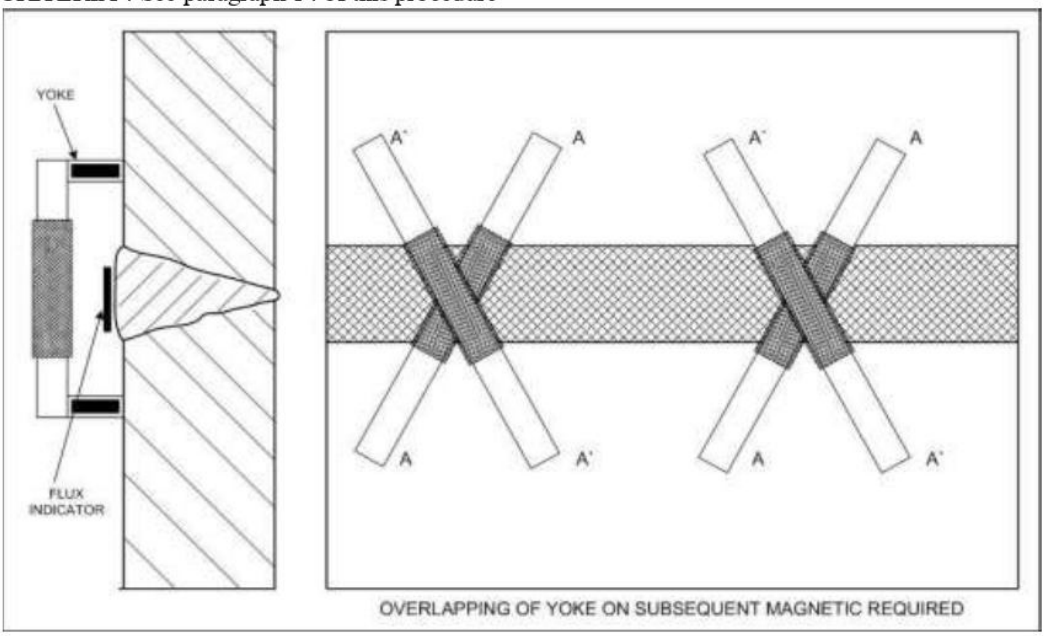
2 TECHNIQUE SHEET No. : MTS - 02

COMPONENT : Butt welds, lap joint or in flat position.
TECHNICAL : Continuous magnetization, color contrast wet method
MATERIAL : Carbon Steel
MAGNETIC SOURCE : Electro magnetic, Yoke
CURRENT : AC
FLUX INDICATOR : Pie Type
POLE SPACING : As Required
BACKGROUND :Cleaned, spray with white contrast paint Magnaflux WCP-2 or Oikosh M 47
MAGNETIC PARTICLES : Magnaflux 7HF or Oikosh I 72
ACCEPTANCE CRITERIA : See paragraph 14 of this procedure



INSPECTION SEQUENCE:

1. Remove slag, weld spatters, debris and other contaminants from weld surface and adjacent 1 inch
2. Spray white paint on test surface (weld). Wait till it dries.
3. Place the magnetic Yoke across the weld with the pole spacing as required.
4. To determine if there is sufficient magnetic force, see Section 11 of this procedure.
5. Apply the magnetic ink between the poles and magnetic short shot the weld while the ink is flowing away from the surface, visually inspect for indication.
6. Reposition the magnetic Yoke so that the magnetic field is perpendicular to that of step 3 above.
7. If indication is observed, determined whether the indication is caused by discontinuity or false/irrelevant indication.
8. This can be done by removing the indication, visually examine the surface and re-MT
9. Indication can be removed
10. Indication can be removed by light grinding. If Indication still appear after grinding repair procedure from client shall be followed.
11. Inspection shall be carried out with sufficient lighting
12. Demagnetization not required
13. During a subsequent magnetization an overlap of least one-inch over the previous step is necessary to ensure complete coverage

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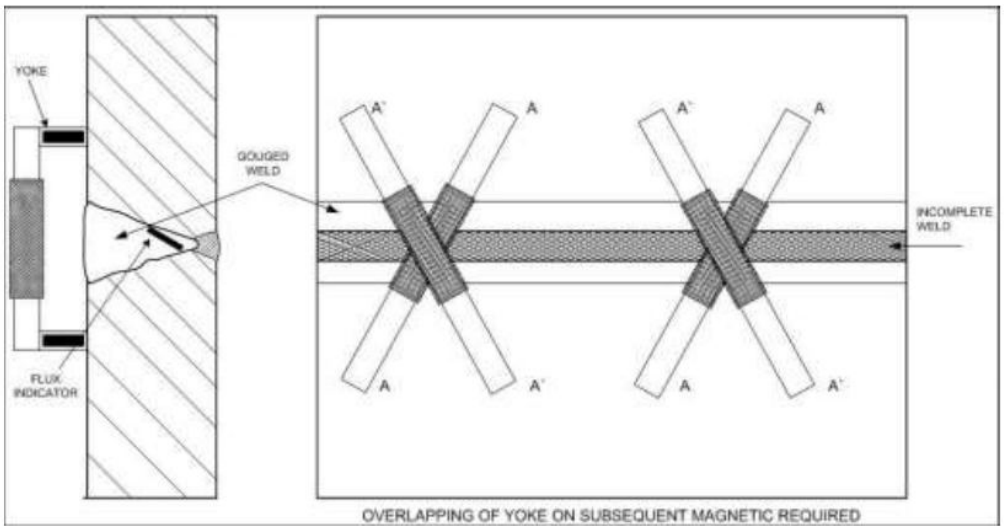
3 TECHNIQUE SHEET No. : MTS – 03

COMPONENT : Back gouging butt welds, and fillet welds.
TECHNICAL : Continuous magnetization, color contrast wet method
MATERIAL : Carbon Steel
MAGNETIC SOURCE : Electro magnetic, Yoke
CURRENT : AC
FLUX INDICATOR : Pie Type
POLE SPACING : As Required
BACKGROUND :Cleaned, spray with white contrast paint Magnaflux WCP-2 or Oikosh M 47
MAGNETIC PARTICLES : Magnaflux 7HF or Oikosh I 72
ACCEPTANCE CRITERIA : See paragraph 14 of this procedure



INSPECTION SEQUENCE:

1. Remove slag, weld spatters and other debris from weld surface
2. Spray white paint on test surface (weld). Wait till it dries.
3. Place the magnetic yoke across the weld with pole spacing as required
4. To determine if there is sufficient magnetic force, see Section 11 of this procedure
5. Apply the magnetic ink between the poles and magnetic short shot the weld while the ink is flowing away from the surface, visually inspect for indication.
6. Reposition the magnetic Yoke at A – A or A' – A' as shown above. Repeat 5 above.
7. If indication is observed, determined whether the indication is caused by discontinuity or false/ or irrelevant indication. This can be done by removing the indication, visually examine the surface and re-MT.
8. Indications can be removed by light grinding. If indications still appear after grinding, repair procedure from client shall be followed.
9. Inspection shall be carried out with sufficient lighting
10. Demagnetization not required.
11. During a subsequent magnetization an overlap of least one-inch over the previous step is necessary to ensure complete coverage.

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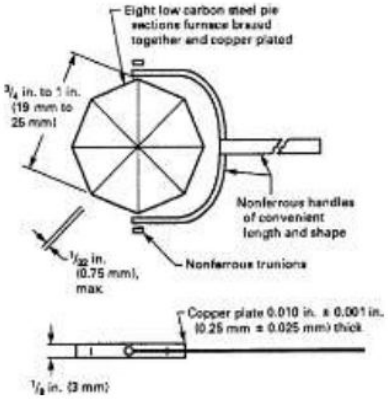
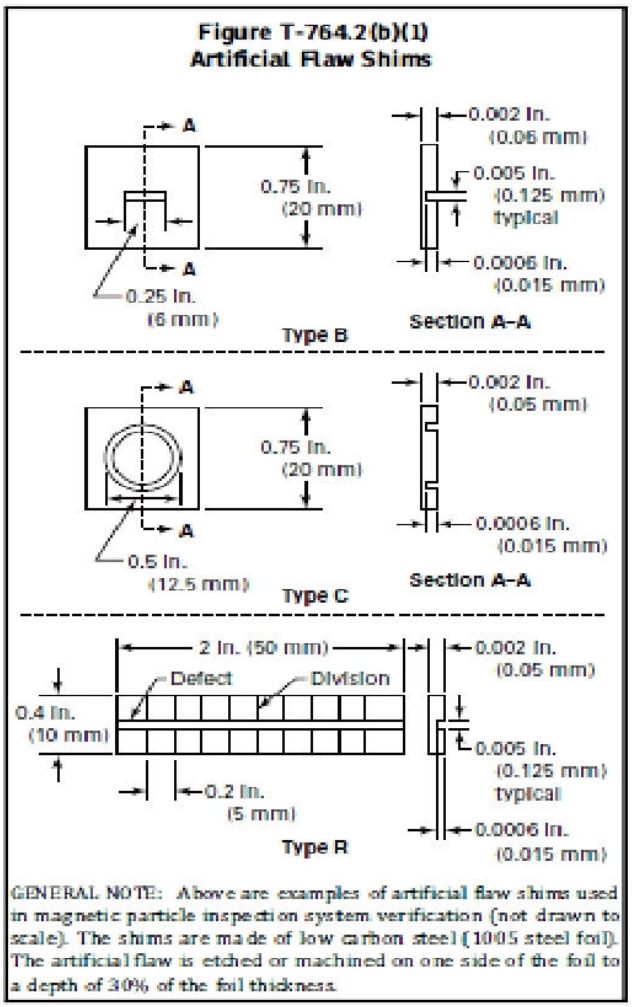
APPENDIX 2



PIE SHAPE



ARTIFICIAL L\FLAW SHIM

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3. ULTRASONIC EXAMINATION PROCEDURE

ULTRASONIC EXAMINATION PROCEDURE
ASME BPV Code

DOCUMENT : TLA-UT-ASME - 03
REVISION NO. : 00

Prepared by	Reviewed by	Reviewed and Approved by
Name : Riswan	Name : Agus Riyanto	Name : Adi Padmo
Position : NDE Level II	Position : DIRECTOR	Position : NDE LEVEL III Cert. No. 126596
Date : 16 April, 2022	Date : 16 April, 2022	Date : 16 April, 2022

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SUMMARY OF REVISION SHEET

This page is a record of all revisions of the procedure and the following revision (s) has (have) been made to this procedure.

REV.	DATE	PAGE	BRIEF OF REVISION
00	16 April, 2022	All	First Issue
			-

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	Daftar Isi	/	Table of Content	
Par.	**Uraian**	**Par.**	**Description**	**Page**

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1 Tujuan

1.1 Prosedur ini untuk digunakan sebagai petunjuk pengujian Manual Ultrasonic Examinations (MUT)

1.2 Procedure ini terdiri dari versi Inggris dan Indonesia, jika ada konflik antara keduanya maka versi Inggris yang dipakai.

2 Ruang Lingkup

2.1 Prosedur ini menyajikan syarat-syarat dan standar acceptance yang digunakan untuk pengujian dengan Ultrasonic kontak pada:

2.1.1 Lasan full penetrasi ferrous material (carbon steel, low alloy steel, forging) dengan ketebalan antara 0.25 in. (6 mm) sampai 1.0 in. (25 mm).
Sambungan las bisa terbuat dari pipa, tube, plat atau batang.

2.1.2 Base material dari ferrous metal (carbon steel, low alloy steel, forging) dengan ketebalan antara 0.25 in. (6 mm) sampai 1.0 in. (25 mm) untuk pengujian laminasi atau defect lainnya.

2.2 Procedure harus diqualifikasi dengan demonstrasi, jika ada perubahan dari persyaratan di Table T-421 diketahui sebagai essential variable harus perlu diqualifikasi ulang dengan demonstrasi. Perubahan dari persyaratan diketahui sebagai nonessential variable tidak diperlukan requalifikasi procedure. Semua perubahan dari essential atau non essential variable dari yang disebut dalam prosedur ini harus diperlukan revisi dari atau dengan addendum ke procedure.

2.3 Persyaratan Demonstrasi :

a. Demonstrasi harus dilaksanakan untuk mendapatkan kepuasan Authorized Inspector, dibawah control dan pengawasan dari Level III penguji yang qualified dan certified untuk melaksanakan ujian method dan teknik.

1 Purpose

1.1 This procedure provides guidance during the conduct of Manual Ultrasonic Examinations (MUT)

1.2 This procedure consists of English and Indonesian versions, shall there is conflict between these versions the English version shall govern.

2 Scope

2.1 This procedure provides the requirements and acceptance standards for the contact ultrasonic examination for:

2.1.1 **Full penetration welds** of ferrous material (carbon steel, low alloy steel, forging) with thickness between 0.25 in. (6 mm) up to 1.0 in. (25 mm).
Weld joints may be made of pipes, tubes, plates or bar.

2.1.2 **Base materials** of ferrous metals (carbon steel, low alloy steel, forging) with thickness between 0.25 in. (6 mm) up to 1.0 in. (25 mm) for lamination check or other defects.

2.2 Procedure shall be qualified by demonstration, when a change of requirement in Table T-421 identified as an essential variable shall require requalification of the procedure by demonstration. A change of a requirement identified as a nonessential variable does not require re-qualification the procedure. All changes of essential or nonessential variable from those specified by this procedure shall require revision of or an addendum to the procedure.

2.3 Demonstration requirements :

a. The demostration shall be performed to the satisfaction of the Authorized Inspector, under the control and supervision of a Level III examiner who is qualified and certfied for performing the examination method and technique.

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b. Demonstrasi harus pada minimum satu test spesimen yang mempunyai cacat dimana ukuran, lokasi, orientasi, jumlah, dan karakterisasi telah ditentukan sebelum demonstrasi dan diketahui hanya oleh

b. The demonstration shall be on minimum one test specimen having flaws whose size, location, orientation, quantity, and characterization have been determined prior to demonstration and are known only by the supervising Level III examiner.

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pengawas Level III penguji.

c. Procedure dianggap qualified jika pengawas Level III penguji dan Authorized Inspector telah puas dengan indikasi yang didapat dengan procedure yang demonstrasikan efective menampakkan ukuran, lokasi, orientasi, jumlah, dan karakterisasi dari cacat yang diketahui didapatkan pada specimen test yang diuji.

d. Nama dan / atau identifikasi dan tanda tangan dari pengawas Level III penguji dan Authorized Inspector yang menyaksikan harus ditambahkan untuk menyatakan penerimaan menyatakan qualifikasi procedure.

c. The procedure shall be considered qualified when the supervising Level III and the Authorized Inspector are satisfied that indications produced by the demonstrated procedure effectively reveal the size, location, orientation, quantity, and characterization of the flaws known to be present in the examination test specimen.

d. The name and/or identity and signature of the supervising Level III and the witnessing Authorized Inspector shall be added to indicate their acceptance of the procedure indicate qualification.

3 Persyaratan Keselamatan

3.1 Safety regulasi dari PT. TITIAN LANCAR ABADI harus diikuti selama pengujian.

3.2 SAFETY (S.H.E INSTRUCTION)

- Selalu menggunakan PPE such as Safety shoes, hand glove, safety glass, and helmet.
- Waspada tempat yang licin dan benda jatuh
- Waspada benda berbahaya sekitar tempat kerja
- Berhenti kerja dan lapor ke Team Leader untuk tempat kerja yang tidak aman
- Pakai alat pengaman ketinggian jika kerja diatas 2 m
- Pungut sampah dan buang ditempat yang tersedia
- Jangan membuang pelumas, oli atau cairan bekas test ke lantai

3 Safety Requirements

3.1 PT. TITIAN LANCAR ABADI's safety regulation shall be followed during examination.

3.2 SAFETY (S.H.E INSTRUCTION)

- Always use PPE such as Safety shoes, hand glove, safety glass, and helmet.
- Watch out for slippery and falling object
- Watch out for the hazard around the areas.
- Stop the activities and report to Team Leader for unsafe working condition.
- Use fall protection equipment if working above 2 m.
- Collect all waste and put it in agreed place.
- Do not expose any lubricant, oil or test fluid to the ground.

4 Referensi

4.1 PT. TITIAN LANCAR ABADI Written Practice

4.2 ASME Code Sect.I, V Article 4, VIII Div. 1, VIII Div. 2, IX, 2021 Edition

4.3 ASME / ANSI B31.1, 2020 Edition, Power Piping

4 References

4.1 PT. TITIAN LANCAR ABADI's Written Practice

4.2 ASME Code Sect.I, V Article 4, VIII Div. 1, VIII Div. 2, IX, 2021 Edition

4.3 ASME / ANSI B31.1, 2020 Edition, Power Piping

5 Definisi–Definisi

5 Definitions

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5.1	Primary reference response (level): respon dari ultrasonic dari refector di blok kalibrasi pada jarak sound path tertentu, secara electronic di	**5.1**	**Primary reference response (level)**: the ultrasonic response from the basic calibration reflector at the specified sound path distance,

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	atur sampai persen tertentu dari ketinggian screen.		electronically adjusted to a specified percentage of the full screen height.
5.2	DAC: Distance Amplitude Correction kurva.	**5.2**	**DAC**: Distance Amplitude Correction curve.
5.3	Probe (Probe): sebuah alat electro acoustic digunakan untuk meneruskan atau menerima ultrasonic energy.	**5.3**	**Search Unit (Probe)**: an electro acoustic device used to transmit or receive ultrasonic energy.
5.4	Transducer: sebuah alat electro acoustical untuk merubah energi listrik ke energi getaran dan sebaliknya. Probe atau transducer akan digunakan didalam prosedur ini dengan pengertian yang sama.	**5.4**	**Transducer**: an electro acoustical device for converting electrical energy into acoustical energy and vice versa. Probe or transducer will be used in this procedure with the same meaning.
5.5	Kalibrasi: hubungan dari respon sistem ultrasonic dengan kalibrator.	**5.5**	**Calibration**: correlation of the ultrasonic system respond(s) with calibration reflector(s)
5.6	Straight beam: sebuah gelombang getaran pulsa yang berjalan normal (tegak lurus) dengan permukaan yang di tes.	**5.6**	**Straight beam**: a vibrating pulse wave train travelling normal to the test surface.
5.7	Angle beam: terminologi digunakan untuk menyatakan sudut datang atau pembiasan selain tegak lurus dengan permukaan yang di tes, hanya beam sudut gelombang shear yang digunakan dalam prosedur ini.	**5.7**	**Angle beam**: a term used to describe an angle of incidence or refraction other than normal to the surface of the test object, only angle beam shear waves shall be used in this procedure.
5.8	Manual Ultrasonic Examinations (MUT) : teknik dari pengujian ultrasonic dilaksanakan dengan search unit yang di manipulasikan dengan tangan tanpa bantuan alat apapun untuk system nya.	**5.8**	Manual Ultrasonic Examinations (MUT): a technique of ul-trasonic examination performed with search units that are manipulated by hand without the aid of any mechanical guidance system.
6	**Kualifikasi dan Tanggung Jawab Personnel**	**6**	**Personnel Qualification and Responsibility**
6.1	Personel yang melakukan pengujian untuk persyaratan procedure ini harus di qualifikasi sesuai dengan prosedure dari PT. TITIAN LANCAR ABADI Written Practice sesuai dengan SNT-TC-1A, ACCP atau ISO 9712:2012	**6.1**	Personnel performing examinations to the requirements of this specification shall be qualified in accordance with PT. TITIAN LANCAR ABADI's Written Practice in accordance wtith SNT-TC-1A, ACCP or ISO 9712:2012
6.2	Personel yang melaksanakan tes dan mengevaluasi dengan prosedure ini harus memiliki Level II atau Level III.	**6.2**	Personnel performing examinations and evaluation to the requirements this procedure shall be Level II or Level III.
7	**Perlengkapan**	**7**	**Equipments**
7.1	**Alat – alat Ultrasonic**	**7.1**	**Ultrasonic Equipments**
7.1.1	**Frekwensi**	**7.1.1**	**Frequency**

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Pengujian ini harus dilaksanakan dengan menggunakan instrumen ultrasonic pulsa gema yang bisa menimbulkan frekwensi minimum antara 1 MHz sampai 5 MHz dan harus mempunyai gain kontrol step 2.0 dB atau kurang.

Instrumen dengan frequensi lain bisa

This examination shall be conducted with a pulse-echo ultrasonic instrument capable of generating frequencies over the range of at least 1 MHz to 5 MHz and shall be equipped with a stepped gain control in units of 2.0 dB or less.

Instrument operating at other frequencies

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digunakan, jika setara atau lebih baik sensitivitasnya dapat didemonstrasikan dan didokumentasikan.

7.2 Search units

7.2.1 Frequensi transducer harus diantara 1 MHz sampai 5 MHz.

7.2.2 Search Unit untuk Weld Metal Overlay Cladding harus menggunakan Dual element, staright beam search unit menggunakan sudut teknik pitch-catch. Termasuk sudut antara elemen search unit harus sedemikian rupa sehingga jarak effective focal spot adalah terkonsentrasi dalam area yang diperhatikan.

7.2.3 Pengujian harus dilaksanakan hanya dengan mode gelombang shear dari probes yang sudut nominalnya di material carbon steel and low alloy steel adalah 45, 60, 70 derajat dan mode gelombang longitudinal probe normal dengan teknik kontak langsung. Ukuran probe yang digunakan, probe sudut 8x9 mm dan probe normal dengan diameter 10 mm.

Ukuran probe selain yang disebut bisa digunakan, jika sensitivitas setara atau lebih baik dapat didemonstrasikan dan didokumentasikan.

7.2.4 Sepatu Probe

a. Direkomendasikan untuk **Angle beam** search unit menambah sepatu (sepatu 3 mm mika) pada probe, dengan menggunakan lem super glue, sebelum mulai proses penyetelan. Kemudian yang digosok adalah sepatu flexi glasnya.

Harus hati–hati supaya tidak ada udara yang terjebak ketika proses pengeleman tersebut.

b. Jika pengujian dilaksanakan pada komponen kurva dengan diameter kurang dari 14 in. (350 mm) (pada permukaan uji)harus dilaksanakan dengan sepatu probe yang melengkung, untuk meyakinkan kecukupan menempelnya ultrasonic dan untuk membatasi potensi probe yang mengambang yang digerakkan sepanjang sekeliling komponen.

may be used, if equal or better sensitivity can be demonstrated and documented.

7.2 Search units

7.2.1 The frequencies of the transducer shall be from 1 MHz to 5 Mhz.

7.2.2 Search Unit for Weld Metal Overlay Cladding shall use Dual element, straight beam search unit using an angled pitch-catch technique. The included angle between the search unit's elements shall be such that the effective focal spot distance is centered in area of interest.

7.2.3 Examination shall be performed with **only shear** wave mode which the angle beam search units whose **nominal angles** in the carbon steel and low alloy steel material are **45, 60, 70 deg**. and longitudinal wave mode straight beam search unit using direct contact technique. **Angle beam** search units dimension 8x9 mm and **straight beam** search diameter 10 mm shall be used.

The other stated search unit dimensions may be used, if equal or better sensitivity can be demonstrated and documented.

7.2.4 Contact Wedges.

a. It is recommended for **Angle beam** search units that an extra wear plate **(3 mm plexi glass probe shoe)** be attached to the probe, using Eastman/super glue, before starting the fitting process. Fitting then takes place using the plexiglas probe shoe. Care is to be taken that no bubbles are trapped in the glue where the shoe adheres to the probe.

b. When the examinations are performed on a curved component having a diameter less than 14 in. (350 mm) (at the examination surface) shall be performed using contoured wedge, to ensure sufficient ultrasonic couplings achieved and to limit any potential rocking of the search unit as it is moved along the circumference of the component.

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Ukuran probe yang melengkung harus dipilih dari Table (1) dan (2) berikut, dan harus ditentukan menggunakan ukuran komponen yang sama dari permukaan dilaksanakannya pengujian (I. D. atau O.

The search unit contoured dimension shall be selected from the tables in (1) and (2) below, and shall be determined using the same component dimension from which the examination is being

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D.)

(1) Maximum contour untuk pengujian dari O. D. , lihat **Table 1**

(2) Minimum contour untuk pengujian dari I.D. , lihat **Table 2**

7.2.5 Toleransi yang dizinkan dari sudut beam adalah +2°/-0°. Jika deviasi dari sudut beam melebihi toleransi ini, harus dibetulkan dengan cara menggerinda salah satu ujung dari permukaan sepatu.

7.2.6 Pemilihan probe

Material Thickness	Probe Angle
≤ 25 mm	60^0 and/or 70^0
>25 mm	45^0 and 60^0 or 45^0 and 70^0

7.2.7 Penggunaan kombinasi probe selain yang disebut diatas diizinkan, asalkan seluruh volume dari bagian yang di uji bisa tercakup.

7.3 Couplant

7.3.1 Couplant yang mempunyai karakteristik pelicin seperti oli mesin SAE 20 sampai 30, grease, Carboxyl Methyl Cellulose (C.M.C.) dicampur dengan glycerin (80% glycerin konsentrasi) atau C.M.C. harus digunakan.

7.3.2 Couplant yang digunakan untuk pengujian harus sama dengan couplant yang digunakan saat kalibrasi.

7.4 Blok Kalibrasi

7.4.1 Reflectors

Blok kalibrasi reflektor (seperti side drilled holes, flat bottom holes, notches,dll) harus digunakan untuk menentukan primary reference response dari alat. Sebuah alternative reflector boleh digunakan asalkan menghasilkan sensitivity sama atau lebih bagus dari reflector yang disebut (seperti side drilled holes sebagai ganti dari notches, flat bottom holes sebagai ganti dari side drilled holes).

7.4.2 Blok Material

performed (I. D. or O. D.)

(1) Maximum contour for examinations performed from O. D. , see **Table 1**

(2) Minimum contour for examinations performed from I.D. , see **Table 2**

7.2.5 A tolerance of +2°/-0° in beam angle is permissible. Where the beam angle deviation exceeds this tolerance, it is to be corrected by grinding more at one end of the wear probe shoe.

7.2.6 Search Unit selection

Material Thickness	Probe Angle
≤ 25 mm	60^0 and/or 70^0
>25 mm	45^0 and 60^0 or 45^0 and 70^0

7.2.7 Using other search unit combinations as mentioned above are permitted, provided the whole volume of part examined can be covered.

7.3 Couplant

7.3.1 Couplant having good wetting characteristics such as SAE 20 to 30 machine oil, grease, Carboxyl Methyl Cellulose (C.M.C.) mixed with glycerin (more than 80% concentration of glycerin) or C.M.C. shall be used.

7.3.2 The couplant for examination shall be the same with the couplant used in calibration

7.4 Calibration Block

7.4.1 Reflectors

The basic calibration reflectors (i.e., side drilled holes, flat bottom holes, notches, etc.) shall be used to establish a primary reference response of the equipment. An alternative reflector(s) may be used provided that the alternative reflector(s) produce sensitivity equal to greater than the specified reflector(s) (e.g., side drilled holes in lieu of notches, flat bottom holes in lieu of side drilled holes).

7.4.2 Block Material

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7.4.2.1	Material dari blok kalibrasi harus dibuat dari bentuk produk yang sama, dan spesifikasi material yang sama atau P–	**7.4.2.1**	The material from which the block is fabricated shall be of the same product form, and material specification or

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number yang setara dengan material yang akan di dites. Yang dimaksud di paragraf ini, P-Nos. 1. 3. 4, 5A sampai 5C, dan 15A sampai 15F adalah bisa dianggap setara.

equivalent P-number grouping of the materials being examined. For the purposes of the paragraph, P-Nos. 1. 3. 4, 5A through 5C, and 15A through 15F materials are considering equivalent.

7.4.2.2 **b.** Kalibrasi blok untuk material yang berbeda, pemilihan material harus berdasarkan pada material yang dimana pengujian akan dilaksanakan; jika pengujian akan dilaksanakan dari kedua belah sisi reflektor kalibrasi harus dibuat dengan kedua material tersebut. Jika dua atau lebih ketebalan dalam suatu pengujian, reflektor kalibrasi harus ditentukan dengan rata–rata dari ketebalan lasan tsb.

7.4.2.2 Calibration blocks for dissimilar metals weld, the material selection shall be base on the material on the side of the weld from which the examination will be conducted; if the examination will be conducted from both side, calibration reflector shall be provided in both materials. Where two or more base material thickness are involved, the calibration reflector shall be determined by the average thickness of the weld.

7.4.2.3 Transfer koreksi. Jika material block tidak dari product form yang sama atau tidak menerima perlakuan panas yang sama, bisa digunakan asalkan memenuhi semua persyaratan block lainnya dan transfer koreksi untuk perbedaan sifat akustik digunakan. Transfer koreksi harus ditentukan dengan mencatat perbedaan antara sinyal respon, menggunakan probe dan sepatu yang sama yang digunakan dalam pengujian, yang diterima salah satu

(1) dihasilkan dari reference reflector (sama type dan ukuran) pada basic block kalibrasi dan pada komponen yang diuji. atau

(2) dua probe yang diposisikan pada orientasi yang sama pada basic block kalibrasi dan komponen yang diuji.

Sensitivity pengujian harus diatur untuk perbedaan tersebut

7.4.2.3 Transfer Correction. When the block material is not of the same product form or has not received the same heat treatment, it may be used provided it meets all other block requirements and a transfer correction for acoustical property differences is used. Transfer correction shall be determined by noting the difference between the signal response, using the same transducers and wedges to be used in the examination, received from either

(1) the corresponding reference reflector (same type and dimensions) in the basic calibration block and in the component to be examined, or

(2) two search units positioned in the same orientation on the basic calibration block and component to be examined.

The examination sensitivity shall be adjusted for the difference.

7.4.2.4 Blok kalibrasi harus diuji dengan probe normal. Area yang mengandung indikasi cacat melebihi refleksi backwall harus dibuang pada jarak beam yang dibutuhkan, untuk menghindari pantulan yang bervariasi dan membingungkan.

7.4.2.4 The calibration block material shall be completely examined with a straight beam search unit. Area that contains an indication exceeding the remaining back reflection shall be excluded from the beam paths required to reach the various calibration reflectors.

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7.4.2.5 Blok kalibrasi harus menerima perlakuan tempering minimum sesuai dengan yang dibutuhkan dari spesifikasi material untuk type dan grade. Jika calibration block mengandung lasan selain cladding, dan komponen las pada waktu pengujian telah di heat treatment, block juga harus menerima perlakuan heat treatment yang

7.4.2.5 The calibration block shall receive at least the minimum tempering treatment required by the material specification for the type and grade. If calibration block cotains welds other than cladding, and the component weld at the time of examination has been heat treated, the block shall receive the same heat

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sama.

7.4.2.6 Permukaan blok kalibrasi harus mewakili permukaan komponen yang diuji.

7.4.2.7 Cladding

a. Pemilihan Block. Block yang difabrikasi harus dari material salah satu dari yang berikut ini :

1. Nozzle yang dipotong dari component
2. Perpanjangan dari component
3. Material dari yang sama spesifikasinya, bentuk produknya, dan kondisi heat treatment seperti material yang mana search unit akan diaplikasikan selama dalam pengujian.

b. Clad.

Jika material komponennya adalah clad dan cladding menjadi faktor selama pengujian, block harus juga diclad ke komponen, tebal nominal clad ± 1/8 in (3 mm). Desposisi dari clad harus sama methodenya (seperti rol-bond, manual weld deposited, automatic wire deposited, or automatic strip deposited) seperti dipakai clad komponen yang di uji. Jika method cladding tidak diketahui, desposisi cladding boleh dengan cara methode manual.

Note : untuk informasi lainnya yang tidak disebut dalam procedure ini harus merujuk ke ASME Code section V, par. 434.1.4

7.4.3 Block Bentuk Curva.
Material dengan Diameter lebih Besar dari 20 inci (508 mm).

7.4.3.1 Untuk pengujian pada material dimana surface diameter lebih besar dari 20 inches (508 mm),harus menggunakan blok yang mendekati bentuk curvanya, atau alternatif dengan flat **(lihat Fig. 1 B).**

7.4.3.2 Untuk menguji permukaan material cekung kedalam dengan diameter lebih besar dari 20 inches (508 mm), dengan menggunakan basic calibration block flat, pengaturan gain diperlukan.

treatment.

7.4.2.6 The finish on the surfaces of the block shall be representative of the surface finish on the components.

7.4.2.7 Cladding

a. Block selection. The material from which the block is fabricated shall be from one of the following :

1. Nozzle dropout from the component
2. A component prolongation
3. Material of the same specification, product form, and heat treatment condition as the material to which the search unit is applied during the examination.

b. Clad.

Where the component material is clad and cladding is a factor during examination, the block shall be clad to the component, clad nominal thickness ± 1/8 in (3 mm). Deposition of clad shall be the same method (i.e., rol-bond, manual weld deposited, automatic wire deposited, or automatic strip deposited) as used to clad the component to be examined. When the cladding method is not known, deposition of cladding may be by the manual method.

Note : for other informations are not specified in this procedure, shall refer to the ASME Code section V, par. 434.1.4

7.4.3 Block Curvature.
Materials with Diameters Greater Than 20 inches (508 mm).

7.4.3.1 For examination in materials where the examination surface diameter is greater than 20 inches (508 mm),a block of essentially the same curvature, or alternatively, flat basic calibration block **(see Fig.1 B),** shall be used.

7.4.3.2 For examination convex surface materials with diameter greater than 20 inches (508 mm), using flat basic calibration block, adjustment of receiver gain may be required.

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7.4.4 Block Bentuk Curva.
Material dengan Diameter 20 inci (508 mm) dan Lebih Kecil.
Blok kalibrasi harus dibentuk curva untuk

7.4.4 Block Curvature.
Materials with Diameters 20 inches (508 mm) and Less.
The basic calibration block shall be

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material dengan diameter 508 mm dan lebih kecil. Kecuali yang di nyatakan dalam paragrap ini, single blok kalibrasi bentuk curva boleh digunakan untuk mengkalibrasi surface benda uji dengan range dari curva mulai 0,9 sampai 1,5 kali blok kalibrasi diameter.

7.4.5 Non-Piping Calibration Block

7.4.5.1 Basic calibration block configurasi, reflectors dan thickness harus seperti Fig. 1 B (T-434.2.1). Ukuran block dan lokasi reflector harus cukup untuk melakukan kalibrasi dengan probe sudut dan dengan jarak range yang dipakai.

7.4.5.2 Range Ketebalan Block.

Jika block thickness ± 1 inch (25 mm) diantara range dua weld thickness sepert pada Fig. 1 B (T-434.2.1), block yang digunakan harus diterima pada porsi diatas dari masing – masing thickness range dengan 1 inch (25 mm) dari thickness calibration block.

Contoh, calibration block dengan thickness 1.5 inch (38 mm) bisa di gunakan untuk thickness lasan 0.5 inch (13 mm) sampai 2.5 inch (64 mm).

7.4.6 Piping Calibration Block

a. Basic calibration block configurasi dan reflector harus seperti pada **Fig 1 C (T-434.3-1)** sebagai alternative seperti pada **Fig 1 D (T-434.3-2.)**

b. Thickness T, harus didalam range ± 25% dari thickness nominal dari componen yang di uji. Ukuran block dan lokasi reflector harus cukup untuk melakukan kalibrasi dengan probe sudut dan dengan jarak range yang dipakai.

7.4.7 Weld Metal Overlay Cladding Calibration Blocks

7.4.7.1 Calibration Block untuk Teknik satu.

curved for materials with diameters 508 mm and less. Except where otherwise states in this article, a single curved basic calibration block may be used to calibrate the examination on surfaces in the range of curvature from **0.9 to 1.5** times the basic calibration block diameter.

7.4.5 Non-Piping Calibration Block

7.4.5.1 Basic calibration block configuration, reflectors and thickness shall be as shown in Fig. 1 B (T-434.2.1). The block size and reflector locations shall be adequate to perform calibrations for beam angle(s) and distance range(s) to be used.

7.4.5.2 Block Thickness Range.

When the block thickness ± 1 inch (25 mm) spans two weld thickness ranges shown in Fig. 1 B (T-434.2.1), the block's use shall be acceptable in those portions of each thickness range coverage by 1 inch (25 mm) of calibration block's thickness.

As an example, a calibration block with thickness of 1.5 inch (38 mm) could be used for weld thickness of 0.5 inch (13 mm) to 2.5 inch (64 mm).

7.4.6 Piping Calibration Blocks

a. The basic calibration block configuration and reflectors shall be as shown in **Fig 1 C (T-434.3-1)** or the alternate provided in **Fig 1 D (T-434.3-2.)**

b. Thickness T, shall be ± 25% of the nominal thickness of component to be examined. The block size and reflector locations shall be adequate to perform calibrations for beam angle(s) and distance range(s) to be used.

7.4.7 Weld Metal Overlay Cladding Calibration Blocks

7.4.7.1 Calibration Block for Technique One.

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Konfigurasi dari Calibration block dan reflector harus seperti yang ditunjukkan di Fig. T-434.4.1. Salah satu side drilled hole atau flat bottom hole boleh digunakan. Tebal dari weld metal overlay cladding harus paling sedikit setebal yang diuji. Tebal dari material dasarnya harus paling sedikit dua kali ketebalan dari weld metal overlay cladding.

The calibration block configuration and reflectors shall be as shown in Fig. T-434.4.1. Either a side drilled hole or flat bottom hole may be used. The thickness of the weld metal overlay cladding shall be at least as thick as to be examined. The thickness of the base material shall be at least twice the thickness of the weld metal overlay cladding.

7.4.7.2 Alternative Calibration Block untuk

7.4.7.2 Alternate Calibration Blocks for

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Teknik satu.

Alternative Calibration Blocks seperti ditunjukkan di Fig. T-434.4.2.1 dan Fig. T-434.4.2.2 boleh digunakan. Tebal dariweld metal overlay cladding harus paling sedikit setebal yang diuji. Tebal dari material dasarnya harus paling sedikit dua kali ketebalan dari weld metal overlay cladding.

7.4.7.3 Calibration Block for Teknik dua

Konfigurasi dari Calibration block dan reflector harus seperti gambar yang ditunjukkan di Fig. T-434.4.3. Flat bottom hole di bor sampai perbatasan lasan / base metal yang digunakan. Hole ini boleh di bor dari sisi base material atau weld metal overlay cladding. Tebal dari weld metal overlay cladding harus paling sedikit setebal yang diuji. Tebal dari material dasarnya harus dalam range 1 in (25 mm) dari ketebalan calibration block jika pengujian dilaksanakan dari permukaan base material. Tebal dari material dasarnya harus paling sedikit dua kali ketebalan dari weld metal overlay cladding jika pengujian dilaksanakan dari permukaan weld metal overlay cladding surface.

7.4.8 Calibration Block untuk Nozzle Side Weld Fusion dan/atau Nozzle Parent Metal yang berdekatan

7.4.8.1 Configurasi calibration block harus seperti pada Fig. 1 I (T-434.5.1). Ukuran block dan lokasi reflector harus mencukupi untuk melakukan kalibrasi pada nozzle side weld fusion zone dan/atau nozzle parent metal yang berdekatan.

7.4.8.2 Block thickness harus maximum thickness dari nozzle wall yang dekat ke nozzle weld plus 0.75 inch (19 mm)

7.4.8.3 Untuk pengujian nozzle gengan diameter (ID) sama atau lebih kecil dari than 20 inches (508 mm), block contact surface harus mempunyai curva yang sama atau dalam range 0.9 to 1.5 kali diameter seperti detail pada Fig. 1 A (434.1.7.2)

Technique One.

Alternately, calibration blocks as shown in Fig. T-434.4.2.1 and Fig. T-434.4.2.2 may be used. The thickness of the weld metal overlay cladding shall be at least as thick as to be examined. The thickness of the base material shall be at least twice the thickness of the weld metal overlay cladding.

7.4.7.3 Calibration Block for Technique Two.

The calibration block configuration and reflectors shall be as shown in Fig. T-434.4.3. A flat bottom hole drilled to the weld / base metal interface shall be used. This hole may be drilled from the base material or weld metal overlay cladding side. The thickness of the weld metal overlay cladding shall be at least as thick as to be examined. The thickness of the base metal shall be within 1 in (25 mm) of the calibration block thickness when the examination is performed from the base material surface. The thickness of the base material shall be at least twice the thickness of the weld metal overlay cladding when the examination is performed from the weld metal overlay cladding surface.

7.4.8 Nozzle Side Weld Fusion and/or AdjacentNozzleParent Metal Calibration Block.

7.4.8.1 The calibration block configuration shall be as shown in **Fig. 1 I (T-434.5.1).** The block size and reflector locations shall be adequate to perform calibrations to cover the nozzle side weld fusion zone and/or the adjacent nozzle parent metal.

7.4.8.2 The block thickness shall be the maximum thickness of the nozzle wall adjacent to nozzle weld plus 0.75 inch (19 mm)

7.4.8.3 For examinations of nozzle with an diameter (ID) equal to or less than 20 inches (508 mm), the contact surface of calibration block shall have the same cuvature or within the range of 0.9 to 1.5 times the diameter as detailed in **Fig. 1 A (434.1.7.2)**

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7.4.8.4	Calibration reflector harus side- drilled hole sesuai dengan persyaratan pada Fig. 1 B (T-434.2.1) untuk nozzle wall thickness	**7.4.8.4**	The calibration reflectors shall be side-drilled hole(s) that are in accordance with the requirements of Fig. **1 B (T-434.2.1)** for the nozzle wall thickness
7.4.8.5	Alternative Calibration block yang ada bisa digunakan untuk pengujian yang	**7.4.8.5**	The alternative calibration blocks may be used for similar types of examinations

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typenya sejenis asalkan jarak sound path ke reflector dalam range 0.25 inch (6 mm) yang dipersyaratkan dan side-drilled hole sama atau diameternya lebih kecil dari yang dipersyaratkan.

provided the sound path distance(s) to the block's reflector(s) is (are) within 0.25 inch (6 mm) of what is required and the side-drilled hole(s) is (are) the same or a smaller diameter than what required.

8 Procedure

8 Procedure

8.1 Persiapan Permukaan

8.1 Surface Preparation.

8.1.1 Base Metal (permukaan kontak)

Base metal pada setiap sisi lasan harus bebas dari spater, permukaan yang tidak teratur, atau benda asing yang mungkin mengganggu dalam pengujian.

8.1.1 Base Metal (contact surface)

The base metal on each side of the weld shall be free of weld spatter, surface irregularities, or foreign matter that might interfere with the examination.

8.1.2 Weld Metals.

Jika permukaan lasan mengganggu dalam pengujian, lasan harus di persiapkan secukupnya supaya tidak mengganggu dalam pengujian (sesuai peraturan permukaan bisa di buat/digerinda sampai rata dengan permukaan base metal).
Persiapan permukaan dengan mesin gerinda atau mesin proses

8.1.2 Weld Metals.

Where the weld surfaces interfere with the examination, the weld shall be prepared as needed to permit examination (as a rule, weld surface should be finished up to the same surface as the base metal).
The method of surface preparation may be by grinding or machining.

9 Calibration Alat

9 Instrument Calibration

9.1 Instrumen Lineariti

Kalibrasi screen height linearity dan amplitude control linearity harus dilaksanakan pada interval waktu tidak lebih dari 3 bulan untuk type analog dan 1 (satu) tahun untuk type digital atau pada setiap pemakaian awal setelahnya.

9.1 Instrument Linearity

The calibration of screen height and amplitude linearity shall be performed at intervals time not exceed 3 months for analog type instruments and 1 (one) year for digital type instruments, or prior to first use thereafter.

9.1.1 Lineariti ketinggian Screen

Ultrasonic instrumen harus menunjukkan linearitas ketinggian screen sesuai dengan ASME Section V dan PT. TITIAN LANCAR ABADI Calibration Procedure.

9.1.1 Screen height linearity

The ultrasonic instrument shall provide screen height linearity in accordance with ASME Section V and PT. TITIAN LANCAR ABADI's Calibration Procedure.

9.1.2 Lineariti Kontrol Amplitudo

Instrumen ultrasonic harus menggunakan control akurasi amplitudo dalam range ±20% dari perbandingan nominal amplitudo, untuk memungkinkan mengukur indikasi-indikasi diluar range dari vertikal display pada screen. Prosedur yang mengevaluasi lineariti control amplitudo sesuai dengan ASME Section V dan PT. TITIAN LANCAR ABADI

9.1.2 Amplitude control linearity

The ultrasonic instrument shall utilize an amplitude control accurate over its useful range to ±20% of the nominal amplitude ratio, to allow measurement of indications beyond the linear range of the vertical display on the screen. The procedure for evaluating amplitude control linearity in accordance with ASME Section V and PT.

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Calibration Procedure.

TITIAN LANCAR ABADI's Calibration Procedure.

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10 Kalibrasi System

10.1 Persyaratan Umum Kalibrasi

a. Kalibrasi harus meliputi semua sistem pengujian alat ultrasonic dan harus dilaksanakan sebelum system digunakan dalam range thickness dalam pengujian.

b. **Permukaan kalibrasi.** Kalibrasi harus dilaksanakan dari permukaan (clad atau tidak clad; cembung atau cekung) sesuai dengan permukaan dari komponen yang akan dilaksanakannya pengujian.

c. **Pelapisan kontak.** Pelapisan kontak yang sama harus digunakan selama pengujian dan kalibrasi.

10.2 Temperature

Untuk pengujian sistem kontak, beda temperatur antara basic calibration block dan permukaan benda yang di uji harus dalam range dari 25 ^{0}F (14°C).

10.3 Kalibrasi untuk selain Piping

Kalibrasi harus dilaksanakan menggunakan calibration block seperti pada Fig. T-434.2.1.

10.3.1 Kalibrasi Probe Normal

Kalibrasi harus meliputi pengukuran[2] sebagai berikut.

10.3.1.1 Kalibrasi Jarak (lihat Fig. 4, sebagai contoh)

Kalibrasi dari pengukuran beam path bisa digunakan control range dengan memposisikan refleksi dari backwall blok untuk pembagian divisi yang sama untuk tebal yang diukur dari blok IIW V1 atau V2 atau blok standar yang setara.

10.3.1.2 Sensitivity Probe Normal

a. Tidak dengan DAC

Sweep horizontal harus diatur pada jarak kalibrasi sehingga menghasilkan paling tidak dua pulsa yang setara ketebalan pada layer.

Sensitivitassnya harus diatur pada lokasi yang bebas dari indikasi sehingga pantulan pertama dari sisi terjauh dari pelat berada pada 50% sampai 75% Full Screen Height.

10 System Calibration

10.1 General Calibration Requirements

a. Calibration shall include the complete ultrasonic examination system and shall be performed prior to use of the system in the thickness range under examination

b. **Calibration surface.** Calibration shall be performed from the surface (clad or unclad; convex or cocave) corresponding to the surface of the component from which the examination will be performed

c. **Contact wedges.** The same contact wedges to be used during the examination shall be used for calibration.

10.2 Temperature

For contact examination, the temperature differential between basic calibration block and examination surfaces surface shall be within 25 ^{0}F (14°C).

10.3 Calibration for Non Piping

Calibrations shall be performed utilizing the calibration block shown in Fig. T-434.2.1.

10.3.1 Straight Beam Calibration

The calibration shall provide the following measurements.

10.3.1.1 Distance Range Calibration (see Fig. 4, for example)

Calibration of beam path measurement may use range control by positioning of the block back wall reflection to the distance division number (or multiple) equal to the measured thickness of IIW VI or V2 or equivalent standard test block.

10.3.1.2 Straight Beam Sensitivity

a. Non DAC

The horizontal sweep shall be adjusted for distance calibration to present the equivalent of at least two plate thicknesses on the display.

Sensitivity shall be adjusted at a location free of indications so that the first back reflection from the far side of the plate will be 50 % ~ 75 % of Full Screen Height.

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b. DAC

Pengaturan **Sensitivity** menggunakan DAC harus mengikuti **Fig. no. 5**

b. DAC.

Sensitivity adjustment using DAC shall follow as shown in **Fig. no. 5**

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10.3.2 Teknik Kalibrasi Probe Sudut

Sesuai ketentuan, minimum kalibrasi harus meliputi pengukuran [2] berikut:

10.3.2.1 Kalibrasi Jarak (lihat Fig. 6 atau 7)

Kalibrasi jarak harus di atur untuk mewakili aktual sound path dengan menggunakan IIW – V1 atau IIW – V2. Kalibrasi jarak (contoh) harus menggunakan skala 4 inch (100 mm). Kalibrasi jarak yang lainnya bisa digunakan dengan mempertimbangkan joint configuration atau thickness of component yang di uji

10.3.2.2 Koreksi Jarak-Amplitudo (DAC)

Tidak ada satu titikpun pada kurva DAC kurang dari 20% full screen height (FSH). Jika ada porsi pada kurva DAC kurang dari 20% FSH, harus menggunakan split DAC. Kalibrasi reflektor pertama pada DAC ke dua harus mulai pada 80% ± 5% FSH. Jika perbandingan reflector signal-to-noise tidak menghalangi evaluasi efektive indikasi dan karakterisasi, maka split DAC boleh titdak digunakan. (Article 4, Nonmandatory Appendix Q tersedia sebagai contoh.)

a. Posisi dari probe **(lihat Fig.8)** untuk respon maksimum :
- dari SDH di kedalaman ¾ dari ketebalan blok, untuk bahan dengan ketebalan t < 25 mm
- dari SDH di kedalaman ¼ atau ¾ dari ketebalan blok, untuk bahan dengan ketebalan t > 25 mm
- Selain yang disebutkan sesuai referensi SDH di atas dapat di pilih, memberikan cakupan untuk dilakukan pengujian.

Catatan:
SDH singkatan Lubang Bor Side
SDH diatas disebut sebagai referensi SDH

b. Atur sensitivity control untuk menghasilkan indikasi 80% (±5% tinggi full screen) dari referensi SDH.
Tandai ujung indikasi pada screen. Catat dB dari SDH referensi, dB tersebut dianggap sebagai referensi level.

10.3.2 Angel Beam Calibration Technique

As applicable, the calibration shall provide the following measurements.

10.3.2.1 Distance Range Calibration (see Fig. 6 or 7)

Horizontal Sweep shall be adjusted to represent the actual sound path distance by using IIW – V1 or IIW – V2.
The distance calibration (for example) shall be made using the 4 inch (100 mm) scale. The other distance calibrations may be used in respect to the joint configuration or thickness of component examined.

10.3.2.2 Distance-Amplitude Correction(DAC)

No point on the DAC curve shall be less than 20% of full screen height (FSH). When any portion of the DAC curve will fall below 20% FSH, a split DAC shall be used. The first calibration reflector on the second DAC shall start at 80% ± 5% FSH. When reflector signal-to-noise ratio precludes effective indication evaluation and characterization, a split DAC should not be used. (Article 4, Nonmandatory Appendix Q provides an example.)

a. Position the search unit **(see Fig 8)** for maximum response :
- from SDH at depth the ¾ block thickness, for material thickness t < 25 mm
- from SDH at depth ¼ or ¾ block thickness, for material thickness t > 25 mm
- The other mentioned above reference SDH may be selected, provided the coverage testing can be performed.

Note :
SDH stands for Side Drill Hole
The above SDH is called as reference SDH.

b. Adjust the sensitivity control to provide 80% (±5% of full screen height) indication from the reference SDH.
Mark the peak of the indication on the screen. **Record** the dB from the reference SDH, the dB is considered as **reference level.**

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c. Atur sensitivity control untuk menghasilkan indikasi 40% dari tinggi full screen atau 50% DAC (±5%), dengan mengurangi 6 dB dari referensi level.

c. Adjusting the sensitivity control to provide 40% of full screen height or 50 % DAC (±5%) , by reducing 6 dB from the reference level.

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Tandai ujung indikasi pada screen

d. Atur sensitivity control untuk menghasilkan indikasi 16% dari tinggi full screen atau 20% DAC (±5%), dengan mengurangi 14 dB dari referensi level.
Tandai ujung indikasi pada screen

e. Tanpa merubah Control Range pengaturan, Atur sensitivity control terhadap referensi level, maka posisi dari probe adalah maksimum respon dari SDH lainnya.

f. Ulangi langkah **10.4.2.2, 10.4.2.3** dan **10.4.2.4** diatas. Tandai respon tergambar di screen terhadap sisi SDH yang dibor untuk mendapatkan kurva panjang amplitude (DAC).

g. Hubungkan tanda–tanda dari respon side-drilled hole di screen untuk menghasilkan distance amplitude curve (DAC).

h. Pengukuran Amplitudo Echo dari Notch Permukaan pada Blok Kalibrasi (lihat Fig. 9)

1. Posisikan probe untuk menghasilkan amplitudo maximum dari notch kotak di permukaan dibaliknya, tandai "X" pada ujung indikasi pada screen dari notch tersebut.

2. Notch kotak di permukaan dibaliknya mungkin bisa memberi indikasi 2 banding 1 diatas DAC dari probe 45^0 and ½ DAC at probe 60^0. Oleh karena itu, indikasi dari notch harus diperhatikan saat mengevaluasi reflektor[2] pada posisi permukaan dibaliknya.

10.3.3 Alternative Kalibrasi Probe Sudut

Jika vessel atau konponen lainnya terbuat dari ketebalan ½ in. (13 mm) atau kurang dan diameter sama atau kurang dari 20 in. (500 mm), system kalibrasi probe sudut untuk teknik DAC bisa dilaksanakan menggunakan persyaratan dari par. **10.4.2**

10.4 Kalibrasi untuk Piping

10.4.1 Kalibrasi Probe Normal

Mark the peak of the indications on the screen.

d. Adjusting the sensitivity control to provide 16% of full screen height or 20 % DAC (±5%), by reducing 14 dB **from the reference level.**
Mark the peak of the indications on the screen.

e. Without changing the Range Control adjustment, adjusting the sensitivity control to the **reference level**, then position the search unit for maximum response from another SDHs .

f. Repeat the step **10.4.2.2, 10.4.2.3** and **10.4.2.4** above. Connect the screen marks respond from the side drilled SDHs to provide the distance amplitude curve (DAC).

g. Connect the screen marks respond from the side-drilled holes to provide the distance amplitude (DAC) curve.

h. Echo Amplitude Measurement from the Surface Notch in the Basic Calibration Block (see Fig. 9)

1. Position the search unit for maximum amplitude from the square notch on the opposite surface, "X" mark the peak of the indication on the screen from the notch.

2. The opposite surface square notch may give an indication 2 to 1 above DAC at 45^0 probe and ½ DAC at 60^0 probe. Therefore, the indication from the square notch must be consider when evaluating reflectors at the opposite surface.

10.3.3 Alternative Angle Beam Calibration

When a vessel or other component is made with a thickness of ½ in. (13 mm) or less and a diameter equal to or less than 20 in. (500 mm), the angle beam system calibrations for distance-amplitude technique may be performed using the requirement of par. **10.4.2**

10.4 Calibration for Piping

10.4.1 Straight Beam Calibration

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Teknik untuk kalibrasi probe normal harus dilaksanakan sesuai dengan **Par. 10.3.1 ,** dengan menggunakan calibration block piping, lihat **Fig 1 C (T-434.3.1)** atau alternative pada **Fig 1 D (T-434.3.2.)**

Technique for straight beam calibration shall be performed in according to **Par. 10.3.1 ,** using the piping calibration blocks, see **Fig 1 C (T-434.3.1)** or the alternate provided in **Fig 1 D (T-434.3.2.)**

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10.4.2 Kalibrasi Probe Sudut Dengan Notch, Fig 1 C (T-434.3.1)

Probe sudut harus diarahkan ke notch untuk menghasilkan respon maximum. Gain control diatur sedemikian rupa sehingga respon pada 80% ± 5% FSH. Ini disebut sebagai primary reference level. Tanpa merubah setting alat, probe di gerak – gerakkan, untuk menghasilkan respon maximum dari reflector lainnya secara bertahap untuk mendapatkan 3 point curva distance-amplitude correction (DAC). Kalibrasi terpisah harus dilaksanakan untuk arah memanjang dan melingkar dari notch.

Dan kalibrasi ini harus menghasikan keduanya distance range calibration dan distance-amplitude correction.

10.4.2 Angle Beam Calibration With Notches, Fig 1 C (T-434.3.1)

The angle beam shall be directed toward the notch that yields the maximum response. The gain control shall be set so that this response is 80% ± 5% of FSH. This shall be the primary reference level. The search unit shall be manipulated, without changing instrument settings, to obtain the maximum responses from the calibration reflectors at the distance inrements necessary to generate a three-point distance-amplitude correction (DAC) curve. Separate calibration shall be established for both the axial and circumferential notches. These calibrations shall establish both the distance range calibration and the distance-amplitude correction.

10.4.3 Kalibrasi dengan Side Drilled Holes, Fig 1 D (T-434.3.2)

Probe sudut harus diarahkan ke side drilled hole untuk menghasilkan respon maximum. Gain control diatur sedemikian rupa sehingga respon pada 80% ± 5% FSH. Ini disebut sebagai primary reference level. Tanpa merubah setting alat, probe di gerak – gerakkan, untuk menghasilkan respon maximum dari reflector lainnya secara bertahap untuk mendapatkan 3 T curva distance-amplitude correction (DAC), dimana T adalah tebal dari calibration block. Kemudian, posisikan probe untuk mendapatkan respon maximum dari notch permukaan dan tandai pulsa tertinggi pada screen hal ini untuk pertimbangan jika mengevaluasi dari reflector permukaan. Kalibrasi terpisah harus dilaksanakan untuk arah memanjang dan melingkar dari notch.

Dan calibrasi ini harus menghasikan keduanya distance range calibration dan distance-amplitude correction

10.4.3 Calibration With Side Drilled Holes, Fig 1 D (T-434.3.2)

The angle beam shall be directed toward the side drilled hole that yields the maximum response. The gain control shall be set so that this response is 80% ± 5% of FSH. This shall be the primary reference level. The search unit shall the be manipulated, without changing instrument settings, to obtain the maximum responses from the calibration reflectors at the distance inrements necessary to generate up to a 3T distance-amplitude correction (DAC) curve, wher T is the thickness of the calibration block. Next, position the search unit for maximum response for the surface notch positions and marks the peaks on the screen for consideration when evaluating sruface reflectors. Separate calibration shall be established for both the axial and circumferential scans. Thesecalibrations shall establish both the distance range calibration and the distance-amplitude correction.

10.5 Kalibrasi untuk Weld Metal Overlay Cladding

10.5 Calibration For Weld Metal Overlay Cladding

10.5.1 Teknik kalibrasi ke satu.

10.5.1 Calibration for Technique One.

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Kalibrasi harus menggunakan calibration block sepaerti pada Fig. 1E (T-434.4.1). Probe diposisikan untuk mendapatkan

Calibrations shall be utilizing the calibration block shown in **Fig. 1E (T-434.4.1).** The search unit shall be

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respon maximum dari calibration reflector. Jika side drilled hole yang digunakan untuk kalibrasi, permukaan sisi pemisah dari element probe dual harus diposisikan paralel dengan as dari hole. Gain control diatur sedemikian rupa sehingga respon pada 80% ± 5% FSH. Ini disebut sebagai primary reference level.

10.5.2 Teknik kalibrasi ke dua.

Kalibrasi harus menggunakan calibration block seperti pada **Fig. 1 H (T-434.4.3).** Probe diposisikan untuk mendapatkan respon maximum yang didapat dari reflector bottom pertama.

Gain control diatur sedemikian rupa sehingga respon pada 80% ± 5% FSH. Ini disebut sebagai primary reference level.

10.5.3 Alternative Kalibrasi Untuk Teknik ke satu.

Kalibrasi harus menggunakan calibration block seperti pada **Fig. 1 F (T-434.4.2.1) or Fig. 1 G (T-434.4.2.2).**

Kalibrasi harus dilaksanakan seperti berikut :

a. Probe diposisikan untuk mendapatkan respon maximum adri reflector yang memberikan amplitude tertinggi.

b. Jika menggunakan calibration block **Fig. 1 G (T-434.4.2.2)** permukaan sisi pemisah dari element probe dual harus diposisikan paralel dengan as dari hole.

c. Gain control diatur sedemikian rupa sehingga respon pada 80% ± 5% FSH. Ini disebut sebagai primary reference level. Beri tanda peak tertinggi di screen

d. Tanpa merubah setting alat, probe di posisikan untuk menghasilkan respon maximum dari setiap reflector lainnya dan beri tanda semua peak yang didapat pada screen.

e. Sambungkan semua tanda – tanda di screen untuk mendapatkan curva DAC.

10.6 Kalibrasi untuk Nozzle Zone Fusi dari lasan dan / atau yang berdekatan dengan material induknya.

positioned for maximum response from the calibration reflector. When side drilled hole is used for calibration, the plane separating elements of dual element search unit shall be positioned paralel to the axis of the hole. The gain control shall be set so that this response is 80% ± 5% of FSH. This shall be the primary reference level.

10.5.2 Calibration for Technique Two.

Calibrations shall be utilizing the calibration block shown in **Fig. 1 H (T-434.4.3).** The search unit shall be positioned for maximum response of the first resolvable indication from the bottom of the calibration reflector. The gain control shall be set so that this response is 80% ± 5% of FSH. This shall be the primary reference level.

10.5.3 Alternative Calibration for Technique One.

Calibrations shall be performed utilizing the calibration blocks shown in **Fig. 1 F (T-434.4.2.1) or Fig. 1 G (T-434.4.2.2).** The calibration shall be performed as follows:

a. The search unit shall be positioned for maximum response from the reflector, which gives the highest amplitude.

b. When the calibration block **Fig. 1 G (T-434.4.2.2)** is used the plane separating elements of dual element search unit shall be positioned paralel to the axis of the hole.

c. The gain control shall be set so that this response is 80% ± 5% of FSH. This shall be the primary reference level. Mark the peak on the screen

d. Without changing instrument settings, position search unit for maximum responses from each of the other reflectors and mark their peaks on the screen.

e. Connect the screen marks for each reflector to provide and DAC curve.

10.6 Calibration For Nozzle Side Weld Fusion Zone And / Or Adjacent Nozzle Parent Metal.

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Jumlah dari hole kalibrasi tergantung dari persyaratan dari pengujian. Jika hanya zone side fusion saja yang di uji, diperlukan hanya satu side drilled hole pada ketebalan nozzle saja yang perlu

The number of calibration holes used depends upon the requirements for examination. If only side fusion zone is to be examined, then only a single side drilled hole at the nozzle wall thickness

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digunakan.

a. **Satu hole.** Respon dari satu hole diatur sedemikian rupa sehingga respon pada 80% ± 5% FSH. Ini disebut sebagai primary reference level.

b. **Multiple Holes.** Probe normal harus diarahkan ke reflector untuk menghasilkan respon maximum. Gain control diatur sedemikian rupa sehingga respon pada 80% ± 5% FSH. Ini disebut sebagai primary reference level. Tanpa merubah setting alat, probe di gerak – gerakkan, untuk menghasilkan respon maximum dari posisi hole lainnya untuk mendapatkan curva distance-amplitude correction (DAC).

10.7 Konfirmasi Kalibrasi

10.7.1 Sitem Perubahan.

Pengecekan kalibrasi harus di laksanakan, jika ada penggantian system alat pengujian, untuk memverifikasi bahwa range jarak dan seting sensitivity , pada kondisi sebagai berikut:

- Pengecekan kalibrasi harus dilakukan pada blok kalibrasi (V1 or V2) untuk memverifikasi jarak antara poin.
- Pengecekan kalibrasi harus dilakukan pada blok kalibrasi (BCB) untuk memverifikasi pengaturan sensitivitas.

10.7.2 Pengecekan untuk pemeriksaan berkala

Pengecekan kalibrasi harus dilakukan pada satu reflector di dalam blok kalibrasi dengan kondisi sebagai berikut :

- Setiap akhir dari setiap pengujian atau
- Pemeriksaan serupa dan berkelanjutan.
- Ketika personel penguji diganti.

10.7.3 Konfirmasi Nilai Penerimaan

Semua indikasi yang direcord sejak kalibrasi terakhir yang valid atau check kalibrasi harus di uji ulang dengan kalibrasi yang benar dan nilai pada data sheet harus dirubah, jika :

needs to be used.

a. **Single Hole.** The response from the single side drilled hole shall be set so that this response is 80% ± 5% of FSH. This shall be the primary reference level

b. **Multiple Holes.** The straight beam shall be directed toward the calibration reflector that yields the maximum response. The gain control shall be set so that this response is 80% ± 5% of FSH. This shall be the primary reference level.
The search unit shall then be manipulated, without changing instrument settings, to obtain the maximum responses from the other hole position(s) to generate a distance-amplitude correction (DAC) curve.

10.7 Calibration Confirmation

10.7.1 System Changes.

A calibration check shall be performed, when any part of examination system is changed, to verify that distance range points and sensitivity setting , at the following stage:

- Calibration check shall be made on the calibration block (V1 or V2) verify that distance range points.
- Calibration check shall be made on the calibration block (BCB) to verify the sensitivity setting.

10.7.2 Periodic Examination Check

A calibration check shall be made on at least one of the basic reflector in the basic calibration block of the following conditions :

- At the finish of each examination or
- Series of similar examination.
- When examination personnel are changed.

10.7.3 Confirmation Acceptance Values

All recorded indication since the last valid calibration check shall be re examined with the corrected calibration and the values shall be changed on their data sheet, if :

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- Setiap poin pada curva DAC telah berubah dari garis kalibrasi jarak lebih besar dari 10% dari pembacaan jarak atau 5% dari jarak penuh (screen), maka diambil yang lebih besar, koreksi jarak kalibrasi dan beri catatan dari koreksi pada record pengujian
- Setting sensitivity telah mengalami

- A point on the DAC curve has moved on distance line more than 10% of distance reading or 5% of full distance, whichever is greater, correct the distance range calibration and note the correction in the examination record
- Any sensitivity setting has decreased or

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penurunan atau kenaikan lebih dari 20% atau 2 dB dari amplitudo nya.

increased by more than 20% or 2 dB of its amplitude.

11 Pengujian

11 Examination

11.1 Cakupan

Volume harus di uji dengan menggerakkan probe keseluruh permukaan yang di uji sehingga bisa menscan seluruh volume pengujian. Setiap jalan/jalur dari probe harus overlaping minimum 10% dari ukuran probe, tegak lurus dengan dimensi dari arah scaning.

11.1 Coverage

The volume shall be examined by moving the search unit over the examination surface so as to scan the entire examination volume. Each pass the search unit shall be overlapping a minimum of 10% of transducer (element), dimension perpendicular to the direction of the scan.

11.2 Syarat-syarat Scanning

11.2 Scanning Requirements

11.2.1 Kecepatan dari manual scaning harus tidak lebih dari 6 in/sec. (150 mm/sec.)

11.2.1 The rate of manual scanning shall not exceed 6 in/sec (150 mm/sec).

11.2.2 Scaning harus dilaksanakan dengan mengatur gain seting minimum dua kali dari primary reference level. Evaluasi harus dilaksanakan dengan mengacu pada primary reference level.
Sebagai alternative scanning sensitivity level harus diset pada 14 dB lebih tinggi dari reference level.
(Tambahan gain ini membuat reference kurva DAC 20% , sehingga indikasi yang melebihi 20% DAC bisa dengan mudah diidentifikasi dan dievaluasi).

11.2.2 The scanning shall be performed at gain setting at least two times the primary reference level. Evaluation shall be performed with respect to the primary reference level.
As an alternate, the scanning sensitivity level shall be set at 14 dB higher than the reference level gain setting.
(This additional gain makes the reference a 20% DAC curve, so that indications exceeding 20% DAC may be easily identified and evaluated.).

11.2.3 Scaning harus dilaksanakan dari kedua sisi lasan (jika memungkinkan).

11.2.3 The scanning shall be performed from both sides of the weld (if accessible).

11.3 Scaning dengan Probe Normal

11.3 Straight Beam Scanning

11.3.1 Scaning probe normal harus dilaksanakan pada volume dari base material dimana akan dilewati probe sudut untuk mengetahui reflector yang mungkin membatasi kemampuan probe sudut untuk menguji volume lasan, dan ini tidak digunakan sebagai acceptance criteria.

11.3.1 The straight beam scanning shall be performed on the volume of base material through which the angle beams will travel to locate any reflectors that might limit the ability of the angle beam to examine the weld volume, and is not to be used for an acceptance-rejection examination.

11.3.2 Lokasi dan area yang ditemukan reflektor harus direcord dan menjadi bahan pertimbangan Engineering.

11.3.2 Location and areas of such reflectors found shall be recorded and subject to Engineering evaluation.

11.3.3 Scaning probe normal harus dilaksanakan pada volume dari base material dimana cacat mungkin mengakibatkan gangguan di service yang di refer oleh Code section lainnya atau persyaratan lainnya.

11.3.3 The straight beam scanning shall be performed on the volume of base material in which the defects may affect the service referenced by other Code section or other requirements.

11.4 Scanning dengan Probe Sudut untuk Reflektor yang Paralel dengan Lasan.

11.4 Angle Beam Scanning for Reflectors Parallel to the Weld

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Probe sudut harus diarahkan ke lasan dengan sudut yang benar kearah axis dari	The angle beam shall be directed at approximate right angle to the weld axis

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lasan dari daerah yang memungkinkan. Probe harus di manipulasi sehingga semua energi ultrasonic berjalan melalui volume yang diperlukan dari lasan dan base metal sekitarnya.

from to directions where possible. The search unit shall be manipulated so that the ultrasonic energy pass-through the required volumes of weld and adjacent base metal.

11.5 Scanning dengan Probe Sudut untuk Reflektor yang Melintang dengan Lasan.

11.5 Angle Beam Scanning for Reflection Oriented Transversal to the Weld.

11.5.1 Probe sudut harus diarahkan sedapat mungkin paralel dengan axis dari lasan. Probe harus di manupulasi sehingga semua energy ultrasonic berjalan melalui volume yang diperlukan dari lasan dan base metal sekitarnya.

11.5.1 The angle beam shall be directed essentially parallel to the weld axis. The search unit shall be manipulated so that the beam angle through the required volumes of weld and adjacent base metal.

11.5.2 Probe harus di putar 180 derajat dan pengujian diulangi.

11.5.2 The search unit shall be rotated 180 deg. and the examination repeated.

11.5.3 Probe sudut bisa digunakan untuk menguji base materials, probe harus di arahkan ke segala arah untuk scanning cacat yang arah nya ber macam – macam.

11.5.3 The angle beam may be used for examination base materials, the search unit shall be manipulated in any direction for scanning the any orientation defects.

12 Pengevaluasian

12 Evaluation

12.1 Indikasi Non-Relevant

Non-Relevant Indication mungkin disebabkan oleh :

12.1 Non-Relevant Indication

Non-Relevant Indication may be caused by :

12.1.1 Cacat metallurgy di heat-effected yang bisa memantulkan setelah fabrikasi. Pengujian dengan probe normal, mungkin bisa tampak seperti indikasi spot atau garis,

12.1.1 Metallurgical discontinuities such as plate segregates in heat-effected zone that become reflective after fabricatiouUnder straight beam examination, this may appear as spot or line indications.

12.1.2 Pengujian dengan probe sudut, indikasi yang datangnya dari kondisi permukaan (seperti weld root geometry) atau variasi pada metallurgy pada ustenitic material (seperti automatic ke manual weld clad interface).

12.1.2 Under angle beam examination, indication that are determined to originate from the surface conditions (such as weld root geometry) or variation in metallurgical structure in austenitic materials (such as the automatic to manual weld clad interface).

12.1.3 Berikut ini langkah – langkah yang diperlukan untuk mengklasifikasi indikasi dari geometry :

12.1.3 The following steps shall be taken to classify an indication as geometric :

a. Di interprete area yang diperkirakan reflector sesuai dengan procedure.

a. Interprete the area containing the reflector in accordance with the applicable examination procedure.

b. Di plot dan verifikasi reflector ordinate. Buat gambar tampak memotong yang menunjukkan posisi dan kondisi permukaan seperti root dan counterbore.

b. Plot and verify the reflector coordinates. Prepare a cross-sectional sketch showing the reflector position and surface discontinuities such as root and counterbore.

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c. Review gambar fabrikasi dan persiapan bevel las. Pengujian dengan Tehnik ultrasonic lain atau pengujian dengan metode nondestructive lain mungkin bisa membantu menentukan posisi, ukuran dan orientasi.

c. Review fabrication or weld preparation drawings. Other ultrasonic techniques or nondestructive examination methods may be helpful in determining a reflector's true position, size, and orientation.

12.2 Level Evaluasi.

12.2 Evaluation Level.

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12.2.1 Distance Amplitude Technique.
Semua indikasi lebih besar dari 20 % reference level harus di investigasi sehingga bisa dievaluasi sesuai dengan acceptance criteria dar reference Code Section.

12.2.1 Distance Amplitude Technique.
All indications greater than 20% of reference level shall be investigated to the extent that they can be evaluated in terms of acceptance criteria of reference Code Section.

12.2.2 Evaluation Laminar Reflector.
Reflector yang diketahui dari cacat laminasi pada base material yanf akan menghalangi untuk bisa pengujian secara keseluruhan dengan probe sudut diperlukan tehnik laing dalam pengujian dengan modifikasi sehingga keseluruhan pengujian bisa dilaksanakan dan di beri note pada record pengujian.

12.2.2 Evaluation of Laminar Reflector.
Reflector evaluted as laminar reflectors in base material which interfere with scanning of examination volumes shall require the angle beam examination technique to be modified such that the maximum feasible volume is examined, and shall be noted in the record of examination.

13 Pengukuran Cacat

13 Sizing of Indications

13.1 Pengujian dengan Probe normal.

13.1 Straight Beam Testing

13.1.1 Jika cacat yang terjadi lebih kecil dari ukuran probe, maka evaluasi dari ukuran cacat harus dilaksanakan dengan memulai dari arah luar dan kedalam dari cacat, menggerakkan probe kearah area cacat sampai terdapat indikasi pada layar kelihatan. Ujung dari probe/search unit diindikasikan sebagai ujung dari cacatnya.

13.1.1 When discontinuity is smaller than the transducer size, the size evaluation shall be made by beginning outside of the discontinuity, moving the transducer toward the area of discontinuity until an indication on the display begins to form. The leading edge of the search unit at this point is indicative of the edge of the discontinuity.

13.1.2 Jika cacat lebih besar dari ukuran probe, kehilangan refleksi back wall akan terjadi dan evaluasi metode dengan menggunakan cara 6 dB drop (50% penurunan dari ketinggian amplitudo aslinya) harus digunakan dan untuk menentukan ujung cacat dengan mengukur center line dari probe.

13.1.2 When discontinuity larger than the transducer size, a full loss of back reflection will occur and evaluation method of a 6 dB loss of amplitude (drop to 50% from the original screen height) shall be used and measurement to the center line of the transducer is determining discontinuity edge.

13.2 Pengujian dengan Probe Sudut.

13.2 Angle Beam Testing

13.2.1 Panjang dan tinggi dari cacat harus ditentukan dengan menggerakkan probe dari daerah cacat sampai ada penurunan amplitudo 6 dB drop (turun 50% dari amplitudo aslinya) dan untuk menentukan ujung cacat dengan mengukur center line dari probe.

13.2.1 The length and height of the discontinuity shall be determined by moving the transducer from the discontinuity area until a 6 dB loss of amplitude (drop to 50% from the original screen height) and measurement to the center line of the transducer is determining discontinuity edge.

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13.2.2 Reflektor yang berbentuk bulat bisa di bedakan dengan yang berbentuk planar dengan melihat respond yang ditunjukkan pada layar seperti akan begitu mencolok drop dari amplitudonya jika probe dijauhkan dari area cacat atau dimanipulasi dengan sudut tertentu dari maximum respond dari area cacat.

13.2.2 The spherical reflector may be differentiated from Planar reflector by their respond shown as amplitude significant drop when the transducer moving away from the indicative area or when the transducer manipulated to an angle from the maximum respond of indicative area.

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14	**Pembersihan akhir setelah pengujian**	**14**	**Post –Examination Cleaning.**
14.1	Pembersihan setelah pengujian harus dilakukan sesegera mungkin sebelum step fabrikasi selanjutnya dilakukan.	**14.1**	Post examination cleaning shall be performed as soon as possible after examinations have been finished and before the next steps of fabrication proceeded.
14.2	Untuk couplant bahan dasarnya air (CMC) dengan cara menglap dengan kain bersih sebelum couplant mengering.	**14.2**	For water base couplant (CMC) by wipping with dry rags before the couplant dry.
14.3	Untuk yang bersifat oli dengan cara mengelap dengan kain bersih yang di basahi dengan solvent / cleaner.	**14.3**	For oil base couplant by wipping with the clean and dry rags wetted with solvent / cleaner.
15	**Dokumentasi**	**15**	**Documentation**
15.1	Hasil dari pengujian ultrasonic harus di report dalam Form Ultrasonic Test Report yang tersedia (terlampir).	**15.1**	Ultrasonic examination results shall be reported on the provided Ultrasonic Test Report Form (attached).
15.2	Record dari area yang repair harus dicatat seperti hasil dari pengujian ulang setelah repair.	**15.2**	The record of repair areas shall be noted as well as the results of the reexamination of repair areas.
15.3	Semua refeksi dari area yang tidak direpair mempunyai respon melebihi 50% reference level harus direcord. Record harus menunjukan lokasi, respon level, dimensi, kedalaman dibawah permukaan, dan klasifikasi	**15.3**	Alll reflectons from uncorrected areas having responses that exceed 50% of reference level shall be recorded. The record shall locate each area, the response level, the dimensions, the depth below the surface, and the classification.
15.4	Lokasi lasan dan identifikasi harus direcord pada weld map atau di identifikasi plan.	**15.4**	Weld locations and their identification shall be recorded on the a weld map or in an identification plan.
15.5	Jika lasan di identifikasin permanen, low stress stamps dan /atau vibratooling bisa digunakan.	**15.5**	If the welds are to be permanently marked, low stress stamps and/or vibratooling may be used.
15.6	**System Reference**	**15.6**	**Reference System**
15.6.1	Setiap lasan harus dilokasikan dan diidentifikasi dengan system reference line. System harus bisa mengidentifikasi setiap center line dari lasan dan tanda secara regular interval sepanjang lasan, tetapi system yang berbeda bisa digunakan asalkan masih memenuhi persyaratan diatas.	**15.6.1**	Each weld shall be located and identified by a system of reference points. The system shall permit identification of each weld center line and designation of regular interval along the length of weld, however , a different system may be utilized provided it meets the above requirements.

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15.6.2 Semua pantulan dari area yang tidak dikoreksi, mempunyai respon melebihi 50% dari reference level harus direcord dalam form ultrasonic test report, record ini harus menyebutkan setiap area, respond level, dimensi, dalamnya dari permukaan dan klasifikasi.

15.6.2 All reflections from uncorrected areas having responses that exceed 50% of the reference level shall be recorded on the attached record form, this record shall indicate each area, the response level, the dimension, the depth below the surface, and the classification.

15.6.3 Ultrasonic reports harus disimpan dalam periode 3 tahun atau sesuai dengan

15.6.3 Ultrasonic reports shall be maintained for the period 3 years or as required by Code

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persyaratan Code atau yuridiksi lokal yang berlaku oleh pabrik.

16 Standar Penerimaan

16.1 ASME BPV Code Section VIII Division.1, Appendix 12 Para 12.3

Ketidak sempurnaan yang menghasilkan respon lebih besar dari_20% dari batas refernsi harus di investigasi lagi agar operator dapat memeriksa bentuk, identitas dan lokasi dari semua ketidak sempurnaan dan mengevaluasi sesuai dengan standar penerimaan di dalam (a) dan (b) berikut ini

16.1.1 Indikasi dengan karakteristis sebagai retak, kurang fusi atau penetrasi yang tidak lengkap tidak dapat di terima terlepas dari panjang nya.

Ketidak sempurnaan lainnya tidak dapat di terima jika indikasi melebihi amplitude referensi dan memiliki panjang yang melebihi:

a. 6 mm (1/4 in.) untuk **t** hingga 19mm (3/4 in.),

b. 1/3t untuk **t** 19 mm (3/4 in.) hingga 57 mm (2¼ in.) inclusive.

c. 19 mm untuk **t** lebih dari 57mm (2¼ in)

dimana **t** = ketebalan dari las tidak termasuk reinforcement yang di ijinkan. Untuk sambungan las butt weld dua item dengan memiliki ketebalan yang berbeda pada lasan, **t** adalah ketebalan yang lebih tipis dari kedua ketebelan. Jika pengelasan dengan penetrasi penuh termasuk lasan fillet, ketebalan throat dari fillet harus masukan di **t**.

16.2 ASME BPV Code Section VIII Division.2, para 7.5.4.2 :

Ketidak sempurnaan yang menghasilkan respon lebih besar dari_20% dari batas refernsi harus di investigasi lagi agar operator dapat memeriksa bentuk, identitas dan lokasi dari semua ketidak sempurnaan dan mengevaluasi sesuai dengan standar penerimaan di dalam (a) dan (b) di bawah ini.

or local jurisdiction requirement as applicable by Manufacturer.

16 Acceptance Standards

16.1 ASME BPV Code Section VIII Division.1, Appendix 12 Para 12.3

Imperfections which produce a response greater than_20% of the reference level shall be investigated to the extent that the operator can examine the shape, identity and location of all such imperfections and evaluate them in terms of acceptance standards given in (a) and (b) below.

16.1.1 Indications characterized as cracks, lack of fusion or incomplete penetration are unacceptable regardless of the length

16.1.2 Other imperfections are not acceptable if the indications exceed the reference level amplitude and have lengths which exceed:

a. 6 mm (1/4 in.) for **t** up to 19 mm (3/4 in.),

b. 1/3t for **t** from 19 mm (3/4 in.) to 57 mm (2¼ in.) inclusive,

c. 19 mm (3/4 in.) for **t** over 57 mm (2¼ in).

where t = the thickness of the weld excluding any allowable reinforcement. For a butt weld joining two members having different thicknesses at the weld, **t** is the thinner of the two thicknesses. If a full penetration weld includes a fillet weld, the thickness of the throat of the fillet shall be included in t.

16.2 ASME BPV Code Section VIII Division.2, para 7.5.4.2 :

Imperfections which produce a response greater than_20% of the reference level shall be investigated to the extent that the operator can examine the shape, identity and location of all such imperfections and evaluate them in terms of acceptance standards given in (a) and (b) below.

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16.2.1	Indikasi dengan karakteristis sebagai retak, kurang fusi atau penetrasi yang tidak lengkap	**16.2.1**	Indications characterized as cracks, lack of fusion or incomplete penetration are

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tidak dapat di terima terlepas dari panjang nya.

16.2.2 Ketidak sempurnaan lainnya tidak dapat di terima jika indikasi melebihi amplitude referensi dan memiliki panjang yang melebihi:

a. 6 mm (1/4 in.) untuk **t** hingga 19mm (3/4 in.),

b. 1/3t untuk **t** 19 mm (3/4 in.) hingga 57 mm (2¼ in.) inclusive.

c. 19 mm untuk **t** lebih dari 57mm (2¼ in)

dimana **t** = ketebalan dari las tidak termasuk reinforcement yang di ijinkan. Untuk sambungan las butt weld dua item dengan memiliki ketebalan yang berbeda pada lasan, **t** adalah ketebalan yang lebih tipis dari kedua ketebelan. Jika pengelasan dengan penetrasi penuh termasuk lasan fillet, ketebalan throat dari fillet harus masukan di **t**.

16.3 **<u>ASME BPV Code Section IX Para QW 191.2:</u>**

16.3.1 Indikasi dengan karakteristis sebagai retak, kurang fusi atau penetrasi yang tidak lengkap tidak dapat di terima terlepas dari panjang nya

16.3.2 Indikasi panjang melebihi 1/8 in (3 mm) dianggap relevan dan tidak dapat di terima jika panjangnya melebihi

a. 1/8 in (3 mm) untuk **t** hingga 3/8 in (10 mm)

b. 1/3 **t** untuk **t** dari 3/8 in hingga 2 ¼ in (10 mm hingga 57 mm).

c. ¾ in (19 mm) untuk t lebih dari 2 ¼ in (57 mm),

dimana t adalah ketebalan las tidak termasuk reinforcement yang di ijinkan. Untuk sambungan las butt weld dua item dengan memiliki ketebalan yang berbeda pada lasan, t adalah ketebalan yang lebih tipis dari kedua ketebelan. Jika pengelasan dengan penetrasi penuh termasuk lasan fillet , ketebalan throat dari fillet harus masukan di t..

unacceptable regardless of the length

16.2.2 Other imperfections are not acceptable if the indications exceed the reference level amplitude and have lengths which exceed:

a. 6 mm (1/4 in.) for **t** up to 19 mm (3/4 in.),

b. 1/3t for **t** from 19 mm (3/4 in.) to 57 mm (2¼ in.) inclusive,

c. 19 mm (3/4 in.) for **t** over 57 mm (2¼ in).

where t = the thickness of the weld excluding any allowable reinforcement. For a butt weld joining two members having different thicknesses at the weld, **t** is the thinner of the two thicknesses. If a full penetration weld includes a fillet weld, the thickness of the throat of the fillet shall be included in t.

16.3 **<u>ASME BPV Code Section IX Para QW 191.2:</u>**

16.3.1 Indications characterized as cracks, lack of fusion or incomplete penetration are unacceptable regardless of the length

16.3.2 Indications exceeding 1/8 in (3 mm) in length are considered relevant and are unacceptable when their length exceed

a. 1/8 in (3 mm) for **t** up to 3/8 in (10 mm)

b. 1/3 **t** for **t** from 3/8 in to 2 ¼ in (10 mm to 57 mm).

c. ¾ in (19 mm) for t over 2 ¼ in (57 mm),

where t is the thickness of the weld excluding any allowable reinforcement. For a butt weld joining two members having different thicknesses at the weld, t is the thinner of these two thicknesses. If a full penetration weld includes a fillet weld, the thickness of the throat of the fillet shall be included in t.

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16.4 **<u>ASME BPV Code Section I Para PW-52:</u>**

Pengelasan yang di periksa dengan Ultrasonik dan memiliki diskontinuitas

16.4 **<u>ASME BPV Code Section I Para PW-52:</u>**

Weld that are shown by Ultrasonic Examination to have discontinuities

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menghasil kan indikasi lebih besar dari 20% dari batas refernsi harus di investigasi lagi agar personel pengujian ultrasonik dapat memeriksa bentuk, identitas dan lokasi dari semua ketidak sempurnaan dan mengevaluasi sesuai dengan standar penerimaan di dalam (a) dan (b) di bawah ini:

a. Indikasi dengan karakteristis sebagai retak, kurang fusi atau penetrasi yang tidak lengkap tidak dapat di terima terlepas dari panjang nya.

b. Ketidak sempurnaan lainnya tidak dapat di terima jika indikasi melebihi referensi dan memiliki panjang yang melebihi:

1. 6 mm (1/4 in.) untuk **t** hingga 19mm (3/4 in.),

2 1/3t untuk **t** 19 mm (3/4 in.) hingga 57 mm (2¼ in.) inclusive.

3. 19 mm untuk **t** lebih dari 57mm (2¼ in)

dimana **t** = ketebalan dari las dari yang di periksa. Jika sambungan lasan dua item dengan memiliki ketebalan yang berbeda pada lasan, **t** adalah ketebalan yang lebih tipis dari kedua ketebelan.

which produce an indication greater than 20% of the reference level shall be investigated to the extent that the operator can determine the shape, identity and location so that they may evaluate each discontinuity for in accordance with (a) and (b) given below :

a. Indications characterized as cracks, lack of fusion or incomplete penetration are unacceptable regardless of the length

b. Other imperfections are unacceptable if the indications exceed the reference level and have lengths which exceed:

1. 6 mm (1/4 in.) for **t** up to 19 mm (3/4 in.),

2 1/3t for **t** from 19 mm (3/4 in.) to 57 mm (2¼ in.) inclusive,

3. 19 mm (3/4 in.) for **t** over 57 mm (2¼ in).

where t = the thickness of the weld being examined. If the weld joining two members having different thicknesses at the weld, **t** is the thinner of the two thicknesses.

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16.5 **ASME Code B.31.1 Power Piping Para 136.74.6**

Pengelasan yang di periksa dengan Ultrasonik dan memiliki diskontinuitas menghasil kan indikasi lebih besar dari 20% dari batas refernsi harus di investigasi lagi agar personel pengujian ultrasonik dapat memeriksa bentuk, identitas dan lokasi dari semua ketidak sempurnaan dan mengevaluasi sesuai dengan standar penerimaan di dalam (a) dan (b) di bawah ini:

(a) Indikasi dengan karakteristis sebagai retak, kurang fusi atau penetrasi yang tidak lengkap tidak dapat di terima terlepas dari panjang nya

(b) Ketidak sempurnaan lainnya tidak dapat di terima jika indikasi melebihi amplitude referensi dan memiliki panjang yang melebihi:

1) 6 mm (1/4 in.) untuk **t** hingga 19mm (3/4 in.),
2) 1/3t untuk **t** 19 mm (3/4 in.) hingga 57 mm (2¼ in.) inclusive.
3) 19 mm untuk **t** lebih dari 57mm

dimana **t** = ketebalan dari las dari yang di periksa. Jika sambungan lasan dua item

16.5 **ASME Code B.31.1 Power Piping Para 136.74.6**

Welds that are shown by ultrasonic examination to have discontinuities which produce an indication greater than 20% of the reference level shall be investigated to the extent the ultrasonic examination personnel can determine their shape, identity and location so that they may evaluate each discontinuity for in accordance with (a) and (b) given below:

(a) Indications characterized as cracks, lack of fusion or incomplete penetration are unacceptable regardless of the length

(b) Other imperfections are not acceptable if the indications exceed the reference level amplitude and have lengths which exceed:

1) 6 mm (1/4 in.) for **t** up to 19mm (3/4 in.),
2) 1/3t for **t** 19 mm (3/4 in.) to 57 mm (2¼ in.) inclusive.
3) 19 mm for **t** over 57mm

where t is the thickness of the weld being examined. If the weld joins two members having different thickness at the

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dengan memiliki ketebalan yang berbeda pada lasan, **t** adalah ketebalan yang lebih tipis dari kedua ketebelan.

weld, t is the thinner of the two thicknesses.

17 Pengujian Hasil Perbaikan

Cacat yang tidak diterima harus di buang dan direpair. Hasil repair harus diuji ulang dengan prosedure yang sama dengan yang digunakan untuk cacat aslinya.

17 Examination of Repairs

Unacceptable discontinuities shall be removed and repaired. Repairs shall be reexamined by the same procedures used for original of the discontinuity.

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Figure 1 A. RATIO LIMITS FOR CURVED SURFACES

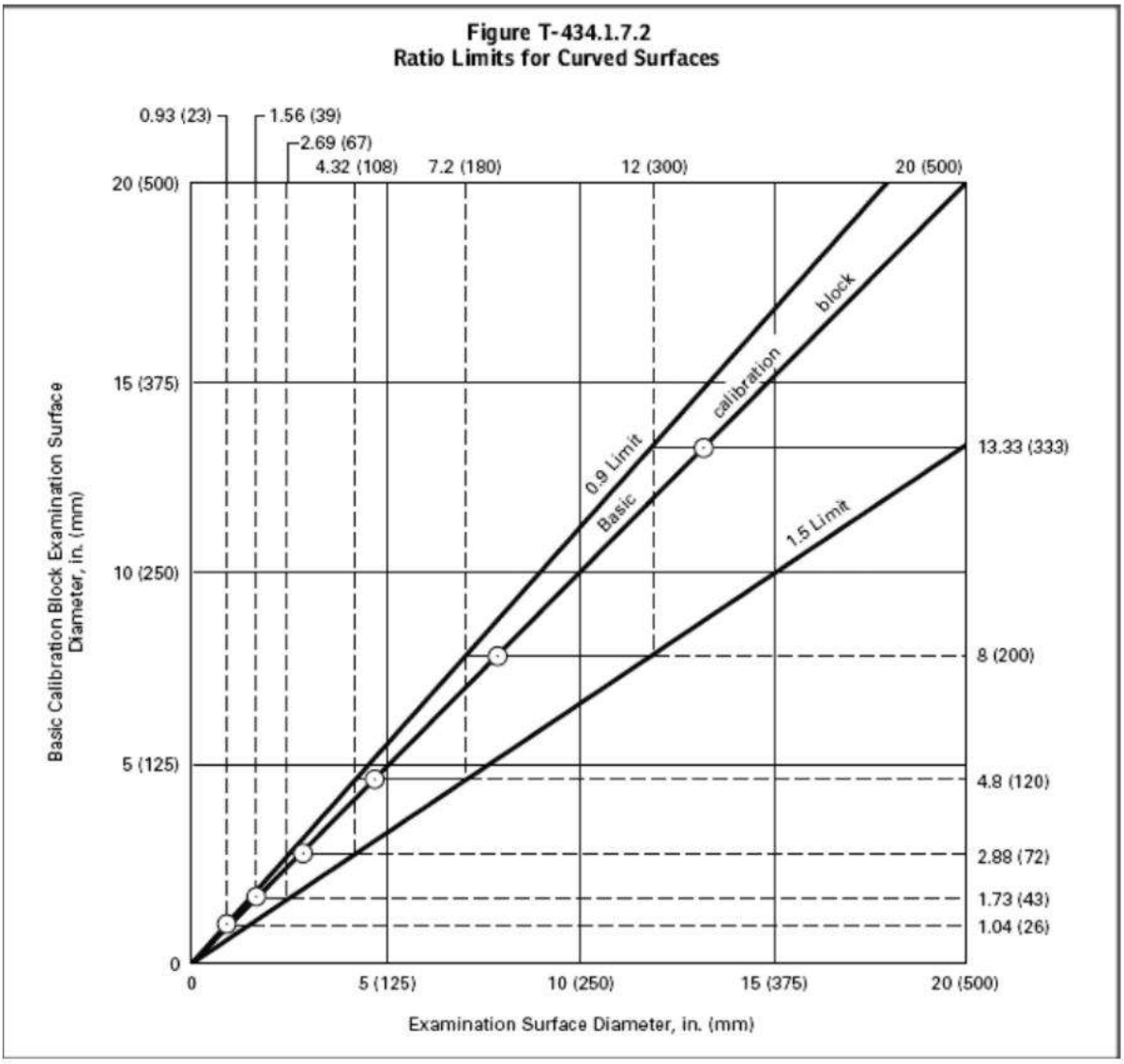

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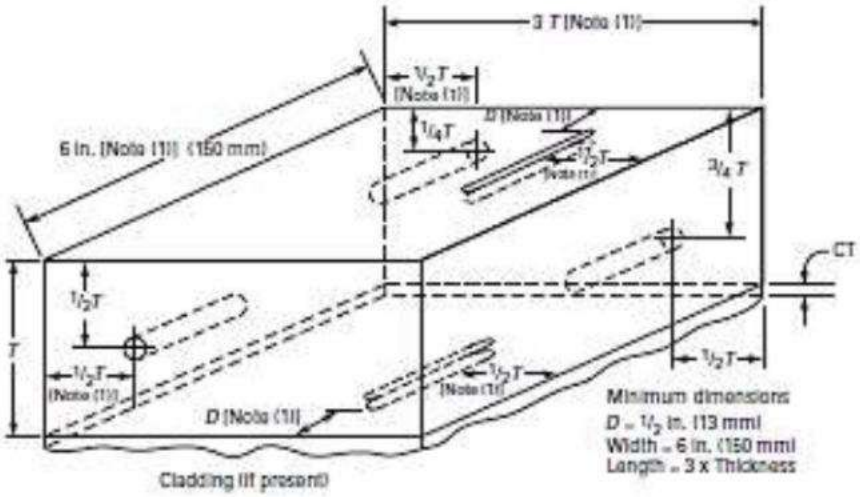
Figure 1 B. NON PIPING BASIC CALIBRATION BLOCK

(21)

Figure T-434.2.1
Nonpiping Calibration Blocks



Notch Dimensions, in. (mm)
Notch depth = 1.6% T to 2.2% T
Notch width = 1/4 (6) max.
Notch length = 1 (25) min.

Weld Thickness (t), in. (mm)	Calibration Block Thickness (T), in. (mm)	Hole Diameter, in. (mm)
≤1 (≤25)	3/4 (19) or t	3/32 (2.5)
>1 (>25) through 2 (50)	1 1/2 (38) or t	1/8 (3)
>2 (>50) through 4 (100)	3 (75) or t	3/16 (5)
>4 (>100)	t ±1 (25)	(Note (2))

GENERAL NOTES:

(a) Holes shall be drilled and reamed 1.5 in. (38 mm) deep minimum, essentially parallel to the examination surface.

(b) For components equal to or less than 20 in. (500 mm) in diameter, calibration block diameter shall meet the requirements of T-434.1.7.2. Two sets of calibration reflectors (holes, notches) oriented 90 deg from each other shall be used. Alternatively, two curved calibration blocks may be used.

(c) The tolerance for hole diameter shall be ±3/32 in. (0.8 mm). The tolerance for hole location through the calibration block thickness (i.e., distance from the examination surface) shall be ±1/8 in. (3 mm).

(d) For blocks less than 3/4 in. (19 mm) in thickness, only the 1/2 T side-drilled hole and surface notches are required.

(e) All holes may be located on the same face (side) of the calibration block, provided care is exercised to locate all the reflectors (holes, notches) to prevent one reflector from affecting the indication from another reflector during calibration. Notches may also be in the same plane as the inline holes (see Nonmandatory Appendix J, Figure J-431). As in Figure J-431, a sufficient number of holes shall be provided for both angle and straight beam calibration at the 1/4 T, 1/2 T, and 3/4 T depths.

(f) When cladding is present, notch depth on the cladding side of the block shall be increased by the cladding thickness, CT (i.e., 1.6% T + CT minimum to 2.2% T + CT maximum).

(g) Maximum notch width is not critical. Notches may be made by EDM or with end mills up to 1/4 in. (6.4 mm) in diameter.

(h) Weld thickness, t, is the nominal material thickness for welds without reinforcement or, for welds with reinforcement, the nominal material thickness plus the estimated weld reinforcement not to exceed the maximum permitted by the referencing Code Section. When two or more base material thicknesses are involved, the calibration block thickness, T, shall be determined by the average thickness of the weld; alternatively, a calibration block based on the greater base material thickness may be used provided the reference reflector size is based upon the average weld thickness.

NOTES:

(1) Minimum dimension.

(2) For each increase in weld thickness of 2 in. (50 mm) or fraction thereof over 4 in. (100 mm), the hole diameter shall increase 1/16 in. (1.5 mm).

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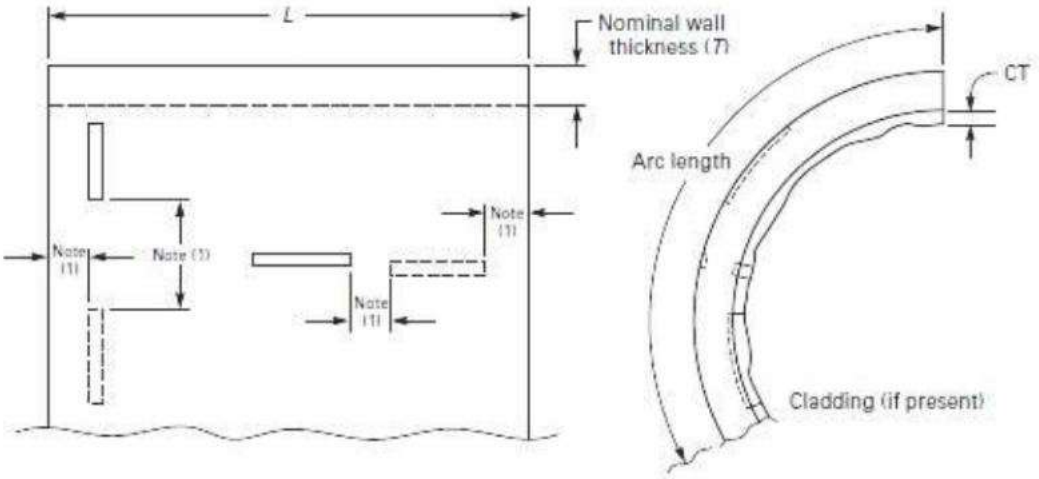
Figure 1 C. PIPING BASIC CALIBRATION BLOCK

(15)

Figure T-434.3-1
Calibration Block for Piping



GENERAL NOTES:

(a) The minimum calibration block length, *L*, shall be 8 in. (200 mm) or 8*T*, whichever is greater.

(b) For O.D. 4 in. (100 mm) or less, the minimum arc length shall be 75% of the circumference. For O.D. greater than 4 in. (100 mm), the minimum arc length shall be 8 in. (200 mm) or 3*T*, whichever is greater.

(c) Notch depths shall be from 8% *T* minimum to 11% *T* maximum. When cladding is present, notch depths on the cladding side of the block shall be increased by the cladding thickness, CT (i.e., 8% *T* + CT minimum to 11% *T* + CT maximum). Notch widths shall be $^1/_4$ in. (6 mm) maximum. Notch lengths shall be 1 in. (25 mm) minimum.

(d) Maximum notch width is not critical. Notches may be made with EDM or with end mills up to $^1/_4$ in. (6 mm) in diameter.

(e) Notch lengths shall be sufficient to provide for calibration with a minimum 3 to 1 signal-to-noise ratio.

(f) Two blocks shall be used when a weld joining two different thicknesses of material is examined and a single block does not satisfy the requirements of T-434.3.

(g) When a flat block is used as permitted by T-434.1.7.1, the two axial notches may be omitted and the block width may be reduced to 4 in. (100 mm), provided the I.D. and O.D. notches are placed on opposite examination surfaces of the block. When cladding is not present, only one notch is required provided each examination surface is accessible during calibrations.

NOTE:

(1) Notches shall be located not closer than $^1/_2$*T* or $^1/_2$ in. (13 mm), whichever is greater, to any block edge or to other notches.

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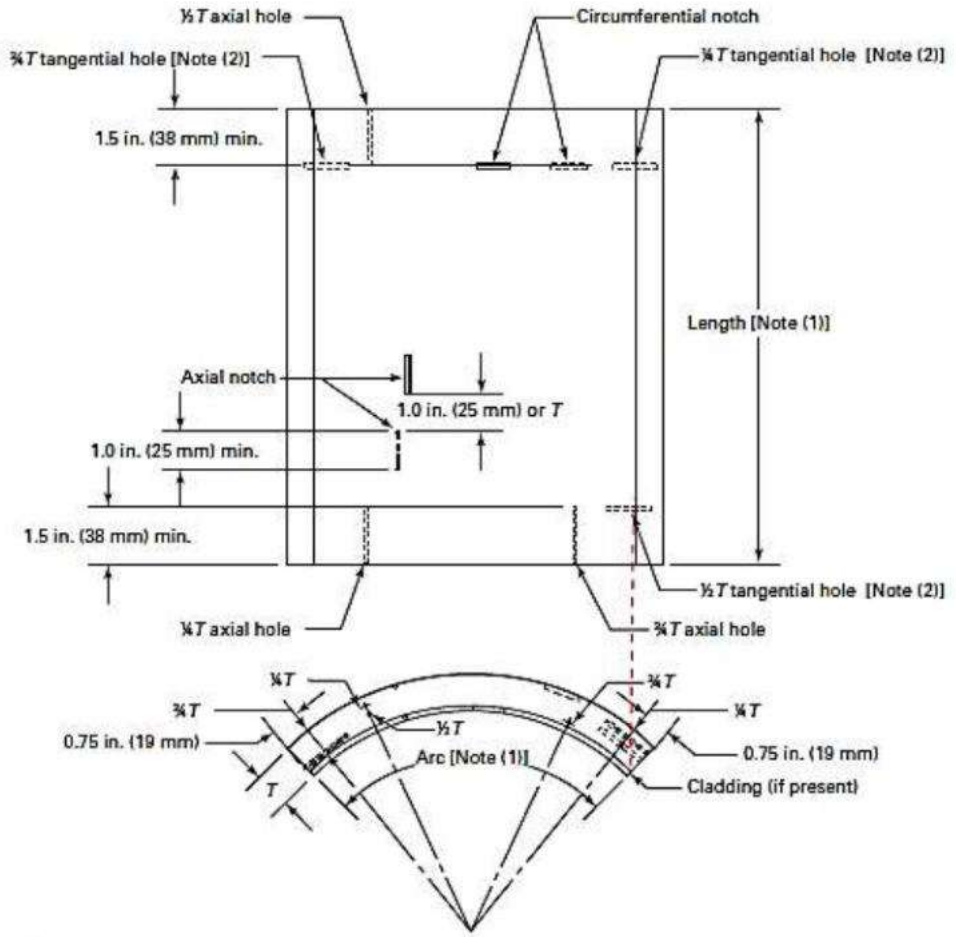
Figure 1 D. ALTERNATE BASIC CALIBRATION BLOCK FOR PIPING

ARTICLE 4 ASME BPVC.V-2019

(19)

Figure T-434.3-2
Alternate Calibration Block for Piping



GENERAL NOTES:

(a) For blocks less than ¾ in. (19 mm) in thickness, only the ½T side drilled hole is required.

(b) Inclusion of notches is optional. Notches as shown in Figure T-434.3-1 may be utilized in conjunction with this calibration block.

(c) Notch depths shall be from 8% T minimum to 11% T maximum. Notch widths shall be ¼ in. (6 mm) maximum. Notch lengths shall be 1 in. (25 mm) minimum.

(d) Notches may be made with EDM or with end mills up to ¼ in. (6 mm) in diameter.

(e) Notch lengths shall be sufficient to provide for calibration with a minimum 3 to 1 signal-to-noise ratio.

(f) Notches shall be located not closer than T or 1½ in. (38 mm), whichever is greater, to any block edge or to other notches.

NOTES:

(1) Length and arc shall be adequate to provide required angle beam calibration.

(2) Side-drilled hole diameter, length, and tolerance shall be in accordance with T-434.2.1, as permitted by T-464.1.3. Tangential side-drilled holes at ¼T, ½T, and ¾T positions or locations are to have the depth confirmed at one-half of their length. The radius of the side-drilled hole shall be added to the measured depth to ensure the correct depth. Where thickness does not permit, the required depth of the side-drilled hole and the location of the tangential position shall be indicated on the block surface.

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Table 1.
Maximum contour for examinations performed from O. D.

Actual Component Outside Diameter, in. (mm)	Allowable Increase in Contour Diameter Over Component O.D., in. (mm)
<4.0 (<100)	<1 (<25)
≥4.0 to 10 (≥100 to 250)	<2 (<50)
>10 (>250)	<4 (<100)

Table 2.
Minimum contour for examinations performed from I.D.

Actual Component Inside Diameter, in. (mm)	Allowable Decrease in Contour Diameter Under Component I.D., in. (mm)
<4.0 (<100)	<1 (<25)
≥4.0 to 10 (≥100 to 250)	<2 (<50)
>10 (>250)	<4 (<100)

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Figure 1 E. CALIBRATION BLOCK FOR TECHNIQUE ONE

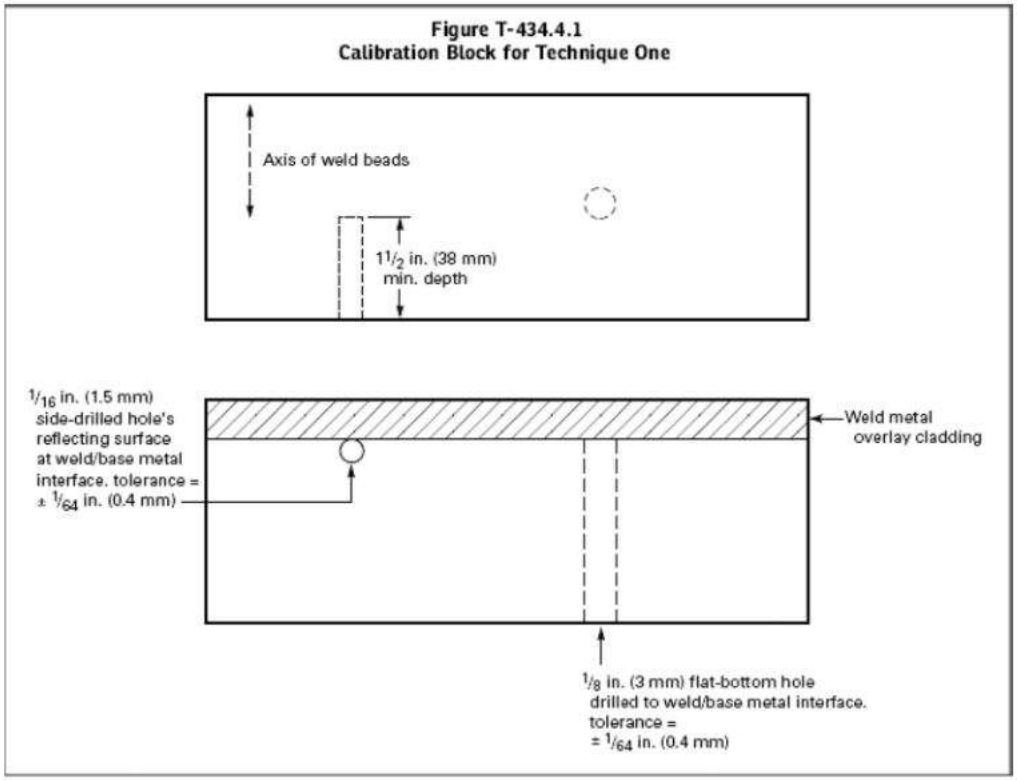

Figure 1 F. ALTERNATE CALIBRATION BLOCK FOR TECHNIQUE ONE

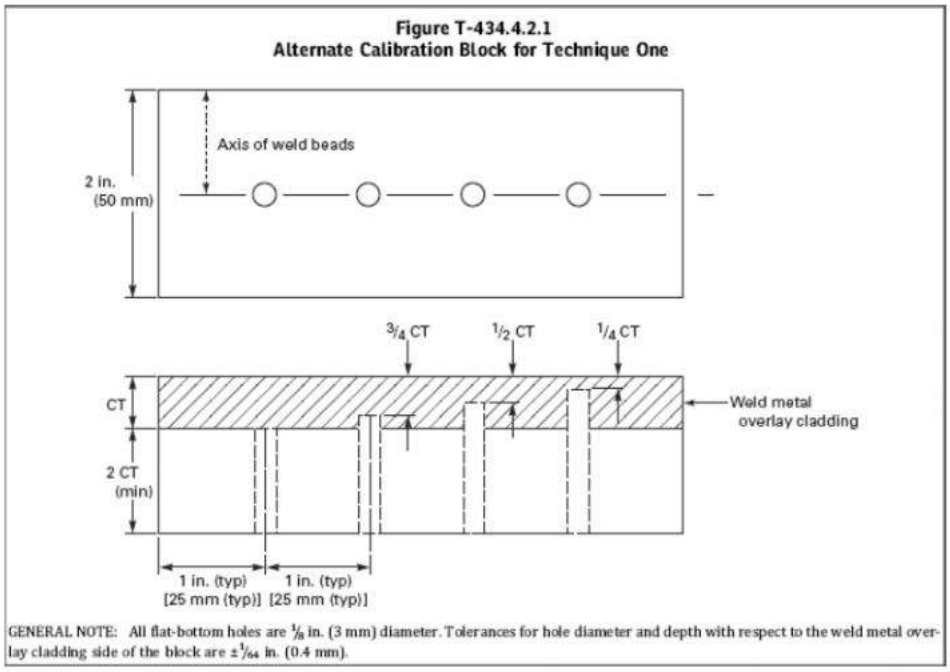

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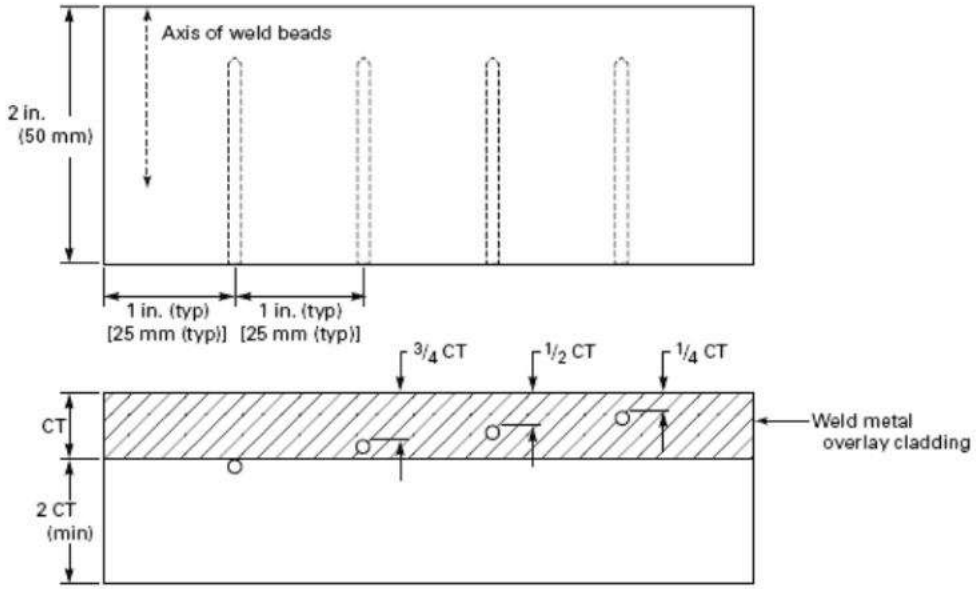
Figure 1 G. ALTERNATE CALIBRATION BLOCK FOR TECHNIQUE ONE

Figure T-434.4.2.2
Alternate Calibration Block for Technique One



GENERAL NOTE: All side-drilled holes are $^{1}/_{16}$ in. (1.5 mm) diameter. Tolerances for hole diameter and depth with respect to the weld metal overlay cladding side of the block are $\pm^{1}/_{64}$ in. (0.4 mm). All holes drilled to a minimum depth of 1.5 in. (38 mm).

Figure 1 H. CALIBRATION BLOCKS FOR TECHNIQUE TWO

Figure T-434.4.3
Calibration Block for Technique Two

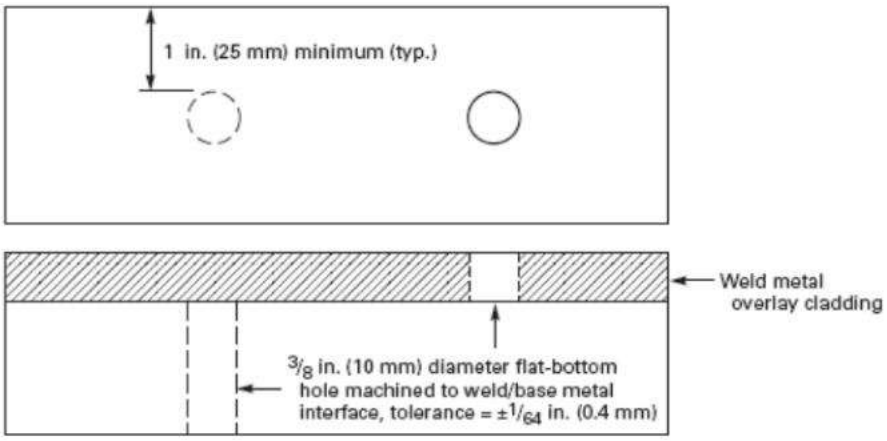


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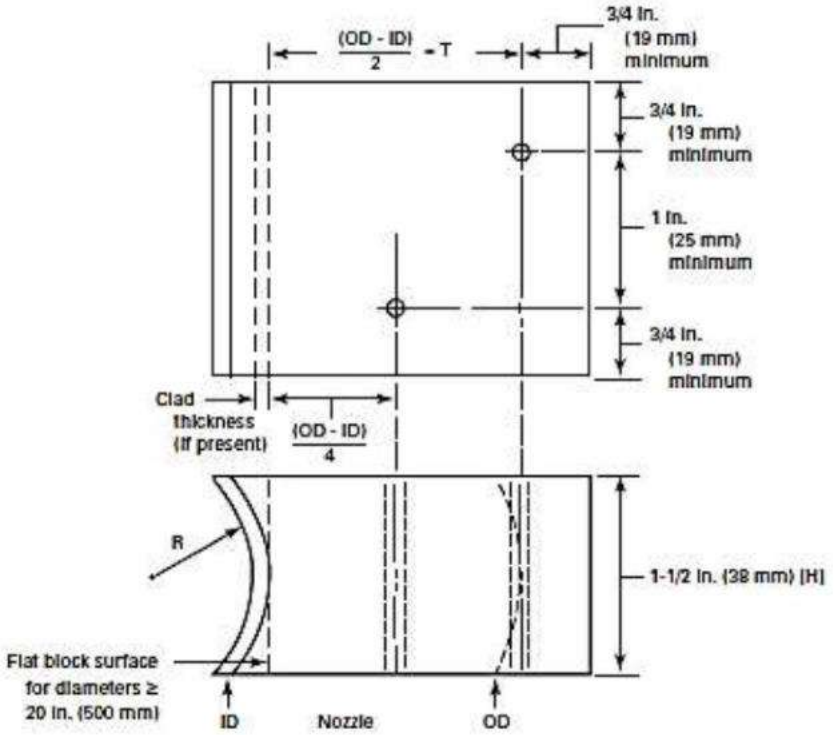
Figure 1 I. BASIC CALIBRATION BLOCK FOR STRAIGHT BEAM EXAMINATION OF NOZZLE.

Figure T-434.5.1
Calibration Block for Straight Beam Examination of Nozzle Side Weld Fusion Zone and/or Adjacent Nozzle Parent Metal (21)



GENERAL NOTES:

(a) The thickness, T, of the calibration block (O.D. − I.D.)/2 shall be selected for the maximum nozzle wall thickness under the nozzle attachment weld.

(b) Side-drilled holes shall be drilled and reamed the full height, H, of the block.

(c) The diameter of the side-drilled holes shall be selected for the maximum nozzle wall thickness per (a) above and Figure T-434.2.1.

(d) For nozzle side examinations, when the wall thickness of the calibration block exceeds 2 in. (50 mm), additional side-drilled holes shall be placed in the block as required in the table below.

Calibration Block Wall Thickness, in. (mm)	Hole Location, $^5/_4T$	Hole Location, $^3/_4T$	Hole Location, $^7/_4T$
>2 (>50) through 3 (75)	—	X	—
>3 (>75)	X	X	X

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Figure 1 J. IIW – V1 AND V2 REFERENCE CALIBRATION BLOCK

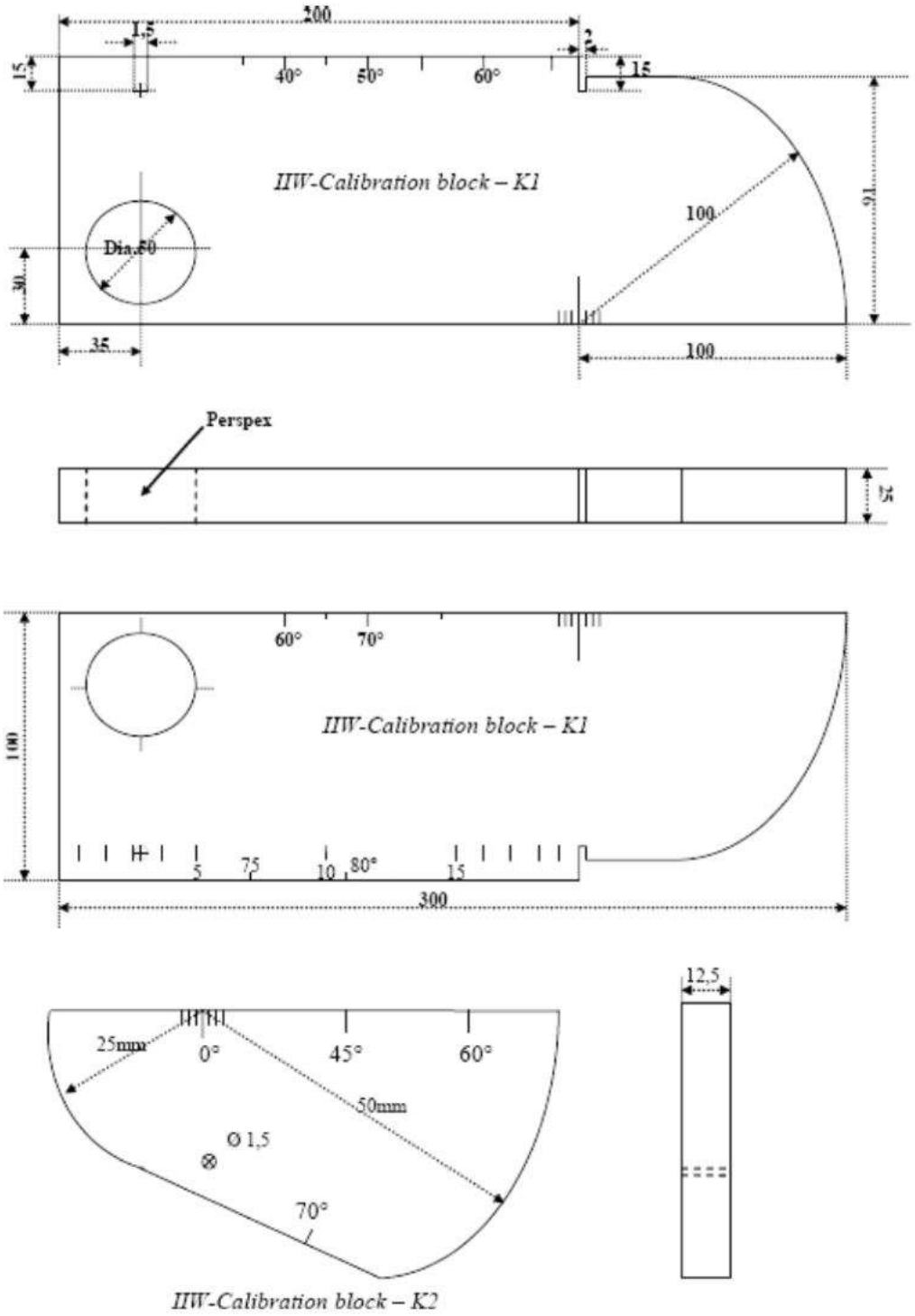

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Figure 2. INDEX POINT MEASUREMENT

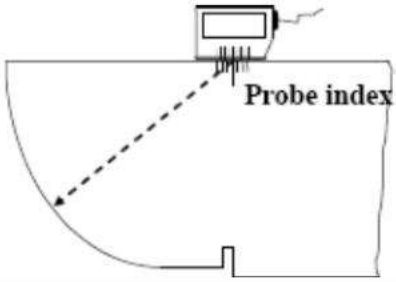
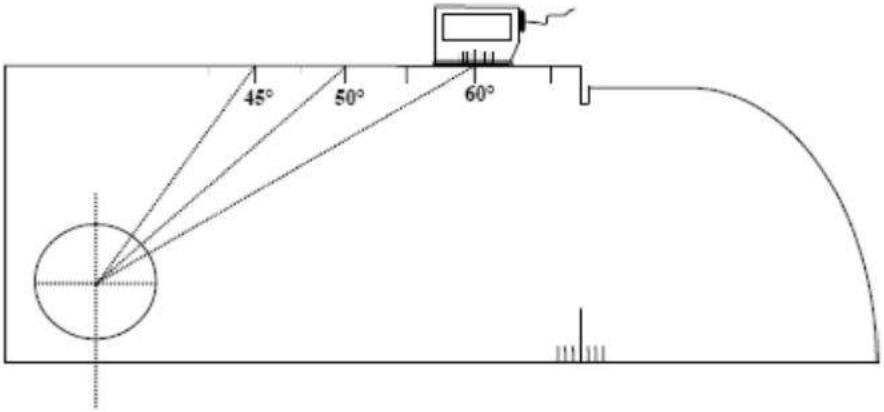


Figure 3. BEAM ANGLE MEASUREMENT



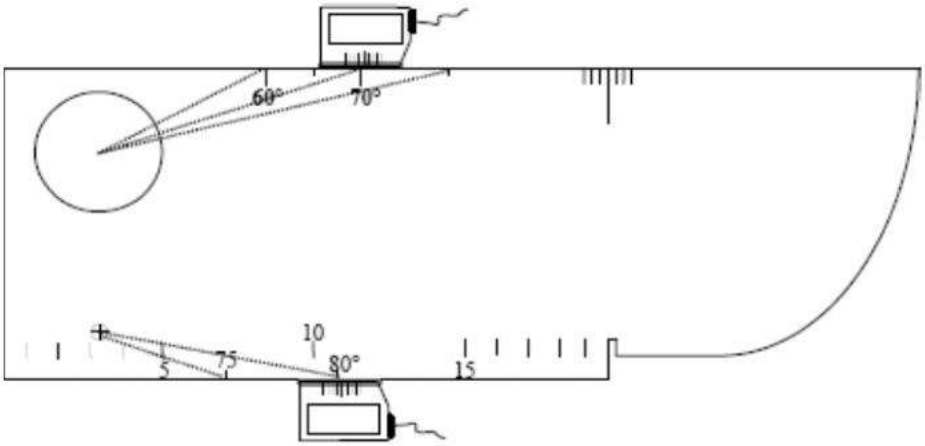


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Fig. 4 DISTANCE RANGE CALIBRATION FOR STRAIGHT BEAM TRANDUCER USING IIW V 1 REGFERENCE BLOCK.

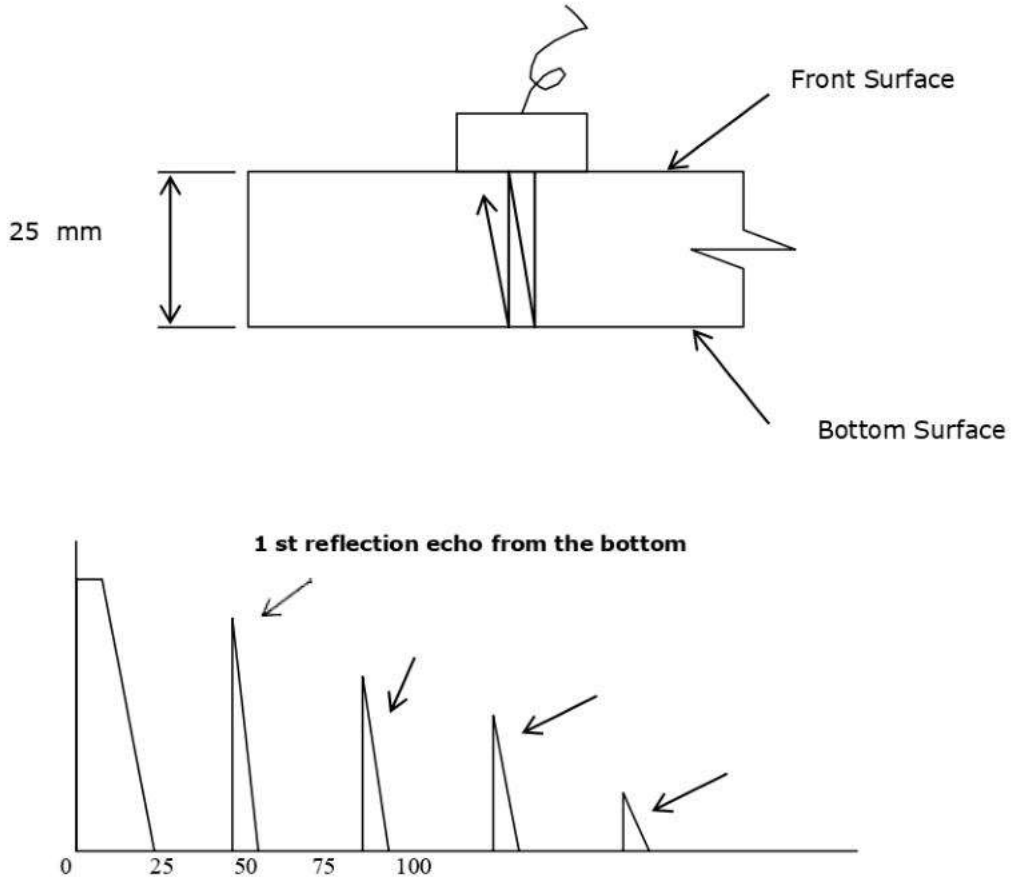

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Fig. 5 DISTANCE AMPLITUDE CORRECTION FOR STRAIGHT BEAM TRANSDUCER

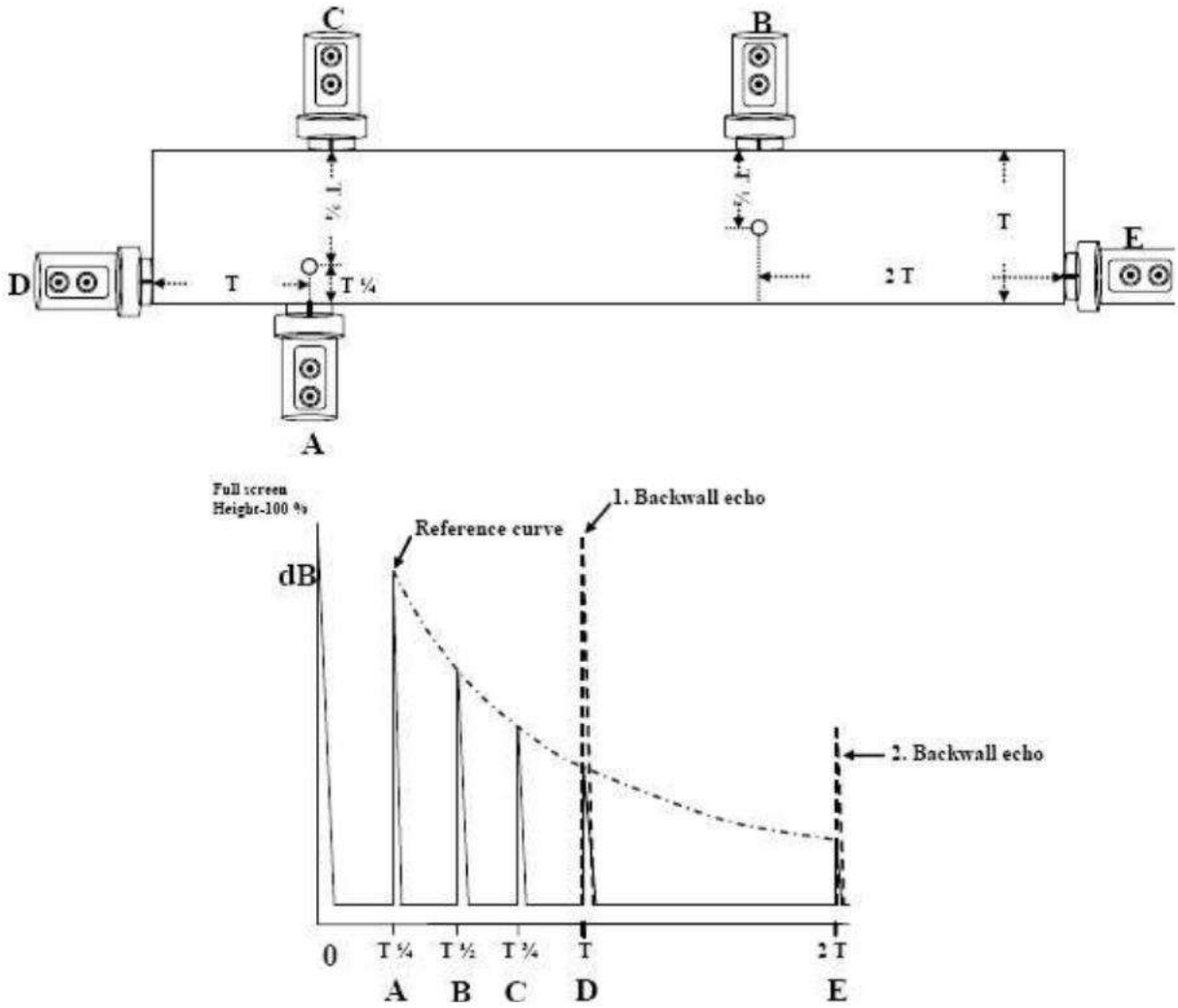

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Fig. 6. DISTANCE RANGE CALIBRATION FOR ANGLE BEAM USING IIW - V1 REFERENCE BLOCK

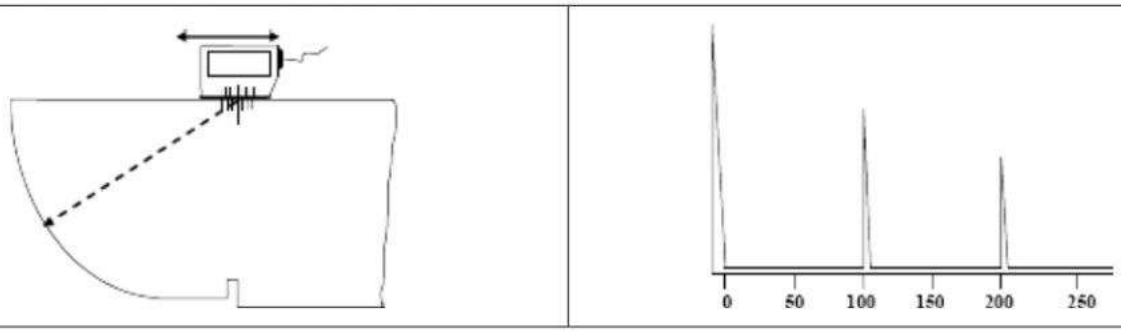

Fig. 7. DISTANCE RANGE CALIBRATION FOR ANGLE BEAM TRANSDUCER USING IIW - V2 REFERENCE BLOCK

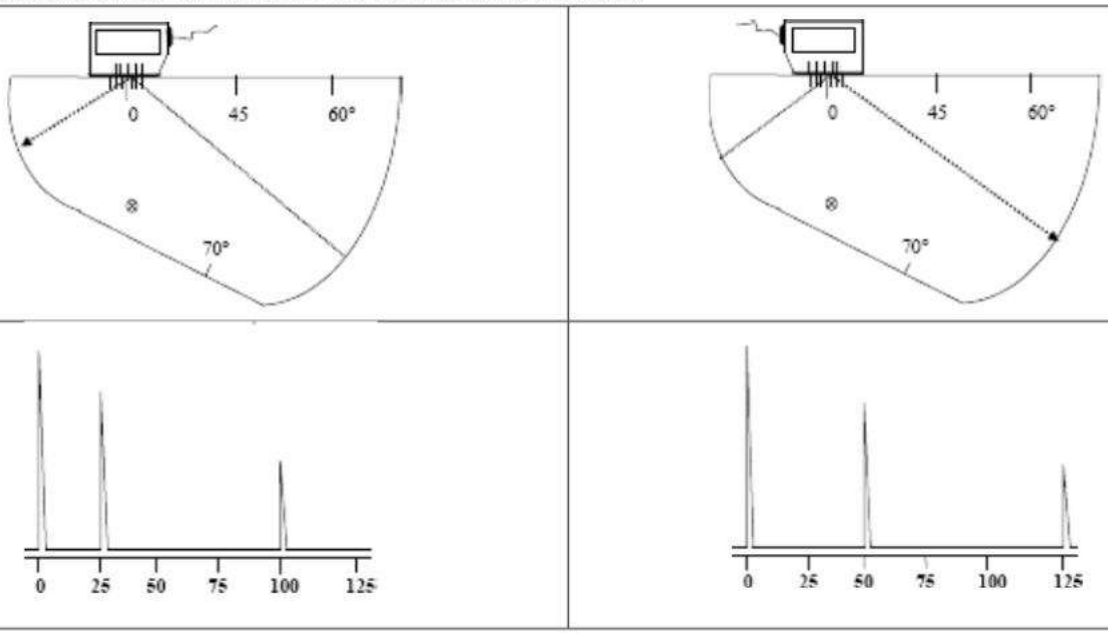

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Fig. 8. DISTANCE AMPLITUDE CORRECTION (DAC)

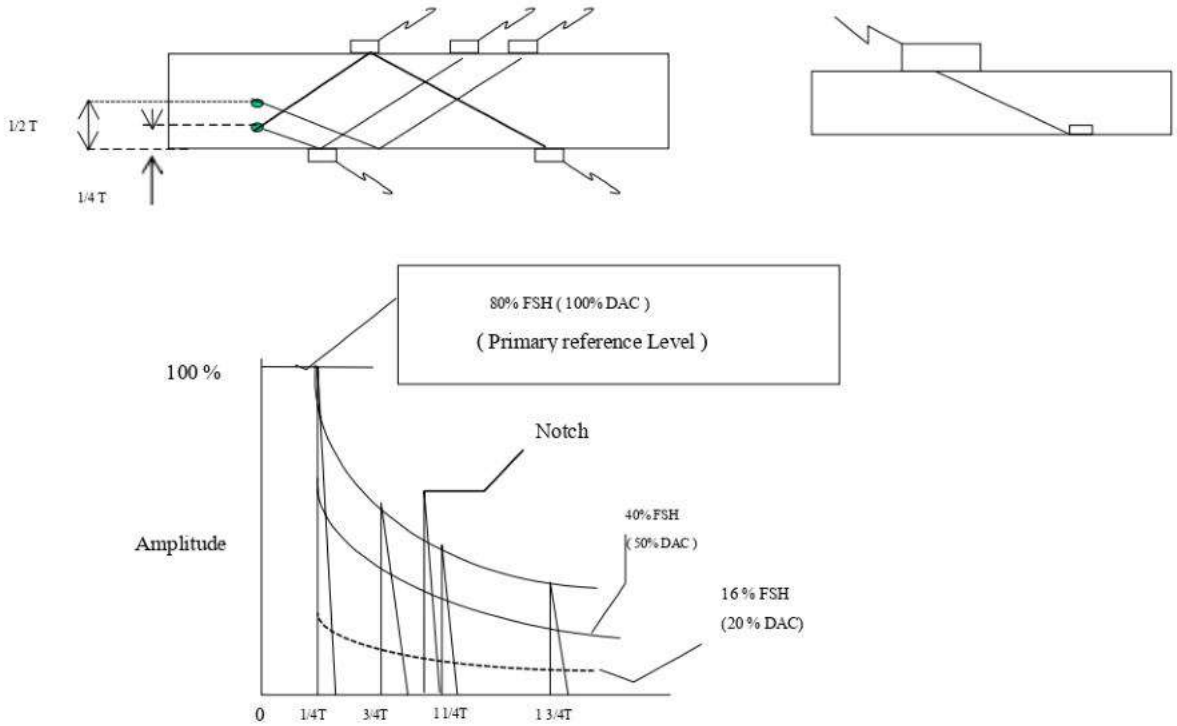
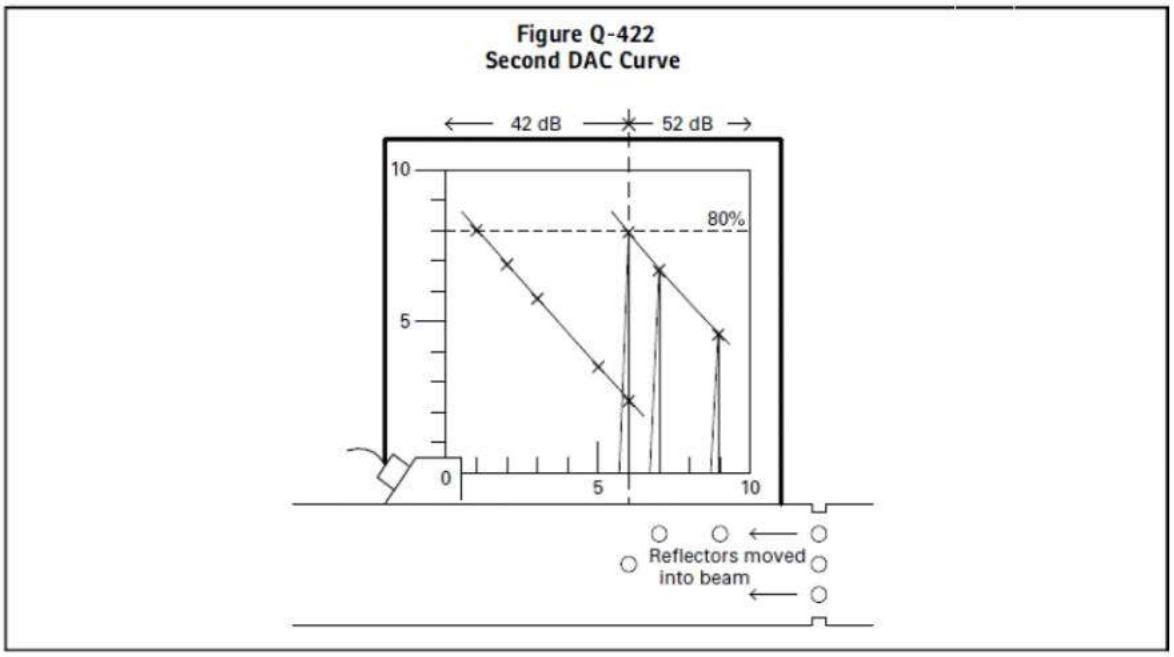


Fig. 9 SPLIT DAC



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ULTRASONIC TEST REPORT

Customer	:.....	Drawing No.	:..... Rev.....	Report No	:.....- UT-....
Project Name	:.....	Procedure No.	:.....,Rev.....		
Unit No	:.....	Applicable CODE	:.....	NCR Ref No	:.....

Material Spec.	:	Welding Process	:	Surface condition	: .....
Joint type	: ☐ Butt joint	☐ T joint	☐ Corner joint	☐ Plate to plate	☐ Pipe tp pipe

UT INSTRUMENT		Cable Type & Length	Couplant	EXAMINATION TECHNIQUE		
Model	Serial No			☐ Contact	☐ Straight beam	☐ Angle beam Only shear wave in the tested matrial

SCANNING

Scanning surface	☐ Both side of weld	☐ One side of weld	☐ From A	☐ From B	☐ From C
Scanning Technique	☐ Half to full skip distance	☐ Half skip distance		☐ Other	
Scanning direction of angle beam	☐ Swivel	☐ Right angle to weld axis		☐ Essentially parallel to weld axis	
Sizing of indication	Length of indication	☐ 6 dB drop (50% from highest amp.)		☐ 14 dB drop (20% from highest amp.)	
	Height of indication	☐ 6 dB drop (50% from highest amp.)		☐ 14 dB drop (20% from highest amp.)	

CALIBRATION

Search Unit				Block ID				Data			Gain Setting		Test Range
Angle	Serial No.	Frequency	Size	V1	V2	BCB	Sulzer	Hole ∅	Amplitude	Refference reflector	Reference Level	Scanning Level	

Part/Weld No	Thickness (mm)	Indication				Result		Remark
		Sound Path	Amplitude Level	Length	Depth	ACC	REJ	

Notes :

Examined by : Name : NDE Level :	Reviewed / witnessed by :	Reviewed / witnessed by :
Date :	Date :	Date :

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SKETCH

Customer :	Drawing No. : Rev.	Report No. :
Project Name :	Procedure No. : Rev.	
Unit No. :	Applicable CODE :	Page No. : of

Indication No	From " 0 " datum	Length	Depth from surface	Height (if required)	Result		Remark
					ACC	REJ	

Examined by : Name :	Reviewed / witnessed by :	Reviewed / witnessed by :
NDE Level :		
Date :	Date :	Date :

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Table T - 421
Requirements of an Ultrasonic Examination Procedure

Requirement	Essential Variable	Non essential Variable	Par. Ref.	Qualified range
Weld configurations to be examined, including thickness, dimensions and base material product form (pipe, plate, etc.)	X		2	Butt joint Pipe Φ > 500 mm and plate , 13 ~ 25 mm thk.
The surfaces from which the examination shall be performed	X		11.2	Both side of weld
Techniques (straight beam, angle beam, contact, and/or immersion)	X		1 / 10.3 / 10.4	Contact straight and angle probe
Angle(s) and mode(s) of wave propagation in the material	X		7.2.2	Only shear wave in the material with angle 45, 60 and 70 degrees.
Search unit type(s) , frequency(ies) and element size(s) / shape(s)	X		7.2.1 / 7.2.2	Freq. : 1~4 Mhz Normal 10 mm dia., Angle 45, 60 and 70 deg, dimension 8x10 mm
Special search units, wedges, shoes, or saddle, when used	X		7.2.4	Angle without or with shoe max. 4mm thk.
Ultrasonic Instrument(s)	X		7.1.1	1 ~ 5 Mhz,
Calibration [calibration block(s) and technique(s)]	X		7.4 / 9	V1, V2 and BCB
Direction and extent of scanning	X		11.2	Base metal, Right angle and essentially parallel to the weld axis (angle probe)
Scanning (manual vs. automatic)	X		11.2	Manual
Method for discriminating geometric from flaw indications	X		12	Plot and verify reflector coordinate
Method for sizing indications	X		13.1 / 13.2	6 db drop for length
Computer enhance data acquisition , when used	X		NA	NA
Scan overlap (decrease only)	X		11.1	Minimum 10% of probe size
Personnel performance requirements, when required	X		6.1 / 6.2	Refer to Written Practice
Personnel qualification requirements		X	6.1 / 6.2	SNT-TC-1A, 2006 Edition and 2011 Edition.
Surface condition (examination surface, calibration block)		X	8.1 / 7.4.2.4	Free from foreign material which interfere exam/ surface of BCB shall be representative component being examined
Couplant : brand name or type		X	7.3	CMC, glycerin, light oil
Post examination cleaning technique		X	14	Solvent wipe for oil
Automatic alarm and / or recording equipment, when applicable		NA	NA	
Records, including minimum calibration data to be recorded (e.g., instrument settings)		X	15	As stated in Form Report

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4. RADIOGRAPHIC EXAMINATION PROCEDURE

RADIOGRAPHIC EXAMINATION PROCEDURE ASME BPV Code

DOCUMENT : TLA-RT-ASME - 03
REVISION NO. : 00

Prepared by	Reviewed by	Reviewed and Approved by
Name : Riswan	Name : Agus Riyanto	Name : Adi Padmo
Position : NDE Level II	Position : DIRECTOR	Position : NDE LEVEL III Cert. No. 126596
Date : 16 April, 2022	Date : 16 April, 2022	Date : 16 April, 2022

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SUMMARY OF REVISION SHEET

This page is a record of all revisions of the procedure and the following revision (s) has (have) been madeto this procedure.

REV.	DATE	PAGE	BRIEF OF REVISION
00	16 April, 2022	All	First Issue
			-

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Daftar Isi / Table of Content

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1 Tujuan

1.1 Untuk menyediakan petunjuk pelaksanaan pengujian radiografi pada lasan material ferrous (carbon steel, low alloy steel dan stainless steel material) termasuk kupon test welder, menggunakan Iridium (Ir 192) atau X-ray

1.2 Prosedur ini terdiri dari versi Inggris dan Indonesia, jika ada konflik antara keduanya maka versi Inggris yang dipakai.

1 Purpose

1.1 This procedure provides guidance during the conduct of radiographic examination of welds of ferrous material (carbon steel, low alloy steel and stainless steel material) include welder test coupons, using Iridium (Ir 192) or X-ray

1.2 This procedure consists of English and Indonesian versions, should there is conflict between these versions the English version shall govern.

2 Ruang Lingkup

2.1 Prosedur ini menyajikan syarat–syarat dan standar penerimaan untuk pengujian dengan radiografi pada lasan.

2.2 Sambungan pengelasan dari pipa , tube atau plat dengan tebal 4 sampai 100 mm.

2 Scope

2.1 This procedure provides the requirements and acceptance standards for Radiographic examination for welds.

2.2 Weld joints may be from pipes, tubes or plates with thickness 4 up to 100 mm.

3 Persyaratan Keselamatan

3.1 Safety regulasi dari PT. TITIAN LANCAR ABADI harus diikuti selama pengujian.

3.2 **KESELAMATAN (INSTRUKSI K3L)**

- Selalu menggunakan APD seperti sepatu Safety, sarung tangan, kacamata safety, and helm.
- Waspada tempat yang licin dan benda jatuh
- Waspada benda berbahaya sekitar tempat kerja
- Berhenti kerja dan lapor ke client dan supervisor untuk tempat kerja yang tidak aman
- Pasang barricade atau tali pengaman pada jarak aman selama radiografi
- Pakai alat pengaman ketinggian jika bekerja diatas 2 m
- Pungut sampah dan buang ditempat yang tersedia
- Jangan membuang pelumas, oli atau cairan bekas test ke lantai

3 Safety Requirements

3.1 PT. TITIAN LANCAR ABADI's safety regulation shall be followed during examination.

3.2 **SAFETY (S.H.E INSTRUCTION)**

- Always use PPE such as Safety shoes, hand glove, safety glass, and helmet.
- Watch out for slippery and falling object.
- Watch out for the hazard around the areas.
- Stop the activities and report to client and supervisor for unsafe working condition.
- Put barricade or safety line in the safe distance during the radiographic
- Use fall protection equipment if working above 2 m.
- Collect all waste and put it in agreed place.
- Do not expose any lubricant, oil or test fluid to the ground.

4 Referensi-referensi

4.1 PT. TITIAN LANCAR ABADI Written Practice Prosedur

4.2 ASME BPVC Code Sect. I, V, VIII Div. 1, IX, VIII Div. 2, 2021 Edition

4 References

4.1 PT. TITIAN LANCAR ABADI's Written Practice Procedure

4.2 ASME BPVC Code Sect. I, V, VIII Div. 1, IX, VIII Div. 2, 2021 Edition

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4.3	ASME / ANSI B31.1, 2020 Edition, Power Piping	**4.3**	ASME / ANSI B31.1, 2020 Edition, Power Piping

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5 Definisi-definisi

5.1 RT: Pengujian Radiografi.

5.2 NDE: Pengujian tanpa merusak.

5.3 IQI: Indikator qualitas gambar radiografi.

5.4 Densitometer: sebuah alat untuk mengukur density film radiografi.

5.5 Indikasi: respon atau tanda bukti dari sebuah pengujian tanpa merusak yang memerlukan interpretasi untuk relevansi.

5 Definitions

5.1 RT: Radiographic Examination.

5.2 NDE: Non Destructive Examination.

5.3 IQI: Image Quality Indicator.

5.4 Densitometer: a device for measuring the optical density of radiograph film.

5.5 Indication: the respond or evidence from a nondestructive examination that requires interpretation to determine relevance.

6 Qualifikasi Personel dan Tanggung Jawab

6.1 Personel yang melakukan pengujian untuk persyaratan procedure ini harus di qualifikasi sesuai dengan prosedure dari PT. TITIAN LANCAR ABADI Written Practice sesuai dengan SNT-TC-1A, ACCP atau ISO 9712:2012

6.2 Personel yang menentukan keberterimaan sesuai syarat–syarat dari prosedur ini harus mempunyai qualifikasi Level II atau Level III.

6 Personnel Qualification and Responsibility

6.1 Personnel performing examinations to the requirements of this specification shall be qualified in accordance with PT. TITIAN LANCAR ABADI's Written Practice in accordance wtith SNT-TC-1A, ACCP or ISO 9712:2012

6.2 Personnel determining the acceptability to the requirements of this procedure shall be qualified to Level II or Level III.

7 Perlengkapan dan material

7.1 Sumber radiasi harus dari Iridium (Ir. 192) dan X-Ray max. 300 kV. Energy radiasi yang dipakai radiografi harus bisa menghasilkan density dan gambar IQI yang dipersyaratkan.

7.2 Ukuran source atau focal spot harus diidentifikasikan dengan pernyataan tertulis atau jika pernyataan tertulis tidak ada ukuran source bisa ditentukan sesuai dengan SE–1114 dari ASME V.

7.3 IQI harus dipilih dari salah satu grup material alloy yang sama atau seperti grade yang diidentifikasikan di SE–1025 (Hole Type IQI) or SE–747 (Wire Type IQI).

7.4 Film Radiografi harus memakai class (type) II atau butir yang lebih baik.
Berikut ini adalah type film :

7 Equipments and materials

7.1 Radiation source shall be from Iridium (Ir. 192) and X-Ray maximum 300 kV. The radiation energy employed for radiographic technique shall achieve the density and IQI image requirements.

7.2 The source size or focal spot shall be identified by written statements, when the written statements are not available the source size may be determined in accordance with SE–1114 of ASME V.

7.3 IQI shall be selected from either the same alloy material group or grade as identified in SE–1025 (Hole Type IQI) or SE–747 (Wire Type IQI).

7.4 Radiographic film shall be class (type) II or finer grain.
The followings are the film type :

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Iridium – 192 (Ir 192)		
Trademark	Film Type	Thickness weld
AGFA GEVEART	D 4	6.5 ~ 50 mm
	D 7	6.5 ~ 50 mm
KODAK INDUST.	AA-400	6.5 ~ 50 mm
	MX-125	6.5 ~ 50 mm
FUJI	IX-100	6.5 ~ 50 mm
	IX-50	6.5 ~ 50 mm

Iridium – 192 (Ir 192)		
Trademark	Film Type	Thickness weld
AGFA GEVEART	D 4	6.5 ~ 50 mm
	D 7	6.5 ~ 50 mm
KODAK INDUST.	AA-400	6.5 ~ 50 mm
	MX-125	6.5 ~ 50 mm
FUJI	IX-100	6.5 ~ 50 mm
	IX-50	6.5 ~ 50 mm

X Ray		
Trademark	Film Type	Thickness weld
AGFA GEVEART	D 4	3 ~ 50 mm
	D 7	3 ~ 50 mm
KODAK INDUST.	AA-400	3 ~ 50 mm
	MX-125	3 ~ 50 mm
FUJI	IX-100	3 ~ 50 mm
	IX-50	3 ~ 50 mm

X Ray		
Trademark	Film Type	Thickness weld
AGFA GEVEART	D 4	3 ~ 50 mm
	D 7	3 ~ 50 mm
KODAK INDUST.	AA-400	3 ~ 50 mm
	MX-125	3 ~ 50 mm
FUJI	IX-100	3 ~ 50 mm
	IX-50	3 ~ 50 mm

7.5 Densitometer yang terkalibrasi harus digunakan sewaktu mengevaluasi film RT.

7.6 National standard step tablet yang di gunakan untuk kalibrasi densitometer harus di verifikasi setiap tahun , mampu telusur ke national standard dan minimum mempunyai 5 step dengan netral density dari 1.0 sampai 4.0.

7.5 Calibrated Densitometer shall be used during RT film evaluation.

7.6 A national standard step tablet used for calibrating the densitometer shall be verified annually, traceable to the national standards and having at least 5 steps with neutral densities from at least 1.0 through 4.0.

8 Prosedur

8.1 Persiapan Permukaan

8.1.1 Bentuk lasan atau permukaan lasan baik didalam ataupun diluar (bila dapat dijangkau) harus dihilangkan sampai batas tertentu sehingga tidak mempengaruhi gambar radiografi dikarenakan bentuk lasan dapat menutupi atau membingungkan gambar

8 Procedure

8.1 Surface Preparation

dari cacat pada hasil film radiography.

8.1.2 Permukaan akhir dari butt join lasan bolehdi ratakan dengan base material atau boleh memiliki mahkota las yang seragam, dengan reinforcement, asalkan tidak melebihi persyaratan dari code yang digunakan.

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8.1.1 Weld ripples or weld surface irregularities on both the inside (where accessible) and outside shall be removed to such a degree that the resulting radiographic image due to surface irregularities can mask or be confused with the image of any discontinuities on the resulting radiograph.

8.1.2 The finished surface of all butt welded joints may be flush with the base material or may have reasonably uniform crowns, with reinforcement, not to exceed that specified in the referencing code.

8.2 Tehnik Radiografi

8.2.1 Di ijinkan penggunaan untuk teknik radiografi , dimana Unsharpness Geometric (Ug) tidak melebihi berikut ini :

Thickness	UG Max. inch (mm)
Under 2 (50)	0.02 (0.51)
2 - 3 (50 – 75)	0.03 (0.76)
More 3 – 4 (75 - 100)	0.04 (1.02)
More than 4 (100)	0.07 (1.78)

Geometric Unsharpness (Ug) dari radiograph harus ditentukan sebagai berikut:

Ug = F.d / D

8.2 Radiographic Technique

8.2.1 In order to permit the use of radiographic techniques, Geometrirc Unsharpness (Ug) shall not exceed the following :

Thickness	UG Max. inch (mm)
Under 2 (50)	0.02 (0.51)
2 - 3 (50 – 75)	0.03 (0.76)
More 3 – 4 (75 - 100)	0.04 (1.02)
More than 4 (100)	0.07 (1.78)

Geometric Unsharpness (Ug) of radiograph shall be determined in accordance with:

Ug = F.d / D

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dimana :

- Ug= Geometric Unsharpness
- F= ukuran source
- D= jarak dari source ke weld atau object yang diradiography
- d= jarak dari source side dari weld atau object yang diradiography ke film
- D and d harus ditentukan kira- kira senter pada area of interest.

Note : Untuk ASME I, jika kombinasi parameter radiography menghasilkan geomatric unsharpness, UG melebihi 0.07 in. (1.8 mm) maka UT digunakan. UG maximum untuk ASME B31.1 adalah 0.07 in. (2.0 mm)

8.2.2 Arah energy yang digunakan untuk setiap teknik radiografi harus menghasilkan density dan gambar IQI yang disyaratkan.

8.2.3 Arah central beam dari radiasi sebisa mungkin pada center pada area yang diamati.

8.2.4 Screen penguat adalah lead, depan dan belakang, 0.005" sampai 0.010", harus digunakan untuk semua exposure. Screen harus bersih dari semua kotoran, lapisan oksida, lipatan, pitting dan cacat lain. Screen harus kontak langsung dengan film.

Fluorescent screen tidak boleh digunakan.

8.2.5 Timah simbul " B " , dengan ukuran minimum 7/16 in.(11 mm) tinggi dan 1/16 in. (1.5 mm) tebal, harus ditempelkan dibelakang setiap kaset tempat film selama setiap penyinaran untuk menentukan kalau ada paparan radiasi dari belakang mengenai film. Timah simbul " B " harus diletakkan pada lokasi sehingga kelihatan dalam area film radiography yang memenuhi persyaratan density par. 8.7.5

8.3 Sistem identifikasi

where :

- Ug= Geometric Unsharpness
- F= source size
- D= distance from source of radiation to weld or object being radiographed
- d= distance source side of the weld or object being radiographed to film
- D and d shall be determined at approximately center of area of interest

Note : For ASME I, when any combination of radiograpic parameters produces a geomatric unsharpness exceeding, UG 0.07 in. (1.8 mm) then UT shall be used. UG maximum for ASME B31.1 shall be 0.07 in. (2.0 mm).

8.2.2 The direction energy employed for any radiographic technique shall be achieved the density and IQI image requirements.

8.2.3 The direction of central beam of radiation should be centered on the area of interest whenever practical.

8.2.4 Intensifying screens consisting of lead, both front and back, 0.005" up to 0.010", shall be used for all exposures. Screens shall be free of dirt, oxide coatings, wrinkles, pitting and other defects. Screens shall be direct contact to the film.

Fluorescent screen is not permitted.

8.2.5 A lead symbol "B," with minimum dimensions of 7/16 in.(11 mm) in height and 1/16 in. (1.5 mm) in thickness, shall be attached to the back of each film holder during each exposure to determine if backscatter radiation is exposing the film. The lead symbol "B" shall be placed in a location so that it would appear within an area on the radiograph that meets the requirements of density requirements par. 8.7.5

8.3 Identification Systems

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8.3.1 System harus digunakan untuk menghasilkan identifikasi pada setiap film yang terlacak kepada item yang diradiography dan permanen untuk jangka waktu penyimpanan dari film, informasi berikut adalah minimum :

8.3.1 A system shall be used to produce on each radiograph an identification that is traceable to the item being radio-graphed and that is permanent for the required retention period of the radiograph, the following informations as minimum:

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- Symbol atau nama dari Pabrik dan boleh diikutkan juga NDE Subcontractor symbol atau nama
- No. Kontrak / Nama Project
- Komponen dan Manufacture Serial no.
- Identifikasi las (no. Joint , welder no., untuk ASME IX ditambah material spec., proses pengelasan dan posisi)
- Ketebalan / Diameter / Type material
- Tanggal.
- Semua lasan yang telah diperbaiki harus
- ditandai pada film dengan siklus perbaikan (R-1, R-2, dan lain-lain).

8.3.2 Sistem identifikasi tidak harus diperlukan tampak sebagai gambar radiographic.
Dalam keadaan apapun, informasi ini tidak boleh mengganggu pada interes area.

8.4 Persyaratan dan lokasi penandaan.

8.4.1 Lokasi penandaan yang mana nampak dalam image film dan harus ditempatkan di part (bukan dikasetnya). Lokasi–lokasi harus ditandai permanen pada permukaan part yang radiografi jika diizinkan, atau pada map dengan suatu cara dimana area yang interes pada radiografi bisa di lacak secara akurat dengan lokasi pada partnya, untuk selama periode penyimpanan film yang dipersyaratkan. Sebagai tambahan, lokasinya tidak membatasi area interes atau area yang di interpret. Bukti-bukti harus tersedia pada film radiography tersebut sebagai persyaratan bahwa area pengujian telah terpenuhi.

8.4.2 Untuk single wall viewing (Exibit B atau C). Lokasi penandaan harus sebagai berikut:

8.4.2.1 **Source Side Markers.** Lokasi marker harus diletakkan pada sisi source, jika radiography pada yang berikut :

a Sambungan Flat atau Longitudinal pada komponen yang silinder atau conical, (Exhibit C)(a).

- Manufacturer's symbol or name and may be included NDE Subcontractor 's symbol or name
- Contract no./ Project Name
- Component and Manufacture's Serial no.
- Weld identification (joint No, welder No., for ASME IX to add material spec.,welding process and position)
- Thickness / diameter / Material Type
- Date.
- Any weld that has been repaired shall be so marked on the radiograph with the applicable repair cycle (R-1, R-2, etc.).

8.3.2 The identification system does not necessarily require that the information appear as radiographic image.
In any case, this information shall not obscure the area of interest

8.4 Requirement and location markers

8.4.1 Location markers shall appear as radiographic images and shall be placed on the part (not on the exposure holder/cassette). The locations shall be permanently marked on the surface of the part being radiographed when permitted, or on the map, in manner permitting the area of interest on the radiograph to be accurately traceable to its location on the part for the required retention period of radiograph. In ad-dition, their locations do not limit the area of interest or the area to be interpreted. Evidence shall be provided on the radiograph that the required coverage of the region being examined has been obtained.

8.4.2 **For single wall viewing** (Exhibit B or C). Location markers shall be placed as follows :

8.4.2.1 **Source Side Markers.** Location markers shall be placed on the source side when radiographing the following:

a Flat or Longitudinal joints in cylindrical or conical components, (Exhibit C)(a).

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b Sambungan kurva ataupun spherical dimana sisi konkaf kearah sumber dan ketika jarak dari sumber ke material lebih kecil dari radius dalam dari komponen tersebut, (Exhibit C)(b).

c Sambungan kurva dimana sisi konvexnya

b Curved or spherical components whose concave side is toward the source and when the "source-to- material" distance is less than the inside radius of the component, (Exhibit C)(b).

c Curved joints whose convex side is

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kearah sumber radiasi, (Exhibit C)(c).

8.4.2.2 Film Side Markers.

a Lokasi penandaan harus diletakan pada sisi filmharus digunakan ketika melaksanakan radiografi pada sambungan kurva atau spherical dimana sisi kurvanya ke arah sumber dan ketika jarak sumber ke material lebih besar daripada radius dalam dari komponen tersebut.

b **Sebagai ganti** penempatan source side pada para. 8.4.2.1(a), lokasi marker mungkin ditempatkan pada film side jika radiografi menunjukkan lokasi marker melebihi demonstrasi yang pada Exhibit C (e) dan ketika di alternatif ini di dokumentasikan dalam laporan sebagai mana tercantum dalam para. 8.9.

8.4.2.3 Saat lokasi penandaan boleh di letakan pada source side atau film side (Exhibit C, sket (e) atau (f) boleh digunakan baik pada komponen kurva ataupun spherical dimana sisi konkafnya menuju kearah sumber dan jarak dari sumber ke material tersebut sama dengan radius dalam komponen.

8.4.3 **Untuk double wall viewing** (Exhibit B) sekurang-kurangnya satu lokasi penandaan harus ditempatkan pada sisi permukaan sumber (source side surface) berdekatan dengan lasan (atau material yang akan diuji) untuk setiap pemaparan.

8.5 Pemilihan dan persyaratan IQI

Penentuan IQI, pemilihan dan penempatan , harus sebagai berikut :

8.5.1 Penentuan IQI harus jenis lubang atau jenis kawat.

8.5.2 Hal penting ukuran lubang, diameter kawat dan penentuan IQI harus sesuai dengan Exhibit A. 1 (Table T-276; T-283.2). Lebih tipis atau lebih tebal type hole IQI bisa diganti dari sembarang ketebalan seperti di Exhibit A 1 (Table T-276; T-283.2), asalkan sensitivitas dari IQI bisa di pertahankan. Untuk IQI tipe kawat diameter kawat yang lebih kecil boleh menggantikan kawat esensial yang dipersyaratkan untuk semua ketebalan di Table T-276.

toward the source, (Exhibit C)(c).

8.4.2.2 Film Side Markers.

a Location markers shall be placed on film side when radiographing either curved or spherical components whose concave side is toward the source and when the "source–to-material" distance is greater than the inside radius.

b As an alternative to source side placement in 8.4.2.1(a), location markers may be placed on the film side when the radiograph shows coverage beyond the location markers to the extent demonstrated Exhibit C (e) and when this alternate documented in the report as stated in para.8.9.

8.4.2.3 Either source side or film side markers (Exhibit C, sketches (e) or (f) may be used on either curved or spherical components whose concave side is toward the source and the "source-to-material" distance equals the inside radius of the component.

8.4.3 **For double wall viewing** (Exhibit B) at least one location marker shall be placed on the source side surface adjacent to weld (or material in the area of interest) for each exposure.

8.5 Selection and requirement of IQI

IQI designation, selection and place ment, shall be as follows:

8.5.1 The IQI designation shall be either the hole type or the wire type

8.5.2 The essential hole size, wire diameter and designated IQI shall be as specified in Exhibit A. 1 (Table T-276; T-283.2). A thinner or thicker hole–type IQI may be substituted for any section thickness listed in Exhibit A (Table T-276; T 283.2) provided an equivalent IQI sensitivity is maintained. For wire-type IQIs, a smaller-diameter wire may be substituted for the essential wire required for any section thickness listed in Table T-276.

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8.5.3 **Lasan dengan reinforcement**, tebal dari IQI berdasarkan pada satu ketebalan nominal ditambah estimasi reinforcemen yang ada pada kedua sisi lasan (ID. dan

8.5.3 **For Welds with reinforcements,** the thickness on which the IQI is based, is the nominal single wall thickness plus the weld reinforcement thickness estimated to be present on both sides of the welds (ID. and OD) The

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OD.). Nilainya yang digunakan untuk estimasi tebal reinforcement harus mewakili kondisi lasan tidak boleh melebihi maximum yang diijinkan oleh Code Section. Pengukuran reinforcement actual tidak diperlukan. Backing rings atau strips tidak diperhitungkan sebagai bagian dari ketebalan pada saat pemilihan IQI.

values used for the estimated weld reinforcement thicknesses shall be representative of the weld conditions and shall not exceed the maximums permitted by the re-ferencing Code Section. Physical measurement of the actual weld reinforcements is not required. Backing rings or strips shall not be considered as part of the thickness in IQI selection

8.5.4 **Lasan tanpa reinforcement**, tebal dari IQI didasarkan tebal nominal dari single wall. Backing rings atau strips tidak diperhitungkan sebagai bagian tebal dari part pada saat pemilihan IQI.

8.5.4 For Welds Without Reinforcements, the thickness on which the IQI is based is the nominal single wall thickness. Backing rings or strips are not to be considered as part of the thickness in IQI selection.

8.5.5 Peletakan IQI

8.5.5 IQI Placement

8.5.5.1 IQI hole type harus ditempatkan di source side berdekatan dengan lasan, kecuali jika kondisi ini tidak bisa dilaksanakan karena kesulitan konfigurasi geometris, dalam kasus ini maka IQI bisa ditempatkan pada lasan, lihat Figure A-210 of ASME Sect. V

8.5.5.1 IQI hole type shall be placed on source side adjacent to the weld seam, except in instances where the geometric configuration makes it impractical, in which case the IQI hole may be placed on the weld metal, see Figure A-210 of ASME Sect. V

8.5.5.2 Wire IQI. IQI harus diletakkan pada lasan sehingga panjang dari kawat memotong sumbu longitudinaal dari lasan.

8.5.5.2 Wire IQIs. The IQI(s) shall be placed on the weld so that the lengths of the wires are transverse to the longitudinal axis of the weld.

8.5.6 Ketika kesulitan dalam peletakan IQI ini dengan tangan pada source side, IQI harus diletakan pada film side dan huruf "F" dari timah, sekurang-kurangnya sama tinggi dengan nomer identifikasi, harus ditempatkan berdekatan dengan IQI. Identifikasi IQI dan huruf timah "F" jika digunakan harus tidak pada area interes, kecuali jika geometri konfigurasi tidak memungkinkan

8.5.6 Where inaccessibility prevents hand placing the IQI(s) on the source side, the IQI shall be placed on the film side and a lead letter "F", at least as high as the identification number, shall be placed adjacent to the IQI. The IQI identification and, when used, the lead letter "F," shall not be in the area of interest, except when geometric configuration makes it impractical.

8.5.7 Jika konfigurasi las atau ukuran sehingga IQI tidak dapat diletakan di benda atau las-an, IQI boleh diletakan pada sebuah blok terpisah. Blok terpisah harus terbuat dari material yang sama dan mungkin memudahkan memposisikan IQI

8.5.7 When configuration or size, it is not practical to place the IQI on the part, it may be placed on a separate block. Separate blocks shall be made of same or radiographicaly similar material and may be used to facilitate IQI positioning

a. IQI pada source side dari blok terpisah harus diletakkan tidak boleh kurang dari source side dari bagian yang di radiography

a. The IQI on the source side of the separate block shall be placed no closer to the film than the source side of the part being radiographed.

b. Blok terpisah harus diletakkan sedekat mungkin ke bagian yang di radiography

b. The separate block shall be placed as close as possible to the part being radiographed.

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c. Jika menggunakan tipe IQI hole, ukuran dari blok harus lebih dari ukuran IQI sehingga setidaknya tiga sisi image dari

c. When hole-type IQIs are used, the block dimensions shall exceed the IQI dimensions such that the outline of at least three sides of the IQI image shall be visible in the

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IQI harus nampak pada film raiografi.

8.5.8 Kecuali disebutkan pada paragraf selanjutnya, satu IQI harus digunakan untuk setiap film radiografi. Setiap IQI harus mewakili dari area density yang merata pada film radiografi. Bila density radiografi diarea yang diamati tidak memenuhi persyaratan density, maka harus menggunakan IQI tambahan dan harus di radiografi ulang.

8.5.9 Jika dua IQI di persyaratan di suatu kasus untuk memenuhi persyaratan density di Paragraf 8.7.6. Satu harus mewakili area lebih terang dan yang lain mewakili area yang lebih gelap dari film radiografi tersebut. Density dari area yang dilihat, dikontrol oleh setiap IQI dan harus memenuhi persyaratan density. Density yang saling mewakili di film dapat diterima.

8.5.10 Ketika sumber radiasi berada pada sumbu di pengelasan melingkar dan seluruh pengelasan di radiografi dengan single exposure (panoramic), paling sedikit tiga IQI harus diberi jarak masing-masing kurang lebih 120 derajat.

8.5.11 Shim dibawah lubang IQI

a. Dimensi dari shim harus lebih dari dimensi IQI sehingga setidaknya tiga sisi image dari IQI nampak pada film raiografi.

b. Untuk Lasan, shim material harus sejenis dengan material lasan dan harus ditempatkan diantara IQI dan benda uji.

8.6 Teknik Exposure

8.6.1 Single wall penyinaran teknik harus dipakai jika memungkinkan (Exhibit B). Jika tidak memungkinkan menggunakan single wall, double-wall teknik harus dipakai. Kecukupan jumlah dari penyinaran harus didemonstrasikan area cakupan yang dibutuhkan telah bisa terpenuhi.

8.6.2 Single-wall teknik (SWSV)

Dalam single-wall teknik, radiasi menembus melalui hanya satu dinding lasan (material), yang dilihat untuk penerimaan.

radiograph.

8.5.8 Except as provided in sub-paragraph, one IQI shall be used for each radiograph. Each IQI shall represent an area of essentially uniform radiographic density. **If the density of the radiograph does not meet density requirements, then an additional IQI shall be used for each exceptional area and the radiograph retaken.**

8.5.9 If Two IQI's are required in some cases to meet the density requirements of Paragraf 8.7.6. One IQI shall representative of the lighter area of the radiograph and the second shall represent the darker area. The density in the areas of interest controlled by each IQI shall meet the density requirements. The intervening densities on the radiograph are acceptable.

8.5.10 When the source is placed on the axis of a circumferencial weld and the entire weld is radiographed with a single exposure (panoramic), at least three IQIs shall be spaced approximately 120 degrees apart.

8.5.11 Shim under Hole IQI's

a. The shim dimensions shall exceed the IQI dimensions such that the outline of at least three sides of the IQI image shall be visible in the radiograph.

b. For welds, the shim material radiographically shall be similar to the weld metal shall be placed between the part and the IQI.

8.6 Exposure Technique

8.6.1 A single wall exposure technique shall be used whenever practicable (Exhibit B). When it is not practical to use single wall technique, a double –wall technique shall be used. An adequate number of exposures shall be made to demonstrate that the required coverage has been obtained.

8.6.2 Single-wall technique (SWSV)

In the single-wall technique, the radiation passes through only one wall of the weld (material), which is viewed for acceptance on the radiograph.

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8.6.3 Double-wall teknik

Jika tidak memungkinkan menggunakan

8.6.3 Double-wall technique .

When it is not practical to use single wall

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single-wall teknik, salah satu dari teknik berikut harus digunakan.

1. **Single wall Viewing (DWSV)**

   Untuk material dan lasan pada komponen, teknik bisa mggunakan dimana radiasi menembus melalui dua dinding dan hanya lasan (material) pada fillm side yang direview dipakai untuk penerimaan radiography. Jika cakupan komplet diperlukan untuk seluruh keliling lasan (material), minimum tiga penyinaran yang diambil 120 drajat satu sama lainnya.

2. **Double-wall Viewing (DWDV)**

   Untuk material dan lasan pada komponen yang ukuran nominal diameter **3-1/2" (89 mm)** atau kurang, dimana radiasi menembus melalui dua dinding dan lasan (material) dikedua dinding direview untuk penerimaan pada film yang sama (Exhibit B).

   Untuk teknik ini, hanya IQI disisi sumber yang harus digunakan. Tindakan hati–hati sebaiknya dilakukan untuk tidak melewati syarat ketajaman geometris. Bila syarat ketajaman tersebut tidak bisa tercapai, harus menggunakan single wall viewing.

a. Untuk lasan, sumber radiasi bisa digeser menjauh dari lasan tersebut dengan sudut yang cukup untuk memisahkan image antara sisi source dan sisi film lasan tersebut sehingga tidak terjadi overlap dari penyinaran 90^0 satu dan lainnya.

b. Sebagai alternatif, lasan dapat diradiografi dengan memposisikan sinar radiasinya sehingga image dari dua wall tersebut adalah bertumpuk. Sedikitnya tiga penyinaran harus diambil dengan sudut 60^0 atau 120^0 satu sama lain

c. Tambahan penyinaran harus diambil jika cakupan radiography yang diperlukan tidak bisa dihasilkan menggunakan jumlah minimum yang ditunjukkan di (a) dan (b) diatas.

8.7 Evaluasi Film

technique, one of te following double-wall techniques shall be used.

1. **Single wall Viewing (DWSV)**

   For materials and for welds in component, a technique may be used in which the radiation passes through two walls and only the weld (material) on the film-side wall is viewed for acceptance on the radiograph. When complete coverage is required for circumferential welds (materials), a minimum of three exposures taken 120 deg. to each other shall be made.

2. **Double-wall Viewing (DWDV)**

   For materials and for welds in component **3-1/2" (89 mm) or less** in nominal outside diameter, a technique may be used in which the radiation may passes through two walls and the weld (material) in both walls is viewed for acceptance on the same radiograph. (Exhibit B).

   For this technique, **only source side IQI shall be used**. Care should be exercised to ensure that the required geometric un-sharpness is not exceeded. If the geometric un-sharpness requirement can not be met, then single–wall viewing shall be used.

a. For welds, the radiation beam may be offset from the plane of the weld at an angle sufficient to separate the images of the source side and film side portions of the weld so that there is no overlap of the exposures taken at 90^0 to each other.

b. As an alternative, the weld may be radiographed with the radiation beam positioned so that the images of both walls are superimposed. At least three exposures shall be made at 60^0 or 120^0 to each other.

c. Additional exposures shall be made if the required radiograph coverage cannot be obtained using the minimum number of exposures indicate in the (a) and (b) above.

8.7 Film Evaluation

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8.7.1 Fasilitas untuk Review Film Radiography

8.7.1.1 Viewing facilitas harus bisa menghasilkan

8.7.1 Facility for Viewing Radiographs

8.7.1.1 Viewing facilities shall provide subdued

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background lighting yang redup yang tidak akan menyebabkan pantulan, bayangan atau silau pada film radiography yang mengganggu proses interpretasi.

8.7.1.2 Alat yang digunakan untuk mereview film radiography harus bisa menghasilkan cahaya yang bisa diatur, cukup untuk menampilkan essential IQI Hole atau wire yang diperlukan pada range density.

8.7.1.3 Densitometer yang terkalibrasi harus digunakan untuk menentukan persyaratan density film.

8.7.2 National Standard Step Tablet Film

National standard step tablet film traceable ke national standard step tablet dan mempunyai paling sedikit 5 steps dengan neutral densities paling sedikit dari 1.0 sampai 4.0 harus digunakan. **National standard step tablet film** bisa digunakan tanpa verifikasi selama satu tahun setelah dibuka, asalkan masih dalam waktu yang disebut pembuatnya.

8.7.3 Densitometer.

8.7.3.1 Densitometers harus dikalibrasi paling sedikit setiap **3 (tiga) bulan** selama digunakan sebagai berikut :

8.7.3.2 Instruksi pabrik dalam pengoperasian densitometer harus diikuti.

8.7.3.3 Step density yang dekat dengan 1, 2, 3 dan 4 density unit pada step wedge film yang terkalibrasi harus dibaca.

8.7.3.4 Densitometer diterima jika pembacaan density tidak bervariasi lebih dari ±0.05 density unit. Dalam suatu hal ada perbedaan yang berdampak pada penerimaan film, pembacaan densitometer yang dipakai.

8.7.3.5 Kalibrasi check harus dilaksanakan pada setiap awal shift, setelah 8 jam digunakan secara terus menerus atau setelah diganti spare partnya, mana yang terjadi dahulu. Periodic densitometer verification check tidak perlu didokumentasikan, log aktivitas bisa dibuat untuk aktivitas ini.

8.7.4 Persyaratan Qualitas Film

background lighting of an intensity that will not cause reflection, shadow, or glare on the radiograph that interfere with the interpretation process.

8.7.1.2 Equipment used to view radiograph for interpretation shall provide a variable light source, sufficient for essential IQI Hole or designed wire to be visible for specified density range.

8.7.1.3 Calibrated densitometer shall be used for judging film density requirements.

8.7.2 A National Standard Step Tablet Film

A national standard step tablet film traceable to a national standard step tablet and having at least 5 steps with neutral densities from at least 1.0 through 4.0 shall be used. **A national standard step tablet film may be used without verification for one year upon opening, provided it is within the manufacturers stated self-life.**

8.7.3 Densitometers.

8.7.3.1 Densitometers shall be calibrated at **least every 3 (three) months** during use as follow:

8.7.3.2 The manufacturer's instructions for the operation of densitometer shall be followed.

8.7.3.3 The density steps **closest to 1, 2, 3 and 4 density unit** on the calibrated step wedge film shall be read.

8.7.3.4 The densitometer is acceptable if the density readings do not vary more than ±0.05 density unit. In case of a difference affecting acceptability of the film, the densitometer reading shall govern.

8.7.3.5 Calibration verification check shall be performed at **the beginning of each shift, after 8 hrs. continual use or after change of apertures**, whichever comes first. Periodic densitometer verification checks do not have to be documented, **the activity log may be provided.**

8.7.4 Film quality requirements

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Umum :

Standard Guide for Controlling the Quality of Industrial Radiographic Film

General :

Standard Guide for Controlling the Quality of Industrial Radiographic Film

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Processing, SE-999, atau Sections 23 sampai 26 dari Standard Guide for Radiographic Examination Using Industrial Radiographic Film, SE-94/SE-94M, bisa digunakan sebagai guide untuk proses film

8.7.4.1 Pemprosesan film harus sesuai dengan rekomendasi manufacturer produk tersebut. Film processing dan film handling ada di prosedur terpisah, akan tetapi berikut ini adalah untuk Film proses manual :

a. Waktu developing harus kira – kira 5 menit pada temperature 20^0 C (68^0 F). Jika temperature lebih dari 20^0 C (68^0 F), waktu harus diatur untuk disesuaikan.

b. Stop Bath, film harus direndam kedalam stop bath untuk menhentikan aktifitas developer. Waktu Stop bath harus antara 2 ~ 3 menit.

c. Fixing, setelah stop bath film harus direndam kedalam campuran fixer. Waktu fixing harus minimum dua kali waktu clearing, tapi tidak lebih dari 15 menit.

d. Washing, (pencucian) harus didalam air yang mengalir. Waktu washing harus diperkirakan antara 7 ~ 10 menit

e. Drying, (pengeringan) film harus dikeringkan didalam lemari oven atau temperature ruangan.

8.7.4.2 Semua radiographs harus bebas dari mekanik, kimia atau noda/cacat lain untuk maksud tidak menutupi atau tidak membingungkan dengan gambar dari cacat yang berat dalam area yang diamati.

8.7.4.3 Secara umum, pembacaan film harus dengan satu film. Jika ada suatu kondisi seperti: taper, reinforcemen, dan lain-lain, yang tidak memungkinkan batasan density dari pembacaan single film; maka film composit boleh digunakan, asalkan density dari film composit memenuhi syarat.

Processing, SE-999, or Sections 23 through 26 of Standard Guide for Radiographic Examination Using Industrial Radiographic Film, SE-94/SE-94M, may be used as a guide for processing film

8.7.4.1 Film processing shall be in accordance with the manufacturer's recommended practices. The Film processing and film handling is in separated procedure, however the following is for Manual processing film :

a. Developing time shall be approximately 5 minutes at temperature 20^0 C (68^0 F). If the temperature more than 20^0 C (68^0 F) , the time shall be adjusted accordingly.

b. Stop Bath, the films shall be immersed in the stop bath to stop the activity of the developer. The stop bath time shall be 2 ~ 3 minutes.

c. Fixing, after stop bath, the films shall be immersed in fxing solution. The fixing time shall be at least twice the clearing time, but no more than 15 minutes.

d. Washing, the washing shall be in the continue flow of clean fresh water. The washing time shall be approximately 7 ~ 10 minutes

e. Drying, the films shall be dryed in the oven cabinet or normal ambient temperature

8.7.4.2 All radiographs shall **be free** from mechanical, chemical or other blemishes to the extent that they do not mask or are not confused with the image of any objectionable imperfection in the area of interest.

8.7.4.3 In general, film viewing shall be by single film. When conditions exist, i.e., tapers, reinforcements, etc., that do not permit film viewing within the minimum density limitation for single film viewing; then composite viewing may be used, provided that the density of the composite set of film satisfies the requirements.

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8.7.4.4 Jika gambar "B" tampak jelas muncul di latar belakang lebih gelap dari film radiografi, hal itu akan menjadi penyebab di tolaknya hasil radiografi. Gambar yang gelap dari "B" di latar belakang lebih

8.7.4.4 If a light image of the "B" appears on a darker background of the radiograph, it shall be the cause for rejection of that radiograph. A dark image of the "B" on a lighter background is not cause for

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terang bukan alasan untuk penolakan.

8.7.5 Density

8.7.5.1 Density film melalui image radiografi dari body IQI hole-type **yang dekat dengan essential lubang yang dipersyaratkan** atau daerah dekat dengan kawat yang diperlukan dari IQI dan daerah dari yang harus dibaca, harus **2.0** minimum untuk single film viewing radiografi dengan sumber sinar gamma dan **1.8** minimum untuk single film viewing radiografi dengan sumber sinar X-ray.

8.7.5.2 Untuk composite dari multiple film exposure, setiap film dari composite set harus mempunyai minimum density 1.3.

8.7.5.3 Maximum density harus 4.0 untuk masing - masing , single atau composite viewing .

8.7.5.4 Density dari radiografi dimanapun didaerah yang diamati variasinya antara minus 15% atau plus 30% dari density body IQI hole-type **yang dekat dengan essential lubang yang dipersyaratkan** atau dekat dengan kawat yang disyaratkan dari IQI tipe kawat.

8.7.5.5 Jika menghitung variasi density yang diizinkan, kalkulasi boleh di bulatkan dalam range yang dijelaskan pada par. 8.7.5 (1 ~ 3).

8.7.5.6 Jika shim digunakan, batasan density plus 30% boleh dilewati, dan minimum persyaratan density diatas tidak digunakan, asalkan sensitivitas IQI memenuhi syarat

8.7.5.7 Toleransi 0.05 density diantara variasi pembacaan densitometer masih diperbolehkan.

8.7.5.8 Pembaca film harus memberikan catatan bahwa pembacaan composit yang digunakan pada laporan Radiografi.

8.7.6 IQI Sensitivity

rejection.

8.7.5 Density

8.7.5.1 The transmitted film density through the radiographic image of the body of **the designed hole-type IQI adjacent to the essential hole** or adjacent to the designated wire of a wire IQI and area of interest shall be **2.0 minimum** for single film viewing radiographs made with gamma ray source and **1.8 minimum** for single film viewing radiographs made with X- ray source.

8.7.5.2 For composite viewing of multiple film exposure, each film of the composite set shall have a **minimum density of 1.3**.

8.7.5.3 **The maximum density shall be 4.0** for either single or composite viewing.

8.7.5.4 The density of the radiograph anywhere through the area of interest varies by more than **minus 15% or plus 30%** from the density of the body of **the designed hole-type IQI adjacent to the essential hole** or adjacent to the designated wire of a wire IQI.

8.7.5.5 When calculating the allowable variation in density, calculation may be rounded to the nearest 0.1 within the range specified in par. 8.7.5 (1 ~ 3).

8.7.5.6 **When shims are used**, the plus 30% density restriction may be exceeded, and the minimum density requirements above do not apply for IQI, provided the required IQI sensitivity meets the requirements.

8.7.5.7 **A tolerance of 0.05** in density is allowed for variations between densitometer readings.

8.7.5.8 The Radiographer shall note on the Radiography Report that Composite viewing was utilized.

8.7.6 IQI Sensitivity

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8.7.6.1 Radiografi harus dilaksanakan dengan teknik sensitivity yang cukup untuk menampilkan gambar type IQI hole yang disyaratkan (termasuk identifikasi material group notche) dan 2T hole, atau kawat yang esensial dari type IQI wire.

Radiografi juga harus menunjukkan nomer dari identifikasi IQI dan hurufnya. Jika gambar 2T lubang dari type IQI hole yang

8.7.6.1 Radiography shall be performed with a technique of sufficient sensitivity to display the designated hole-type IQI image (including applicable material group identification notches) and the **2T** hole, or the essential wire of a wire IQI type.

The radiograph shall also display the IQI identifying numbers and letter. If the **2T**

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diperlukan, atau kawat yang esensial dari type IQI wire, tidak tampak di film dari multiple film teknik, tapi tampak di composite film viewing, interpretasi hanya diizinkan pada composite film viewing saja.

8.7.6.2 Jika type IQI hole diganti lebih tipis atau lebih tebal dari yang di Table 276 (shown in Exhibit A. 1), setara atau lebih baik sensitivitasnya bisa dilaksanakan dan semua syarat–syarat lainnya dari radiography harus dipenuhi.

8.7.6.3 Untuk IQI tipe wire, esensial wire harus kelihatan dalam area interes mewakili ketebalan yang digunakan untuk menentukan esensial wire, termasuk variasi density yang diizinkan yang di jelaskan pada par. **8.7.5**

8.8 Standar Penerimaan

Umum.

Keberterimaan final dari radiograph harus didasarkan pada kemampuan menampilkan gambar lubang (IQI) dan lubang yang disyaratkan atau kawat yang disyaratkan IQI kawat.

8.8.1 ASME BPV Code Section I Para PW-51

Indikasi yang terlihat pada radiography film lasan dan karakter sebagai cacat adalah tidak bisa diterima dengan kondisi sebagai berikut, dan harus direpair dan repair radiography ke PW-51:

8.8.1.1 Semua karakteristik indikasi tipe crack atau zona fusi tidak komplet atau penetrasi tidak komplet tidak dapat di terima.

8.8.1.2 Semua indikasi yang memanjang pada film radiography dengan panjang lebih dari berikut ini :

- **a** 1/4" (6 mm) for T up to 3/4" (19 mm).
- **b** 1/3T for T over 3/4" (19 mm) to 2-1/4"(57 mm).
- **c** 3/4" (19 mm) for T over 2-1/4" (57 mm), Dimana T adalah ketebalan lasan.

hole of designated IQI hole types, or essential wire, do not show on any film in a multiple film technique, but do show in composite film viewing, interpretation shall be permitted only by composite film viewing.

8.7.6.2 If a **thinner or thicker hole** type IQI than listed in Table 276 (shown in Exhibit A. 1) was substituted, an equivalent or better sensitivity is achieved and all other requirements for radiography are met.

8.7.6.3 For wire-type IQIs, the essential wire shall be visible within the area of interest representing the thickness used for determining the essential wire, inclusive of the allowable density variations described in par. **8.7.5**

8.8 Acceptance Standards

General.

Final acceptance of radiographs shall be based on the ability to see the prescribed hole (IQI) image and the specified hole or the designated wire of a wire IQI.

8.8.1 ASME BPV Code Section I Para PW-51

Indications shown on the radiographs of welds and characterized as imperfections are unacceptable under the following conditions, and shall be repaired and the repair radiographed to PW-51:

8.8.1.1 Any indication characterized as a crack or zone of incomplete fusion or penetration are not acceptable.

8.8.1.2 Any other elongated indication on the radiograph which has a length greater than the following :

- **a** 1/4" (6 mm) for T up to 3/4" (19 mm).
- **b** 1/3T for T over 3/4" (19 mm) to 2-1/4"(57 mm).
- **c** 3/4" (19 mm) for T over 2-1/4" (57 mm), where t is the thickness of the weld

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8.8.1.3 Suatu grup dari cacat dalam satu garis lurus yang memiliki jumlah panjang lebih dari T dari 12T, kecuali bila jarak antara cacat melebihi 6L dimana L adalah panjang dari cacat terpanjang dalam grup itu tidak dapat di terima; dan T adalah ketebalan pengelasan termasuk reinforcement yang di

8.8.1.3 Any group of aligned indications that have an aggregate length greater than T in a length of 12T, except when the distance between the successive imperfections exceeds 6L where L is the length of the longest imperfection in a group are not acceptable; and T is the deposited weld metal

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ijinkan.

8.8.1.4 Indikasi bulat yang melebihi dari spesifikasi standar yang diterima di tentukan dalam Appendix A Para A-250 dari ASME BPV Code Sect. I adalah tidak dapat di terima. Pengelasan yang ada semua type ketidak sempurnaan harus di tentukan tidak dapat di terima.

Catatan: Gambar Density. Density diantara indikasi bisa bervariasi dan tidak dijadikan sebagai penerimaan atau penolakan.

8.8.2 ASME BPV Code Sect. VIII Div.1 Para UW-51 (full examination of welds)

Indikasi yang ditunjukkan oleh radiography lasan yang melebihi criteria berikut adalah tidak diterima dan dianggap sebagai defect. Defect harus direpair dan repair area harus di uji ulang.

Sebagai gantinya dari uji ulang radiography repair area boleh di uji dengan ultrasonic sesuai dengan Mandatory Appendix 12 tergantung opsi dari Manufacture. Untuk material melebihi 1 in.(25 mm), persetujuan dari user diperlukan :

8.8.2.1 Semua karakteristik indikasi tipe crack atau zona fusi tidak komplet atau penetrasi tidak komplet

8.8.2.2 Semua indikasi slag yang memanjang dengan panjang lebih dari berikut ini :

- **a** 1/4" (6 mm) for T up to 3/4" (19 mm).
- **b** 1/3T for T over 3/4" (19 mm) to 2-1/4"(57 mm).
- **c** 3/4" (19 mm) for T over 2-1/4" (57 mm),

Dimana T adalah ketebalan pengelasan tidak termasuk reinforcement yang di ijinkan. Untuk pengelasan sambungan Butt join antara dua bagian yang memiliki perbedaan ketebalan pada pengelasan, T adalah ketebalan yang tipis. Jika pengelasan penetrasi penuh termasuk pengelasan fillet, tebal dari throat fillet harus di masukan dalam T

thickness including allowable reinforcement.

8.8.1.4 Rounded indications in excess of that specified by the acceptance standards given in the Appendix A Para A-250 of ASME BPV Code Sect. I are not acceptable. Weld having any the following type of imperfections shall be judged unacceptable.

Note : Image Density. Density within the indication may vary and is not a criterion for acceptance or rejection

8.8.2 ASME BPV Code Sect. VIII Div.1 Para UW-51 (full examination of welds)

Indications revealed by radiography within a weld that exceed the following criteria are unacceptable and therefore are defects. Defects shall be repaired and the repaired area shall be reexamined.

In lieu of reexamination by radiography, the repaired weld may be ultrasonically examined in accordance with Mandatory Appendix 12 at the Manufacturer's option. For material thicknesses in excess of 1 in.(25 mm), the concurrence of the user shall be obtained :

8.8.2.1 Any indication characterized as a crack or zone of incomplete fusion or penetration

8.8.2.2 Any other elongated indication which has a length greater than the following:

- **a** 1/4" (6 mm) for T up to 3/4" (19 mm).
- **b** 1/3T for T over 3/4" (19 mm) to 2-1/4"(57 mm).
- **c** 3/4" (19 mm) for T over 2-1/4" (57 mm),

Where T is the thickness of the weld excluding any allowable reinforcement. For a butt weld joining two members having different thicknesses at the weld, T is the thinner of the two thicknesses. If a full penetration weld includes a fillet weld, the thickness of the throat of the fillet shall be included in T.

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8.8.2.3 Suatu grup dari cacat dalam satu garis lurus yang memiliki jumlah panjang lebih dari T dari 12T, kecuali bila jarak antara cacat melebihi 6L dimana L adalah panjang dari cacat terpanjang dalam grup itu tidak dapat di terima

8.8.2.3 Any group of aligned indications that have an aggregate length greater than T in a length of 12T, except when the distance between the successive imperfections exceeds 6L where L is the length of the longest imperfection in a group are not acceptable.

8.8.2.4 Indikasi bulat yang melebihi dari

8.8.2.4 Rounded indications in excess of that

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spesifikasi standar yang diterima di tentukan dalam **Mandatory Appendix 4** dari ASME BPV Code Sect. VIII Div.1 (terlampir)

8.8.3 ASME BPV Code Sect. VIII Div.1 Para UW-52 (spot examination of welds)

Berikut ini adalah tidak dapat di terima :

8.8.3.1 Pengelasan dimana indikasi dengan karakteristik tipe crack atau zona fusi tidak komplet atau penetrasi tidak komplet tidak dapat di terima.

8.8.3.2 Pengelasan dimana ada indikasi dengan karakteristic slag inclusions atau cavities adalah tidak dapat di terima jika panjang indikasi lebih dari 2/3 t dimana t adalah tebal dari pengelasan tidak termasuk reinforcement yang dijinkan.

Untuk pengelasan sambungan Butt join antara dua bagian yang memiliki perbedaan ketebalan pada pengelasan, **t** adalah ketebalan yang tipis dari kedua ketebalan. Jika pengelasan penetrasi penuh termasuk pengelasan fillet, tebal dari throat fillet harus di masukan **t.**

Untuk semua ketebalan, indikasi kurang dari 1/4 in. (6 mm) adalah diterima, dan indikasi lebih besar dari 3/4 in. (19 mm) adalah tidak diterima.

Beberapa indikasi yang segaris memenuhi kriteria keberterimaan ini adalah diterima jika jumlah dari ukuran indikasi terpanjang tidak melebihi t dalam panjang 6t (atau secara proposonal radiography film kurang daro 6t), dan jika yang terpanjang L untuk setiap indikasi dipisahkan oleh jarak tidak kurang dari 3L dari indikasi yang berdekatan

8.8.3.3 Indikasi bulat yang bukan factor di terimanya dari pengelasan tidak perlu seluruhnya di radiographi.

8.8.4 ASME BPV Code Sect. VIII Div.2 Para 7.5.3.2

specified by the acceptance standards given in the **Mandatory Appendix 4** of ASME BPV Code Sect. VIII Div.1 (attached)

8.8.3 ASME BPV Code Sect. VIII Div.1 Para UW-52 (spot examination of welds)

The following are not acceptable,

8.8.3.1 Weld in which indications are characterized as a crack or zone of incomplete fusion or penetration are not acceptable.

8.8.3.2 Welds in which indications are characterized as slag inclusions or cavities are not acceptable if the length of such indication is greater than 2/3 t where t is the thickness of the weld excluding any allowable reinforcement.

For a butt weld joining two members having different thicknesses at the weld, t is the thinner of the two thicknesses. If a full penetration weld includes a fillet weld, the thickness of the throat of the fillet shall be included in t.

For all thicknesses, indications less than 1/4 in. (6 mm) are acceptable, and indications greater than 3/4 in. (19 mm) are unacceptable.

Multiple aligned indications meeting these acceptance criteria are acceptable when the sum of their longest dimensions indications does not exceed t within a length of 6t (or proportionally for radiographs shorter than 6t), and when the longest length L for each indication is separated by a distance not less than 3L from adjacent indications.

8.8.3.3 Rounded indications are not a factor in the acceptability of the welds not required to be fully radiographed

8.8.4 ASME BPV Code Sect. VIII Div.2 Para 7.5.3.2

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Indikasi yang ditunjukkan oleh radiography lasan dan karakternya sebagai defect adalah tidak diterima dengan syarat yang di list di paragraph ini dan harus direpair. Repair lasan harus di uji ulang, salah satu dengan radiography

Indications shown on the radiographs of welds and characterized as defects are unacceptable under the conditions listed in this paragraph and shall be repaired. Repaired welds shall be re-examined, either by radiography in accordance with

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sesuai paragraph ini atau, opsi dari Manufacture, dengan ultrasonic sesuai dengan 7.5.4 or 7.5.5 ASME BPV Code Sect. VIII Div. 2

this paragraph or, at the option of the Manufacturer, ultrasoni-cally in accordance with 7.5.4 or 7.5.5 ASME BPV Code Sect. VIII Div. 2

8.8.4.1 Indikasi memanjang

Teminology : ketebalan **t** – ketebalan pengelasan **tidak termasuk** reinforcement yang di ijinkan. Untuk pengelasan sambungan Butt join antara dua bagian yang memiliki perbedaan ketebalan pada pengelasan, **t** adalah ketebalan yang tipis dari kedua ketebalan. Jika pengelasan penetrasi penuh termasuk pengelasan fillet, tebal dari throat fillet harus di masukan dalam **t**

8.8.4.1 Linear Indications

Teminology : Thickness t – the thickness of the weld **excluding** any allowable reinforcement. For a butt weld joining two members having different thicknesses at the weld, t is the thinner of these two thicknesses. If a full penetration weld includes a fillet weld, the thickness of the fillet throat shall be included in the calculation of t

8.8.4.2 Kriteria di terima atau di tolak

a. Semua tipe crack atau fusi tidak komplet atau penetrasi tidak komplet

b. Semua indikasi yang memanjang dengan panjang lebih dari:
- 6 mm (1/4 in) dari t kurang dari atau sama dengan19 mm (3/4 in),
- t / 3 dari t lebih dari 19 mm (3/4 in) dan kurang dari atau sama dengan 57 mm (2 1/4 in),
- 19 mm (3/4 in) dari t lebih dari 57 mm (2 1/4 in).

c. Suatu grup dari cacat dalam satu garis lurus yang memiliki jumlah panjang lebih dari t dari 12t, kecuali bila jarak antara cacat melebihi 6L dimana L adalah panjang dari cacat terpanjang dalam grup

d. Kondisi Internal root weld dapat di teima ketika density atau perubahan gambar lebih terang seperti yang di tunjukan dalam radiograf tidak drastis. Indikasi memanjang pada radiograf di kedua tepi kondisi seperti harus di evaluasi sesuai dengan paragraf ini.

8.8.4.2 Acceptance / Rejection Criteria

a. Any crack or zone of incomplete fusion or lack of penetration

b. Any other linear indication that has a length greater than:
- 6 mm (1/4 in) for t less than or equal to 19 mm (3/4 in),
- t / 3 for t greater than 19 mm (3/4 in) and less than or equal to 57 mm (2 1/4 in),
- 19 mm (3/4 in) for t greater than 57 mm (2 1/4 in).

c. Any group of aligned indications that have an aggregate length greater than t in a length of 12t, except when the distance between the successive imperfections exceeds 6L where L is the length of the longest imperfection in a group.

d. Internal root weld conditions are acceptable when the density or image brightness change as indicated in the radiograph is not abrupt. Linear indications on the radiograph at either edge of such conditions shall be evaluated in accordance with the other sections of this paragraph.

8.8.4.3 Indikasi Bulat :

1 Terminology
Indikasi bulat terminology dijelaskan di para 7.5.3.2.(b) (1) (a, b, c) dari ASME BPV Code Sect. VIII Div. 2

2 Indikasi bulat yang melebihi dari spesifikasi standar penerimaan yang di tunujukan di para 7.5.3.2.(b) (2) of ASME BPV Code Sect. VIII Div. 2 adalah tidak bisa di terima

8.8.4.3 Rounded Indications

1 Terminology
Rounded indication terminology as stated in para 7.5.3.2.(b) (1) (a, b, c) of ASME BPV Code Sect. VIII Div. 2

2 Rounded indications in excess of that specified by the acceptance standards given in the para 7.5.3.2.(b) (2) of ASME BPV Code Sect. VIII Div. 2 are not acceptable

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8.8.5 ASME BPV Code Sect. IX Para QW-191.1.2

8.8.5.1 Indikasi memanjang

a. Semua tipe crack atau fusi tidak komplet atau penetrasi tidak komplet tidak dapat di terima.

b Semua indikasi slag yang memanjang dengan panjang lebih dari berikut ini tidak dapat di terima:
- 3 mm (1/8 in) dari t hingga 10 mm (3/8 in), inclusive
- 1 / 3t dari t lebih dari 10 mm (3/8 in) hingga 57 mm (2 1/4 in), inclusive
- 19 mm (3/4 in) dari t lebih dari 57 mm (2 1/4 in).

c. Suatu group dari slag inclusions dalam satu garis lurus yang memiliki jumlah panjang lebih dari T dari 12T, kecuali bila jarak antara cacat melebihi 6L dimana L adalah panjang dari cacat terpanjang dalam grup itu adalah tidak dapat di terima, dan dimana T adalah ketebalan pengelasan yang di ijinkan.

8.8.5.2 Indikasi bulat dimana melebihi dari batasan yang di ijinkan berikut ini adalah tidak dapat di terima,

a. Maximum dimensi yang dizinkan untuk indikasi bulat harus 20% dar t atau 1/8 in (3 mm), dimana yang lebih kecil,

b. Untuk las di material ketebalan kurang dari 1/8 in (3 mm), jumlah maximum dari indikasi bulat yang diterima tidak boleh lebih dari 12 dalam 6 in. (150 mm) panjang lasan. Secara proporsinal jumlah lebih sedikit dari indikasi bulat harus diterima dalam lasan kurang dari 6 in. (150 mm) panjang.

c. Untuk lasan di material dengan tebal 1/8 in. (3 mm) atau lebih tebal, **Figure QW. 191.1.2.2 (b) (4)** menggambarkan maximum indikasi bulat yang bisa diterima yang digambarkan typical dari clustered, assorted and randomly dispersed configuration. Indikasi bulat dengan diameter maximum kurang dari 1/32 in. (0.8 mm) tidak dianggap dalam standard penerimaan radiografi untuk welder dan welding operator dalam range ketebalan material.

8.8.5 ASME BPV Code Sect. IX Para QW-191.1.2

8.8.5.1 Linear Indications

a. Any type of crack or zone of incomplete fusion or penetration are not acceptable.

b Any elongated slag which has a length greater than the following are not acceptable:
- 3 mm (1/8 in) for t up to 10 mm (3/8 in), inclusive
- 1 / 3t for t over 10 mm (3/8 in) to 57 mm (2 1/4 in), inclusive
- 19 mm (3/4 in) for t over 57 mm (2 1/4 in).

c. Any group of slag inclusions in line that have an aggregate length greater than t in a length of 12t, except when the distance form the successive imperfections exceeds 6L where L is the length of the longest imperfection in that group are not acceptable, and where t is the deposited weld metal thickness exluding allowable weld metal thickness.

8.8.5.2 Rounded indications which exceed the limits given below are not acceptable,

a. The maximum permissible dimension for rounded indications shall be 20% of t or 3 mm (1/8 in.) whichever is smaller,

b. For welds in materials less than 3 mm (1/8 in.) in thickness, the maximum number of acceptable rounded indications shall not exceed 12 in a 150 mm (6 in.) length of weld. A proportionately fewer number of rounded indications shall be permitted in welds less than 150 mm (6 in.) in length.

c. For welds in material 3 mm (1/8in.) or greater in thickness , the charts in **Figure QW. 191.1.2.2 (b) (4)** represent the maximum acceptable types of rounded indications illustrated in typically clustered, assorted and randomly dispersed configurations. Rounded indications less than 0.8 mm (1/32 in.) in maximum diameter shall not be considered in radiographic acceptance tests of welders and welding operators in these ranges of material thicknesses.

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8.8.6 ASME Code B31.1 Power Piping Para 136.4.5

8.8.6.1 Pengelasan yang di tunjukan di radiografi dan memiliki salah satu tipe discontinuities berikut ini adalah tidak dapat di terima:

a. Semua tipe crack atau fusi tidak komplet atau penetrasi tidak komplet,

b. Semua indikasi slag dengan panjang lebih dari berikut ini tidak dapat di terima:
- 6 mm (1/4 in) dari t hingga 19 mm (3/4 in),
- 1 / 3t dari t mulai19 mm (3/4 in) sampai 57 mm (2 1/4 in), inclusive
- 19 mm (3/4 in) dari t lebih dari 57 mm (2 1/4 in) dimana t adalah ketebalan paling tipis dari bagian pengelasan,

c. Suatu grup dari indikasi dalam satu garis lurus yang memiliki jumlah panjang lebih dari T dari 12T, kecuali bila jarak antara cacat melebihi 6L dimana L adalah panjang dari indikasi cacat dalam grup itu.

d. Porosity melebihi yang di tunjukan sebagai di terimanya dalam Appendix A Para A-250 atau ASME BPV Code Section I,

e. Root concavity jika terdapat perbedaan density yang drastis, terlihat di radiograph.

8.9 Dokumentasi

Hasil dari radiography harus didokumentasikan kedalam Report Radiography terlampir atau yang serupa, bersama dengan film radiography harus disimpan sesuai dengan persyaratan dari Section Code yang yang dipakai atau persyaratan Customer.

8.8.6 ASME Code B31.1 Power Piping Para 136.4.5

8.8.6.1 Welds what are shown by radiography to have any of the following types of discontinuities are unacceptable:

a. Any type of crack or zone of incomplete fusion or penetration,

b. Any other elongated indication which has a length greater than:
- 6 mm (1/4 in) for t up to 19 mm (3/4 in),
- 1 / 3t for t from 19 mm (3/4 in) to 57 mm (2 1/4 in), inclusive
- 19 mm (3/4 in) for t over 57 mm (2 1/4 in) where t is the thickness of the thinner portion of weld,

c. Any group of indications in line that have an aggregate length greater than t in a length of 12t, except where the distance between the successive indications exceeds 6L where L is the longest indication in the group,

d. Porosity in excess of that shown as acceptable in Appendix A Para A-250 of ASME BPV Code Section I,

e. Root concavity when there is an abrupt change in density, as indicated on the radiograph

8.9 Documentation

The results of radiographic shall be documented in the attached Radiographic Report or in the typical report, together with the radiograph films shall be maintained in accordance with the requiremnts of other applicable Code Section or Customer's requirements.

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RADIOGRAPHIC TEST REPORT

Page ..... of .....

Project Name : Customer : Job no. : Unit no. :	Drawing No . :.....Rev..... Procedure No. :.....Rev..... Applicable CODE :.....	Report No :.....- RT-..... NCR Ref No :.....

PART

Name :.....

ID/OD :.....

Mat'l Type :.....

Mat'l.Thk. :..... In ☐ mm☐

Reinforc. Thk. :..... In ☐ mm☐

Weld Thk. :..... In ☐ mm☐

Backing Ring : Yes ☐ No☐

FILM

Manufacture's :.....

.....

Type of Film :.....

Dimension :.....X .....In

SCREEN

Lead : Front☐ Back☐

Thickness :..... In ☐ mm☐

RADIATION SOURCE

Isotope : Ir-192 ☐ X-Ray ☐

Activity :..... Ci Volt : ..... Amp. : .....

Source / spot Size.....mm

TECHNIQUE

Exposure : Single Wall Double Wall ☐

Viewing : Single Wall Double Wall ☐

Exposure Time.....Mnt

Min. SOD* :..... Mm Min. DSSOF**..... mm

No.of Film in Holder : Single☐ Multiple☐

IMAGE QUALITY INDICATOR (IQI)

Wire ☐ No. :.....1☐ 2☐ 3☐ 4☐ 4☐ 6☐

Hole ☐ No. :..... 1T☐ 2T☐ 4T☐

Placement : Source Side ☐ Film Side ☐

Block Thickness ..... Mm

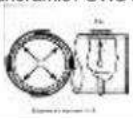
MARKER PLACEMENT

Source Side ☐ Film Side ☐

Use back scatter Yes ☐ No ☐

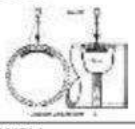
EXPOSURE TECHNIQUE SKETCH

☐Panoramic / SWSV

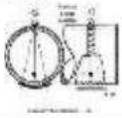


☐SWSV

☐SWSV

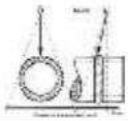


☐DWSV

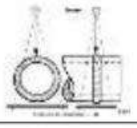


☐DWSV

☐DWDV



☐DWDV



☐ SWSV

Notes for Sketch :

1). **SWSV** = Single Wall Single Viewing
2). **DWSV** = Double Wall Single Viewing
3). **DWDV** = Double Wall Double Viewing
4). **Other** = Other than listed (Please Sketch)

Date of RT	Welder Stamp	Identification		*Result*		*Density*			Sensitivity	Discontinuities Type								Remark & Comment
		Joint No	Location	ACC	REJ	IQI	Min	Max		IF	IP	RC	RUC	P	Incl	Crk	ND	

Examined by :	Reviewed by :	Reviewed by :	Reviewed by :
Nde Level : Date :	Date :	Date :	Date :

Note : *) SOD = Source to Object Distance, **) DSSOF = Distance from Source Side of Object to the Film at the minimum Source to Object Distance
IF = Incomplete Fusion, IP = Incomplete Penetration, RC = Root Concavity, RUC = Root Undercut, P = Porosity, Incl = Inclusion, Crk = Crack, ND = no indication

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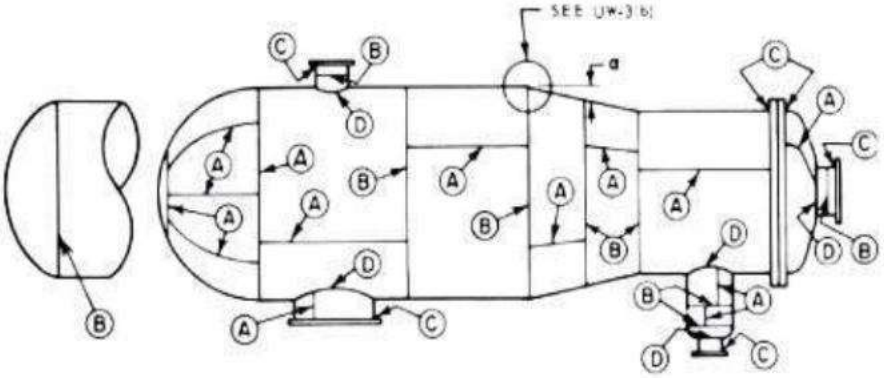
FIG. UW-3 ILLUSTRATION OF WELDED JOINT LOCATIONS TYPICAL OF CATEGORIES A, B, C, AND D



Reinforcement TABLE **

ASME I AND ASME VIII, DIV. 1

MAXIMUM REINFORCEMENT ; INCH (mm)

NOMINAL THICKNESS, INCH (mm)	JOINT CATEGORY		OTHER WELDS	
	SECT. VIII, Div 1 Category B & C Butt weld	SECT. I Circumferential joint in Pipe & tubing	SECT. VIII, Div 1	SECT. I
Less than 3/32 (2.4)	3/32 (2.5)	NA	1/32 (0.8)	NA
3/32 (2.4) to 3/16 (4.8), incl.	1/8 (3)	NA	1/16 (1.5)	NA
Up to 1/8 (3)	NA	3/32 (2.5)	NA	3/32 (2.5)
1/8 (3) to 3/16 (5), incl.	NA	1/8 (3)	NA	3/32 (2.5)
Over 3/16 (4.8) to ½ (13), incl.	5/32 (4)	5/32 (4)	3/32 (2.5)	3/32 (2.5)
Over ½ (13) to 1 (25), incl.	3/16 (5)	3/16 (5)	3/32 (2.5)	3/32 (2.5)
Over 1 (25) to 2 (51), incl.	1/4 (6)	1/4 (6)	1/8 (3)	1/8 (3)
Over 2 (51) to 3 (76), incl.	1/4 (6)	*	5/32 (4)	5/32 (4)
Over 3 (76) to 4 (102), incl.	1/4 (6)	*	7/32 (5.5)	7/32 (5.5)
Over 4 (102) to 5 (127), incl.	1/4 (6)	*	1/4 (6)	1/4 (6)
Over 5 (127)	5/16 (8)	*	5/16 (8)	5/16 (8)

Notes :

*** The greater of 1/4 in. (6 mm) or 1/8 times the width of the weld in inches (mm).**

**** See General note.**

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ASME B31.1
Reinforcement of Girth and Longitudinal Butt Welds

	MAXIMUM THICKNESS OF REINFORCEMENT FOR DESIGN TEMPERATURE		
THICKNESS OF BASE METAL, in. (mm)	Over 750° F (400° C)	350° F - 750° F (175° C - 400° C)	Under 350° F (175° C)
Up to 1/8 (3.0), incl.	1/16 (2.0)	3/32 (2.5)	3/16 (5.0)
Over 1/8 to 3/16 (3.0 to 5.0), incl.	1/16 (2.0)	1/8 (3.0)	3/16 (5.0)
Over 3/16 to 1/2 (5.0 to 13.0), incl.	1/16 (2.0)	5/32 (4.0)	3/16 (5.0)
Over 1/2 to 1 (13.0 to 25.0), incl.	3/32 (2.5)	3/16 (5.0)	3/16 (5.0
Over 1 to 2 (25.0 to 50.0), incl.	1/8 (3.0)	1/4 (6.0)	1/4 (6.0)
Over 2(50.0)	5/32 (4.0)	The greater of ¼ in. (6 mm) or 1/8 times the width of the weld in inches (millimeters)	

General Notes :

1. For double welded butt joints, this limitation or reinforcement given above shall apply separately to both inside and outside surface of joint.
2. For single welded butt joints, the reinforcement limits given above shall apply to the outside surface of the joint only. (For ASME Code, Section I welds, the reinforcement limits apply to both inside and outside surfaces of the joint).
3. The thickness of weld reinforcement shall be based on the thickness of the thinner of the materials being joined.
4. The weld reinforcement thickness shall be determined from the higher of the abutting surfaces involved.
5. Weld reinforcement may be removed if so desired
6. Concavity due to the welding process on the root side of single welded circumferential butt weld is permitted when the resulting thickness of the weld is at least equal to the thickness of the thinner member of the two sections being joined and the contour of the concavity is smooth.

ASME VIII, Division 2
Maximum Reinforcement For Welded Joints

Section Thickness	Circumferential Joint in Pipe and Tubing	Other welds
2.5 mm (3/32 in) < t	2.5 mm (3/32 in)	0.8 mm (1/32 in)
2.5 mm (3/32 in) ≤ t < 5 mm (3/16 in)	2.5 mm (3/32 in)	1.5 mm (1/16 in)
5 mm (3/16 in) ≤ t < 13 mm (½ in)	3 mm (1/8 in)	2.5 mm (3/32 in)
13 mm (½ in) ≤ t < 25 mm (1 in)	4 mm (5/32 in)	2.5 mm (3/32 in)
25 mm (1 in) ≤ t < 50 mm (2 in)	4 mm (5/32 in)	3 mm (1/8 in)
50 mm (2 in) ≤ t < 76 mm (3 in)	4 mm (5/32 in)	4 mm (5/32 in)
76 mm (3 in) ≤ t < 100 mm (4 in)	5.5 mm (7/32 in)	5.5 mm (7/32 in)
100 mm (4 in) ≤ t < 125 mm (5 in)	6 mm (¼ in)	6 mm (¼ in)
T > 125 mm (5 in)	8 mm (5/16 in)	8 mm (5/16 in)
General Notes : ***t is the nominal thickness of the thinner section of weld joint***		

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EXHIBIT A.

Table T-276
IQI Selection (21)

Nominal Single-Wall Material Thickness Range, in. (mm)	IQI					
	Source Side			Film Side		
	Hole-Type Designation	Essential Hole	Wire-Type Essential Wire	Hole-Type Designation	Essential Hole	Wire-Type Essential Wire
≤0.25 (≤6.4)	12	2T	5	10	2T	4
>0.25 through 0.375 (>6.4 through 9.5)	15	2T	6	12	2T	5
>0.375 through 0.50 (>9.5 through 12.7)	17	2T	7	15	2T	6
>0.50 through 0.75 (>12.7 through 19.0)	20	2T	8	17	2T	7
>0.75 through 1.00 (>19.0 through 25.4)	25	2T	9	20	2T	8
>1.00 through 1.50 (>25.4 through 38.1)	30	2T	10	25	2T	9
>1.50 through 2.00 (>38.1 through 50.8)	35	2T	11	30	2T	10
>2.00 through 2.50 (>50.8 through 63.5)	40	2T	12	35	2T	11
>2.50 through 4.00 (>63.5 through 101.6)	50	2T	13	40	2T	12
>4.00 through 6.00 (>101.6 through 152.4)	60	2T	14	50	2T	13
>6.00 through 8.00 (>152.4 through 203.2)	80	2T	16	60	2T	14
>8.00 through 10.00 (>203.2 through 254.0)	100	2T	17	80	2T	16
>10.00 through 12.00 (>254.0 through 304.8)	120	2T	18	100	2T	17
>12.00 through 16.00 (>304.8 through 406.4)	160	2T	20	120	2T	18
>16.00 through 20.00 (>406.4 through 508.0)	200	2T	21	160	2T	20

Table T-283
Equivalent Hole-Type IQI Sensitivity

Hole-Type Designation	Equivalent Hole-Type Designations	
2*T* Hole	1*T* Hole	4*T* Hole
10	15	5
12	17	7
15	20	10
17	25	12
20	30	15
25	35	17
30	40	20
35	50	25
40	60	30
50	70	35
60	80	40
80	120	60
100	140	70
120	160	80
160	240	120
200	280	140

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EXHIBIT A.

TABLE T-233.1
HOLE-TYPE IQI DESIGNATION, THICKNESS, AND HOLE DIAMETERS

IQI Designation	IQI Thickness, in. (mm)	1*T* Hole Diameter, in. (mm)	2*T* Hole Diameter, in. (mm)	4*T* Hole Diameter, in. (mm)
5	0.005 (0.13)	0.010 (0.25)	0.020 (0.51)	0.040 (1.02)
7	0.0075 (0.19)	0.010 (0.25)	0.020 (0.51)	0.040 (1.02)
10	0.010 (0.25)	0.010 (0.25)	0.020 (0.51)	0.040 (1.02)
12	0.0125 (0.32)	0.0125 (0.32)	0.025 (0.64)	0.050 (1.27)
15	0.015 (0.38)	0.015 (0.38)	0.030 (0.76)	0.060 (1.52)
17	0.0175 (0.44)	0.0175 (0.44)	0.035 (0.89)	0.070 (1.78)
20	0.020 (0.51)	0.020 (0.51)	0.040 (1.02)	0.080 (2.03)
25	0.025 (0.64)	0.025 (0.64)	0.050 (1.27)	0.100 (2.54)
30	0.030 (0.76)	0.030 (0.76)	0.060 (1.52)	0.120 (3.05)
35	0.035 (0.89)	0.035 (0.89)	0.070 (1.78)	0.140 (3.56)
40	0.040 (1.02)	0.040 (1.02)	0.080 (2.03)	0.160 (4.06)
45	0.045 (1.14)	0.045 (1.14)	0.090 (2.29)	0.180 (4.57)
50	0.050 (1.27)	0.050 (1.27)	0.100 (2.54)	0.200 (5.08)
60	0.060 (1.52)	0.060 (1.52)	0.120 (3.05)	0.240 (6.10)
70	0.070 (1.78)	0.070 (1.78)	0.140 (3.56)	0.280 (7.11)
80	0.080 (2.03)	0.080 (2.03)	0.160 (4.06)	0.320 (8.13)
100	0.100 (2.54)	0.100 (2.54)	0.200 (5.08)	0.400 (10.16)
120	0.120 (3.05)	0.120 (3.05)	0.240 (6.10)	0.480 (12.19)
140	0.140 (3.56)	0.140 (3.56)	0.280 (7.11)	0.560 (14.22)
160	0.160 (4.06)	0.160 (4.06)	0.320 (8.13)	0.640 (16.26)
200	0.200 (5.08)	0.200 (5.08)	0.400 (10.16)	. . .
240	0.240 (6.10)	0.240 (6.10)	0.480 (12.19)	. . .
280	0.280 (7.11)	0.280 (7.11)	0.560 (14.22)	. . .

EXHIBIT A. 3

TABLE T-233.2
WIRE IQI DESIGNATION, WIRE DIAMETER, AND WIRE IDENTITY

Set A			Set B		
Wire Diameter, in.	(mm)	Wire Identity	Wire Diameter, in.	(mm)	Wire Identity
0.0032	(0.08)	1	0.010	(0.25)	6
0.004	(0.10)	2	0.013	(0.33)	7
0.005	(0.13)	3	0.016	(0.41)	8
0.0063	(0.16)	4	0.020	(0.51)	9
0.008	(0.20)	5	0.025	(0.64)	10
0.010	(0.25)	6	0.032	(0.81)	11

Set C			Set D		
Wire Diameter, in.	(mm)	Wire Identity	Wire Diameter, in.	(mm)	Wire Identity
0.032	(0.81)	11	0.100	(2.54)	16
0.040	(1.02)	12	0.126	(3.20)	17
0.050	(1.27)	13	0.160	(4.06)	18
0.063	(1.60)	14	0.200	(5.08)	19
0.080	(2.03)	15	0.250	(6.35)	20
0.100	(2.54)	16	0.320	(8.13)	21

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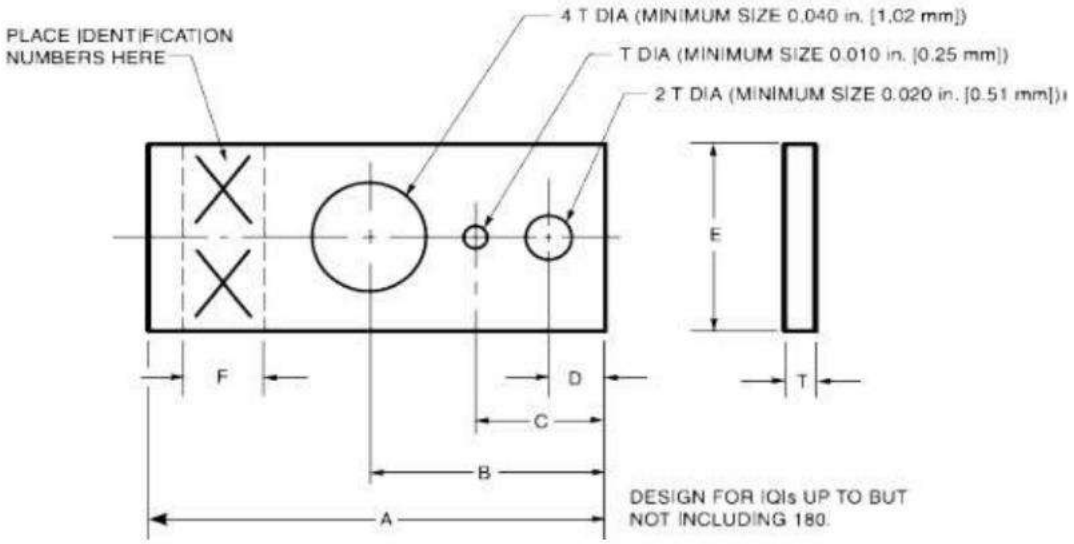
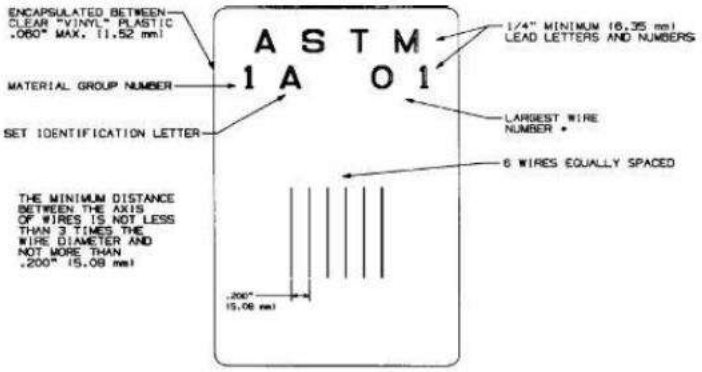
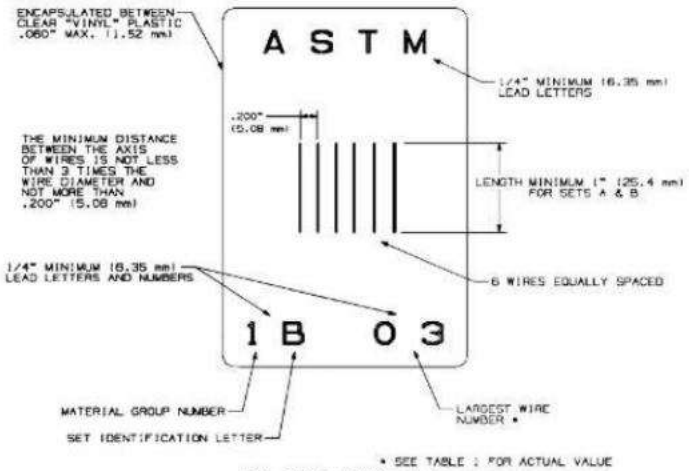
EXHIBIT A. 4





* SEE TABLE 1

FIG. A1.2 Set A/Alternate 2



* SEE TABLE 1 FOR ACTUAL VALUE

FIG. A1.3 Set B/Alternate 1

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EXHIBIT B

FIG. A-210-1 SINGLE-WALL RADIOGRAPHIC TECHNIQUES

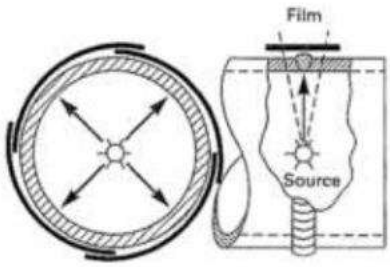
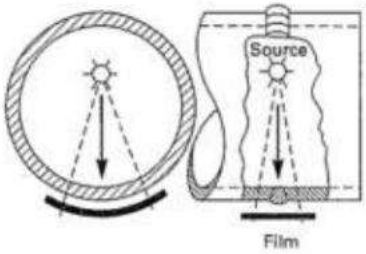
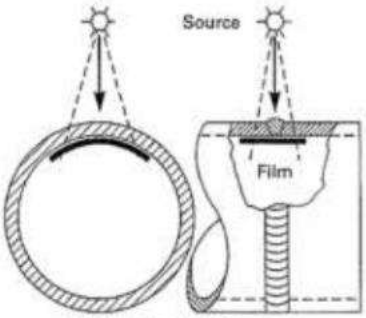
O.D.	Exposure Technique	Radiograph Viewing	Source-Weld-Film Arrangement		IQI		Location Marker Placement
			End View	Side View	Selection	Placement	
Any	Single-Wall T-271.1	Single-Wall	 Exposure Arrangement — A		T-276 and Table T-276	Source Side T-277.1(a) Film Side T-277.1(b)	Either Side T-275.3 T-275.1(c)
Any	Single-Wall T-271.1	Single-Wall	 Exposure Arrangement — B		T-276 and Table T-276	Source Side T-277.1(a) Film Side T-277.1(b)	Film Side T-275.1 (b)(1)
Any	Single-Wall T-271.1	Single-Wall	 Exposure Arrangement — C		T-276 and Table T-276	Source Side T-277.1(a) Film Side T-277.1(b)	Source Side T-275.1 (a)(3)

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EXHIBIT B (continued)

FIG. A-210-2 DOUBLE-WALL RADIOGRAPHIC TECHNIQUES

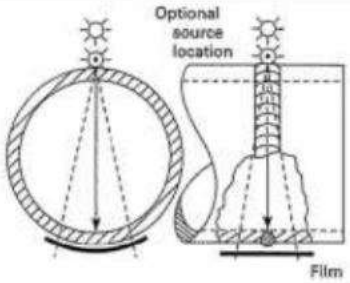
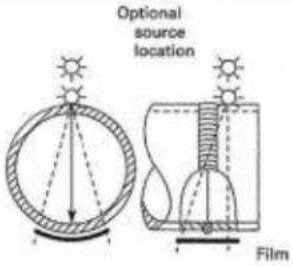
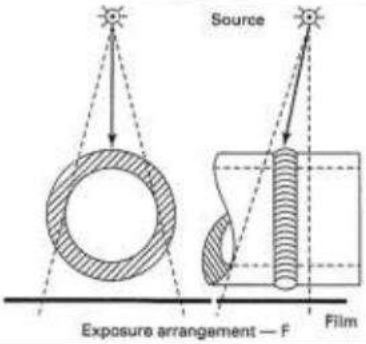
O.D.	Exposure Technique	Radiograph Viewing	Source-Weld-Film Arrangement: End View	Source-Weld-Film Arrangement: Side View	IQI: Selection	IQI: Placement	Location Marker Placement
Any	Double-Wall: T-271.2(a) at Least 3 Exposures 120 deg to Each Other for Complete Coverage	Single-Wall	 Exposure arrangement — D		T-276 and Table T-276	Source Side T-277.1(a) Film Side T-277.1(b)	Film Side T-275.1 (b)(1)
Any	Double-Wall: T-271.2(a) at least 3 Exposures 120 deg to Each Other for Complete Coverage	Single-Wall	 Exposure arrangement — E		T-276 and Table T-276	Source Side T-277.1(a) Film Side T-277.1(b)	Film Side T-275.1 (b)(1)
3½ in. (88 mm) or Less	Double-Wall T-271.2(b)(1) at Least 2 Exposures at 90 deg to Each Other for Complete Coverage	Double-Wall (Ellipse): Read Offset Source Side and Film Side Images	 Exposure arrangement — F		T-276 and Table T-276	Source Side T-277.1(a)	Either Side T-275.2

FIG. A-210-2 DOUBLE-WALL RADIOGRAPHIC TECHNIQUES (CONT'D)

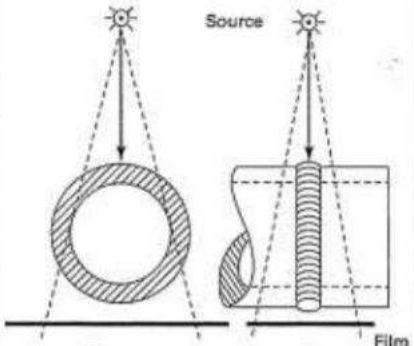
O.D.	Exposure Technique	Radiograph Viewing	Source-Weld-Film Arrangement: End View	Source-Weld-Film Arrangement: Side View	IQI: Selection	IQI: Placement	Location Marker Placement
3½ in. (88 mm) or Less	Double-Wall: T-271.2(b)(2) at Least 3 Exposures at 60 deg or 120 deg to Each Other for Complete Coverage	Double-Wall: Read Superimposed Source Side and Film Side Images	 Exposure arrangement — G		T-276 and Table T-276	Source Side T-277.1(a)	Either Side T-275.2

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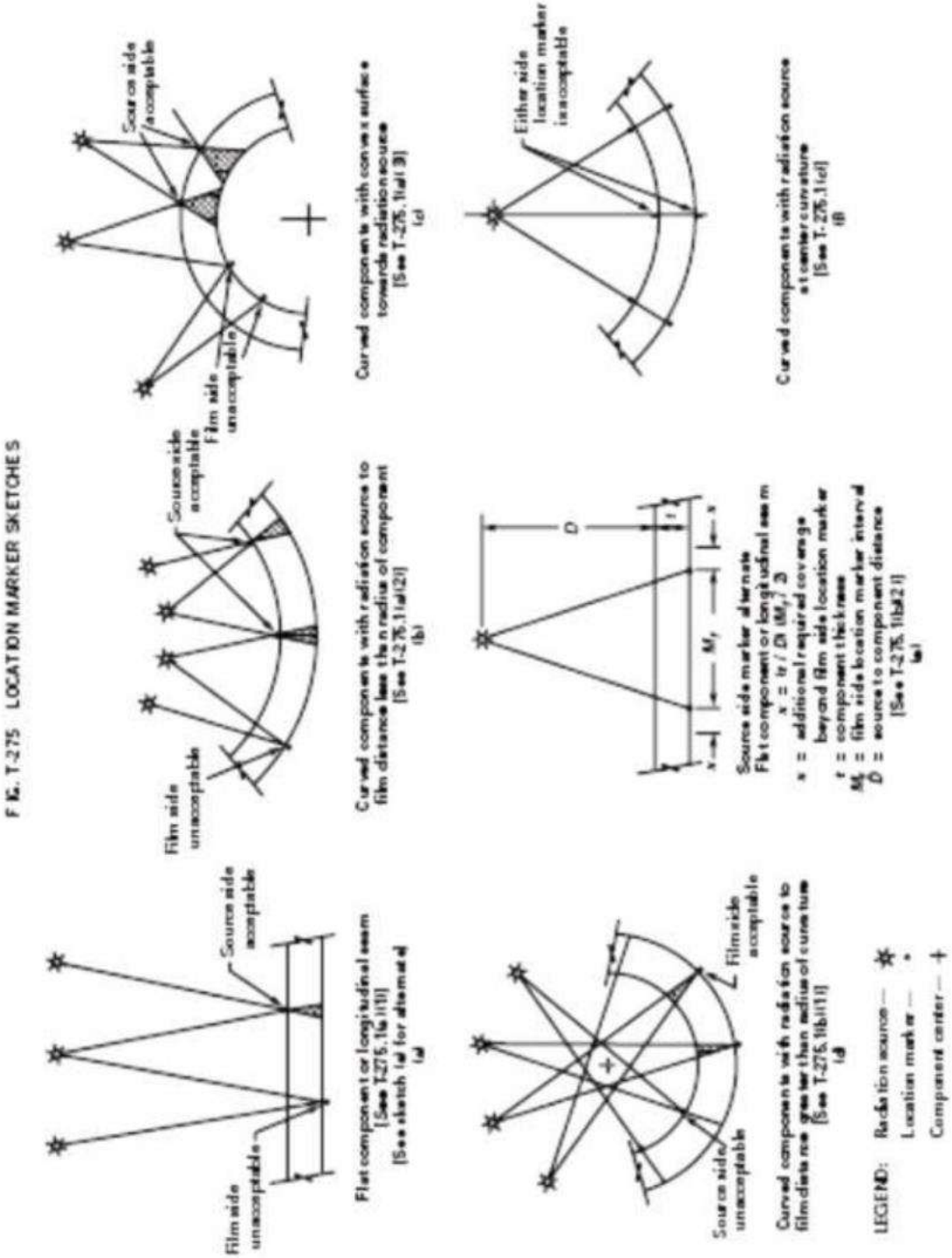
EXHIBIT C, Location Markers



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ROUNDED INDICATION FOR ASME SECTION I

ROUNDED INDICATION CHARTS

A-250 ACCEPTANCE STANDARD FOR RADIOGRAPHICALLY DETERMINED ROUNDED INDICATIONS IN WELDS

A-250.1 Applicability of These Standards. These standards are applicable to ferritic, austenitic, and nonferrous materials.

A-250.2 Terminology.

A-250.2.1 Rounded Indications. Indications with a maximum length of three times the width or less on the radiograph are defined as rounded indications. These indications may be circular, elliptical, conical, or irregular in shape and may have tails. When evaluating the size of an indication, the tail shall be included. The indication may be from any imperfection in the weld, such as porosity, slag, or tungsten.

A-250.2.2 Aligned Indications. A sequence of four or more rounded indications shall be considered to be aligned when they touch a line parallel to the length of the weld drawn through the center of the two outer rounded indications.

A-250.2.3 Thickness *t*. *t* is the thickness of the weld, excluding any allowable reinforcement. For a butt weld joining two parts having different thicknesses at the weld, *t* is the thinner of these two thicknesses. If a full penetration weld includes a fillet weld, the thickness of the fillet weld throat shall be included in *t*.

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A-250.3 Acceptance Criteria.

A-250.3.1 Image Density. Density within the image of the indication may vary and is not a criterion for acceptance or rejection.

A-250.3.2 Relevant Indications (See Table A-250.3.2 for Examples). Only those rounded indications which exceed the following dimensions shall be considered relevant:

(a) $\frac{1}{10}t$ for t less than $\frac{1}{8}$ in. (3 mm)
(b) $\frac{1}{64}$ in. (0.4 mm) for t $\frac{1}{8}$ in. to $\frac{1}{4}$ in. (6 mm), inclusive
(c) $\frac{1}{32}$ in. (0.8 mm) for t $\frac{1}{4}$ in. (6 mm) to 2 in. (50 mm), inclusive
(d) $\frac{1}{16}$ in. (1.6 mm) for t greater than 2 in. (50 mm)

A-250.3.3 Maximum Size of Rounded Indication (See Table A-250.3.2 for Examples). The maximum permissible size of any indication shall be $\frac{1}{4}t$, or $\frac{5}{32}$ in. (4 mm), whichever is smaller; except that an isolated indication separated from an adjacent indication by 1 in. (25 mm) or more may be $\frac{1}{3}t$, or $\frac{1}{4}$ in. (6 mm), whichever is less. For t greater than 2 in. (50 mm) the maximum permissible size of an isolated indication shall be increased to $\frac{3}{8}$ in. (10 mm).

A-250.3.4 Aligned Rounded Indications. Aligned rounded indications are acceptable when the summation of the diameters of the indications is less than t in a length of $12t$ (see Figure A-250.3.4-1). The length of groups of aligned rounded indications and the spacing between the groups shall meet the requirements of Figure A-250.3.4-2.

A-250.3.5 Spacing. The distance between adjacent rounded indications is not a factor in determining acceptance or rejection, except as required for isolated indications or groups of aligned indications.

SI Units

	Maximum Size of Acceptable Rounded Indication, mm		Maximum Size of Nonrevelant Indication, mm
Thickness t, mm	Random	Isolated	
Less than 3	$\frac{1}{4}t$	$\frac{1}{3}t$	$\frac{1}{10}t$
3	0.79	1.07	0.38
5	1.19	1.60	0.38
6	1.60	2.11	0.38
8	1.98	2.64	0.79
10	2.31	3.18	0.79
11	2.77	3.71	0.79
13	3.18	4.27	0.79
14	3.61	4.78	0.79
16	3.96	5.33	0.79
17	3.96	5.84	0.79
19 to 50 incl.	3.96	6.35	0.79
Over 50	3.96	9.53	1.60

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A-250.3.6 Rounded Indication Charts. The rounded indications characterized as imperfections shall not exceed that shown in the charts.

The charts in Figures A-250.3.6-1 through A-250.3.6-6 illustrate various types of assorted, randomly dispersed, and clustered rounded indications for different weld thicknesses greater than $\frac{1}{8}$ in. (3 mm). These charts represent the maximum acceptable concentration limits for rounded indications.

The chart for each thickness range represents full-scale 6 in. (150 mm) radiographs, and shall not be enlarged or reduced. The distributions shown are not necessarily the patterns that may appear on the radiograph, but are typical of the concentration and size of indications permitted.

A-250.3.7 Weld Thickness *t* Less Than $\frac{1}{8}$ in. (3 mm). For *t* less than $\frac{1}{8}$ in. (3 mm), the maximum number of rounded indications shall not exceed 12 in a 6 in. (150 mm) length of weld. A proportionally fewer number of indications shall be permitted in welds less than 6 in. (150 mm) in length.

A-250.3.8 Clustered Indications. The illustrations for clustered indications show up to four times as many indications in a local area, as that shown in the illustrations for random indications. The length of an acceptable cluster shall not exceed the lesser of 1 in. (25 mm) or 2*t*. Where more than one cluster is present, the sum of the lengths of the clusters shall not exceed 1 in. (25 mm) in a 6 in. (150 mm) length of weld.

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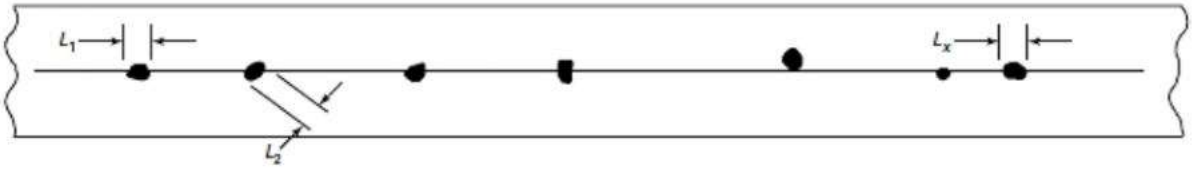
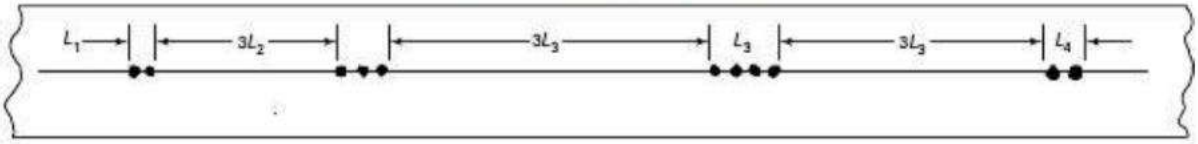
Figure A-250.3.4-1
Aligned Rounded Indications



GENERAL NOTE: Sum of L_1 to L_x shall be less than t in a length of $12t$.

Figure A-250.3.4-2
Groups of Aligned Rounded Indications



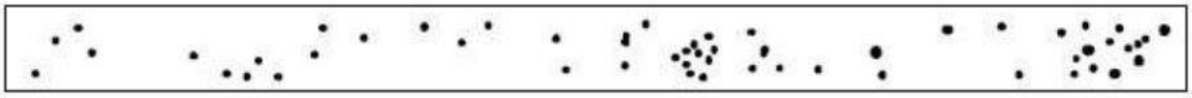
Maximum Group Length
L = 1/4 in. (6 mm) for t less than 3/4 in. (19 mm)
L = 1/3 t for t 3/4 in. (19 mm) to 2 1/4 in. (57 mm)
L = 3/4 in. (19 mm) for t greater than 2 1/4 in. (57 mm)

Minimum Group Spacing
$3L$ where L is the length of the longest adjacent group being evaluated.

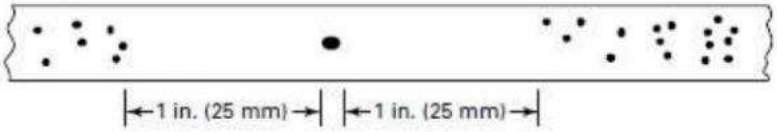
GENERAL NOTE: Sum of the group lengths shall be less than t in a length of $12t$.

ASME BPVC.I-2021

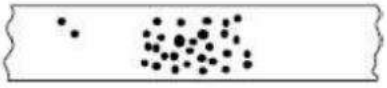
Figure A-250.3.6-1
Charts for t 1/8 in. (3 mm) to 1/4 in. (6 mm), Inclusive



(a) Random Rounded Indications [Note (1)]



(b) Isolated Indication [Note (2)]



(c) Cluster

NOTES:
(1) Typical concentration and size permitted in any 6 in. (150 mm) length of weld.
(2) Maximum size per Table A-250.3.2.

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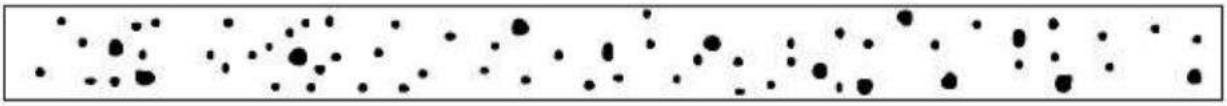
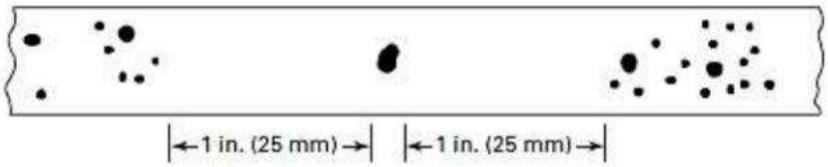
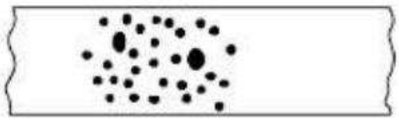
Figure A-250.3.6-2
Charts for t Over $\frac{1}{4}$ in. (6 mm) to $\frac{3}{8}$ in. (10 mm), Inclusive



(a) Random Rounded Indications [Note (1)]



(b) Isolated Indication [Note (2)]

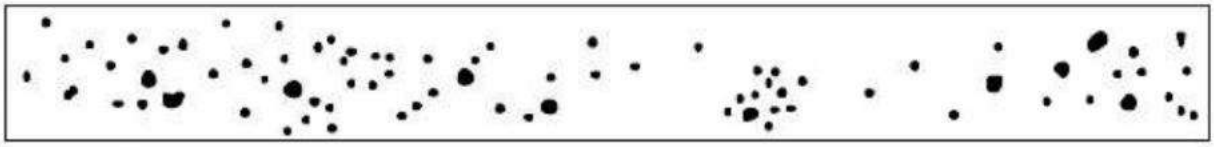


(c) Cluster

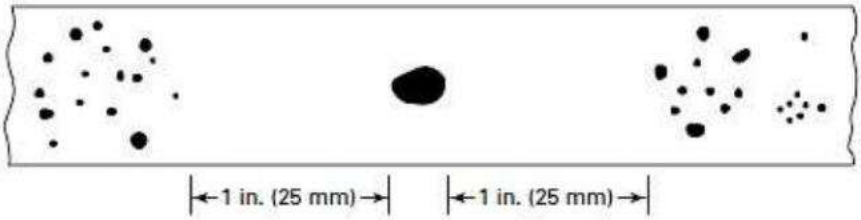
NOTES:
(1) Typical concentration and size permitted in any 6 in. (150 mm) length of weld.
(2) Minimum size per Table A-250.3.2.

ASME BPVC.I-2021

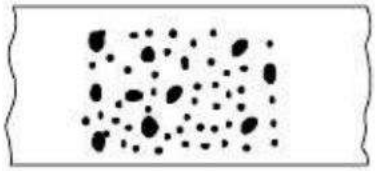
Figure A-250.3.6-3
Charts for t Over $\frac{3}{8}$ in. (10 mm) to $\frac{3}{4}$ in. (19 mm), Inclusive



(a) Random Rounded Indications [Note (1)]



(b) Isolated Indication [Note (2)]



(c) Cluster

NOTES:
(1) Typical concentration and size permitted in any 6 in. (150 mm) length of weld.
(2) Minimum size per Table A-250.3.2.

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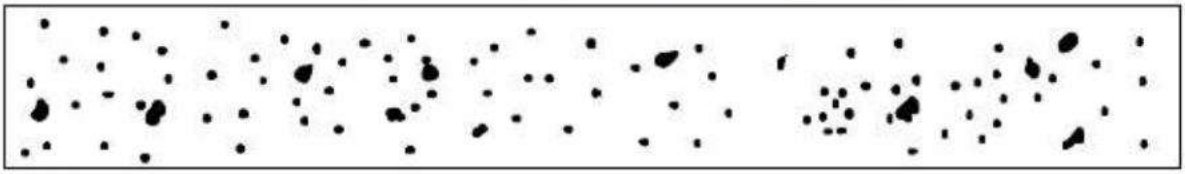
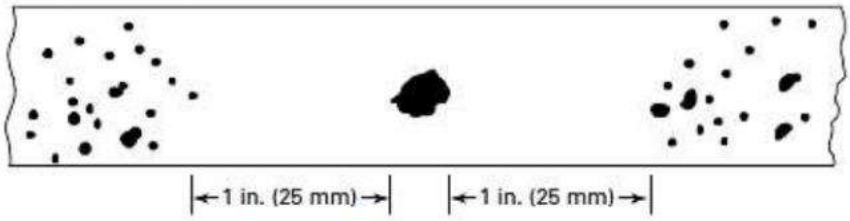
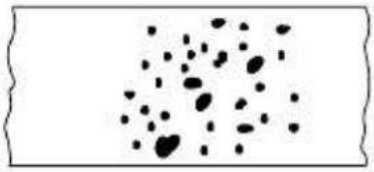
Figure A-250.3.6-4
Charts for t Over $^3/_4$ in. (19 mm) to 2 in. (50 mm), Inclusive



(a) Random Rounded Indications [Note (1)]



(b) Isolated Indication [Note (2)]

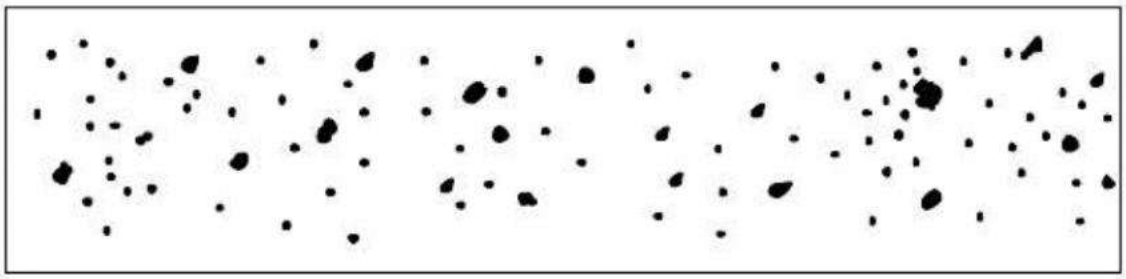


(c) Cluster

NOTES:
(1) Typical concentration and size permitted in any 6 in. (150 mm) length of weld.
(2) Minimum size per Table A-250.3.2.

ASME BPVC.I-2021

Figure A-250.3.6-5
Charts for t Over 2 in. (50 mm) to 4 in. (100 mm), Inclusive



(a) Random Rounded Indications [Note (1)]

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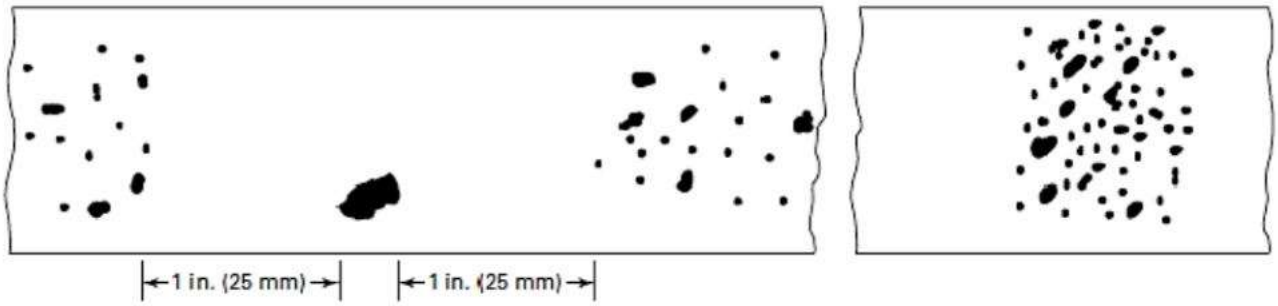
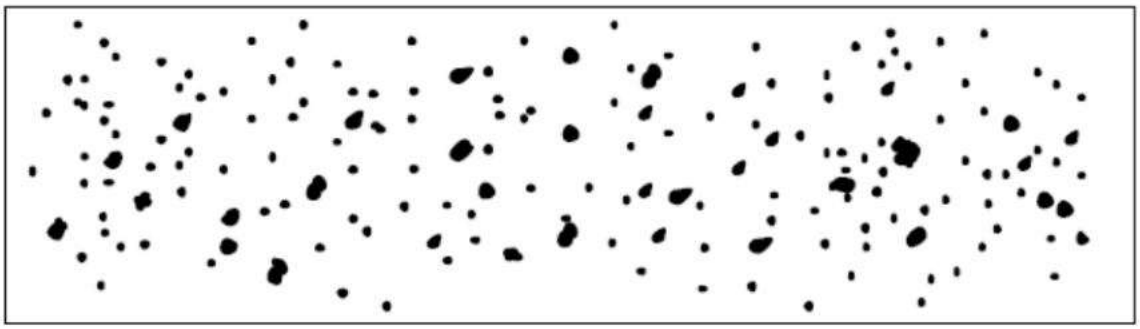


(b) Isolated Indication [Note (2)]

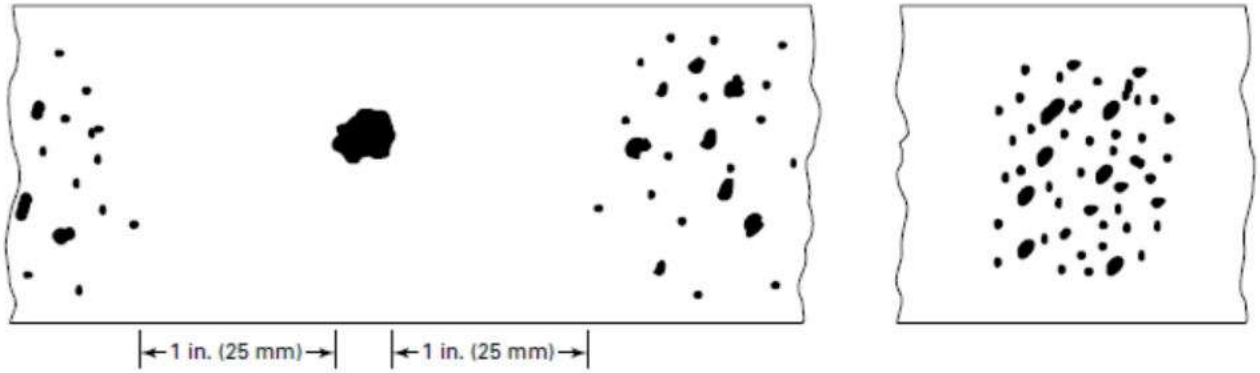
(c) Cluster

NOTES:
(1) Typical concentration and size permitted in any 6 in. (150 mm) length of weld.
(2) Minimum size per Table A-250.3.2.

Figure A-250.3.6-6
Charts for *t* Over 4 in. (100 mm)



(a) Random Rounded Indications [Note (1)]



(b) Isolated Indication [Note (2)]

(c) Cluster

NOTES:
(1) Typical concentration and size permitted in any 6 in. (150 mm) length of weld.
(2) Minimum size per Table A-250.3.2.

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ROUNDED INDICATION FOR ASME SECTION VIII, DIVISION 1

MANDATORY APPENDIX 4
ROUNDED INDICATIONS CHARTS ACCEPTANCE STANDARD FOR RADIOGRAPHICALLY DETERMINED ROUNDED INDICATIONS IN WELDS

4-1 APPLICABILITY OF THESE STANDARDS

These standards are applicable to ferritic, austenitic, and nonferrous materials.

Table 4-1

Customary Units			
	Maximum Size of Acceptable Rounded Indication, in.		Maximum Size of Nonrelevant Indication, in.
Thickness, t, in.	Random	Isolated	
Less than $\frac{1}{8}$	$\frac{1}{4}t$	$\frac{1}{3}t$	$\frac{3}{10}t$
$\frac{1}{8}$	0.031	0.042	0.015
$\frac{3}{16}$	0.047	0.063	0.015
$\frac{1}{4}$	0.063	0.083	0.015
$\frac{5}{16}$	0.078	0.104	0.031
$\frac{3}{8}$	0.091	0.125	0.031
$\frac{7}{16}$	0.109	0.146	0.031
$\frac{1}{2}$	0.125	0.168	0.031
$\frac{9}{16}$	0.142	0.188	0.031
$\frac{5}{8}$	0.156	0.210	0.031
$\frac{11}{16}$	0.156	0.230	0.031
$\frac{3}{4}$ to 2, incl.	0.156	0.250	0.031
Over 2	0.156	0.375	0.063
SI Units			
	Maximum Size of Acceptable Rounded Indication, mm		Maximum Size of Nonrelevant Indication, mm
Thickness, t, mm	Random	Isolated	
Less than 3	$\frac{1}{4}t$	$\frac{1}{3}t$	$\frac{3}{10}t$
3	0.79	1.07	0.38
5	1.19	1.60	0.38
6	1.60	2.11	0.38
8	1.98	2.64	0.79
10	2.31	3.18	0.79
11	2.77	3.71	0.79
13	3.18	4.27	0.79
14	3.61	4.78	0.79
16	3.96	5.33	0.79
17	3.96	5.84	0.79
19.0 to 50, incl.	3.96	6.35	0.79
Over 50	3.96	9.53	1.60

GENERAL NOTE: This Table contains examples only.

4-2 TERMINOLOGY

(a) Rounded Indications. Indications with a maximum length of three times the width or less on the radiograph are defined as rounded indications. These indications may be circular, elliptical, conical, or irregular in shape and may have tails. When evaluating the size of an indication, the tail shall be included. The indication may be from any imperfection in the weld, such as porosity, slag, or tungsten.

(b) Aligned Indications. A sequence of four or more rounded indications shall be considered to be aligned when they touch a line parallel to the length of the weld drawn through the center of the two outer rounded indications.

(c) Thickness t. t is the thickness of the weld, excluding any allowable reinforcement. For a butt weld joining two members having different thicknesses at the weld, t is the thinner of these two thicknesses. If a full penetration weld includes a fillet weld, the thickness of the throat of the fillet shall be included in t.

4-3 ACCEPTANCE CRITERIA

(a) Image Density. Density within the image of the indication may vary and is not a criterion for acceptance or rejection.

(b) Relevant Indications. (See Table 4-1 for examples.) Only those rounded indications which exceed the following dimensions shall be considered relevant.

(1) $\frac{1}{10}t$ for t less than $\frac{1}{8}$ in. (3 mm)

(2) $\frac{1}{64}$ in. for t from $\frac{1}{8}$ in. to $\frac{1}{4}$ in. (3 mm to 6 mm), incl.

(3) $\frac{1}{32}$ in. for t greater than $\frac{1}{4}$ in. to 2 in. (6 mm to 50 mm), incl.

(4) $\frac{1}{16}$ in. for t greater than 2 in. (50 mm)

(c) Maximum Size of Rounded Indication. (See Table 4-1 for examples.) The maximum permissible size of any indication shall be $\frac{1}{4}t$, or $\frac{5}{32}$ in. (4 mm), whichever is smaller; except that an isolated indication separated from an adjacent indication by 1 in. (25 mm) or more may be $\frac{1}{3}t$, or $\frac{1}{4}$ in. (6 mm), whichever is less. For t greater than 2 in. (50 mm) the maximum permissible size of an isolated indication shall be increased to $\frac{3}{8}$ in. (10 mm).

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(d) Aligned Rounded Indications. Aligned rounded indications are acceptable when the summation of the diameters of the indications is less than t in a length of $12t$. See Figure 4-1. The length of groups of aligned rounded indications and the spacing between the groups shall meet the requirements of Figure 4-2.

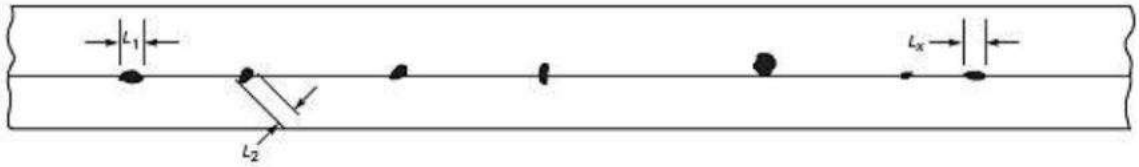
(e) Spacing. The distance between adjacent rounded indications is not a factor in determining acceptance or rejection, except as required for isolated indications or groups of aligned indications.

(f) Rounded Indication Charts. The rounded indications characterized as imperfections shall not exceed that shown in the charts. The charts in Figures 4-3 through 4-8 illustrate various types of assorted, randomly dispersed and clustered rounded indications for different weld thicknesses greater than $^3/_8$ in. (3 mm). These charts represent the maximum acceptable concentration limits for rounded indications. The charts for each thickness range represent full-scale 6 in. (150 mm) radiographs, and shall not be enlarged or reduced. The distributions shown are not necessarily the patterns that may appear on the radiograph, but are typical of the concentration and size of indications permitted.

(g) Weld Thickness t Less Than $^3/_8$ in. (3 mm). For t less than $^3/_8$ in. (3 mm) the maximum number of rounded indications shall not exceed 12 in a 6 in. (150 mm) length of weld. A proportionally fewer number of indications shall be permitted in welds less than 6 in. (150 mm) in length.

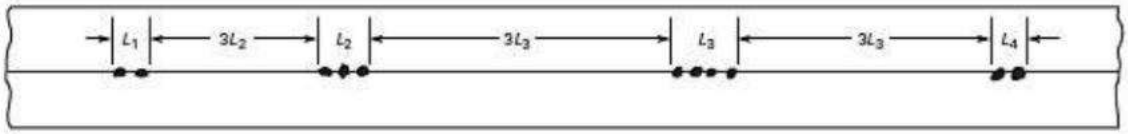
(h) Clustered Indications. The illustrations for clustered indications show up to four times as many indications in a local area, as that shown in the illustrations for random indications. The length of an acceptable cluster shall not exceed the lesser of 1 in. (25 mm) or $2t$. Where more than one cluster is present, the sum of the lengths of the clusters shall not exceed 1 in. (25 mm) in a 6 in. (150 mm) length weld.

Figure 4-1
Aligned Rounded Indications



GENERAL NOTE: Sum of L_1 to L_x shall be less than t in a length of $12t$.

Figure 4-2
Groups of Aligned Rounded Indications



Maximum Group Length	Minimum Group Spacing
L = $^1/_4$ in. (6 mm) for t less than $^3/_4$ in. (19 mm)	$3L$ where L is the length of the longest adjacent group being evaluated
L = $^1/_3t$ for t $^3/_4$ in. (19 mm) to 2 $^1/_4$ in. (57 mm)	
L = $^3/_4$ in. (19 mm) for t greater than 2 $^1/_4$ in. (57 mm)	

GENERAL NOTE: Sum of the group lengths shall be less than t in a length of $12t$.

ASME BPVC.VIII.1-2021

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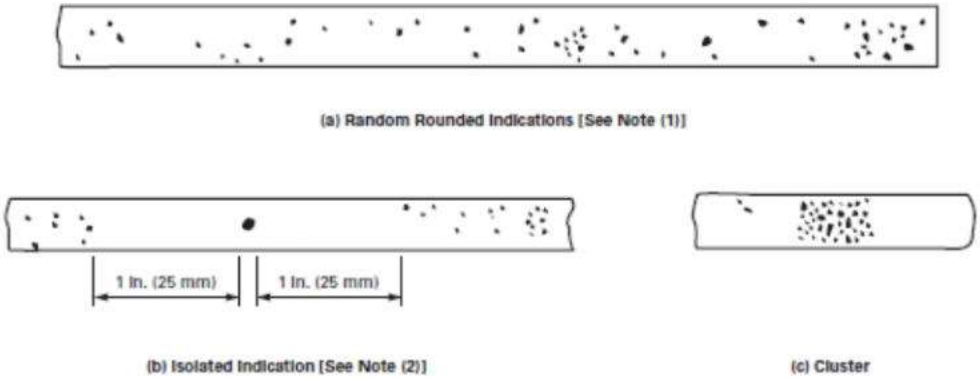
Figure 4-3
Charts for t Equal to $^3/_8$ in. to $^1/_4$ in. (3 mm to 6 mm), Inclusive

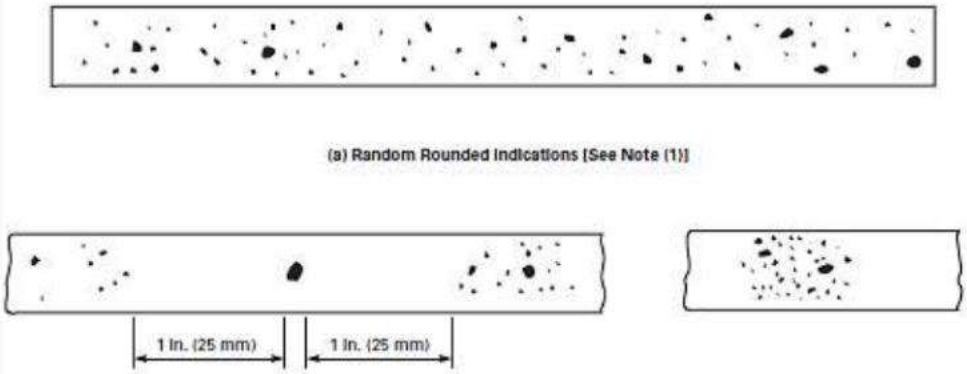


NOTES:
(1) Typical concentration and size permitted in any 6 in. (150 mm) length of weld.
(2) Maximum size per Table 4-1.

408

ASME BPVC.VIII.1-2021 4-3

Figure 4-4
Charts for t Over $^1/_4$ in. to $^3/_8$ in. (6 mm to 10 mm), Inclusive



NOTES:
(1) Typical concentration and size permitted in any 6 in. (150 mm) length of weld.
(2) Maximum size per Table 4-1.

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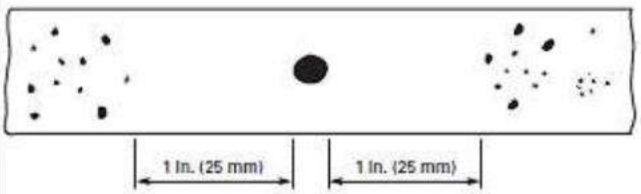
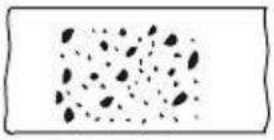
Figure 4-5
Charts for t Over $\frac{3}{8}$ in. to $\frac{3}{4}$ in. (10 mm to 19 mm), Inclusive

(a) Random Rounded Indications [See Note (1)]



(b) Isolated Indication [See Note (2)]



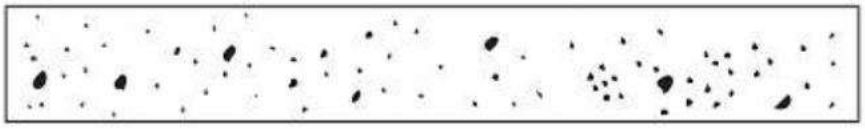
(c) Cluster

NOTES:
(1) Typical concentration and size permitted in any 6 in. (150 mm) length of weld.
(2) Maximum size per Table 4-1.

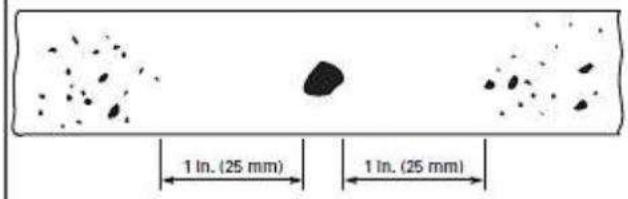
409

4-3 ASME BPVC.VIII.1-2021

Figure 4-6
Charts for t Over $\frac{3}{4}$ in. to 2 in. (19 mm to 50 mm), Inclusive



(a) Random Rounded Indications [See Note (1)]



(b) Isolated Indication [See Note (2)]

(c) Cluster

NOTES:
(1) Typical concentration and size permitted in any 6 in. (150 mm) length of weld.
(2) Maximum size per Table 4-1.

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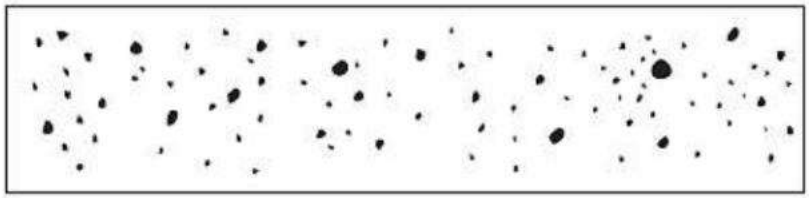
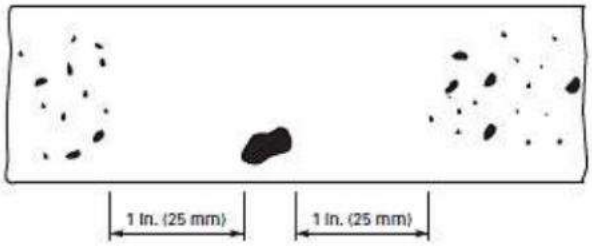
Figure 4-7
Charts for t Over 2 in. to 4 in. (50 mm to 100 mm), Inclusive



(a) Random Rounded Indications [See Note (1)]



(b) Isolated Indication [See Note (2)]

(c) Cluster

NOTES:
(1) Typical concentration and size permitted in any 6 in. (150 mm) length of weld.
(2) Maximum size per Table 4-1.

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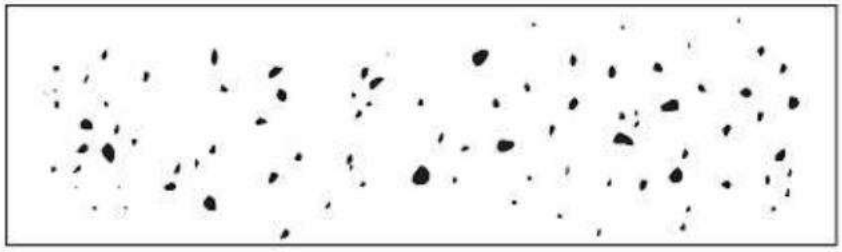
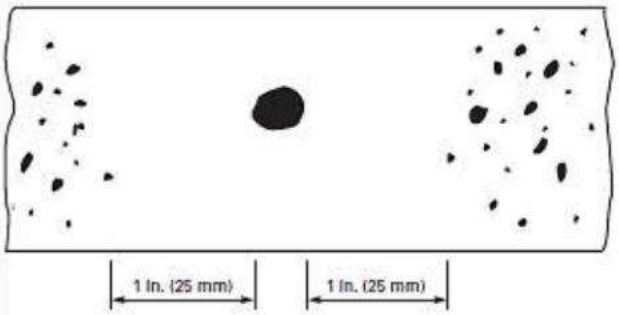
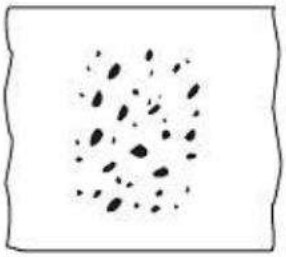
Figure 4-8
Charts for t Over 4 in. (100 mm)



(a) Random Rounded Indications [See Note (1)]



(b) Isolated Indication [See Note (2)]



(c) Cluster

NOTES:
(1) Typical concentration and size permitted in any 6 in. (150 mm) length of weld.
(2) Maximum size per Table 4-1.

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ROUNDED INDICATION FOR ASME SECTION VIII, Div 2

(b) Rounded Indications

(1) Terminology

(-a) Rounded Indications - indications with a maximum length of three times the width or less on the radiograph are defined as rounded indications. These indications may be circular, elliptical, conical, or irregular in shape and may have tails. When evaluating the size of an indication, the tail shall be included.

(-b) Aligned Indications - a sequence of four or more rounded indications shall be considered to be aligned when they touch a line parallel to the length of the weld drawn through the center of the two outer rounded indications.

(-c) Thickness t - see 7.4.3.6

(2) Acceptance Criteria

(-a) Rounded Indication Charts - relevant rounded indications characterized as imperfections shall not exceed those shown in Figures 7.5 through 7.10, which illustrate various types of assorted, randomly dispersed and clustered rounded indications for different weld thicknesses greater than 3 mm ($^1/_8$ in.). The charts for each thickness range represent full-scale 150 mm (6 in.) radiographs, and shall not be enlarged or reduced. The distributions shown are not necessarily the patterns that may appear on the radiograph, but are typical of the concentration and size of indications permitted.

(-b) Relevant Indications (see Table 7.7 for examples) - only those rounded indications that exceed the following dimensions shall be considered relevant and compared to the acceptance charts for disposition.

(-1) $t/10$ for t less than 3 mm ($^1/_8$ in.)

(-2) 0.4 mm ($^1/_{64}$ in.) for t greater than or equal to 3 mm ($^1/_8$ in.) and less than or equal to 6 mm ($^1/_4$ in.)

(-3) 0.8 mm ($^1/_{32}$ in.) for t greater than 6 mm ($^1/_4$ in.) and less than or equal to 50 mm (2 in.)

(-4) 1.5 mm ($^1/_{16}$ in.) for t greater than 50 mm (2 in.)

(-5) Maximum Size of Rounded Indication - the maximum permissible size of any indication shall be $t/4$ or 4 mm ($^5/_{32}$ in.), whichever is smaller; except that an isolated indication separated from an adjacent indication by 25 mm (1 in.) or more may be $t/3$, or 6 mm ($^1/_4$ in.), whichever is less. For t greater than 50 mm (2 in.) the maximum permissible size of an isolated indication shall be increased to 10 mm ($^3/_8$ in.).

(-6) Aligned Rounded Indications - aligned rounded indications are acceptable when the summation of the diameters of the indications is less than t in a length of $12t$ (see Figure 7.3). The length of groups of aligned rounded indications and the spacing between the groups shall meet the requirements of Figure 7.4.

(-7) Clustered Indications - the illustrations for clustered indications show up to four times as many indications in a local area, as that shown in the illustrations for random indications. The length of an acceptable cluster shall not exceed the lesser of 25 mm (1 in.) or $2t$. Where more than one cluster is present, the sum of the lengths of the clusters shall not exceed 25 mm (1 in.) in a 150 mm (6 in.) length weld.

(-8) Weld Thickness t less than 3 mm ($^1/_8$ in.) - for t less than 3 mm ($^1/_8$ in.) the maximum number of rounded indications shall not exceed 12 in a 150 mm (6 in.) length of weld. A proportionally fewer number of indications shall be permitted in welds less than 150 mm (6 in.) in length.

(-c) Image Density - density or image brightness within the image of the indication may vary and is not a criterion for acceptance or rejection.

(-d) Spacing - the distance between adjacent rounded indications is not a factor in determining acceptance or rejection, except as required for isolated indications or groups of aligned indications.

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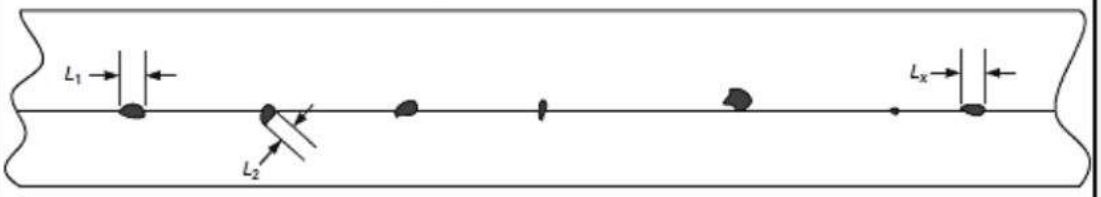
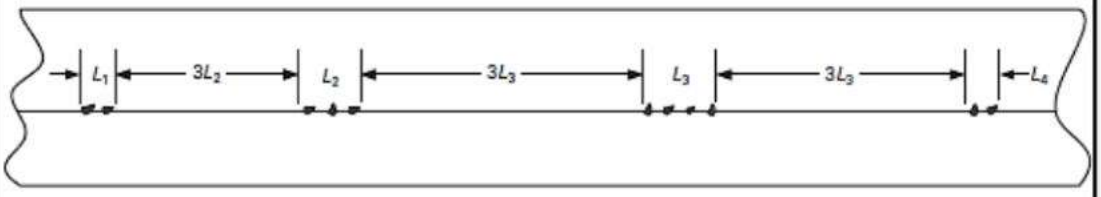
Figure 7.3
Aligned Rounded Indications



GENERAL NOTE: The sum of L_1 to L_x shall be less than t in a length of $12t$.

Figure 7.4
Groups of Aligned Rounded Indications



GENERAL NOTE: The sum of the group of lengths shall be less than t in a length of $12t$.

Maximum Group Length	Minimum Group Spacing
L = 6 mm (3/4 in.) for t < 19 mm (3/4 in.) $L = t/3$ for 19 mm (3/4 in.) ≤ t ≤ 57 mm (2 3/4 in.) L = 19 mm (3/4 in.) for t > 57 mm (2 3/4 in.)	$3L$ where L is the length of the longest adjacent group being evaluated

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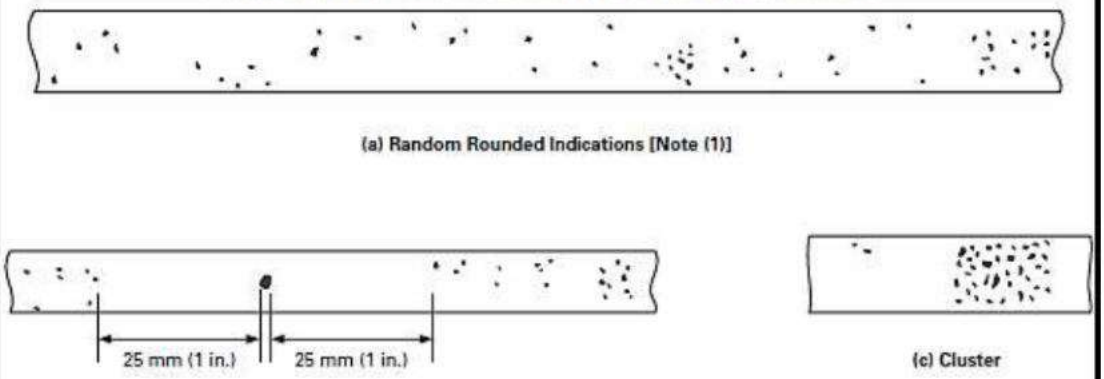
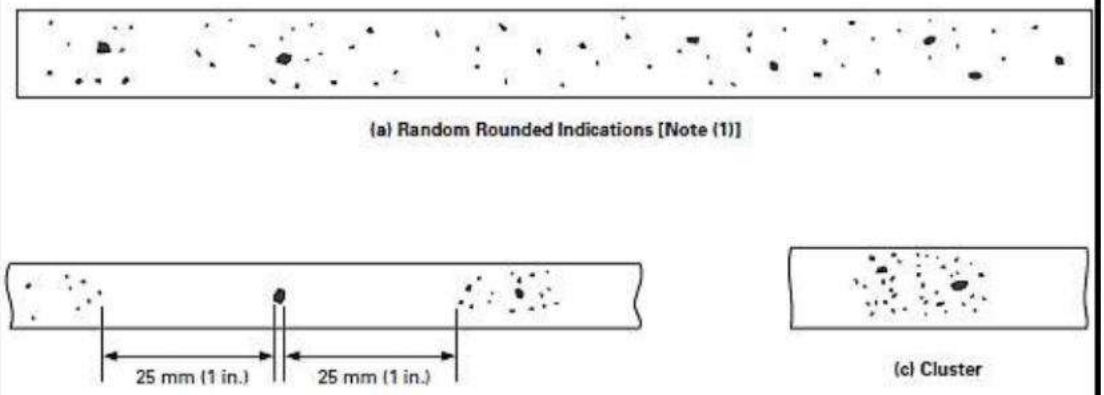
Figure 7.5
Charts for 3 mm (3/8 in.) to 6 mm (1/4 in.) Wall Thickness, Inclusive



NOTES:
(1) Typical concentration and size permitted in any 150 mm (6 in.) length of weld
(2) Maximum size per Table 7.7

Figure 7.6
Charts for Over 6 mm (1/4 in.) to 10 mm (3/8 in.) Wall Thickness, Inclusive



NOTES:
(1) Typical concentration and size permitted in any 150 mm (6 in.) length of weld
(2) Maximum size per Table 7.7

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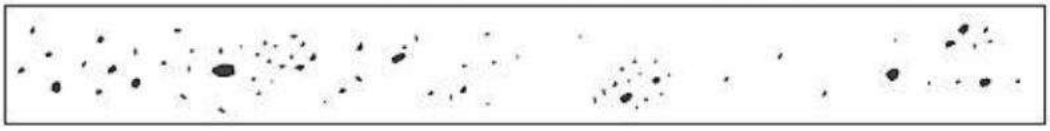
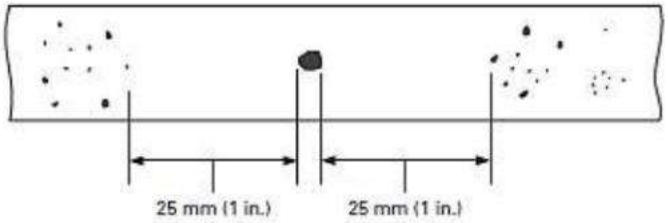
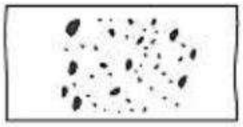
Figure 7.7
Charts for Over 10 mm (3/8 in.) to 19 mm (3/4 in.) Wall Thickness, Inclusive



(a) Random Rounded Indications [Note (1)]



(b) Isolated Indication [Note (2)]

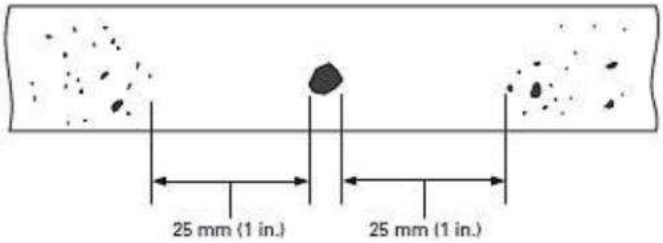


(c) Cluster

NOTES:
(1) Typical concentration and size permitted in any 150 mm (6 in.) length of weld
(2) Maximum size per Table 7.7

Figure 7.8
Charts for Over 19 mm (3/4 in.) to 50 mm (2 in.) Wall Thickness, Inclusive

(a) Random Rounded Indications [Note (1)]



(b) Isolated Indication [Note (2)]

(c) Cluster

NOTES:
(1) Typical concentration and size permitted in any 150 mm (6 in.) length of weld
(2) Maximum size per Table 7.7

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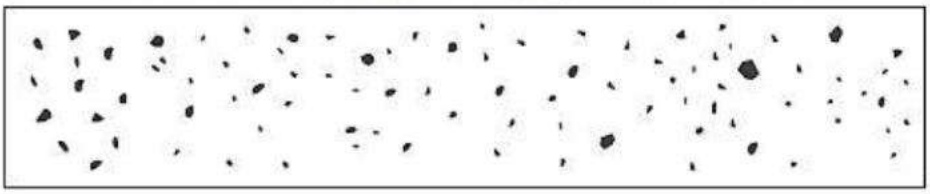
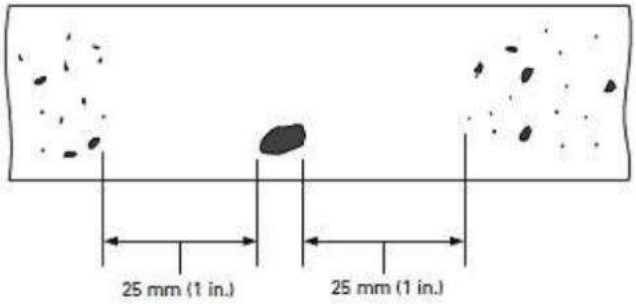
Figure 7.9
Charts for Over 50 mm (2 in.) to 100 mm (4 in.) Wall Thickness, Inclusive



(a) Random Rounded Indications [Note (1)]



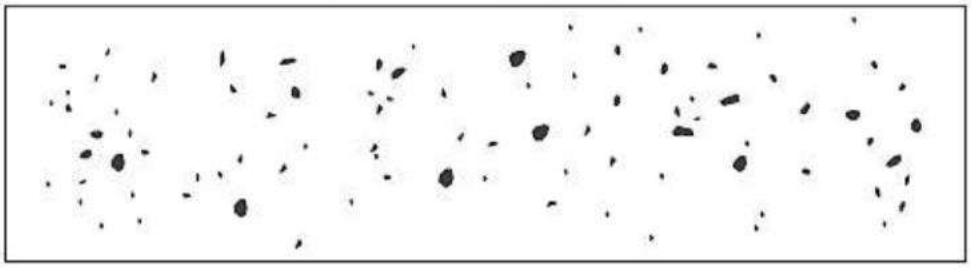
(b) Isolated Indication [Note (2)]

(c) Cluster

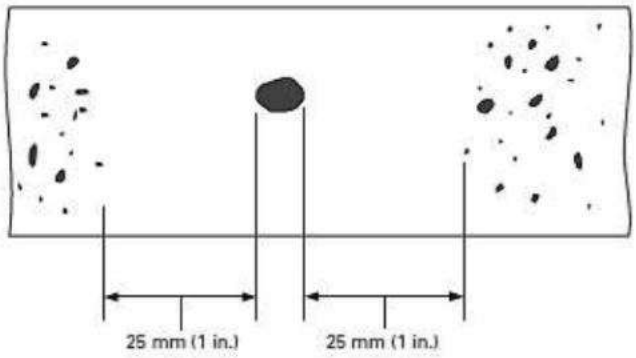
NOTES:
(1) Typical concentration and size permitted in any 150 mm (6 in.) length of weld
(2) Maximum size per Table 7.7

Kp.Gunung Buntu RT005/RW003 Desa,Banyuwangi,Kec.Pulo Ampel Kota Serang/42455
Handphone. 085218282807; 089697533762
Email. pt.titian889@gmail.com

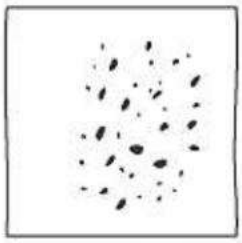
Figure 7.10
Charts for Over 100 mm (4 in.) Wall Thickness



(a) Random Rounded Indications [Note (1)]



(b) Isolated Indication [Note (2)]



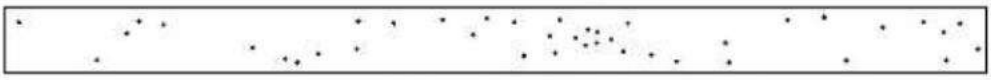
(c) Cluster

NOTES:
(1) Typical concentration and size permitted in any 150 mm (6 in.) length of weld
(2) Maximum size per Table 7.7

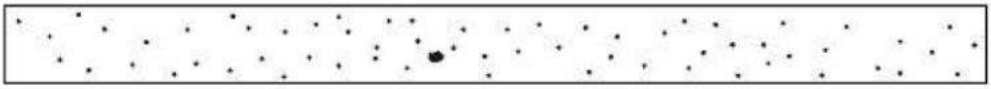
Kp.Gunung Buntu RT005/RW003 Desa,Banyuwangi,Kec.Pulo Ampel Kota Serang/42455
Handphone. 085218282807; 089697533762
Email. pt.titian889@gmail.com

ROUNDED INDICATION FOR ASME SECTION IX

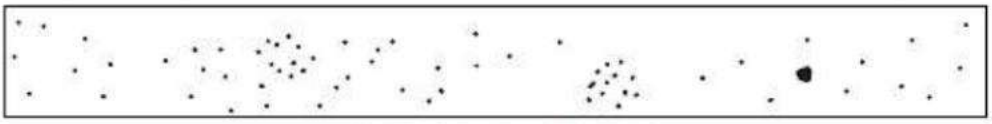
Figure QW-191.1.2.2(b)(4)
Rounded Indication Charts



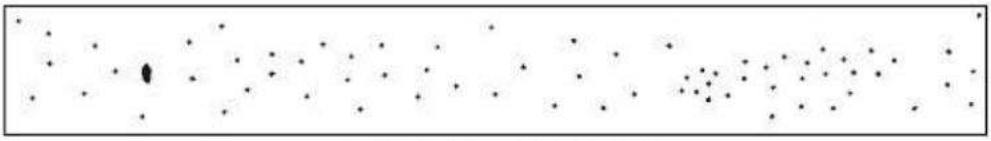
Typical Quantity and Size Permitted in 6 in. (150 mm) Length of Weld $^1/_8$ in. (3 mm) to $^1/_4$ in. (6 mm) Thickness



Typical Quantity and Size Permitted in 6 in. (150 mm) Length of Weld Over $^1/_4$ in. (6 mm) to $^1/_2$ in. (13 mm) Thickness



Typical Quantity and Size Permitted in 6 in. (150 mm) Length of Weld Over $^1/_2$ in. (13 mm) to 1 in. (25 mm) Thickness



Typical Quantity and Size Permitted in 6 in. (150 mm) Length of Weld Over 1 in. (25 mm) Thickness

Kp.Gunung Buntu RT005/RW003 Desa,Banyuwangi,Kec.Pulo Ampel Kota Serang/42455
Handphone. 085218282807; 089697533762
Email. pt.titian889@gmail.com

1. NDE MAP NO. : E2502-NDE-PBY-001

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

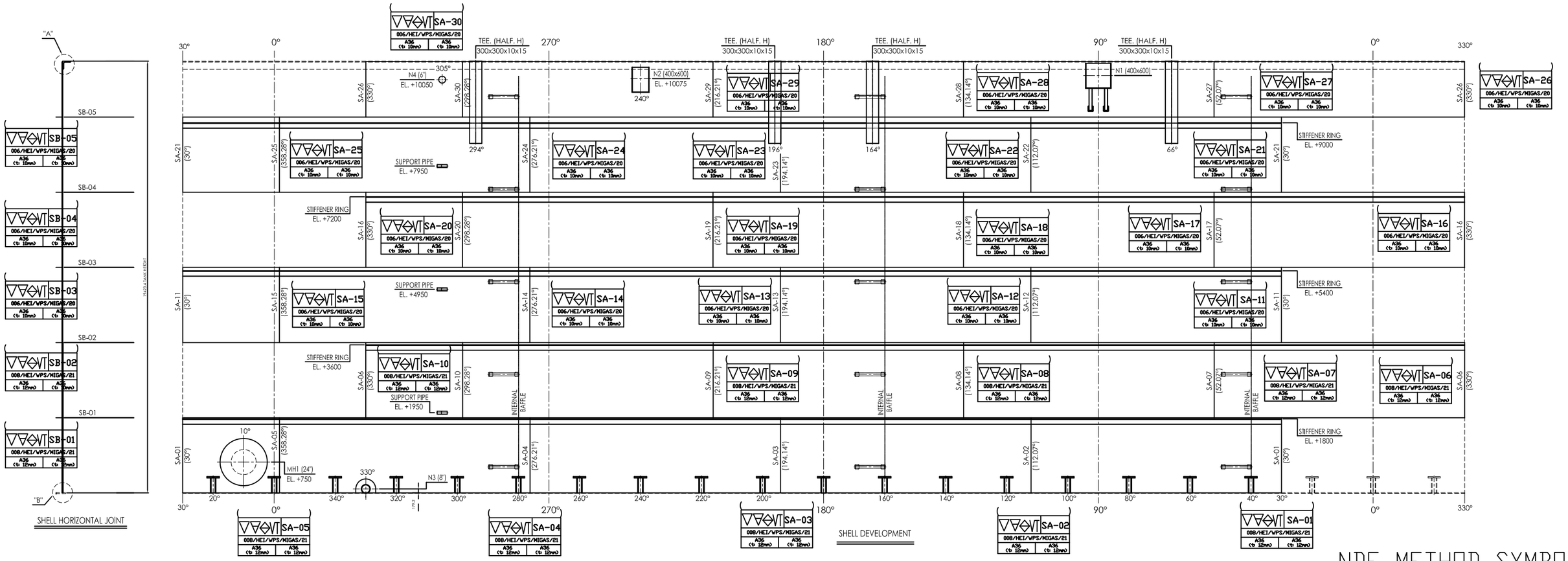
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

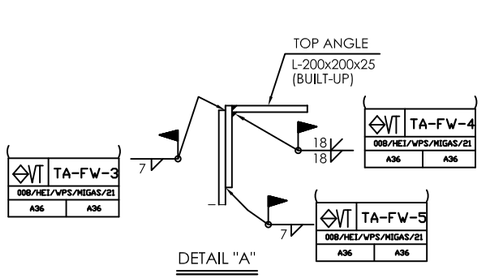
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

3. LIQUID PENETRANT

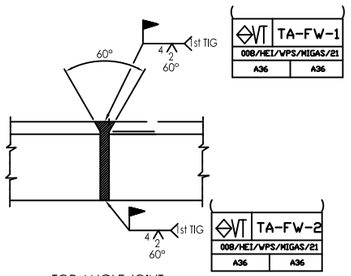
   # LIFTING LUG AND REMOVING OF JIG

   # NOZZLE ATTACHMENT WELDING OF DUCTING

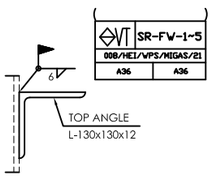




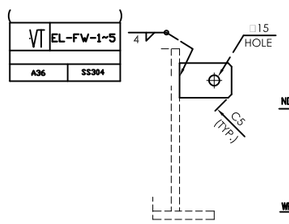
DETAIL "A"



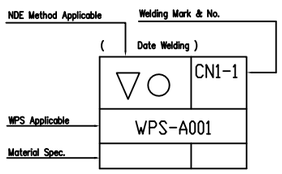
TOP ANGLE JOINT

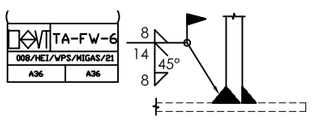


DETAIL OF STIFFENER RING



EARTHNG LUG





DETAIL "B"

NDE METHOD SYMBOL

- □ VACUUM BOX
- ▽ UT SPOT
- ▽ UT SPOT LAMINATION CHECK FOR SHELL
- ◇ MPI 10%
- VT VISUAL 100%

MATERIAL SPECIFICATION	
SHELL	A36
TOP ANGLE	A36
STIFFENER RING	A36

LEGEND :

WPS NO :	008/HEI/WPS/MIGAS/21	SMAW	P1 to P1
	006/HEI/WPS/MIGAS/20	GTAW & SMAW	P1 to P1

File name :

REV	DATE	APPR	
0	29/09/25		

CHANGE BY CAD SYSTEM ONLY

1	2

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

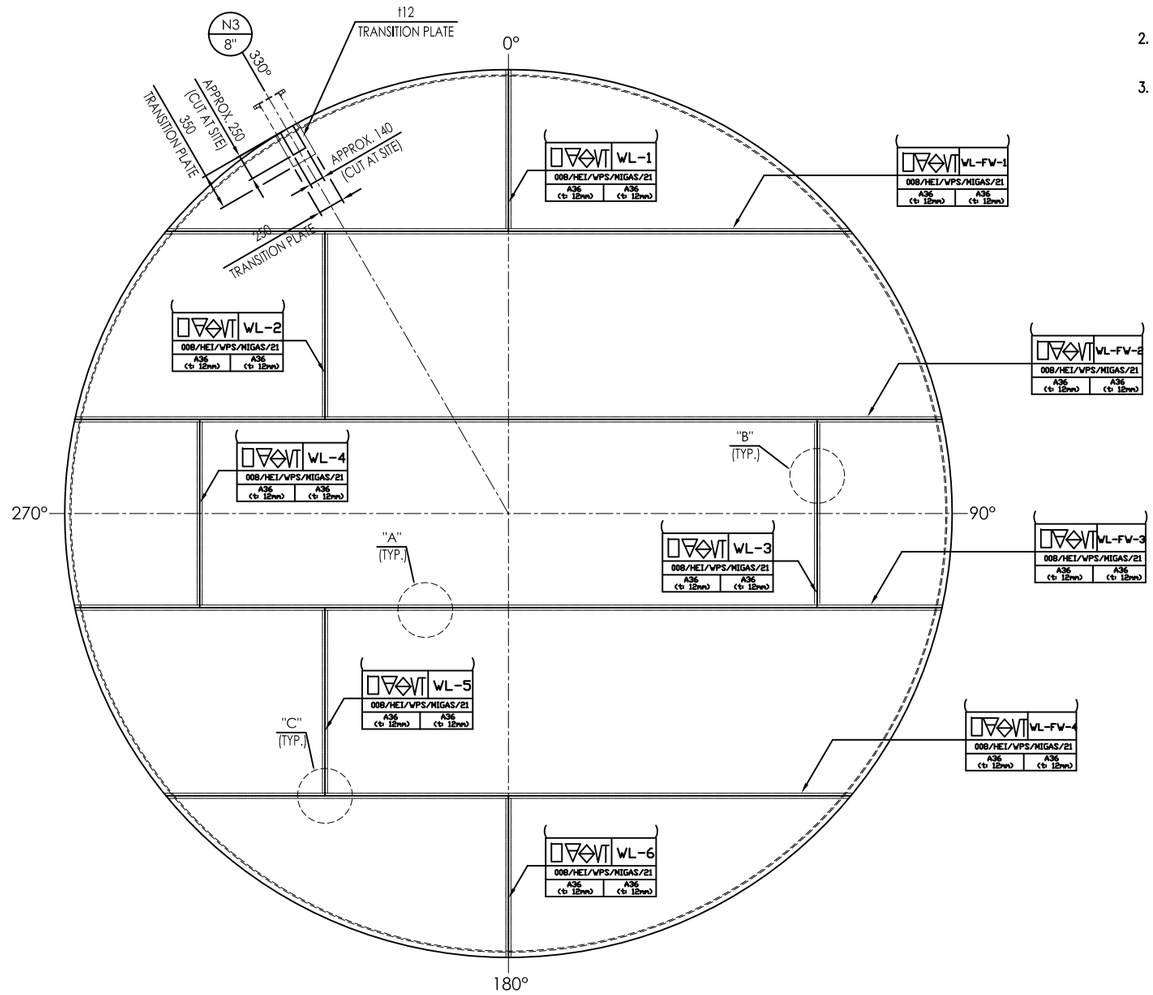
	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name: NDE MAP SHELL LEACH TANK

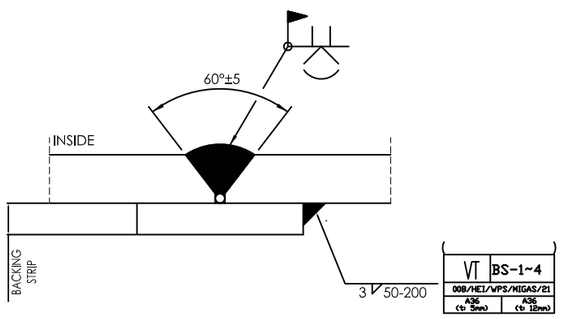
Sheet No./Total sheets	1/9
Size of memory	
PT. HANAZONO Engineering Indonesia — We are always partner with you	
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: LEACH TANK
REFER DWG NO.	: E2502-000-DWG-102
NDE Map No.	E2502-NDE-PBY-001
REV.	0

GENERAL NOTES :

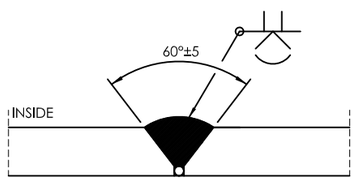
1. BOLT HOLE ORIENTATION
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT
   # LIFTING LUG AND REMOVING OF JIG
   # NOZZLE ATTACHMENT WELDING OF DUCTING



BOTTOM PLATE ARRANGEMENT



DETAIL "A"



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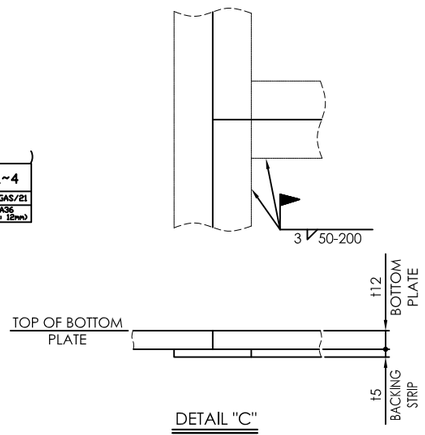
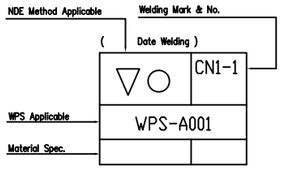


DETAIL "C"



NDE METHOD SYMBOL

- □ VACUUM BOX
- ▽ UT SPOT LAMINATION CHECK FOR BOTTOM
- ◇ MPI 10%
- VT VISUAL 100%

MATERIAL SPECIFICATION	
BOTTOM PLATE	A36
BACKING STRIPE	A36

LEGEND :

WPS NO : 008/HEI/WPS/MIGAS/21 SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

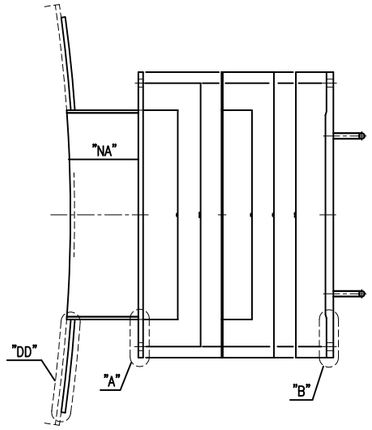
Scale : NTS

Name: NDE MAP BOTTOM LEACH TANK

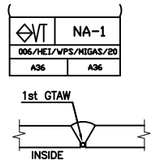
Sheet No./Total sheets	2/9
Size of memory	
PT. HANAZONO Engineering Indonesia — We are always partner with you	
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: LEACH TANK
REFER DWG NO.	: E2502-000-DWG-103
NDE Map No.	E2502-NDE-PBY-001
REV.	0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT
   # LIFTING LUG AND REMOVING OF JIG
   # NOZZLE ATTACHMENT WELDING OF DUCTING



DETAIL OF NOZZLE (MH1) 24"



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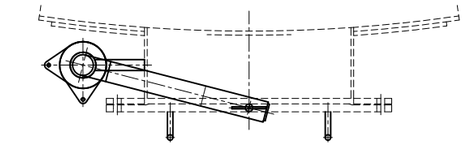
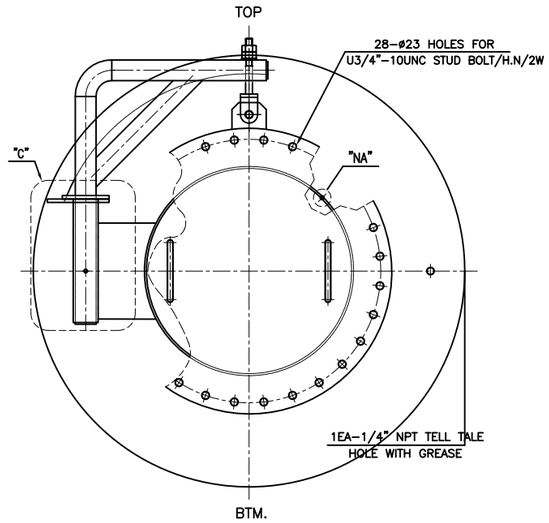
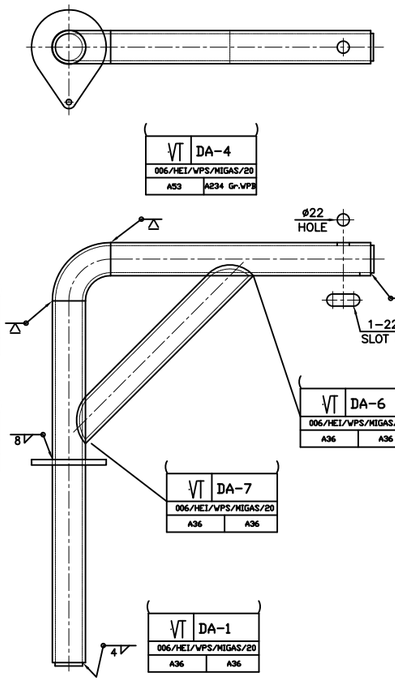
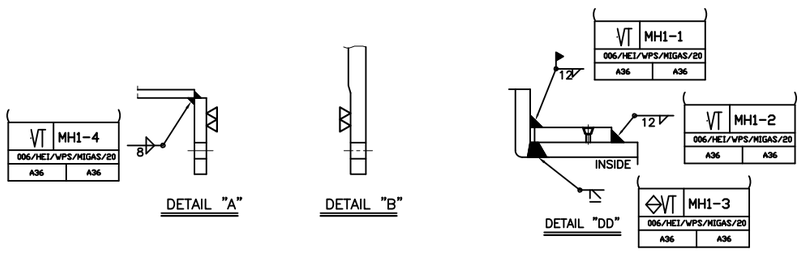




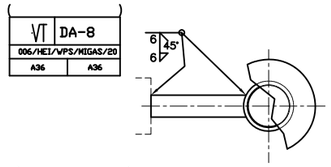
DAVIT ASSEMBLY
(DAVIT ORIENT. SEE ASS'Y DWG)

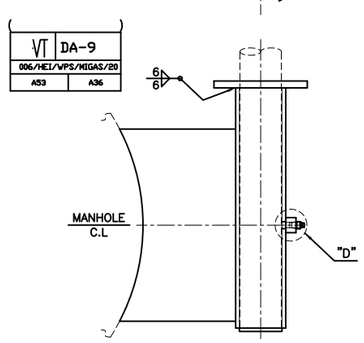


DAVIT DETAIL

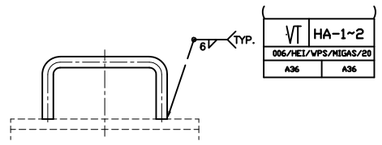


DETAIL "A" DETAIL "B" DETAIL "DD"

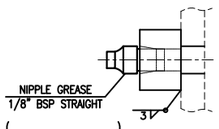




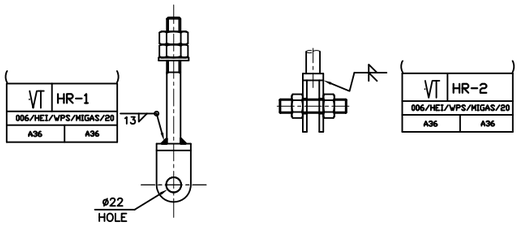
DETAIL "C"



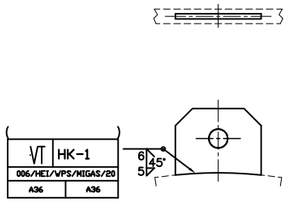
HANDLE DETAIL



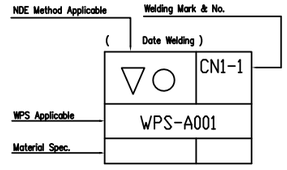
DETAIL "D"



HANGER DETAIL



HOOK



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
HOOK	A36
PIPE DAVIT	A53 Gr.B
HANDLE	A36
NOZZLE NECK	A36
PLATE FLANGE	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name: NDE MAP MANHOLE LEACH TANK

Sheet No./Total sheets: 3/9

Size of memory:

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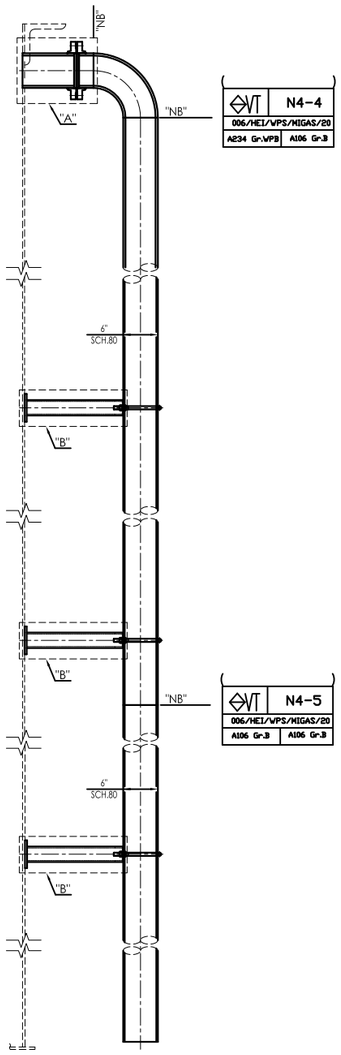
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: LEACH TANK
REFER DWG NO.	: E2502-000-DWG-104

NDE Map No.: E2502-NDE-PBY-001

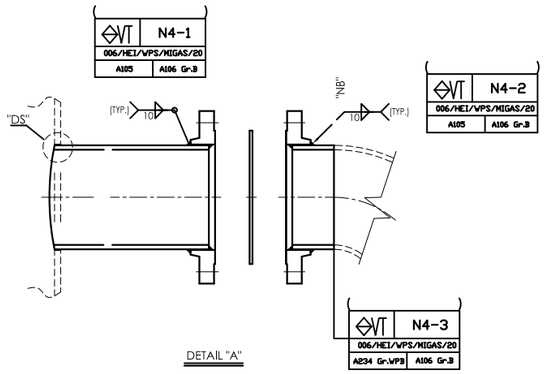
REV.: 0

GENERAL NOTES :

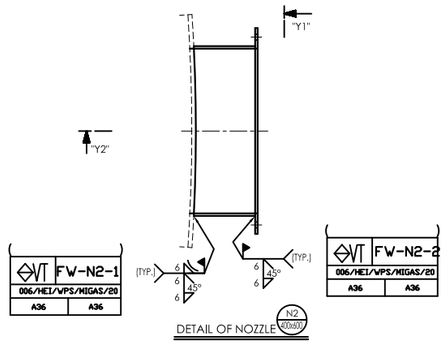
1. BOLT HOLE ORIENTATION
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT
   # LIFTING LUG AND REMOVING OF JIG
   # NOZZLE ATTACHMENT WELDING OF DUCTING



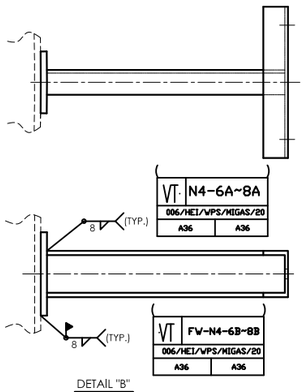
DETAIL OF NOZZLE N4 6"



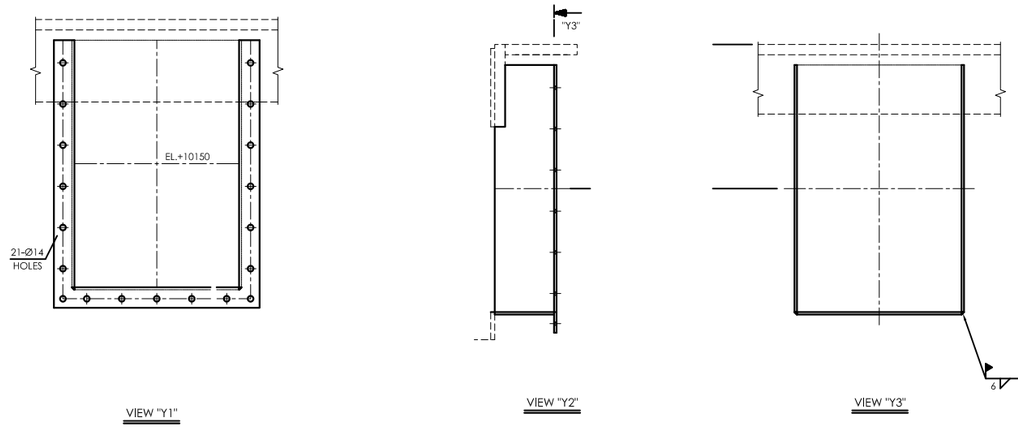
DETAIL "A"



DETAIL OF NOZZLE N2 300x600



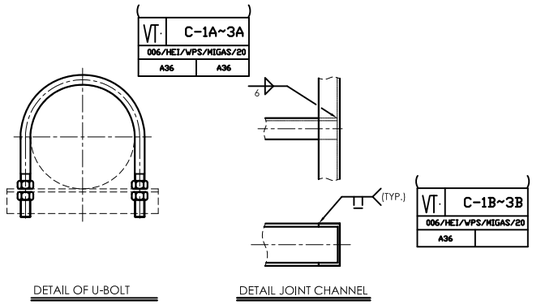
DETAIL "B"



VIEW "Y1"

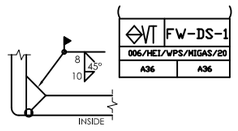
VIEW "Y2"

VIEW "Y3"



DETAIL OF U-BOLT

DETAIL JOINT CHANNEL



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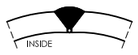
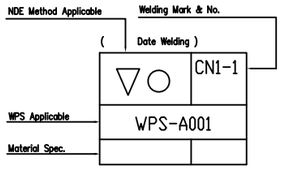


DETAIL "NB"



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
FLANGE	A105
NOZZLE NECK	A106 Gr.B
REINF. PAD	A36
CHANNEL	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

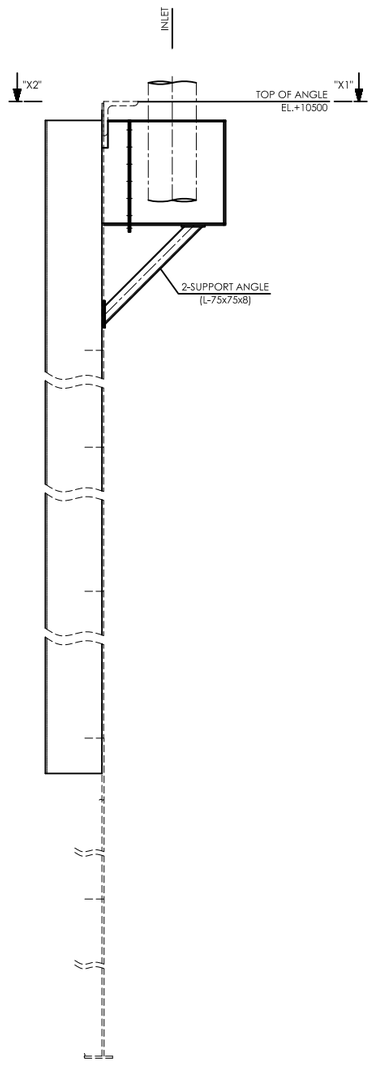
Name

NDE MAP NOZZLE 1-3 LEACH TANK

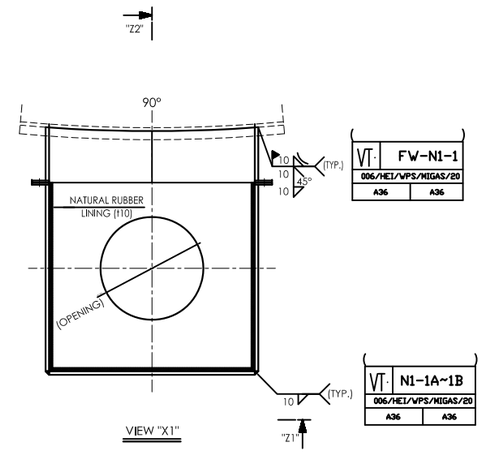
Sheet No./Total sheets	4/9
Size of memory	
PT. HANAZONO Engineering Indonesia — We are always partner with you	
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: LEACH TANK
REFER DWG NO.	: E2502-000-DWG-105
NDE Map No.	E2502-NDE-PBY-001
REV.	0

GENERAL NOTES :

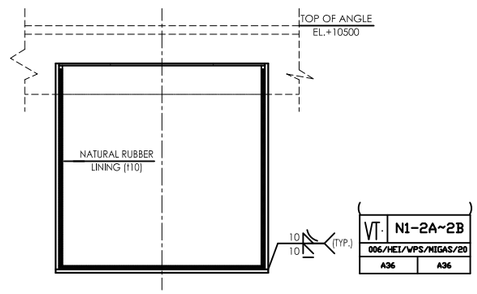
1. BOLT HOLE ORIENTATION
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT
   # LIFTING LUG AND REMOVING OF JIG
   # NOZZLE ATTACHMENT WELDING OF DUCTING



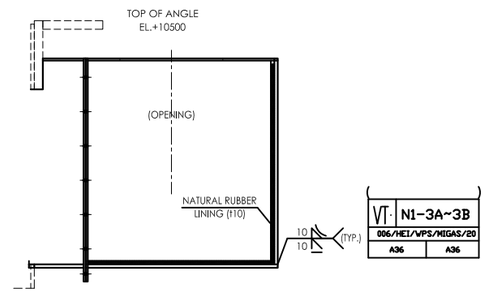
DETAIL OF NOZZLE N1 (100A600)



VIEW "X1"



VIEW "Z1"



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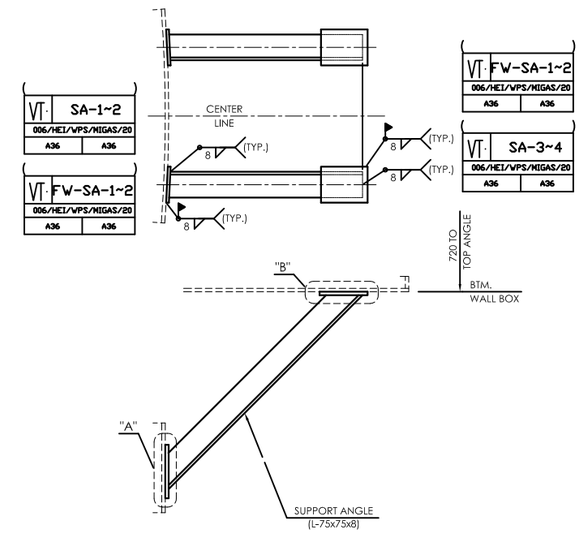
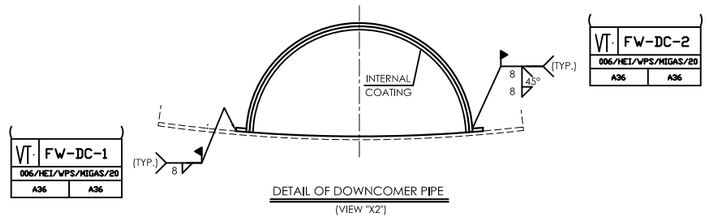
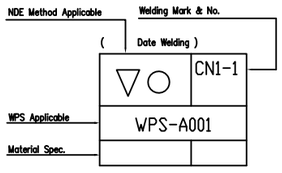




DETAIL OF DOWNCOMER PIPE
(VIEW "X2")



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
FLANGE	A105
NOZZLE NECK	A106 Gr.B
REINF. PAD	A36
CHANNEL	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR	
0	29/09/25		

CHANGE BY CAD SYSTEM ONLY

1	2

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name: NDE MAP NOZZLE 2-3 LEACH TANK

Sheet No./Total sheets	5/9
Size of memory	

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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: LEACH TANK
REFER DWG NO.	: E2502-000-DWG-106

NDE Map No.: E2502-NDE-PBY-001

REV.: 0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

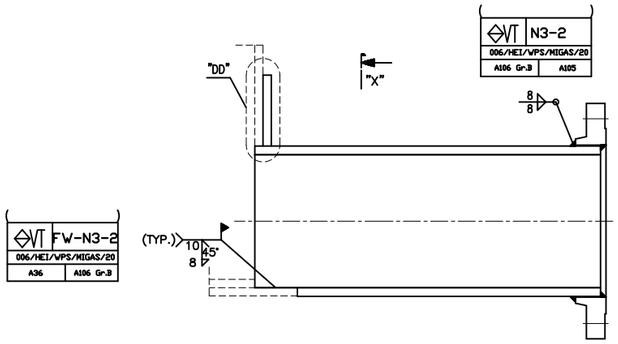
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

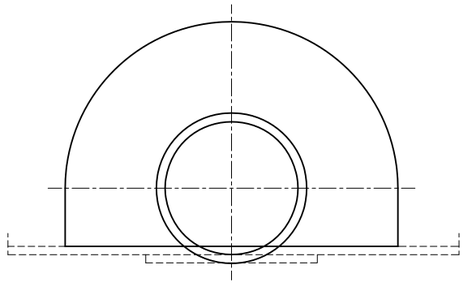
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

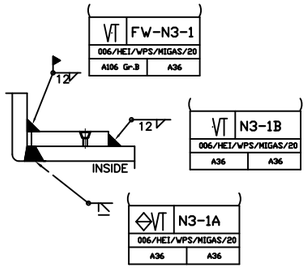
   # NOZZLE ATTACHMENT WELDING OF DUCTING



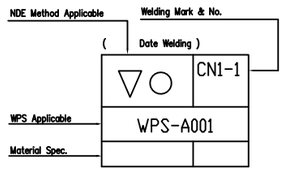
DETAIL OF NOZZLE N3 8"



DETAIL OF REINF. PAD



DETAIL "DD"



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
FLANGE	A105
NOZZLE NECK	A106 Gr.B
REINF. PAD	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name

NDE MAP NOZZLE 3-3 LEACH TANK

Sheet No./Total sheets 6/9

Size of memory

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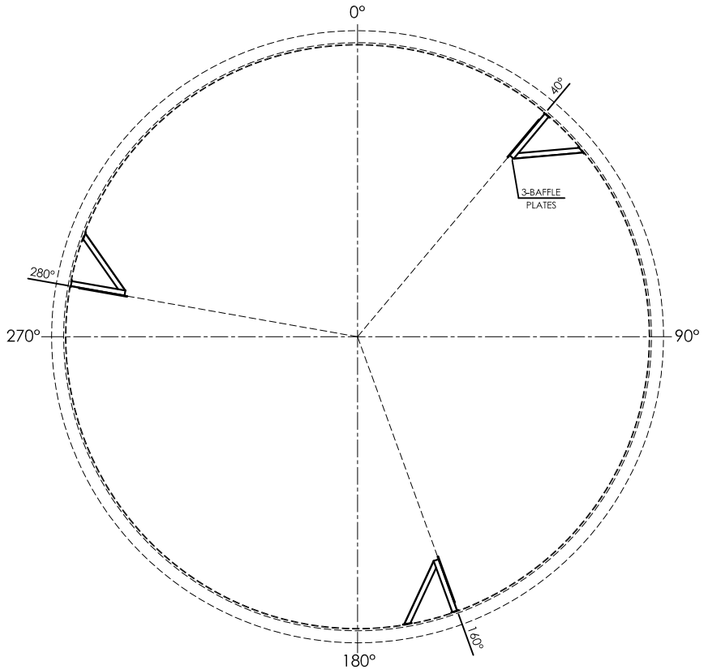
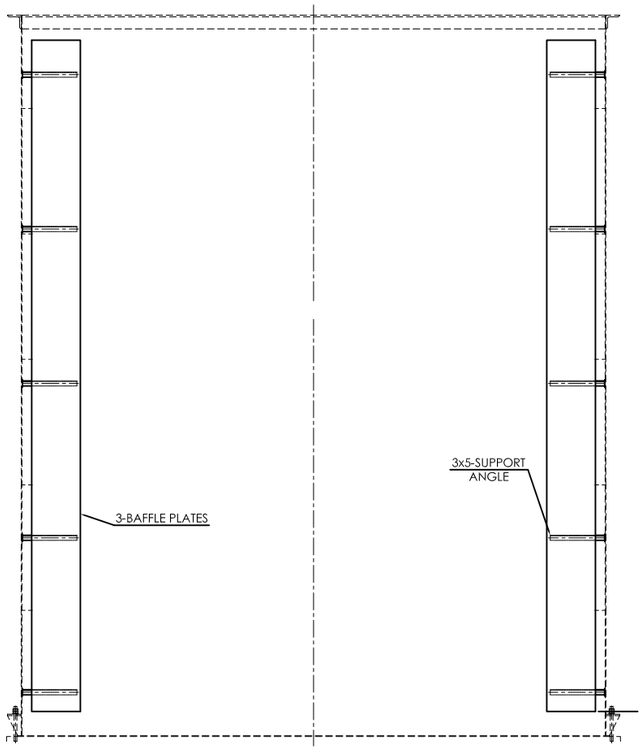
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: LEACH TANK
REFER DWG NO.	: E2502-000-DWG-107

NDE Map No. E2502-NDE-PBY-001

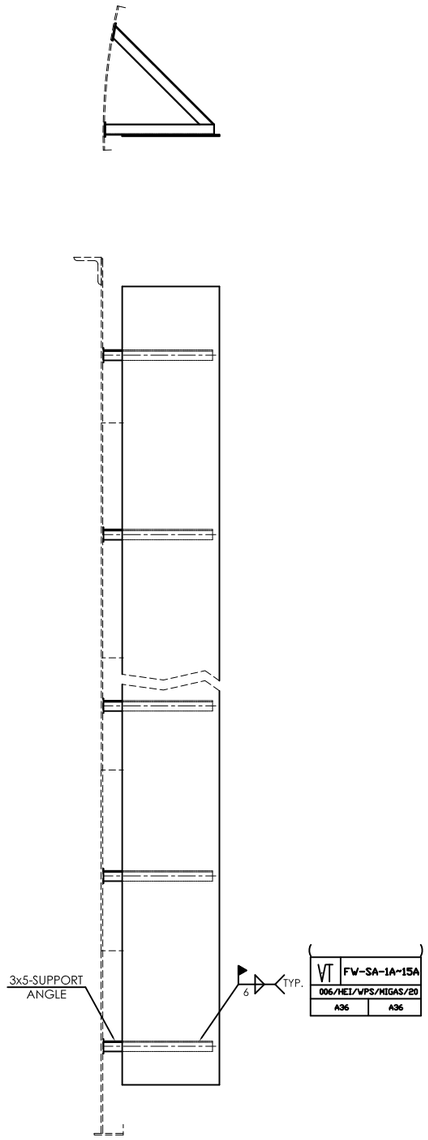
REV. 0



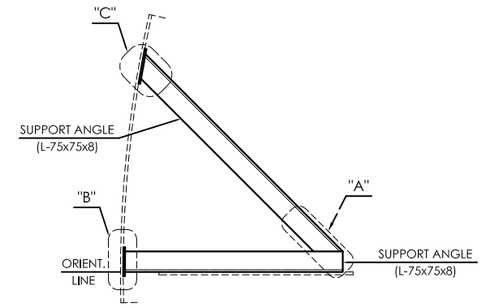
ORIENTATION OF INTERNAL BAFFLE

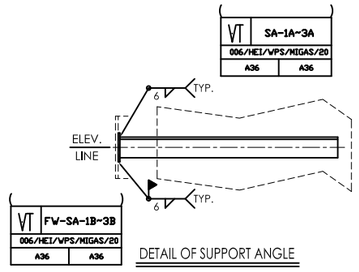


ELEVATION OF INTERNAL BAFFLE

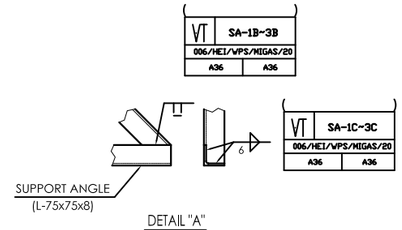


DETAIL OF INTERNAL BAFFLE





DETAIL OF SUPPORT ANGLE



DETAIL "A"

DETAIL "B"

DETAIL "C"

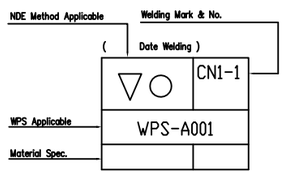
GENERAL NOTES :

1. BOLT HOLE ORIENTATION

   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

   # NOZZLE ATTACHMENT WELDING OF DUCTING



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
INTERNAL BAFFLE	A36
SUPPORT ANGLE	A36
SUPPORT PAD	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name

NDE MAP INTERNAL BAFFLE LEACH TANK

Sheet No./Total sheets 7/9

Size of memory

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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: LEACH TANK
REFER DWG NO.	: E2502-000-DWG-108

NDE Map No. E2502-NDE-PBY-001

REV. 0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

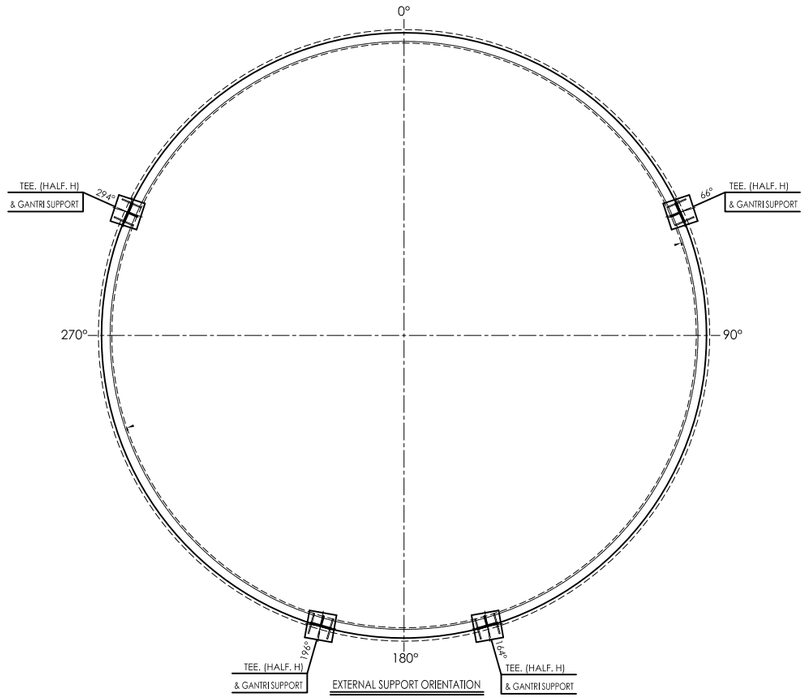
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

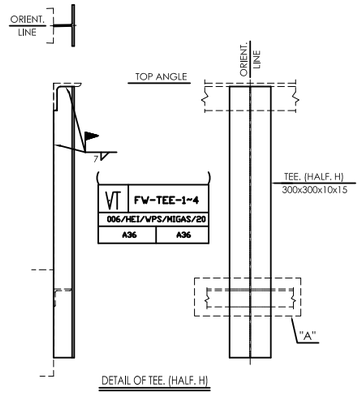
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

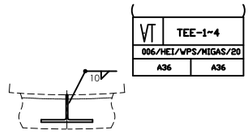
   # NOZZLE ATTACHMENT WELDING OF DUCTING

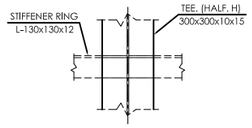


EXTERNAL SUPPORT ORIENTATION

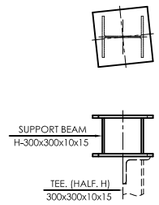


DETAIL OF TEE. (HALF. H)

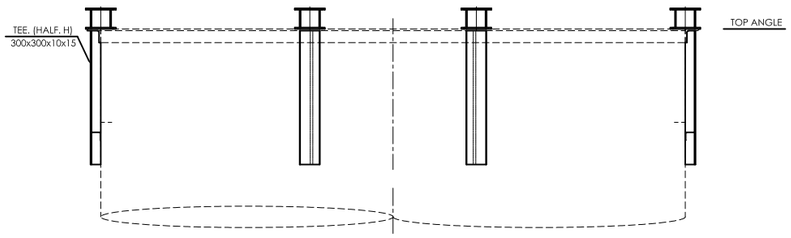




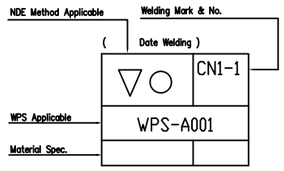
DETAIL "A"



DETAIL OF GANTRI SUPPORT



EXTERNAL SUPPORT ELEVATION



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
TEE HALF	A36
SUPPORT BEAM	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR			
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

1	2

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name

NDE MAP EXTERNAL SUPPORT LEACH TANK

Sheet No./Total sheets	8/9
Size of memory	

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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: LEACH TANK
REFER DWG NO.	: E2502-000-DWG-109

NDE Map No.	REV.
E2502-NDE-PBY-001	0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

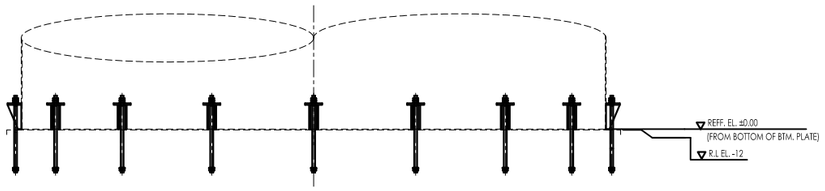
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

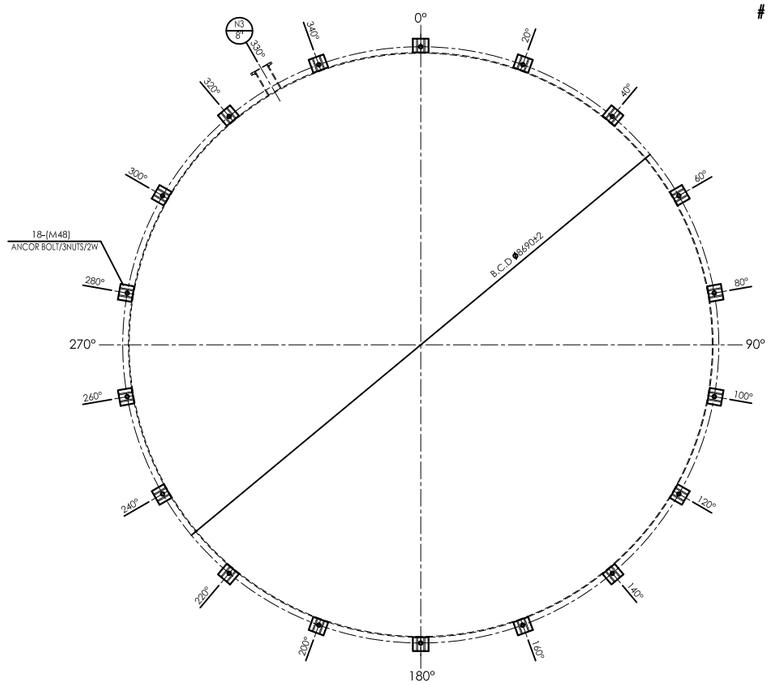
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

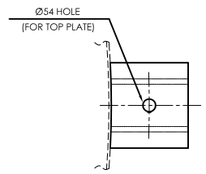
   # NOZZLE ATTACHMENT WELDING OF DUCTING

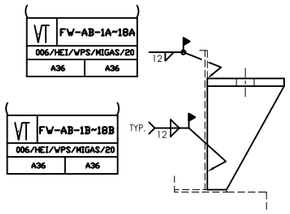


ANCHOR BOLT ELEVATION

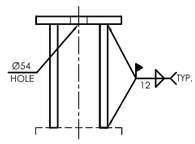


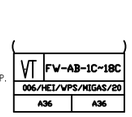
ANCHOR BOLT ORIENTATION
(PLAN VIEW)

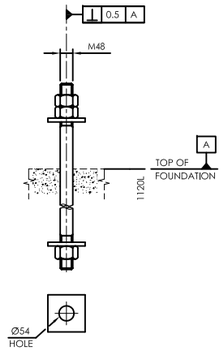




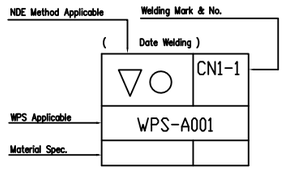
DETAIL OF ANCHOR BOLT CHAIR







ANCHOR BOLT/3N/2W
(BY OTHERS)



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
TOP PLATE	A36
GUSSET PLATE	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR			
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

1	2

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name
NDE MAP ANCHOR BOLT LEACH TANK

Sheet No./Total sheets	9/9
Size of memory	

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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: LEACH TANK
REFER DWG NO.	: E2502-000-DWG-111

NDE Map No.
E2502-NDE-PBY-001

REV.
0

1. NDE MAP NO. : E2502-NDE-PBY-002

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

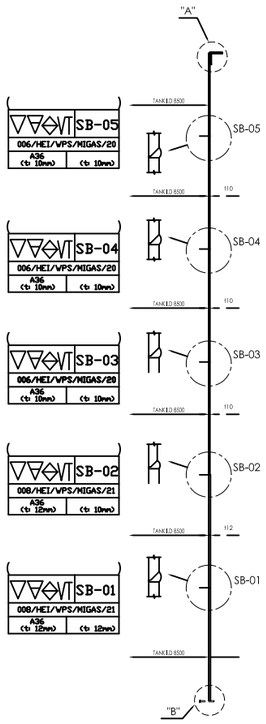
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

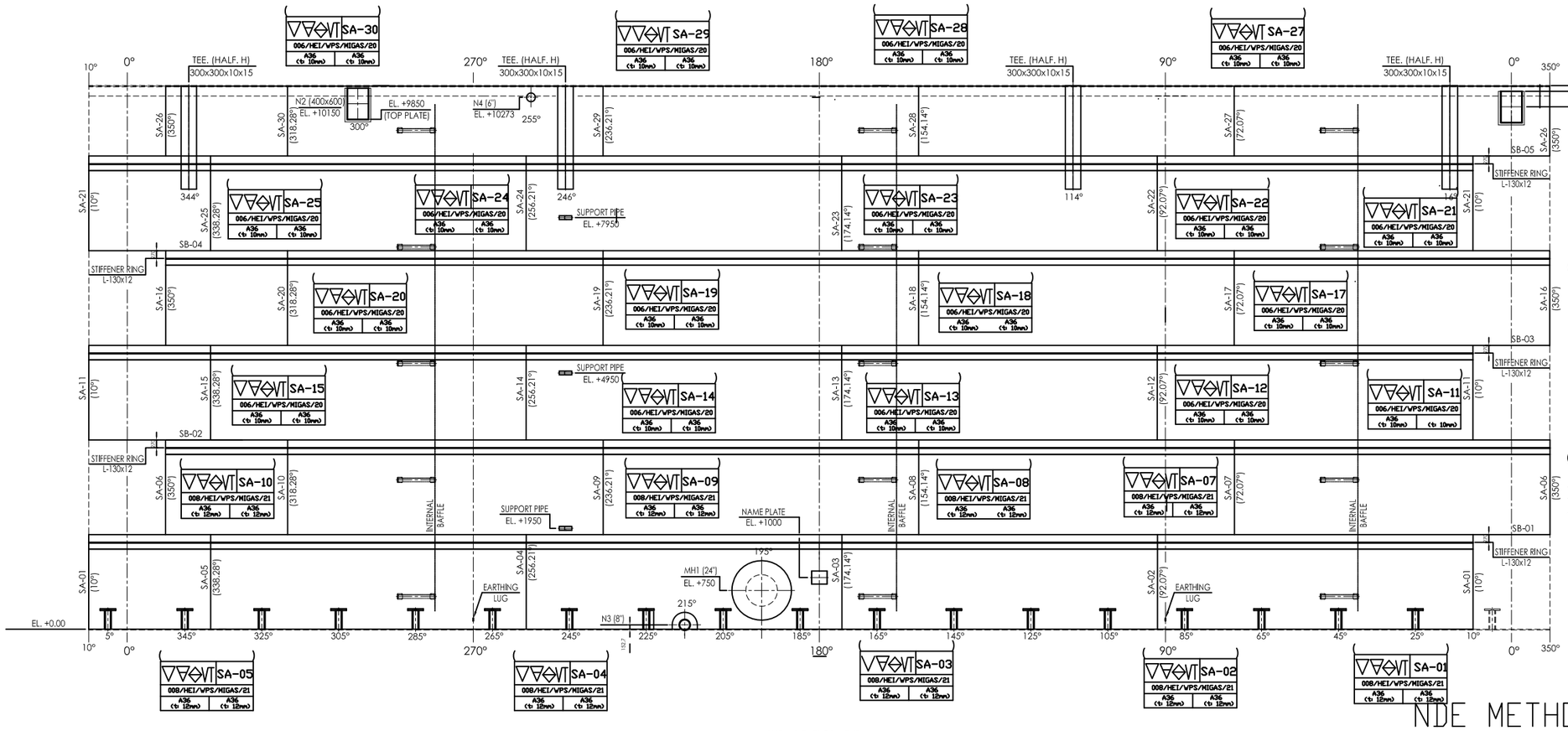
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

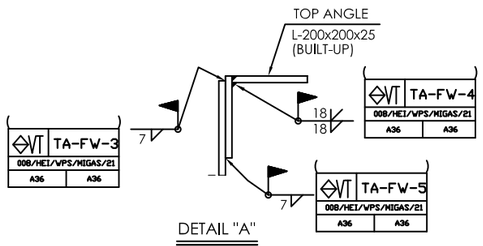
   ‖# NOZZLE ATTACHMENT WELDING OF DUCTING



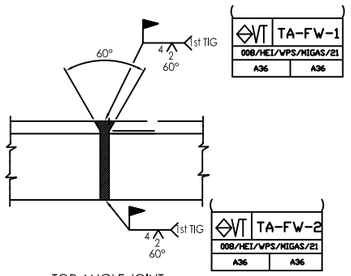
SHELL HORIZONTAL JOINT



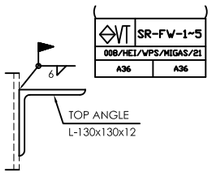
SHELL DEVELOPMENT



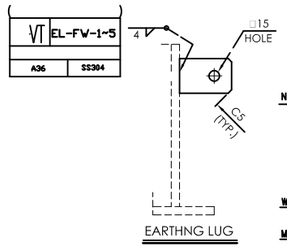
DETAIL "A"



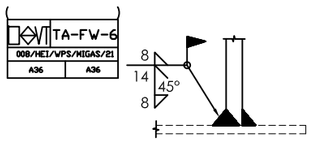
TOP ANGLE JOINT



DETAIL OF STIFFENER RING



EARTHNG LUG



DETAIL "B"

NDE METHOD SYMBOL

- □ VACUUM BOX
- ▽ UT SPOT
- ▽ UT SPOT LAMINATION CHECK FOR SHELL
- ◇ MPI 10%
- VT VISUAL 100%

NDE Method Applicable — Welding Mark & No. — Date Welding — CN1-1 — WPS Applicable — WPS-A001 — Material Spec.

MATERIAL SPECIFICATION	
SHELL	A36
TOP ANGLE	A36
STIFFENER RING	A36

LEGEND :

WPS NO :	008/HEI/WPS/MIGAS/21	SMAW	P1 to P1
	006/HEI/WPS/MIGAS/20	GTAW & SMAW	P1 to P1

File name :

REV	DATE	APPR
0	29/09/25	

CHANGE BY CAD SYSTEM ONLY

1	2

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name: NDE MAP SHELL ADSORPTION TANK 1

Sheet No./Total sheets: 1/10

Size of memory

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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 1
REFER DWG NO.	: E2502-000-DWG-202

NDE Map No.: E2502-NDE-PBY-002

REV.: 0

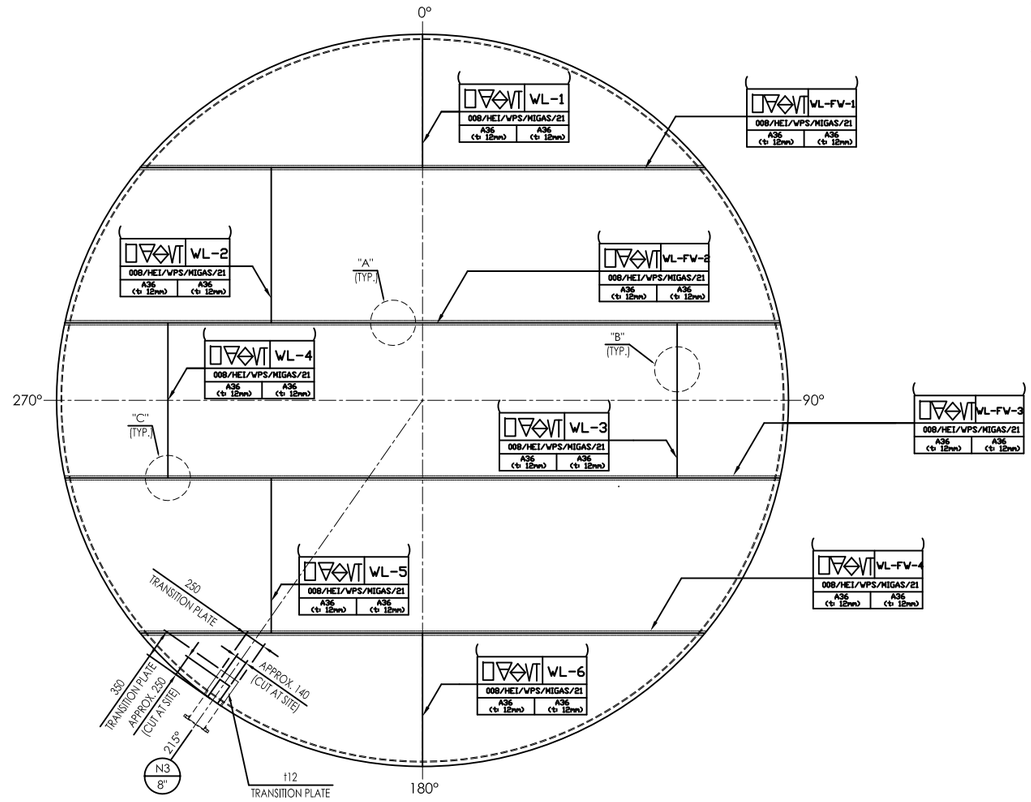
GENERAL NOTES :

1. BOLT HOLE ORIENTATION

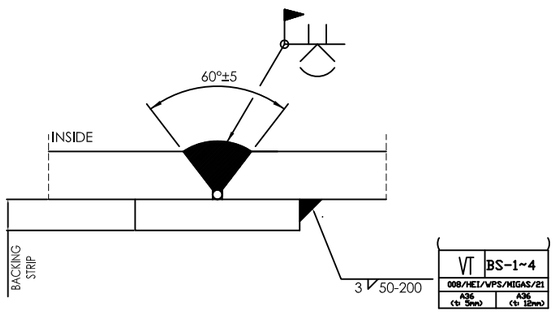
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

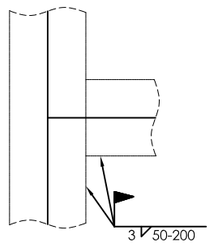
   # NOZZLE ATTACHMENT WELDING OF DUCTING

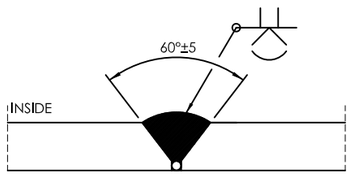


BOTTOM PLATE ARRANGEMENT

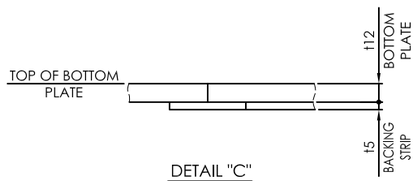


DETAIL "A"

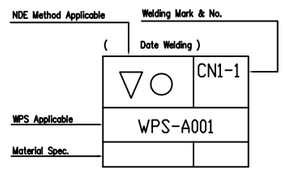




DETAIL "B"



DETAIL "C"



NDE METHOD SYMBOL

- VACUUM BOX
- UT SPOT LAMINATION CHECK FOR BOTTOM
- MPI 10%
- VT VISUAL 100%

MATERIAL SPECIFICATION	
BOTTOM PLATE	A36
BACKING STRIPE	A36

LEGEND :

WPS NO : 008/HEI/WPS/MIGAS/21 SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name

NDE MAP BOTTOM ADSORPTION TANK 1

Sheet No./Total sheets	2/10
Size of memory	

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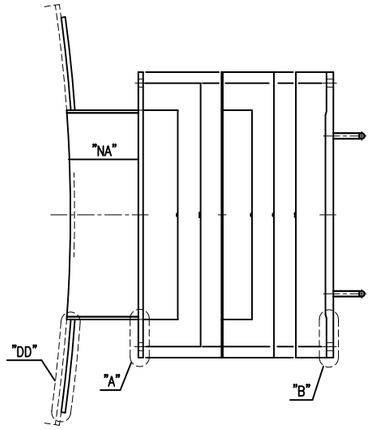
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 1
REFER DWG NO.	: E2502-000-DWG-203

NDE Map No. E2502-NDE-PBY-002

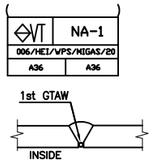
REV. 0

GENERAL NOTES :

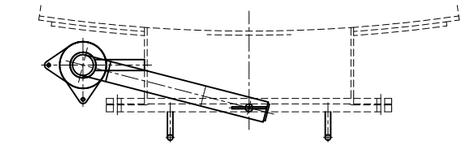
1. BOLT HOLE ORIENTATION
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT
   # LIFTING LUG AND REMOVING OF JIG
   # NOZZLE ATTACHMENT WELDING OF DUCTING

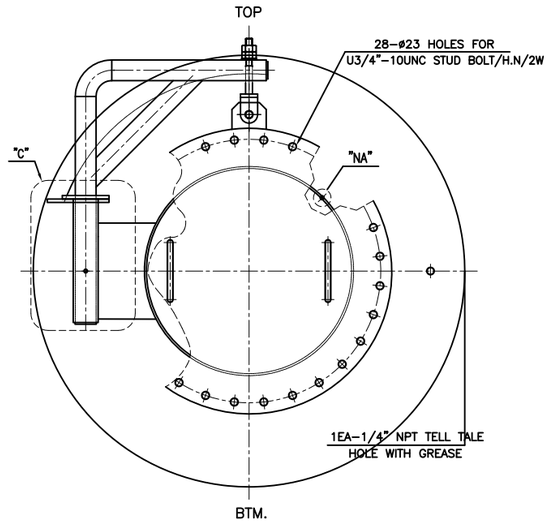


DETAIL OF NOZZLE (MH1) 24"

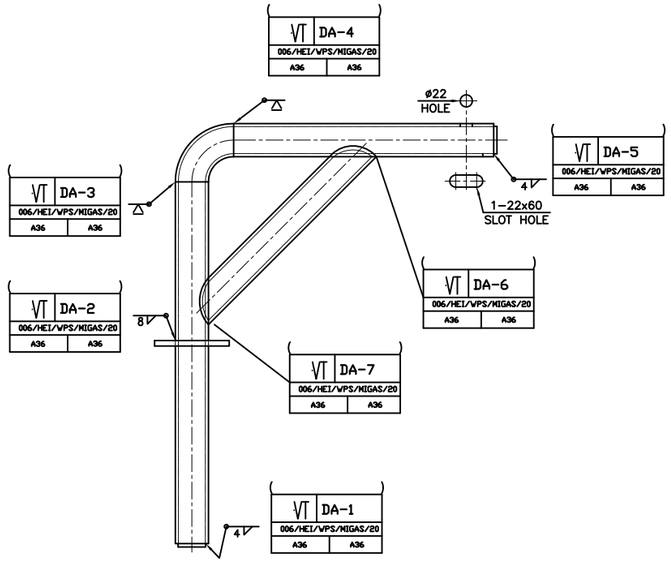


DETAIL "NA"

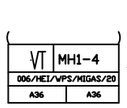




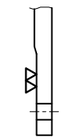
DAVIT ASSEMBLY
(DAVIT ORIENT. SEE ASS'Y DWG)



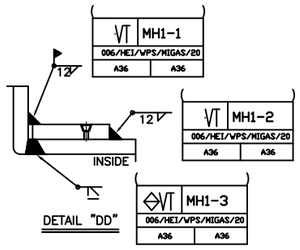
DAVIT DETAIL



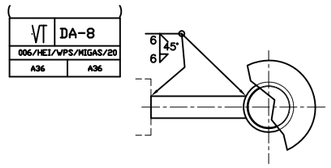
DETAIL "A"

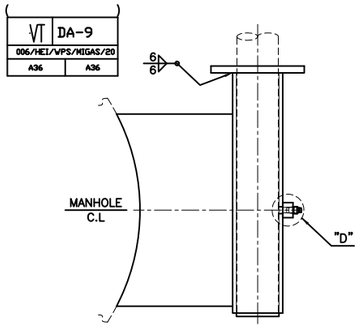


DETAIL "B"

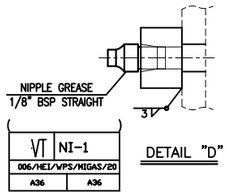


DETAIL "DD"

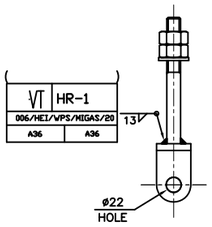




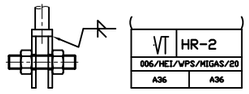
DETAIL "C"

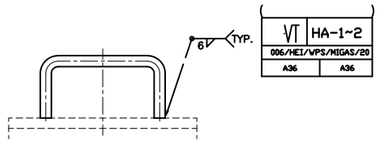


DETAIL "D"

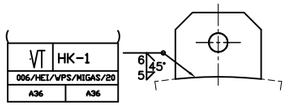


HANGER DETAIL

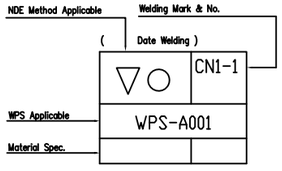




HANDLE DETAIL



HOOK



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
HOOK	A36
PIPE DAVIT	A53 Gr.B
HANDLE	A36
NOZZLE NECK	A36
PLATE FLANGE	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name
NDE MAP MANHOLE ADSORPTION TANK 1

Sheet No./Total sheets	3/10
Size of memory	

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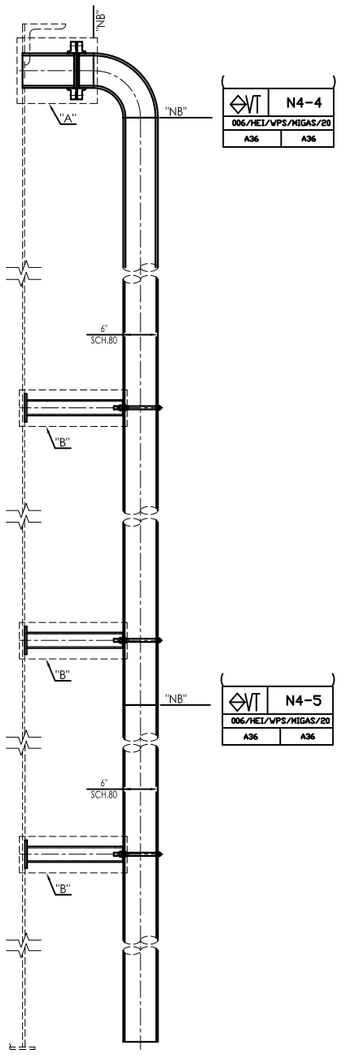
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 1
REFER DWG NO.	: E2502-000-DWG-204

NDE Map No.
E2502-NDE-PBY-002

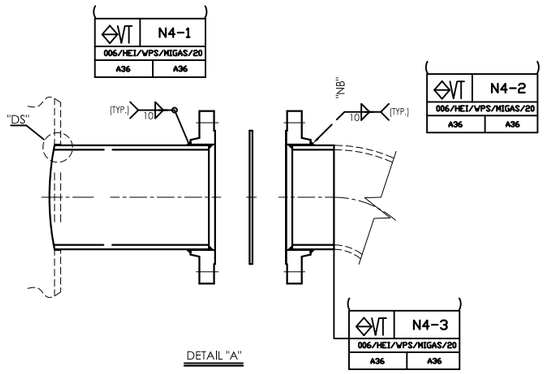
REV.
0

GENERAL NOTES :

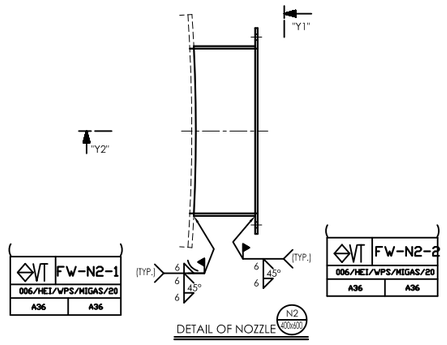
1. BOLT HOLE ORIENTATION
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT
   # LIFTING LUG AND REMOVING OF JIG
   # NOZZLE ATTACHMENT WELDING OF DUCTING



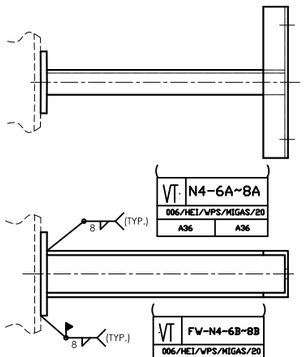
DETAIL OF NOZZLE N4 6"



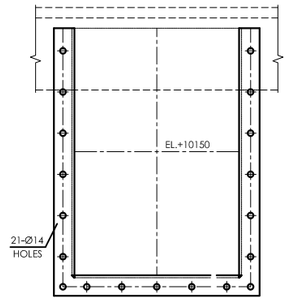
DETAIL "A"



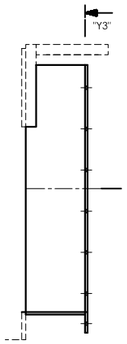
DETAIL OF NOZZLE N2 300x600



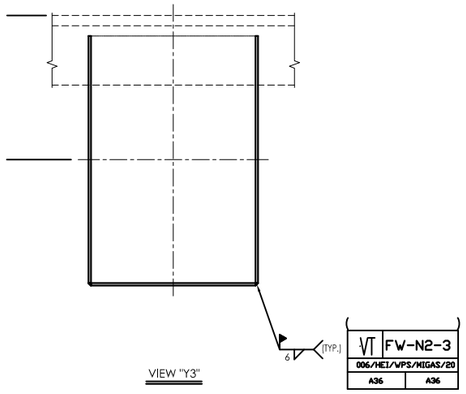
DETAIL "B"



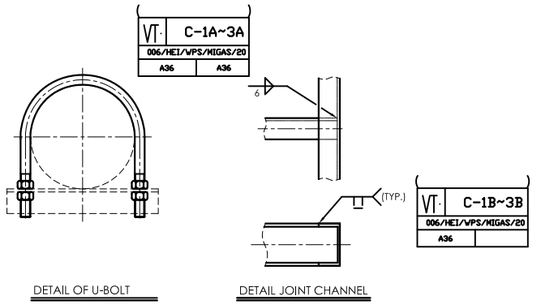
VIEW "Y1"



VIEW "Y2"

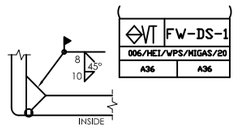


VIEW "Y3"

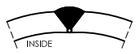


DETAIL OF U-BOLT

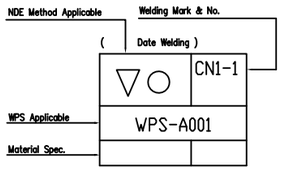
DETAIL JOINT CHANNEL



DETAIL "DS"



DETAIL "NB"



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
FLANGE	A105
NOZZLE NECK	A106 Gr.B
REINF. PAD	A36
CHANNEL	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name
NDE MAP NOZZLE 1-3 ADSORPTION TANK 1

Sheet No./Total sheets	4/10
Size of memory	
PT. HANAZONO Engineering Indonesia — We are always partner with you	
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 1
REFER DWG NO.	: E2502-000-DWG-205
NDE Map No.	E2502-NDE-PBY-002
REV.	0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

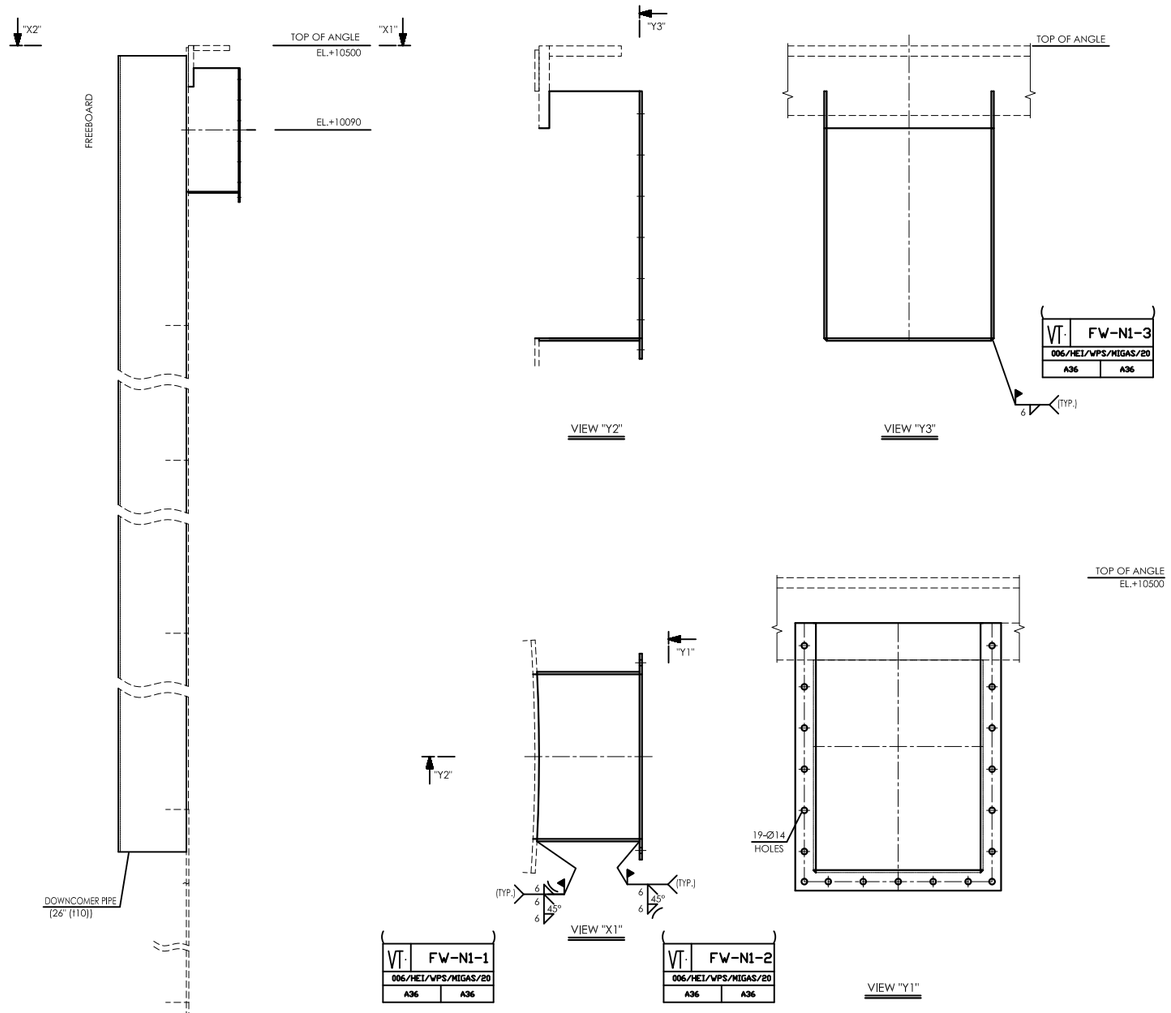
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

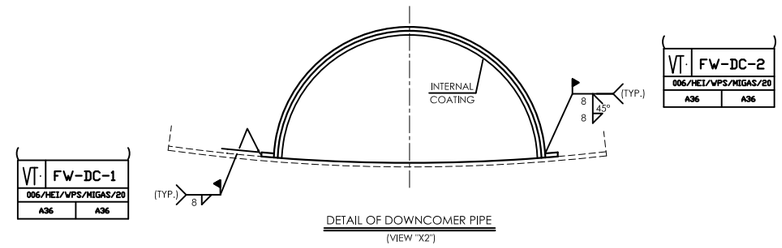
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

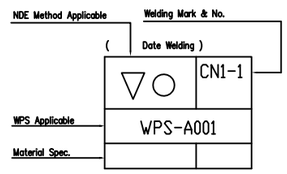
   # NOZZLE ATTACHMENT WELDING OF DUCTING



DETAIL OF NOZZLE N1 (100x50)



DETAIL OF DOWNCOMER PIPE
(VIEW "X2")



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
FLANGE	A105
NOZZLE NECK	A106 Gr.B
REINF. PAD	A36
CHANNEL	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

CHANGE BY CAD SYSTEM ONLY

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name
NDE MAP NOZZLE 2-3 ADSORPTION TANK 1

Sheet No./Total sheets	5/10
Size of memory	

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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 1
REFER DWG NO.	: E2502-000-DWG-206

NDE Map No.
E2502-NDE-PBY-002

REV.
0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

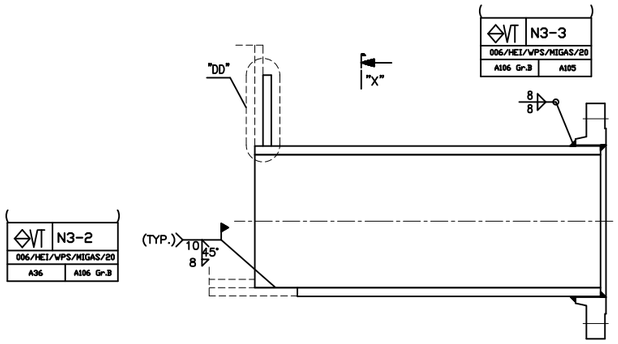
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

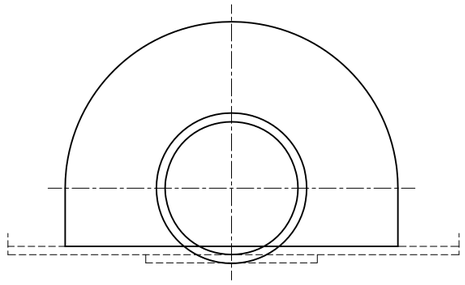
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

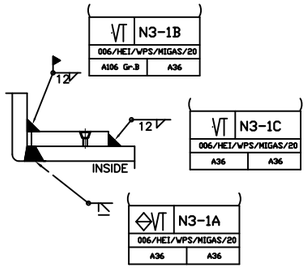
   # NOZZLE ATTACHMENT WELDING OF DUCTING



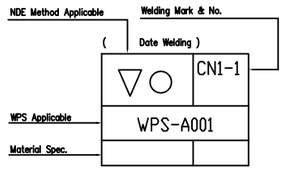
DETAIL OF NOZZLE N3 8"



DETAIL OF REINF. PAD



DETAIL "DD"



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
FLANGE	A105
NOZZLE NECK	A106 Gr.B
REINF. PAD	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name

NDE MAP NOZZLE 3-3 ADSORPTION TANK 1

Sheet No./Total sheets 6/10

Size of memory

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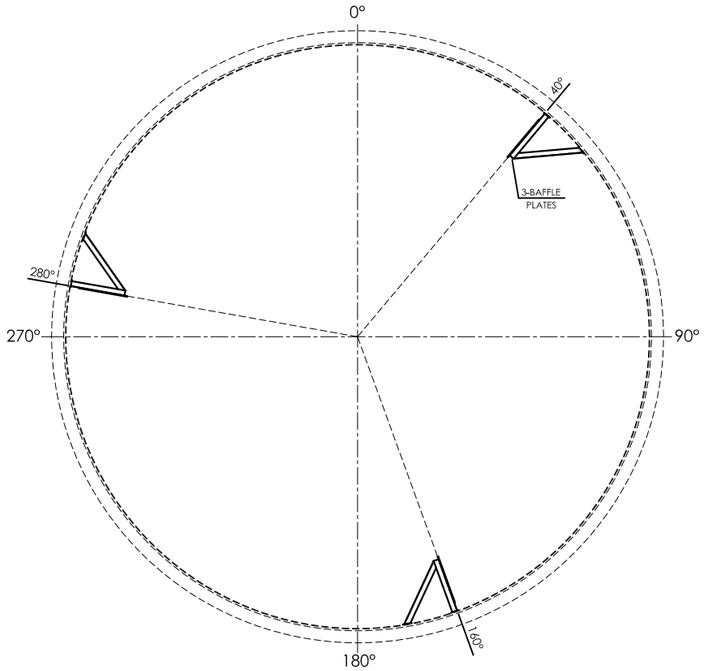
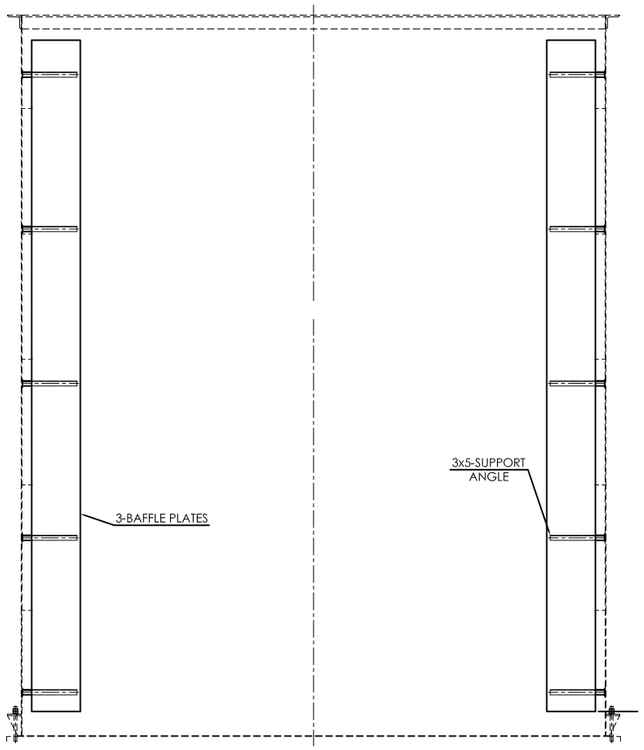
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 1
REFER DWG NO.	: E2502-000-DWG-207

NDE Map No. E2502-NDE-PBY-002

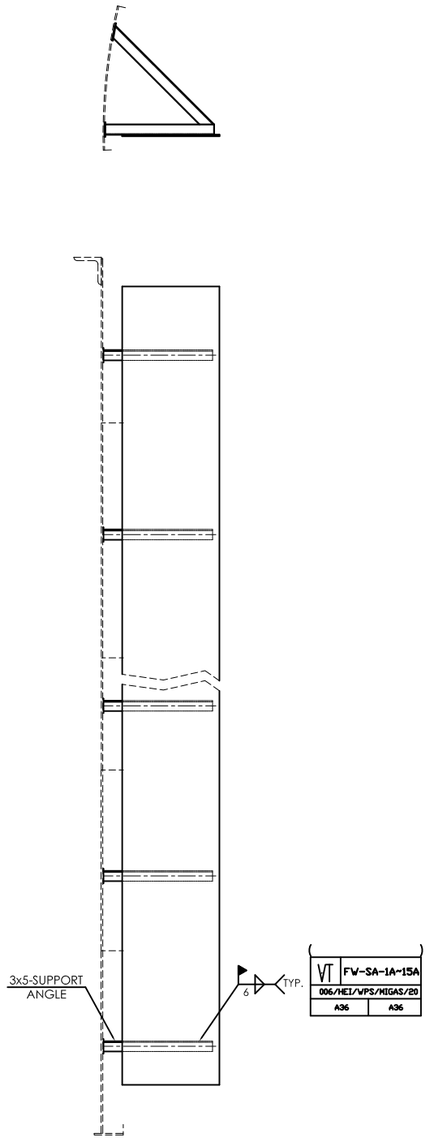
REV. 0



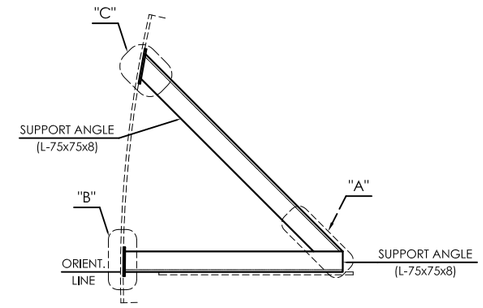
ORIENTATION OF INTERNAL BAFFLE

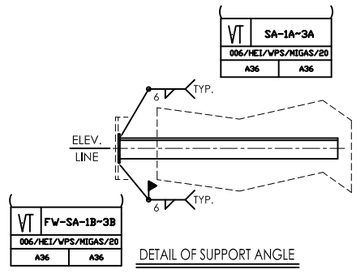


ELEVATION OF INTERNAL BAFFLE

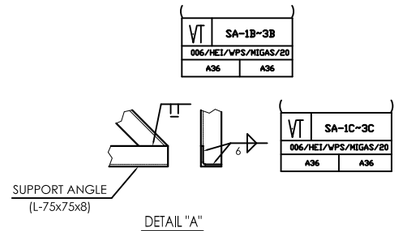


DETAIL OF INTERNAL BAFFLE





DETAIL OF SUPPORT ANGLE



DETAIL "A"

DETAIL "B"

DETAIL "C"

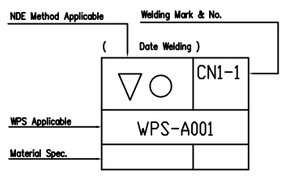
GENERAL NOTES :

1. BOLT HOLE ORIENTATION

   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

   # NOZZLE ATTACHMENT WELDING OF DUCTING



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
INTERNAL BAFFLE	A36
SUPPORT ANGLE	A36
SUPPORT PAD	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name

NDE MAP INTERNAL BAFFLE
ADSORPTION TANK 1

Sheet No./Total sheets	7/10
Size of memory	
PT. HANAZONO Engineering Indonesia — We are always partner with you	
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 1
REFER DWG NO.	: E2502-000-DWG-208
NDE Map No.	E2502-NDE-PBY-002
REV.	0

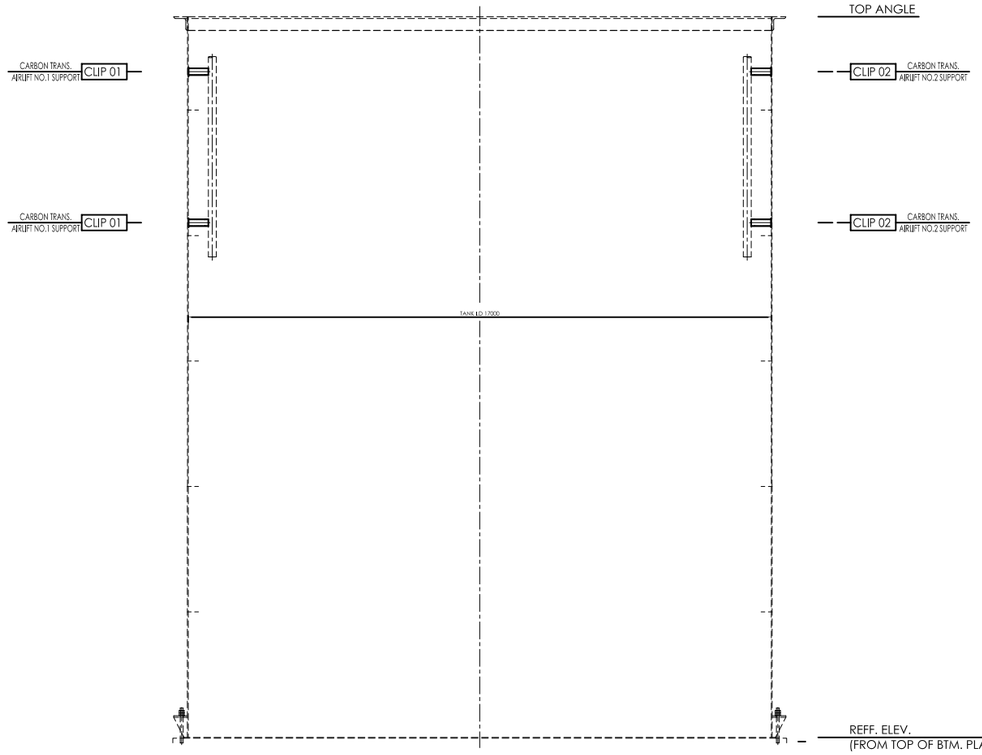
GENERAL NOTES :

1. BOLT HOLE ORIENTATION

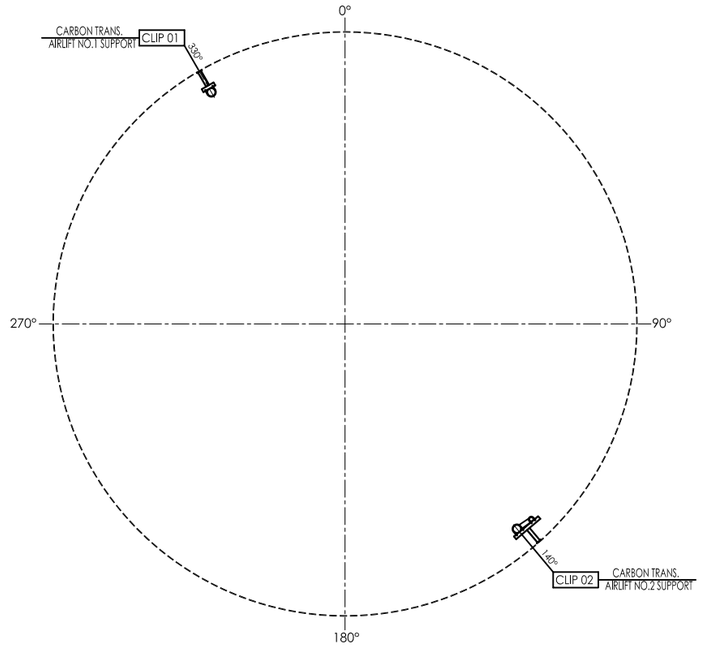
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

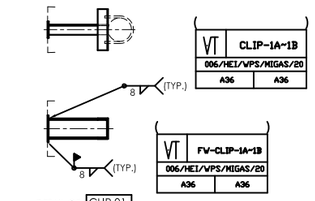
   # NOZZLE ATTACHMENT WELDING OF DUCTING



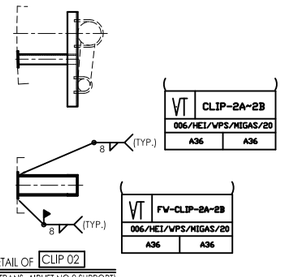
PIPE SUPPORT ELEVATION



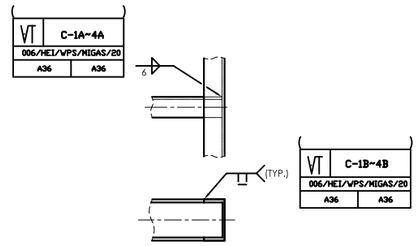
PIPE SUPPORT PLAN



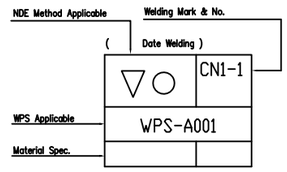
DETAIL OF CLIP 01
(CARBON TRANS. AIRLIFT NO.1 SUPPORT)



DETAIL OF CLIP 02
(CARBON TRANS. AIRLIFT NO.2 SUPPORT)



DETAIL JOINT CHANNEL



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
SUPPORT CHANNEL	A36
REINF. PAD	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR			
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

1	2

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name

NDE MAP INTERNAL SUPPORT
ADSORPTION TANK 1

Sheet No./Total sheets	8/10
Size of memory	

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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 1
REFER DWG NO.	: E2502-000-DWG-209

NDE Map No.
E2502-NDE-PBY-002

REV.
0

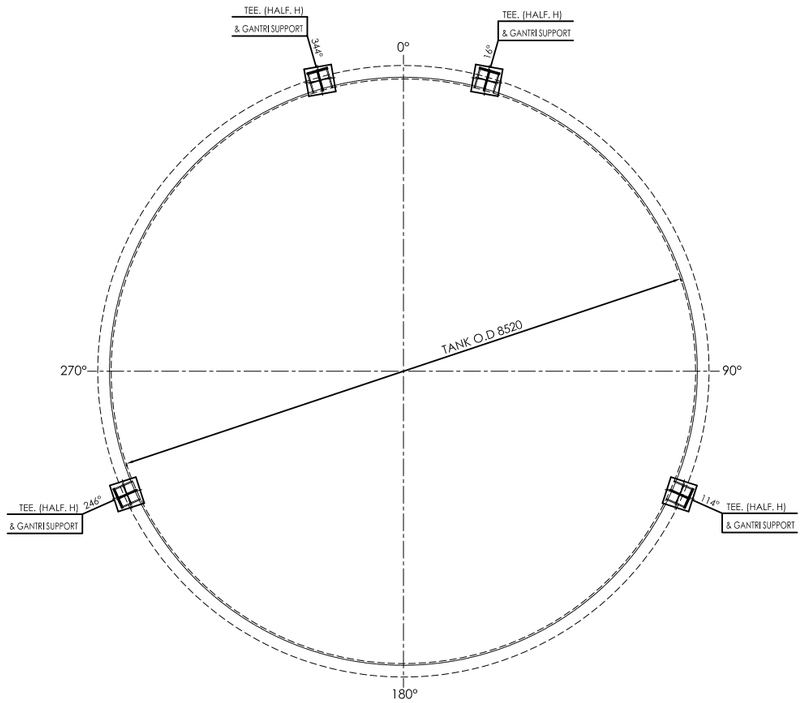
GENERAL NOTES :

1. BOLT HOLE ORIENTATION

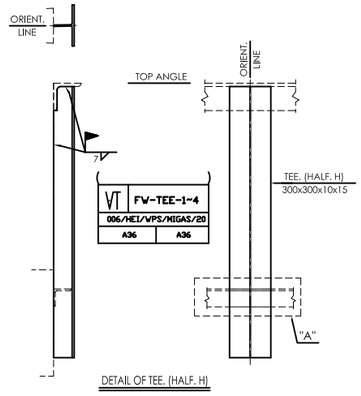
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

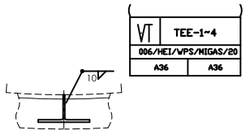
   # NOZZLE ATTACHMENT WELDING OF DUCTING

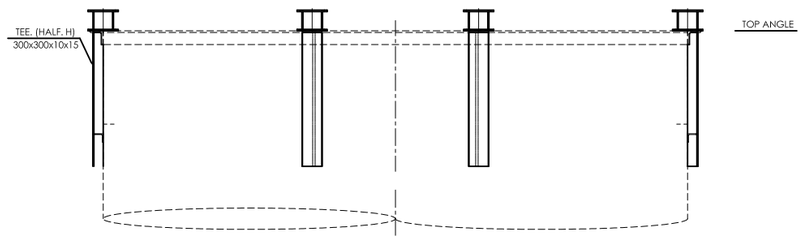


EXTERNAL SUPPORT ORIENTATION

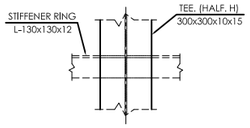


DETAIL OF TEE. (HALF. H)

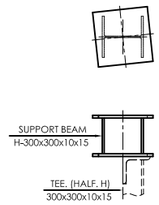




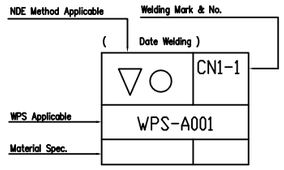
EXTERNAL SUPPORT ELEVATION



DETAIL "A"



DETAIL OF GANTRI SUPPORT



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
TEE HALF	A36
SUPPORT BEAM	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name

NDE MAP EXTERNAL SUPPORT
ADSORPTION TANK 1

Sheet No./Total sheets	9/10
Size of memory	

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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 1
REFER DWG NO.	: E2502-000-DWG-210

NDE Map No.: E2502-NDE-PBY-002

REV.: 0

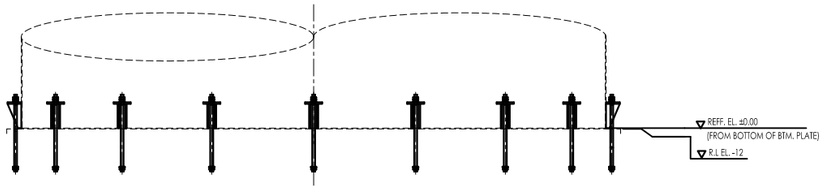
GENERAL NOTES :

1. BOLT HOLE ORIENTATION

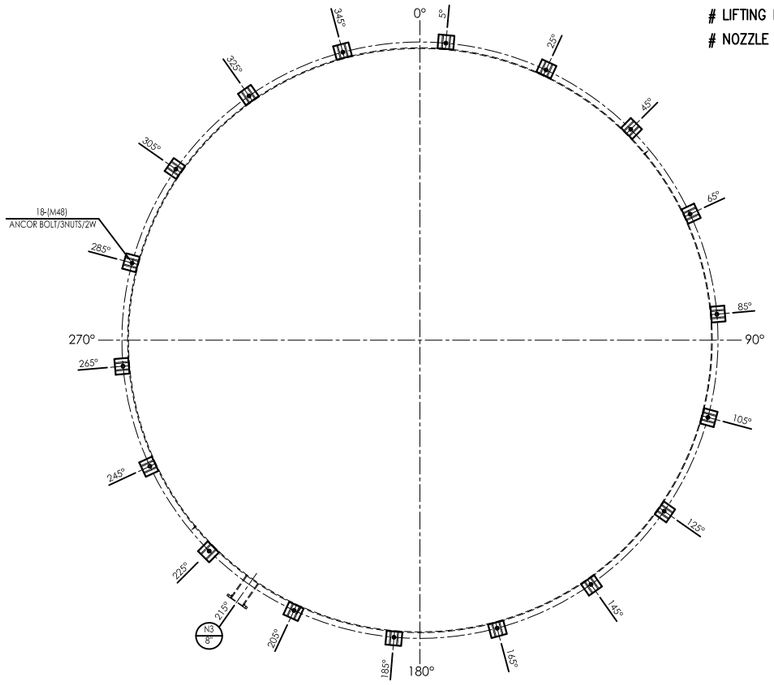
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

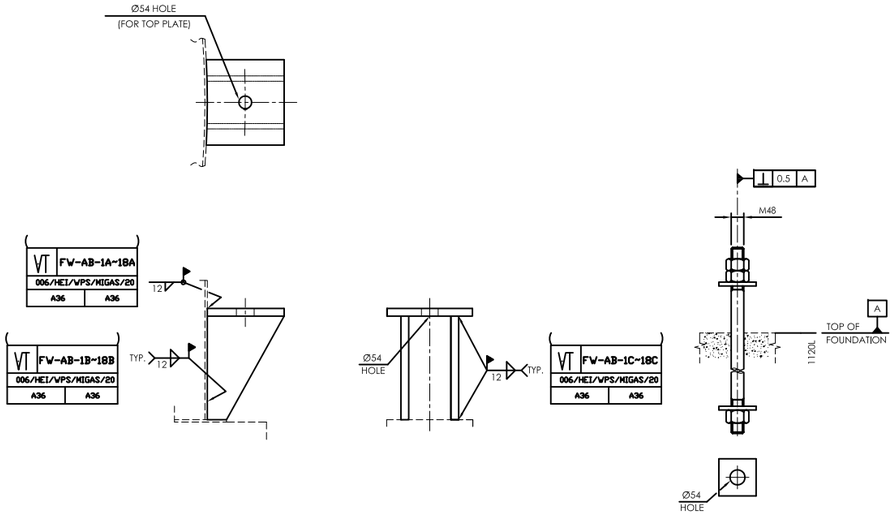
   # NOZZLE ATTACHMENT WELDING OF DUCTING



ANCHOR BOLT ELEVATION

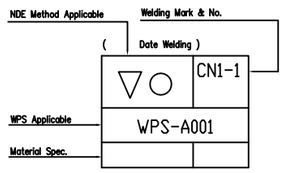


ANCHOR BOLT ORIENTATION
(PLAN VIEW)



DETAIL OF ANCHOR BOLT CHAIR

ANCHOR BOLT/3N/2W
(BY OTHERS)



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION		LEGEND :
TOP PLATE	A36	WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1
GUSSET PLATE	A36	

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name: NDE MAP ANCHOR BOLT ADSORPTION TANK 1

Sheet No./Total sheets: 10/10

Size of memory:

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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 1
REFER DWG NO.	: E2502-000-DWG-211

NDE Map No.: E2502-NDE-PBY-002

REV.: 0

1. NDE MAP NO. : E2502-NDE-PBY-003

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

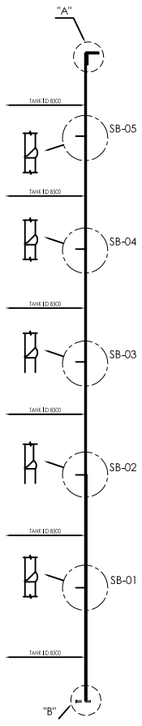
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

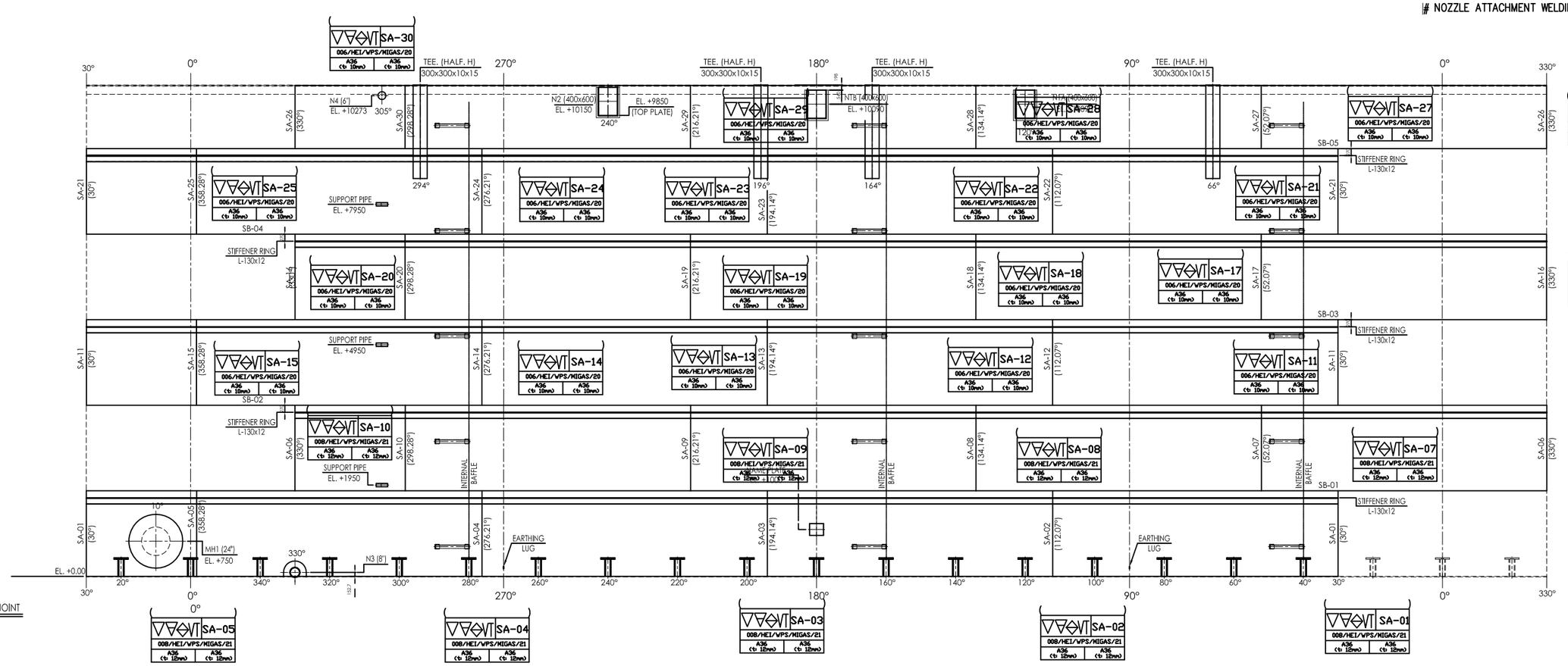
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

   # NOZZLE ATTACHMENT WELDING OF DUCTING



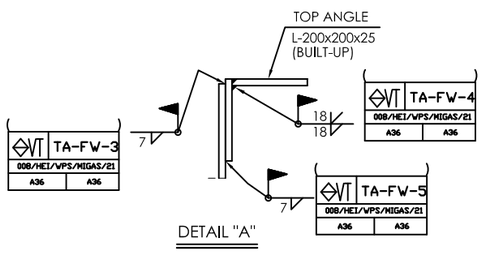
SHELL HORIZONTAL JOINT



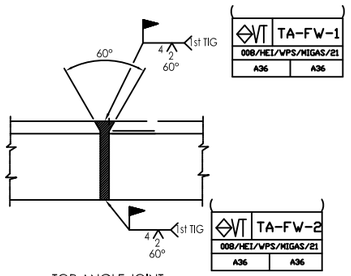
SHELL DEVELOPMENT

NDE METHOD SYMBOL

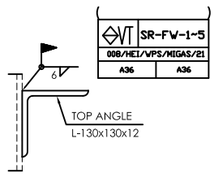
- □ VACUUM BOX
- ▽ UT SPOT
- ▽ UT SPOT LAMINATION CHECK FOR SHELL
- ◇ MPI 10%
- VT VISUAL 100%



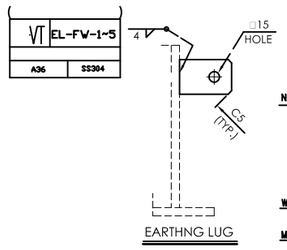
DETAIL "A"



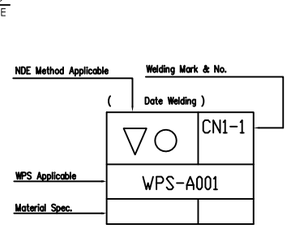
TOP ANGLE JOINT

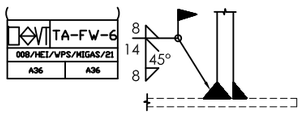


DETAIL OF STIFFENER RING



EARTHNG LUG





DETAIL "B"

MATERIAL SPECIFICATION	
SHELL	A36
TOP ANGLE	A36
STIFFENER RING	A36

LEGEND :

WPS NO :	008/HEI/WPS/MIGAS/21	SMAW	P1 to P1
	006/HEI/WPS/MIGAS/20	GTAW & SMAW	P1 to P1

File name :

REV	DATE	APPR			
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

1	2

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

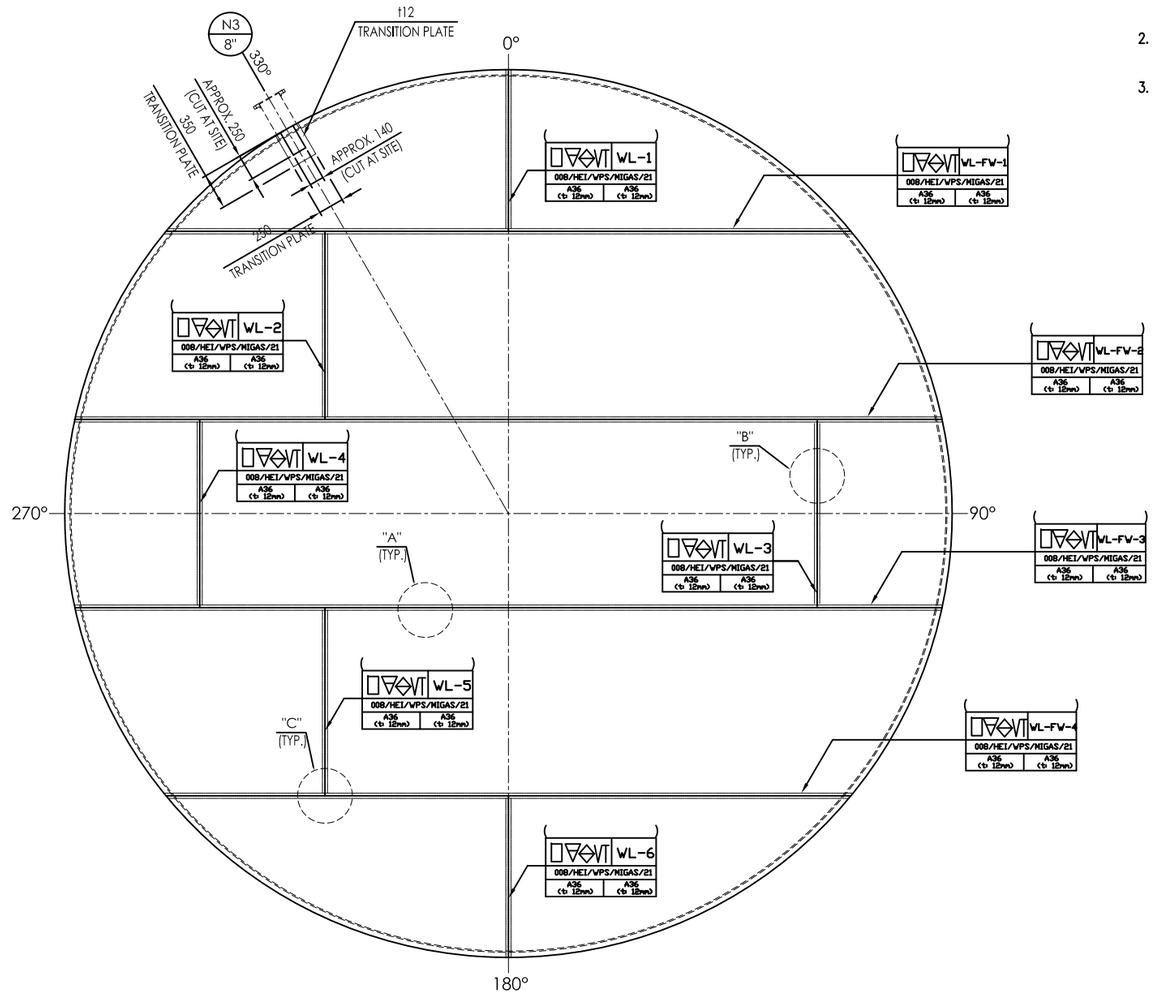
Name

NDE MAP SHELL ADSORPTION TANK 2

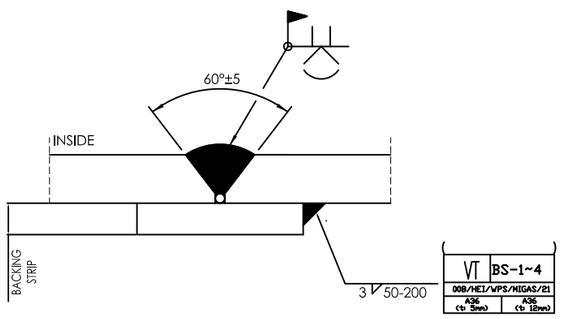
Sheet No./Total sheets	1/10
Size of memory	
PT. HANAZONO Engineering Indonesia — We are always partner with you	
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 2
REFER DWG NO.	: E2502-000-DWG-302
NDE Map No.	E2502-NDE-PBY-003
REV.	0

GENERAL NOTES :

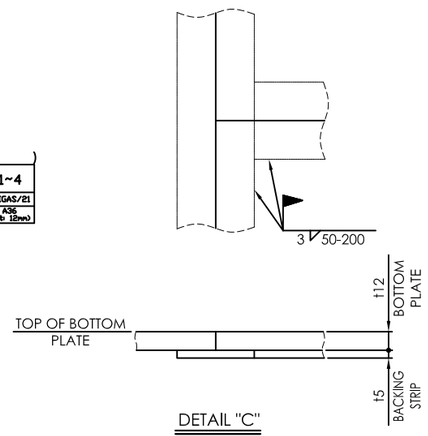
1. BOLT HOLE ORIENTATION
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT
   # LIFTING LUG AND REMOVING OF JIG
   # NOZZLE ATTACHMENT WELDING OF DUCTING



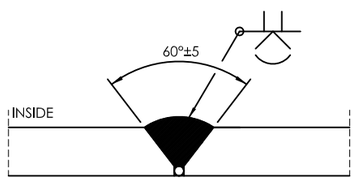
BOTTOM PLATE ARRANGEMENT



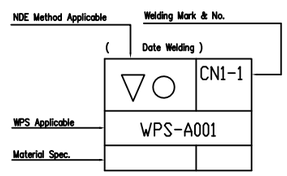
DETAIL "A"



DETAIL "C"



DETAIL "B"



NDE METHOD SYMBOL

- □ VACUUM BOX
- ▽ UT SPOT LAMINATION CHECK FOR BOTTOM
- ◇ MPI 10%
- VT VISUAL 100%

MATERIAL SPECIFICATION	
BOTTOM PLATE	A36
BACKING STRIPE	A36

LEGEND :

WPS NO : 008/HEI/WPS/MIGAS/21 SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

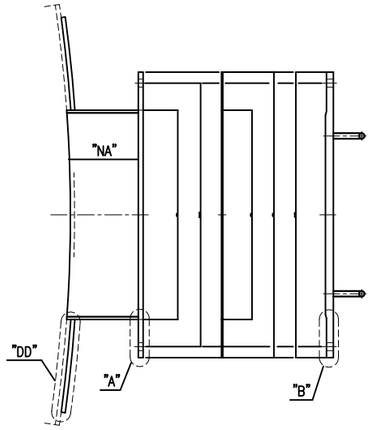
Scale : NTS

Name
NDE MAP BOTTOM ADSORPTION TANK 2

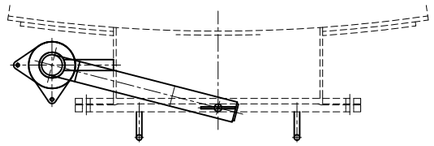
Sheet No./Total sheets	2/10
Size of memory	
PT. HANAZONO Engineering Indonesia — We are always partner with you	
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 2
REFER DWG NO.	: E2502-000-DWG-303
NDE Map No.	E2502-NDE-PBY-003
REV.	0

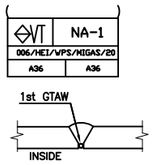
GENERAL NOTES :

1. BOLT HOLE ORIENTATION
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT
   # LIFTING LUG AND REMOVING OF JIG
   # NOZZLE ATTACHMENT WELDING OF DUCTING

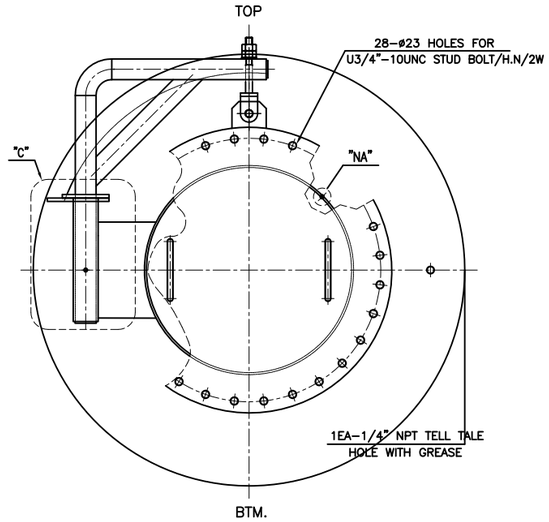


DETAIL OF NOZZLE (MH1) 24"

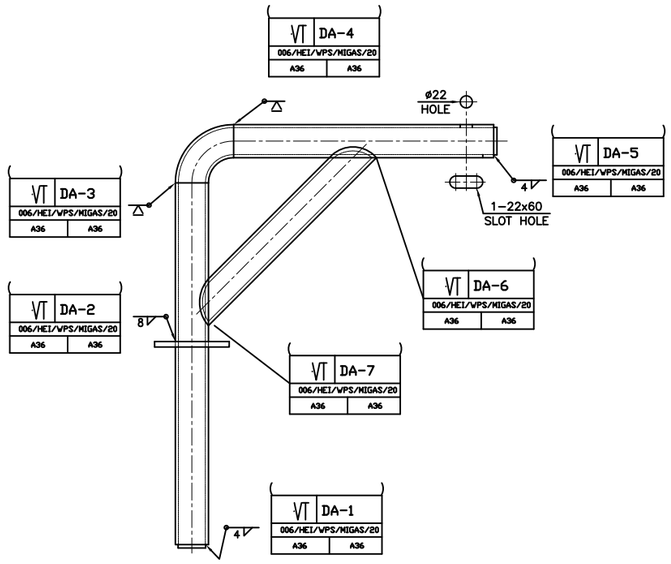




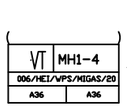
DETAIL "NA"



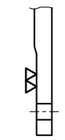
DAVIT ASSEMBLY
(DAVIT ORIENT. SEE ASS'Y DWG)



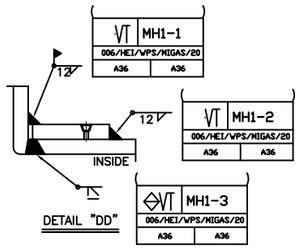
DAVIT DETAIL



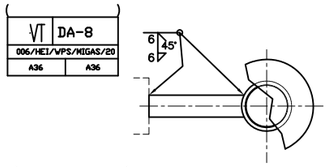
DETAIL "A"

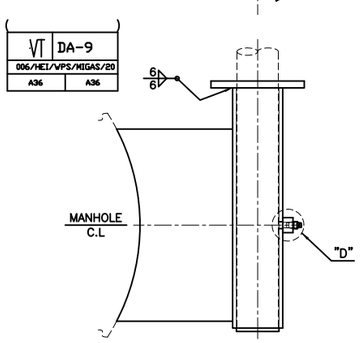


DETAIL "B"

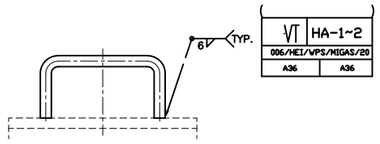


DETAIL "DD"

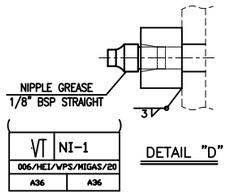




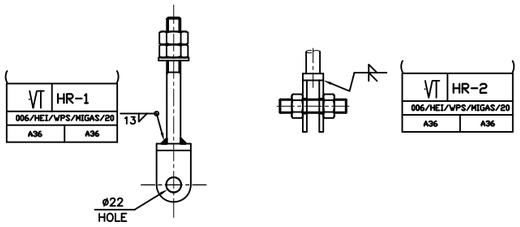
DETAIL "C"



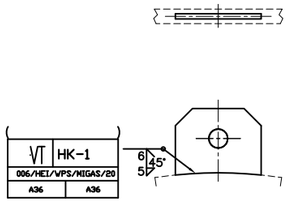
HANDLE DETAIL



DETAIL "D"

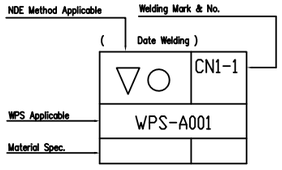


HANGER DETAIL



HOOK

NDE METHOD SYMBOL



▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
HOOK	A36
PIPE DAVIT	A53 Gr.B
HANDLE	A36
NOZZLE NECK	A36
PLATE FLANGE	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name
NDE MAP MANHOLE ADSORPTION TANK 2

Sheet No./Total sheets	3/10
Size of memory	

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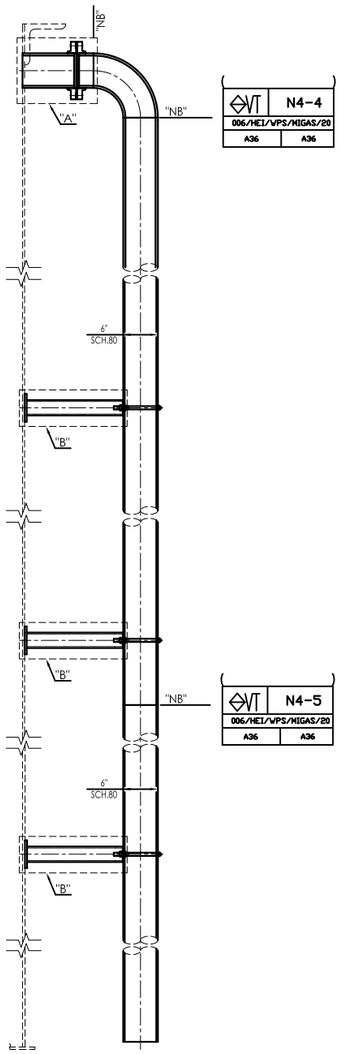
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 2
REFER DWG NO.	: E2502-000-DWG-304

NDE Map No.
E2502-NDE-PBY-003

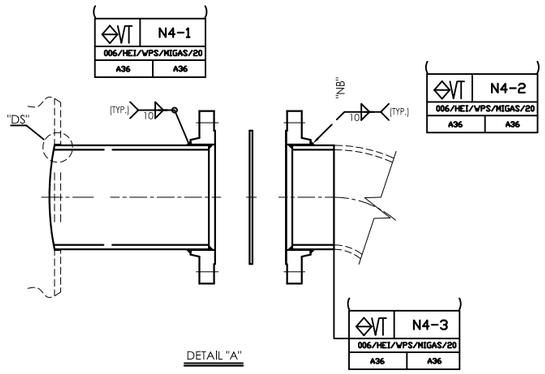
REV.
0

GENERAL NOTES :

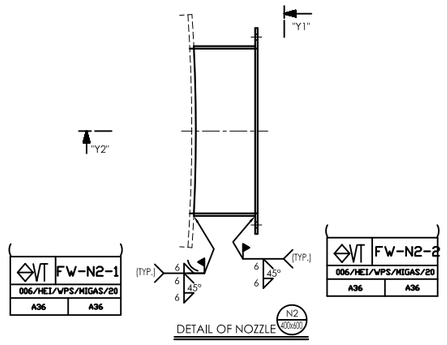
1. BOLT HOLE ORIENTATION
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT
   # LIFTING LUG AND REMOVING OF JIG
   # NOZZLE ATTACHMENT WELDING OF DUCTING



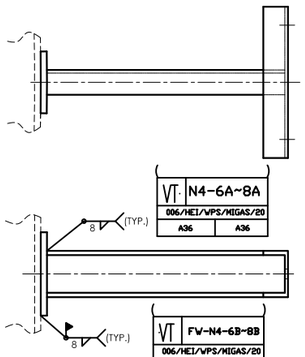
DETAIL OF NOZZLE N4 6"



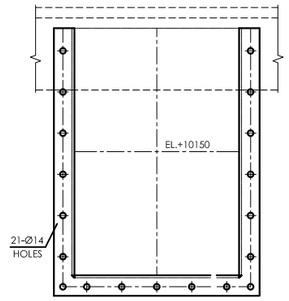
DETAIL "A"



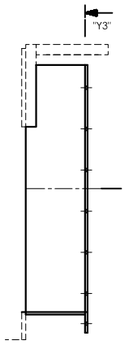
DETAIL OF NOZZLE N2 300x600



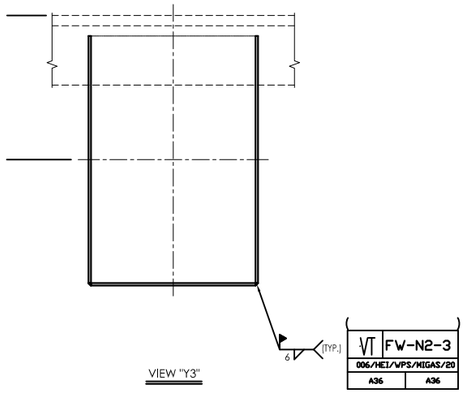
DETAIL "B"



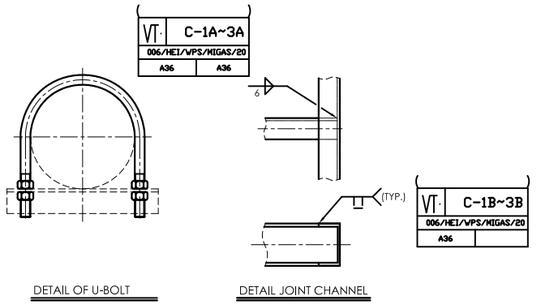
VIEW "Y1"



VIEW "Y2"

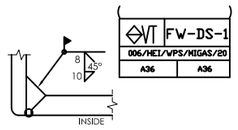


VIEW "Y3"

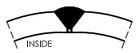


DETAIL OF U-BOLT

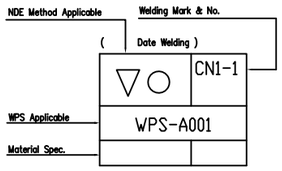
DETAIL JOINT CHANNEL



DETAIL "DS"



DETAIL "NB"



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
FLANGE	A105
NOZZLE NECK	A106 Gr.B
REINF. PAD	A36
CHANNEL	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name
NDE MAP NOZZLE 1-3 ADSORPTION TANK 2

Sheet No./Total sheets	4/10
Size of memory	
PT. HANAZONO Engineering Indonesia — We are always partner with you	
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 2
REFER DWG NO.	: E2502-000-DWG-305
NDE Map No.	E2502-NDE-PBY-003
REV.	0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

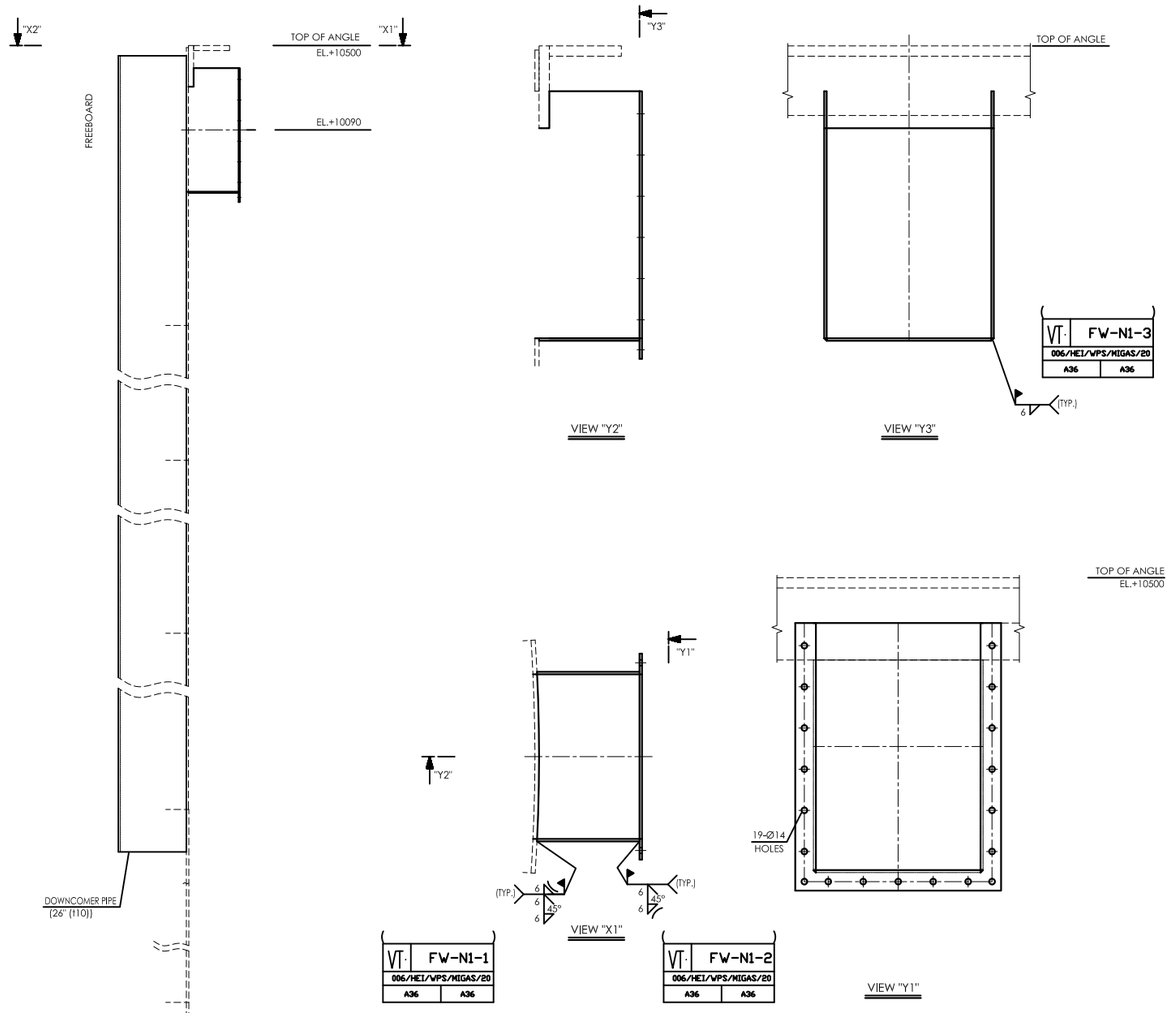
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

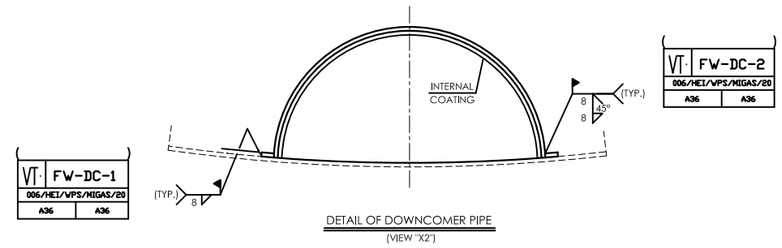
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

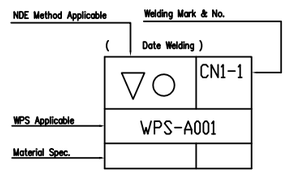
   # NOZZLE ATTACHMENT WELDING OF DUCTING



DETAIL OF NOZZLE N1 (100x50)



DETAIL OF DOWNCOMER PIPE
(VIEW "X2")



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
FLANGE	A105
NOZZLE NECK	A106 Gr.B
REINF. PAD	A36
CHANNEL	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name
NDE MAP NOZZLE 2-3 ADSORPTION TANK 2

Sheet No./Total sheets 5/10

Size of memory

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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 2
REFER DWG NO.	: E2502-000-DWG-306

NDE Map No.
E2502-NDE-PBY-003

REV.
0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

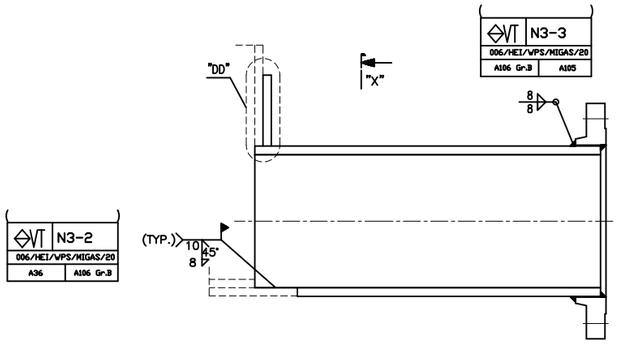
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

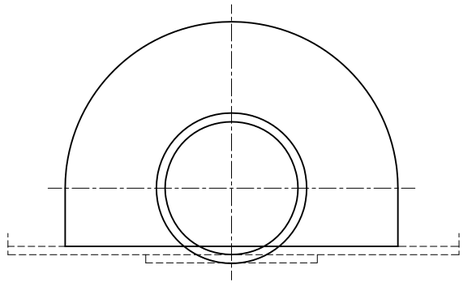
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

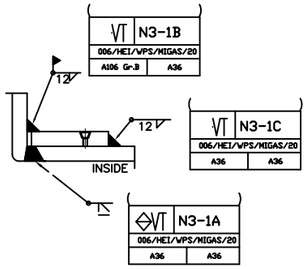
   # NOZZLE ATTACHMENT WELDING OF DUCTING



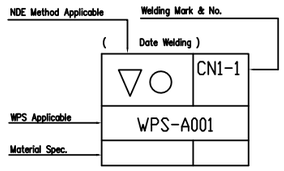
DETAIL OF NOZZLE N3 8"



DETAIL OF REINF. PAD



DETAIL "DD"



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
FLANGE	A105
NOZZLE NECK	A106 Gr.B
REINF. PAD	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name

NDE MAP NOZZLE 3-3 ADSORPTION TANK 2

Sheet No./Total sheets : 6/10

Size of memory

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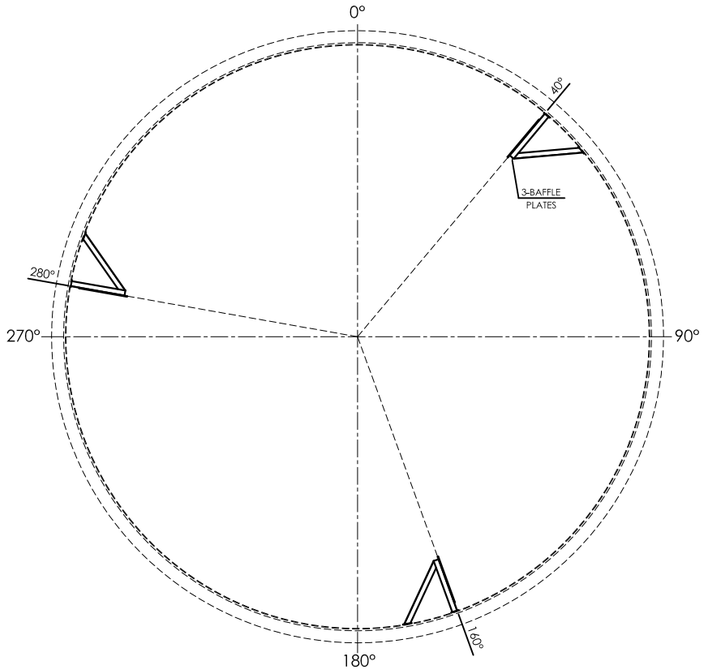
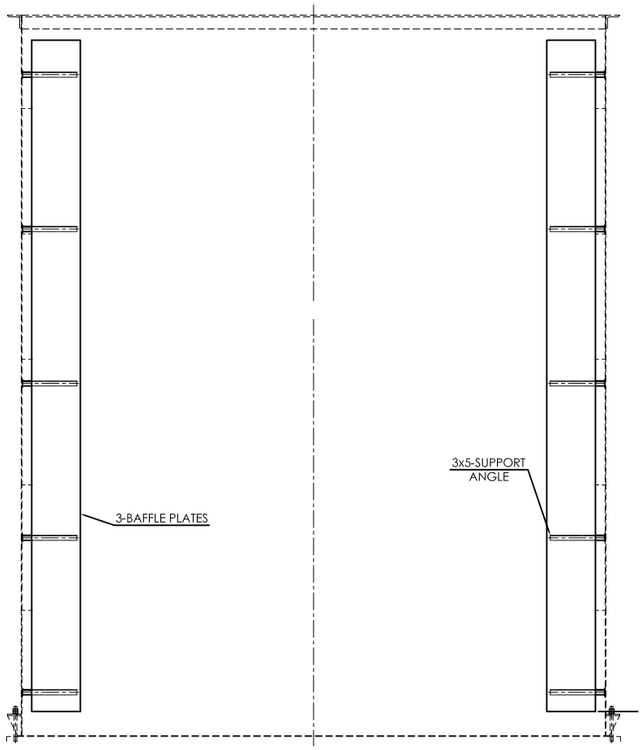
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 2
REFER DWG NO.	: E2502-000-DWG-307

NDE Map No. E2502-NDE-PBY-003

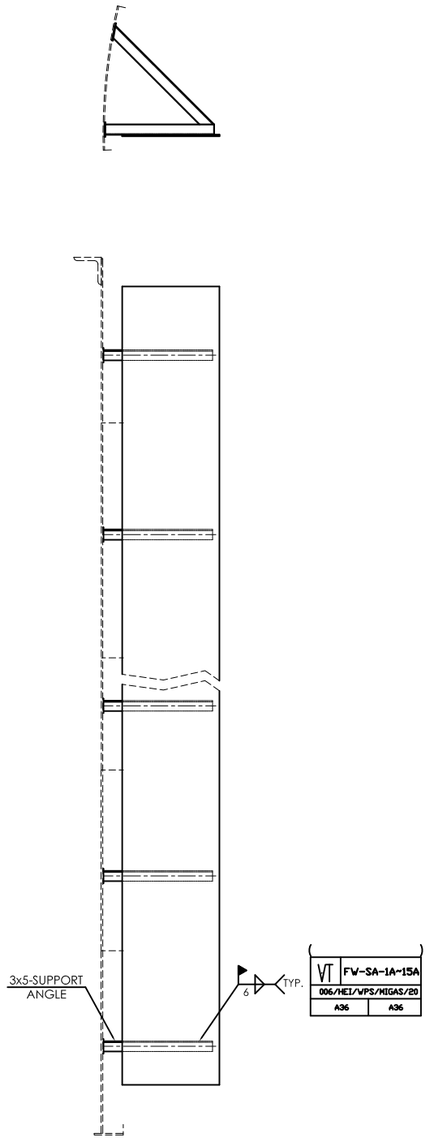
REV. 0



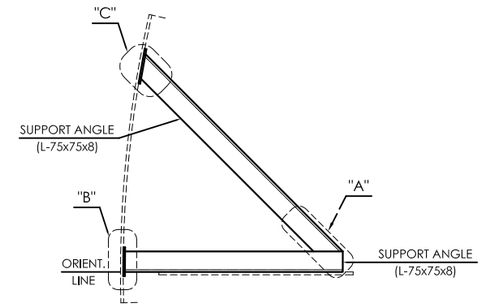
ORIENTATION OF INTERNAL BAFFLE

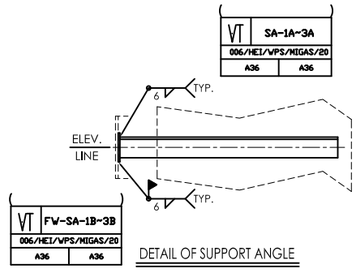


ELEVATION OF INTERNAL BAFFLE

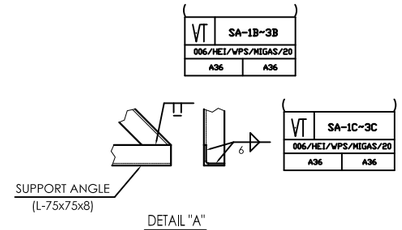


DETAIL OF INTERNAL BAFFLE





DETAIL OF SUPPORT ANGLE



DETAIL "A"

DETAIL "B"

DETAIL "C"

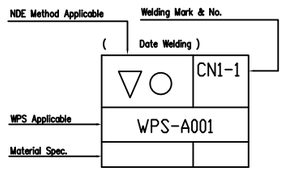
GENERAL NOTES :

1. BOLT HOLE ORIENTATION

   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

   # NOZZLE ATTACHMENT WELDING OF DUCTING



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
INTERNAL BAFFLE	A36
SUPPORT ANGLE	A36
SUPPORT PAD	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name

NDE MAP INTERNAL BAFFLE
ADSORPTION TANK 2

Sheet No./Total sheets	7/10
Size of memory	
PT. HANAZONO Engineering Indonesia — We are always partner with you	
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 2
REFER DWG NO.	: E2502-000-DWG-308
NDE Map No.	REV.
E2502-NDE-PBY-003	0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

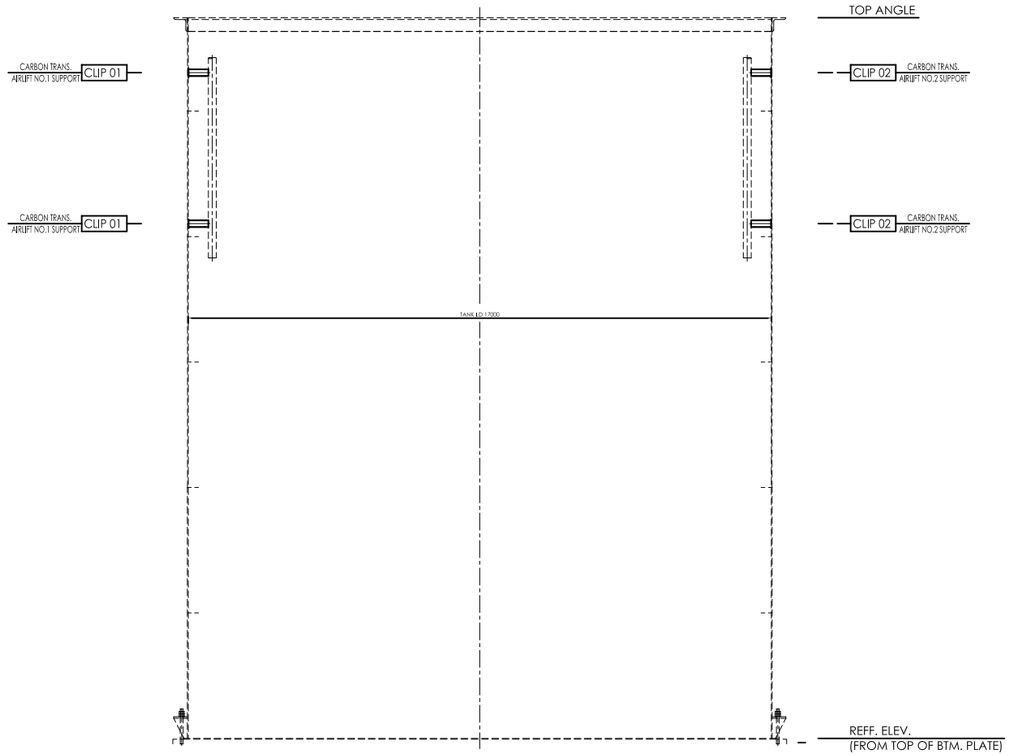
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

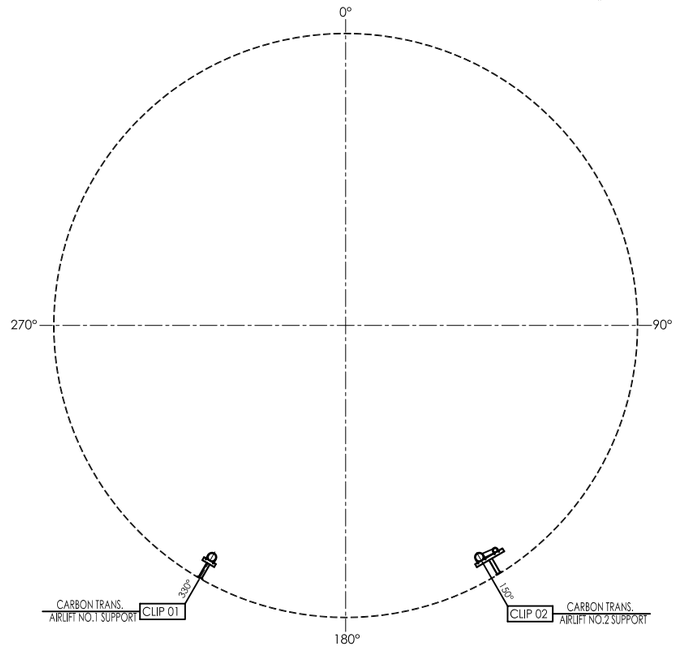
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

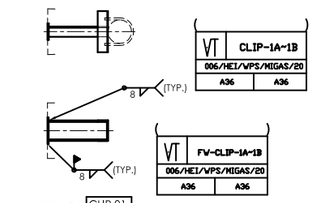
   # NOZZLE ATTACHMENT WELDING OF DUCTING



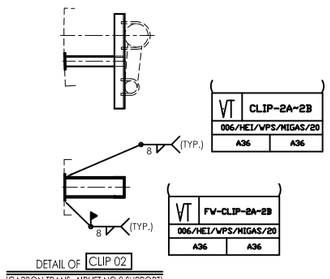
PIPE SUPPORT ELEVATION



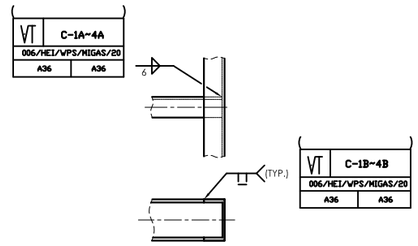
PIPE SUPPORT PLAN



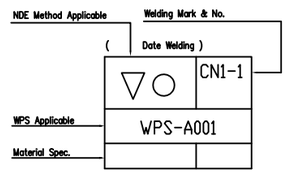
DETAIL OF CLIP 01
(CARBON TRANS. AIRLIFT NO.1 SUPPORT)



DETAIL OF CLIP 02
(CARBON TRANS. AIRLIFT NO.2 SUPPORT)



DETAIL JOINT CHANNEL



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION		LEGEND :
SUPPORT CHANNEL	A36	WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1
REINF. PAD	A36	

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Sheet No./Total sheets 8/10

Size of memory

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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 2
REFER DWG NO.	: E2502-000-DWG-309

Name

NDE MAP INTERNAL SUPPORT
ADSORPTION TANK 2

NDE Map No.

E2502-NDE-PBY-003

REV. 0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

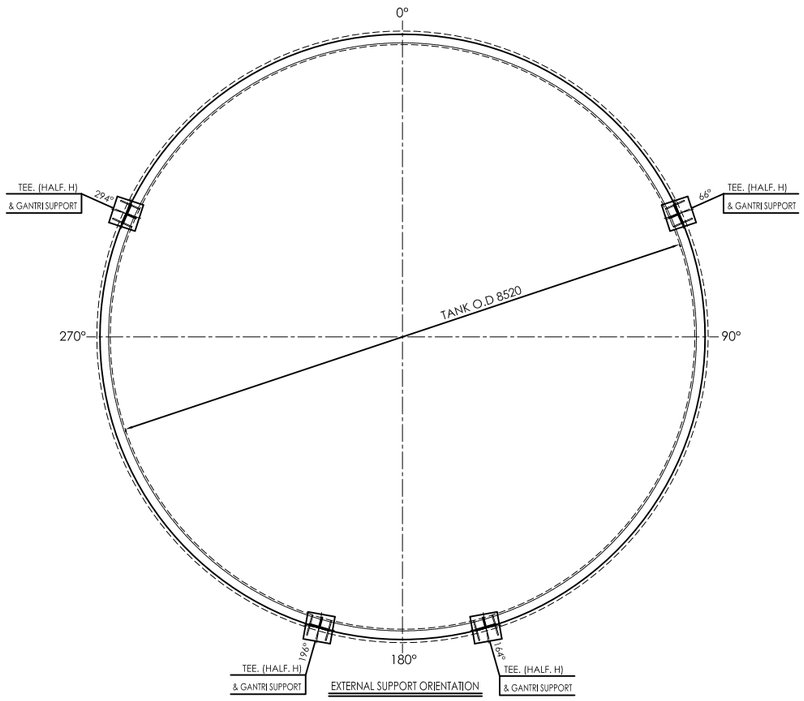
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

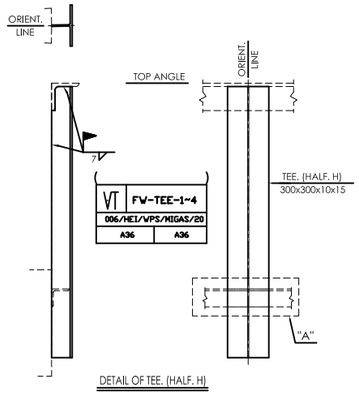
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

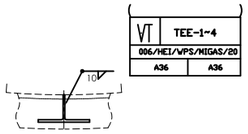
   # NOZZLE ATTACHMENT WELDING OF DUCTING

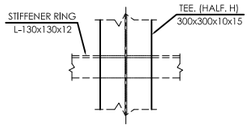


EXTERNAL SUPPORT ORIENTATION

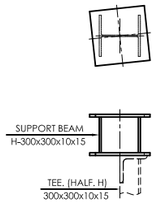


DETAIL OF TEE. (HALF. H)

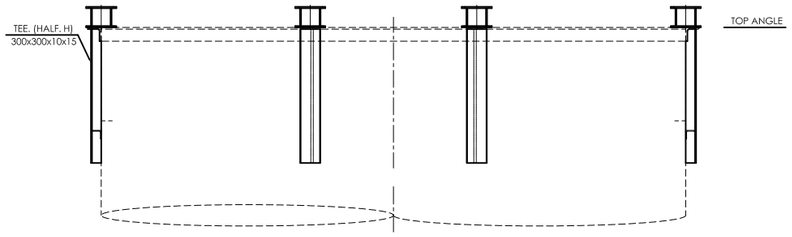




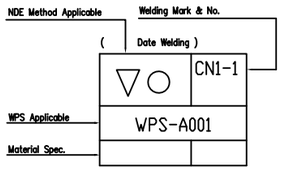
DETAIL "A"



DETAIL OF GANTRI SUPPORT



EXTERNAL SUPPORT ELEVATION



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
TEE HALF	A36
SUPPORT BEAM	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR			
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

1	2

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name

NDE MAP EXTERNAL SUPPORT
ADSORPTION TANK 2

Sheet No./Total sheets	9/10
Size of memory	

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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 2
REFER DWG NO.	: E2502-000-DWG-310

NDE Map No.: E2502-NDE-PBY-003

REV.: 0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

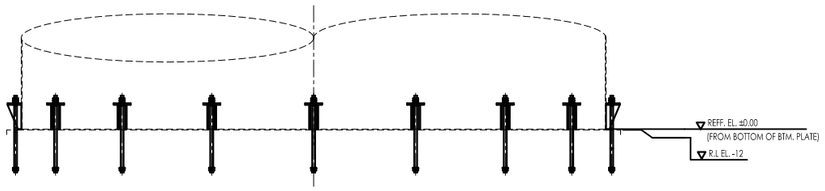
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

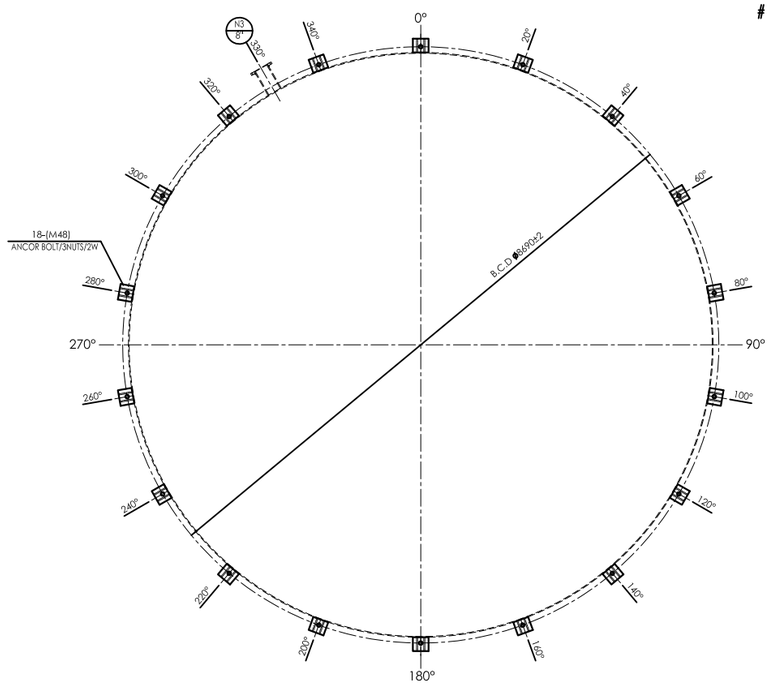
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

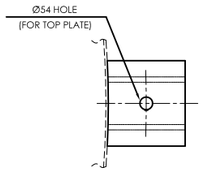
   # NOZZLE ATTACHMENT WELDING OF DUCTING

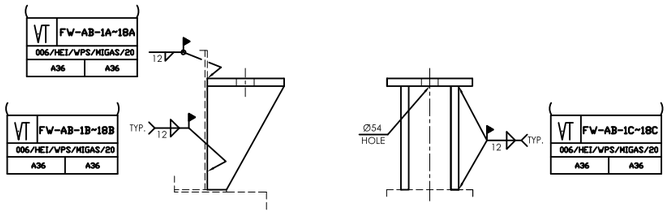


ANCHOR BOLT ELEVATION

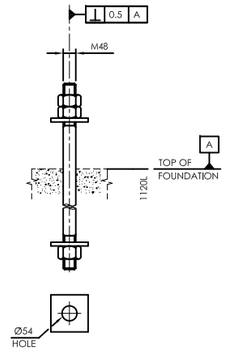


ANCHOR BOLT ORIENTATION
(PLAN VIEW)

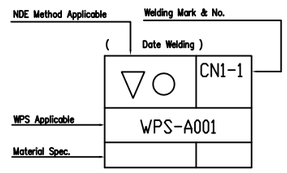




DETAIL OF ANCHOR BOLT CHAIR



ANCHOR BOLT/3N/2W
(BY OTHERS)



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
TOP PLATE	A36
GUSSET PLATE	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name

NDE MAP ANCHOR BOLT ADSORPTION TANK 2

Sheet No./Total sheets	10/10
Size of memory	

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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 2
REFER DWG NO.	: E2502-000-DWG-311

NDE Map No.: E2502-NDE-PBY-003

REV.: 0

1. NDE MAP NO. : E2502-NDE-PBY-004

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

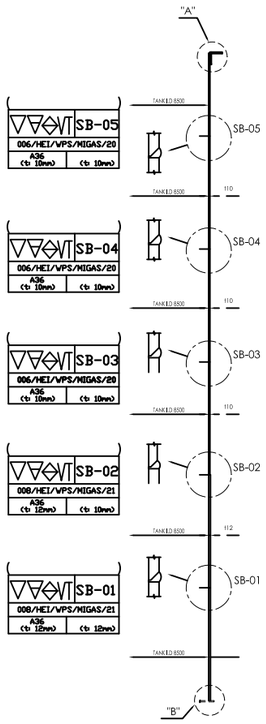
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

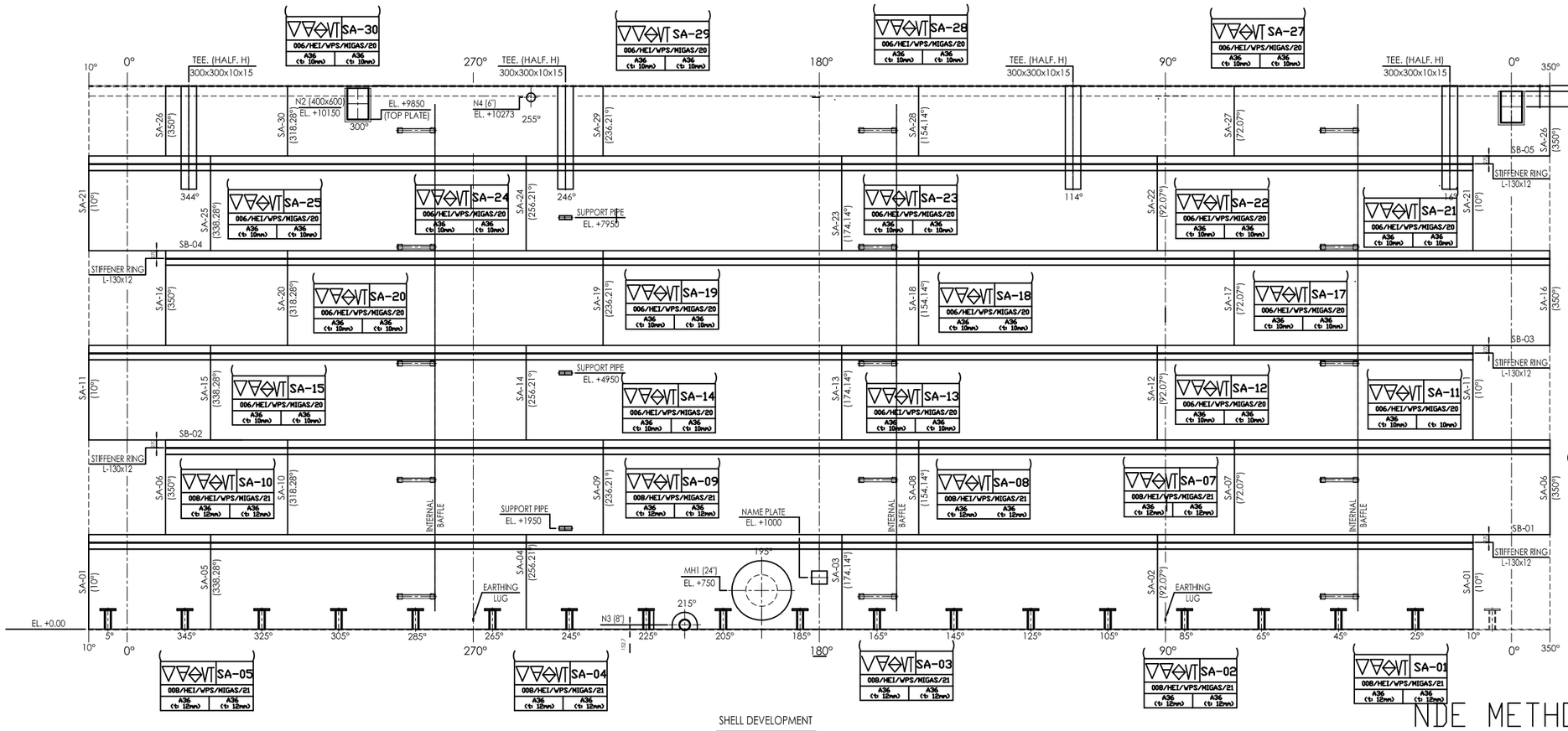
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

   # NOZZLE ATTACHMENT WELDING OF DUCTING



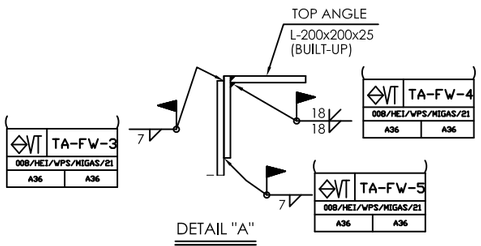
SHELL HORIZONTAL JOINT



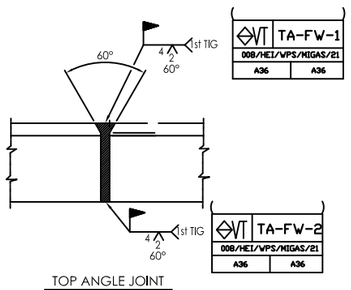
SHELL DEVELOPMENT

NDE METHOD SYMBOL

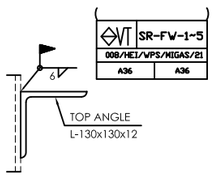
- □ VACUUM BOX
- ▽ UT SPOT
- ▽ UT SPOT LAMINATION CHECK FOR SHELL
- ◇ MPI 10%
- VT VISUAL 100%



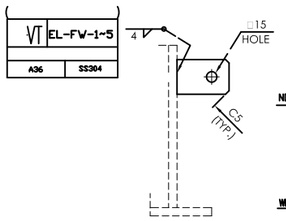
DETAIL "A"



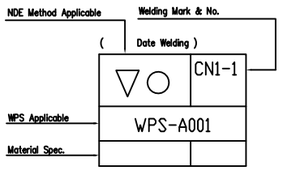
TOP ANGLE JOINT

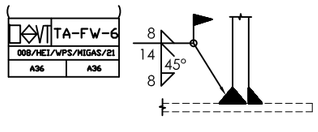


DETAIL OF STIFFENER RING



EARTHNG LUG





DETAIL "B"

MATERIAL SPECIFICATION	
SHELL	A36
TOP ANGLE	A36
STIFFENER RING	A36

LEGEND :

WPS NO :	008/HEI/WPS/MIGAS/21	SMAW	P1 to P1
	006/HEI/WPS/MIGAS/20	GTAW & SMAW	P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name: NDE MAP SHELL ADSORPTION TANK 3

Sheet No./Total sheets	1/10
Size of memory	

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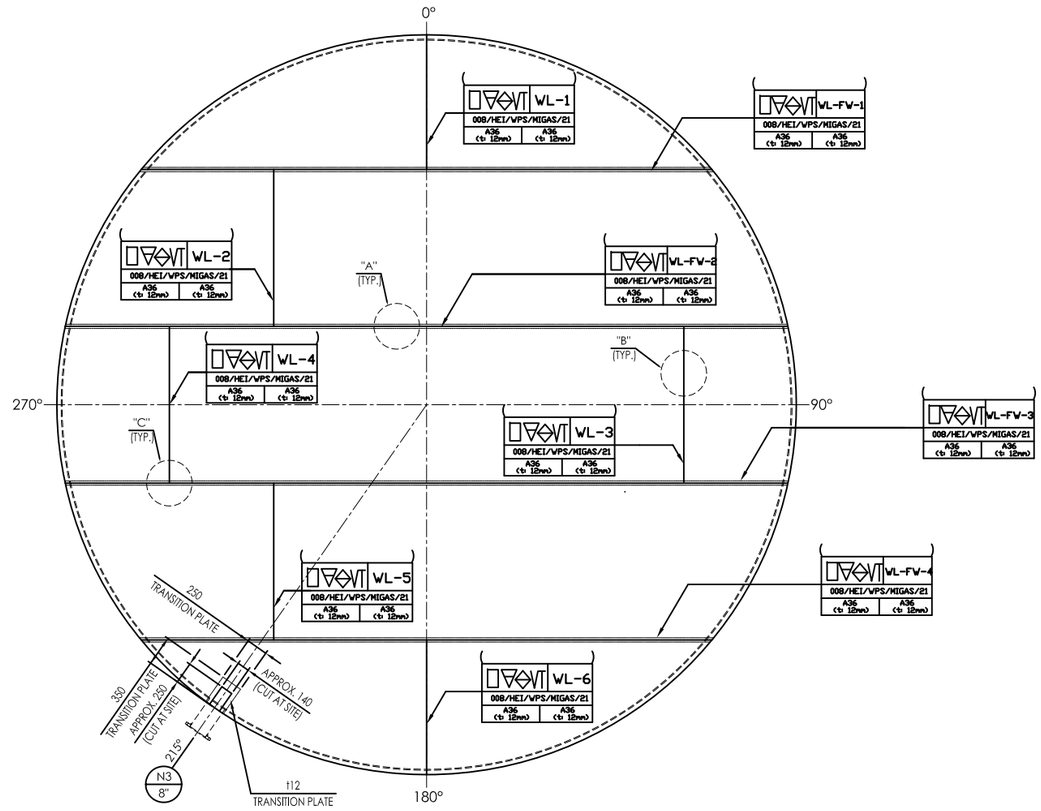
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 3
REFER DWG NO.	: E2502-000-DWG-402

NDE Map No.: E2502-NDE-PBY-004

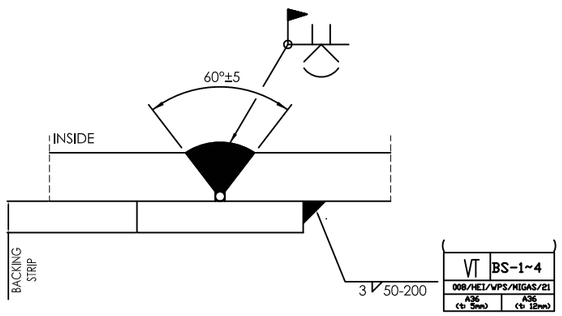
REV.: 0

GENERAL NOTES :

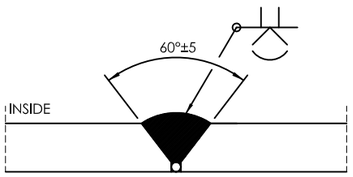
1. BOLT HOLE ORIENTATION
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT
   # LIFTING LUG AND REMOVING OF JIG
   # NOZZLE ATTACHMENT WELDING OF DUCTING



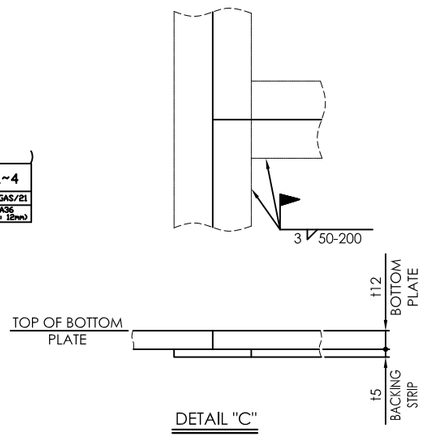
BOTTOM PLATE ARRANGEMENT



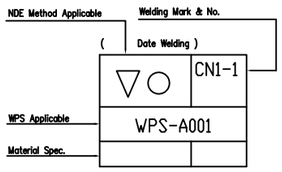
DETAIL "A"



DETAIL "B"



DETAIL "C"



NDE METHOD SYMBOL

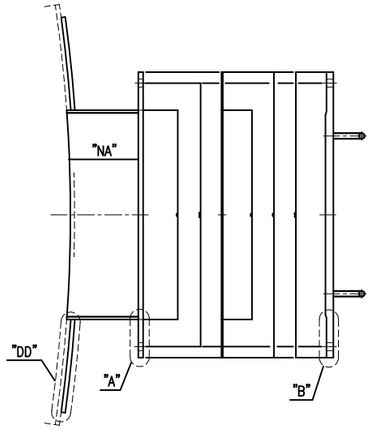
- □ VACUUM BOX
- ▽ UT SPOT LAMINATION CHECK FOR BOTTOM
- ◇ MPI 10%
- VT VISUAL 100%

MATERIAL SPECIFICATION		LEGEND :			File name :				CHANGE BY CAD SYSTEM ONLY						Sheet No./Total sheets	2/10
BOTTOM PLATE	A36	WPS NO : 008/HEI/WPS/MIGAS/21	SMAW	P1 to P1	REV	DATE	APPR		1	2	Deviation for dimensions without indication of tolerance in mm 1) cutting + non cutting machining 2) WELDMENT conecting + forging		DATE	SIGN	Size of memory	
BACKING STRIPE	A36				0	29/09/25						DRAFT		BENRIDHO	PT. HANAZONO Engineering Indonesia We are always partner with you	
												CHECK		RUSNANDI	JOB NO.	: E2502
												APPR			DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
												Scale :	NTS		TAG NO./LINE NO.	: ADSORPTION TANK 3
															REFER DWG NO.	: E2502-000-DWG-403
															NDE Map No.	REV.
															E2502-NDE-PBY-004	0

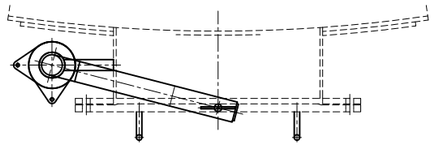
Name
NDE MAP BOTTOM ADSORPTION TANK 3

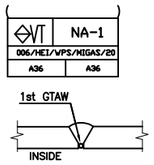
GENERAL NOTES :

1. BOLT HOLE ORIENTATION
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT
   # LIFTING LUG AND REMOVING OF JIG
   # NOZZLE ATTACHMENT WELDING OF DUCTING

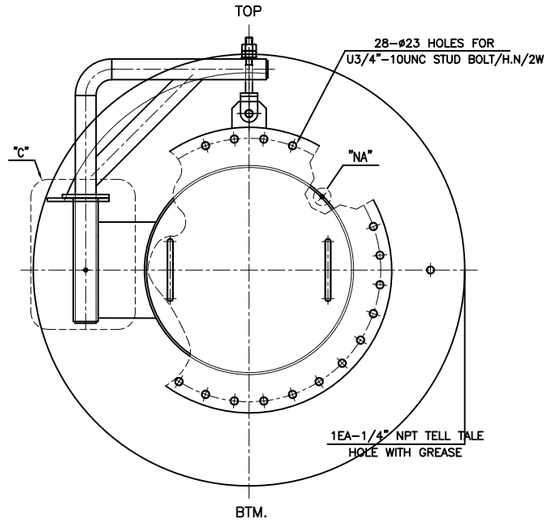


DETAIL OF NOZZLE (MH1) 24"

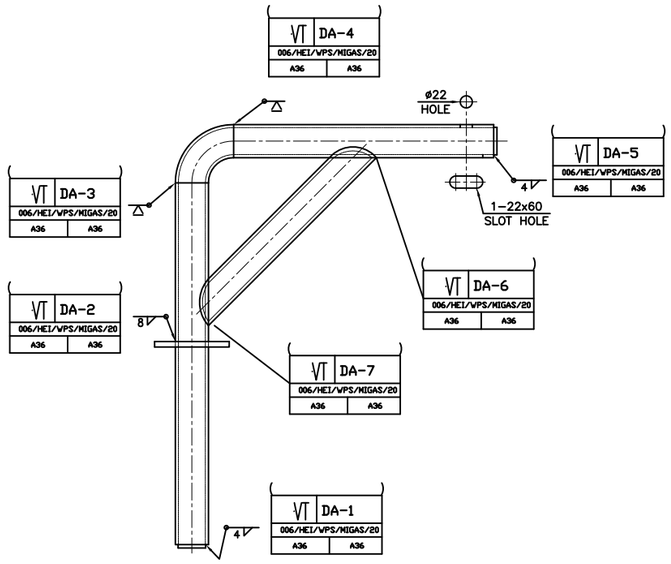




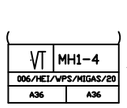
DETAIL "NA"



DAVIT ASSEMBLY
(DAVIT ORIENT. SEE ASS'Y DWG)



DAVIT DETAIL



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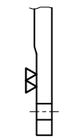
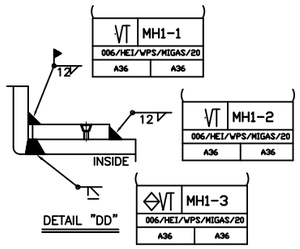
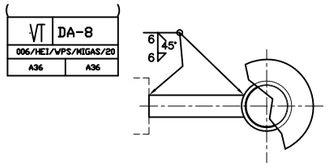
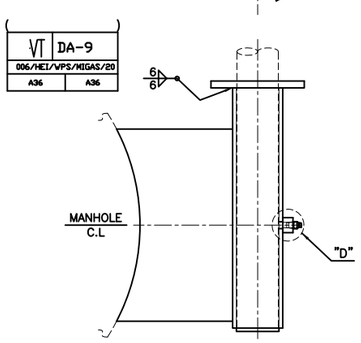


DETAIL "B"

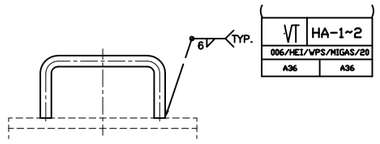


DETAIL "DD"

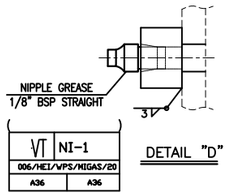




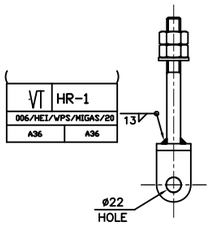
DETAIL "C"

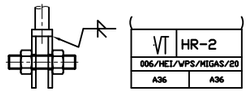


HANDLE DETAIL

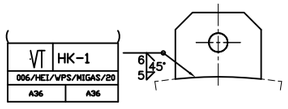


DETAIL "D"

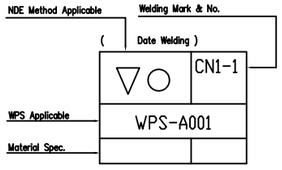




HANGER DETAIL



HOOK



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
HOOK	A36
PIPE DAVIT	A53 Gr.B
HANDLE	A36
NOZZLE NECK	A36
PLATE FLANGE	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name
NDE MAP MANHOLE ADSORPTION TANK 3

NDE Map No.
E2502-NDE-PBY-004

REV.
0

Sheet No./Total sheets : 3/10
Size of memory

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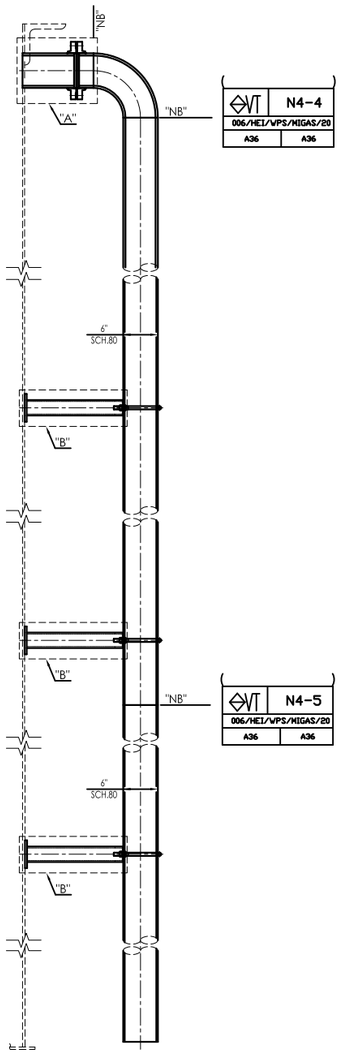
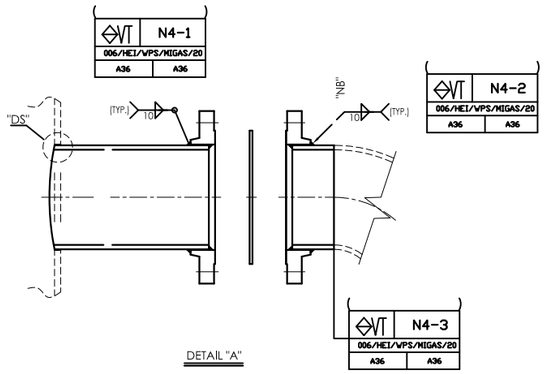
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 3
REFER DWG NO.	: E2502-000-DWG-404

GENERAL NOTES :

1. BOLT HOLE ORIENTATION
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT
   # LIFTING LUG AND REMOVING OF JIG
   # NOZZLE ATTACHMENT WELDING OF DUCTING



DETAIL OF NOZZLE N4 6"



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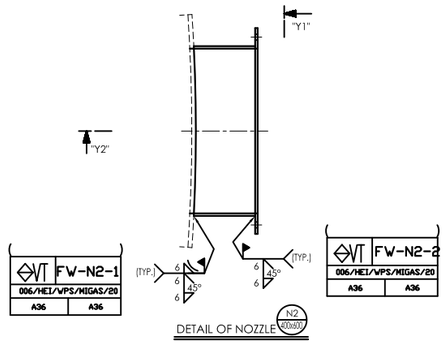
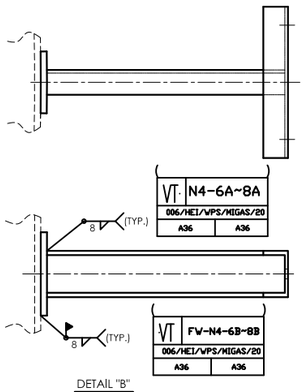
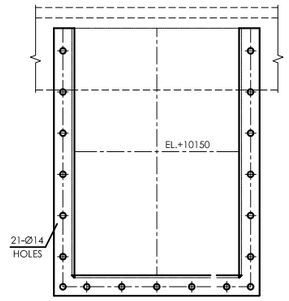


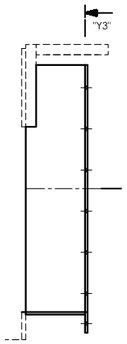
DETAIL OF NOZZLE N2 300x600



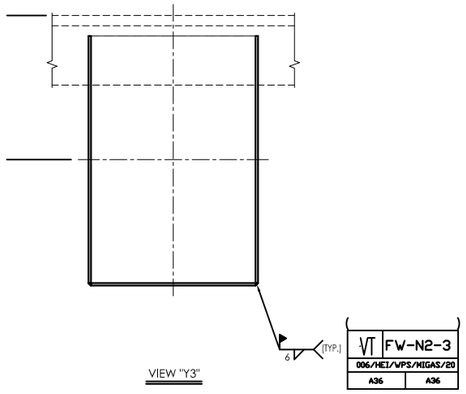
DETAIL "B"



VIEW "Y1"



VIEW "Y2"



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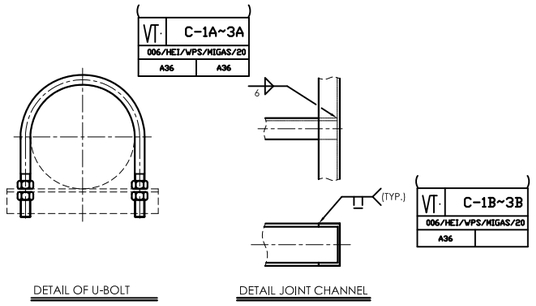
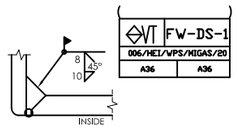


DETAIL OF U-BOLT

DETAIL JOINT CHANNEL



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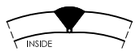
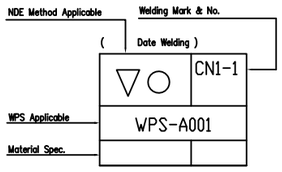


DETAIL "NB"



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
FLANGE	A105
NOZZLE NECK	A106 Gr.B
REINF. PAD	A36
CHANNEL	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name
NDE MAP NOZZLE 1-3 ADSORPTION TANK 3

Sheet No./Total sheets	4/10
Size of memory	
PT. HANAZONO Engineering Indonesia — We are always partner with you	
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 3
REFER DWG NO.	: E2502-000-DWG-405
NDE Map No.	E2502-NDE-PBY-004
REV.	0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

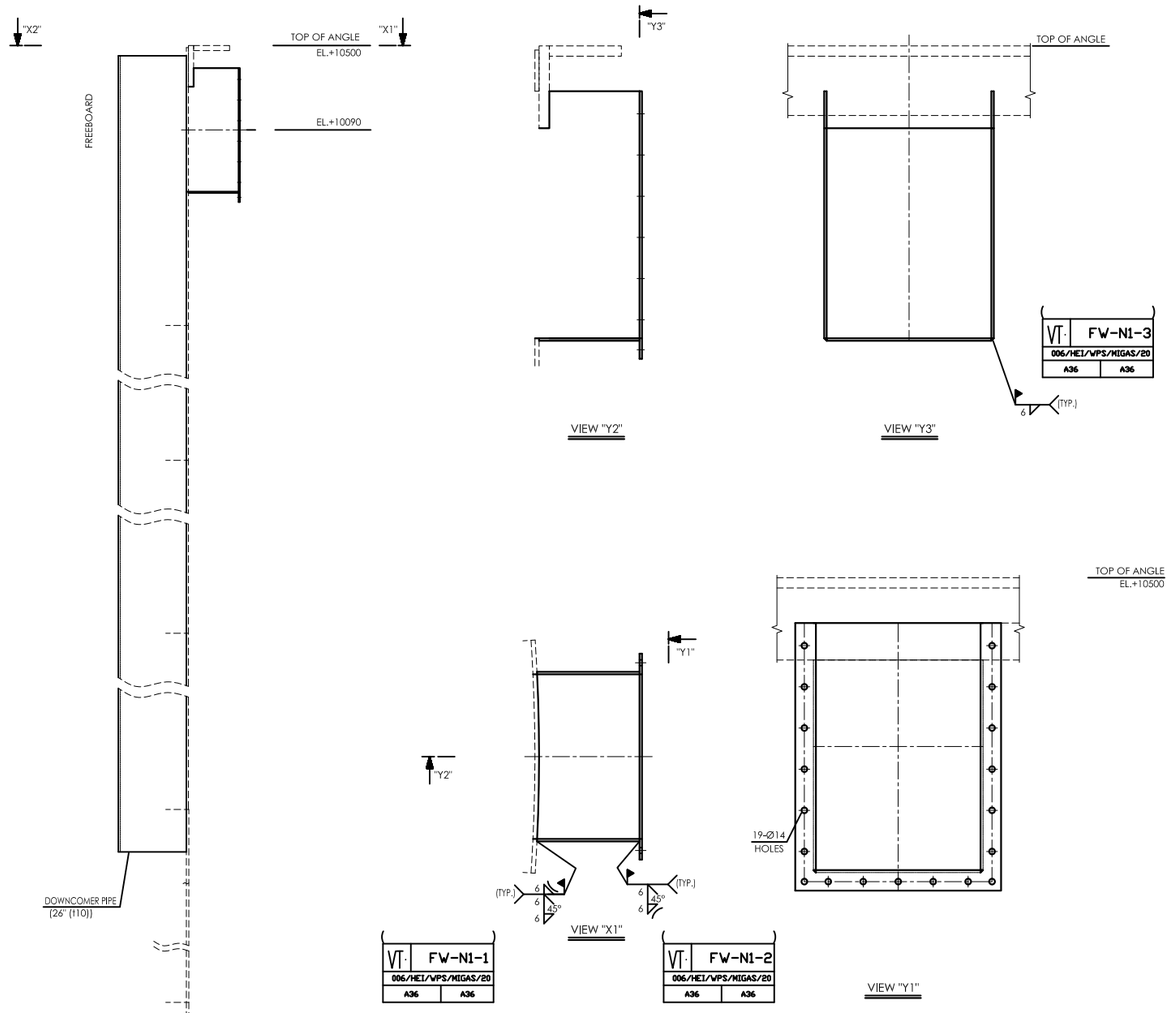
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

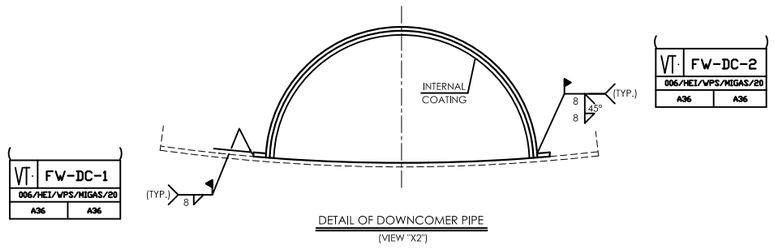
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

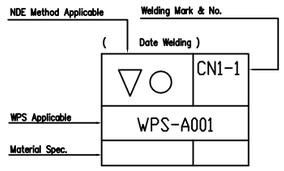
   # NOZZLE ATTACHMENT WELDING OF DUCTING



DETAIL OF NOZZLE N1 (100x50)



DETAIL OF DOWNCOMER PIPE
(VIEW "X2")



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
FLANGE	A105
NOZZLE NECK	A106 Gr.B
REINF. PAD	A36
CHANNEL	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name
NDE MAP NOZZLE 2-3 ADSORPTION TANK 3

Sheet No./Total sheets 5/10

Size of memory

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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 3
REFER DWG NO.	: E2502-000-DWG-406

NDE Map No.
E2502-NDE-PBY-004

REV.
0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

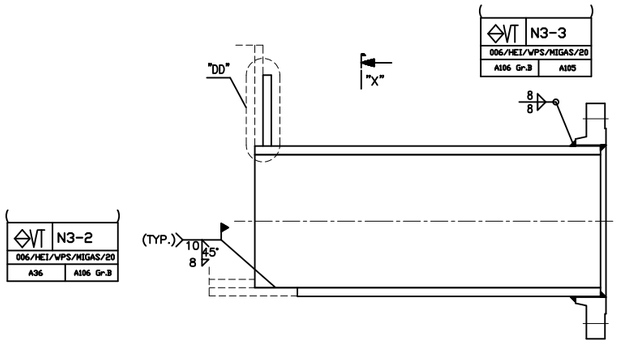
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

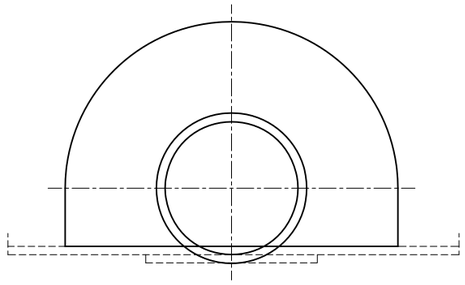
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

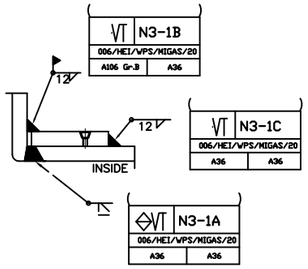
   # NOZZLE ATTACHMENT WELDING OF DUCTING



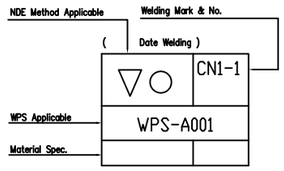
DETAIL OF NOZZLE N3 8"



DETAIL OF REINF. PAD



DETAIL "DD"



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
FLANGE	A105
NOZZLE NECK	A106 Gr.B
REINF. PAD	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR			
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

1	2

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name

NDE MAP NOZZLE 3-3 ADSORPTION TANK 3

Sheet No./Total sheets	6/10
Size of memory	

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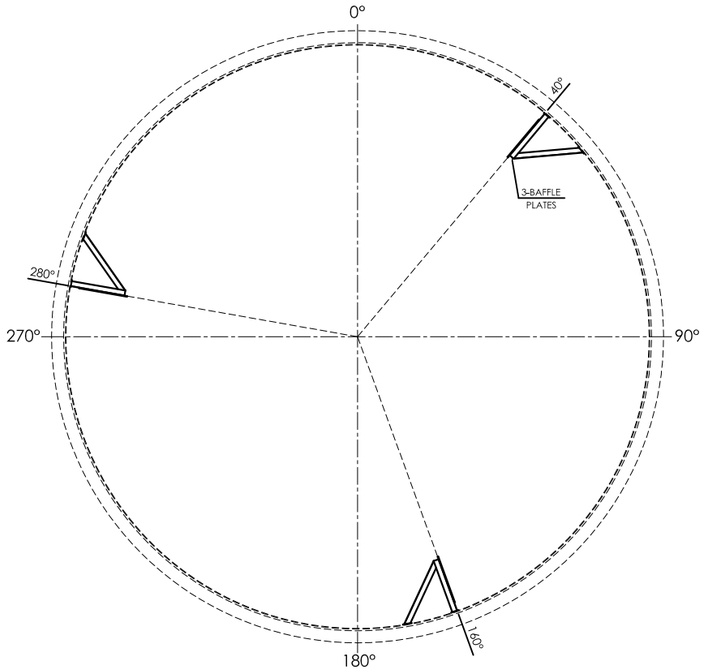
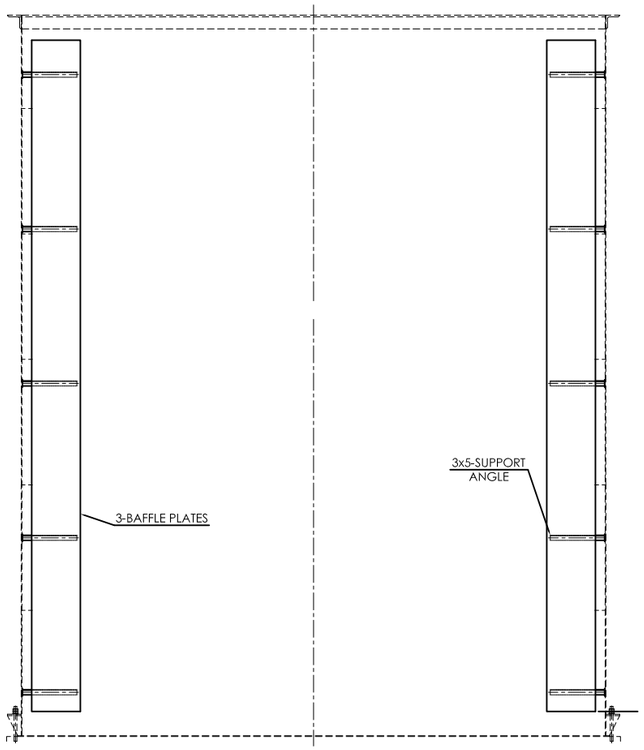
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 3
REFER DWG NO.	: E2502-000-DWG-407

NDE Map No. E2502-NDE-PBY-004

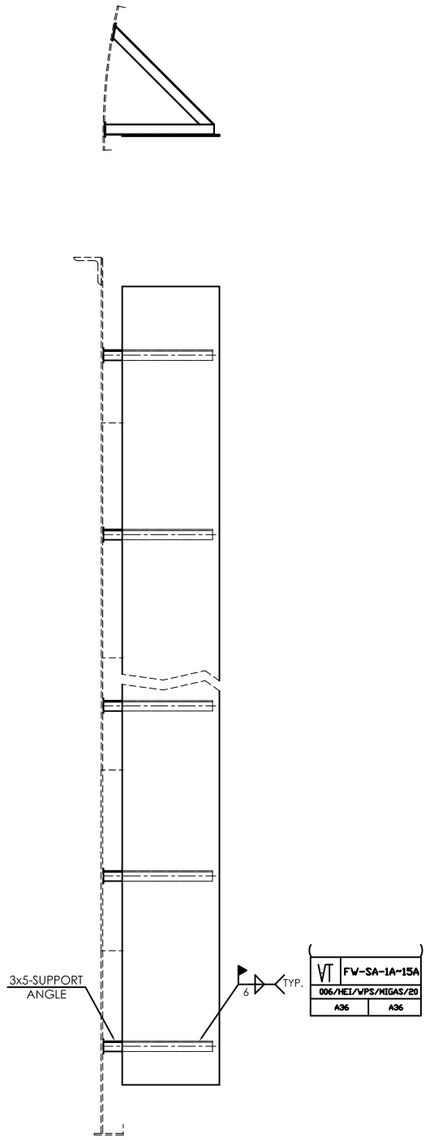
REV. 0



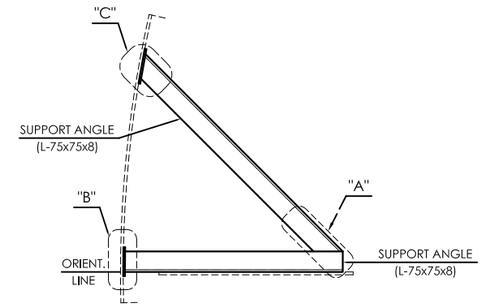
ORIENTATION OF INTERNAL BAFFLE

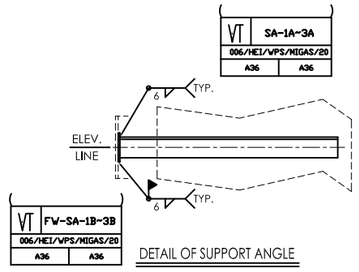


ELEVATION OF INTERNAL BAFFLE

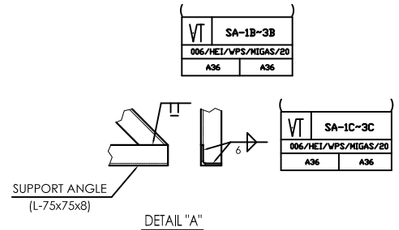


DETAIL OF INTERNAL BAFFLE





DETAIL OF SUPPORT ANGLE



DETAIL "A"

DETAIL "B"

DETAIL "C"

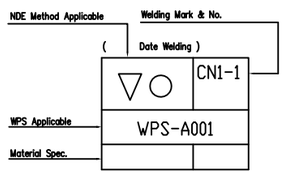
GENERAL NOTES :

1. BOLT HOLE ORIENTATION

   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

   # NOZZLE ATTACHMENT WELDING OF DUCTING



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
INTERNAL BAFFLE	A36
SUPPORT ANGLE	A36
SUPPORT PAD	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name

NDE MAP INTERNAL BAFFLE
ADSORPTION TANK 3

Sheet No./Total sheets	7/10
Size of memory	

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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 3
REFER DWG NO.	: E2502-000-DWG-408

NDE Map No. E2502-NDE-PBY-004

REV. 0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

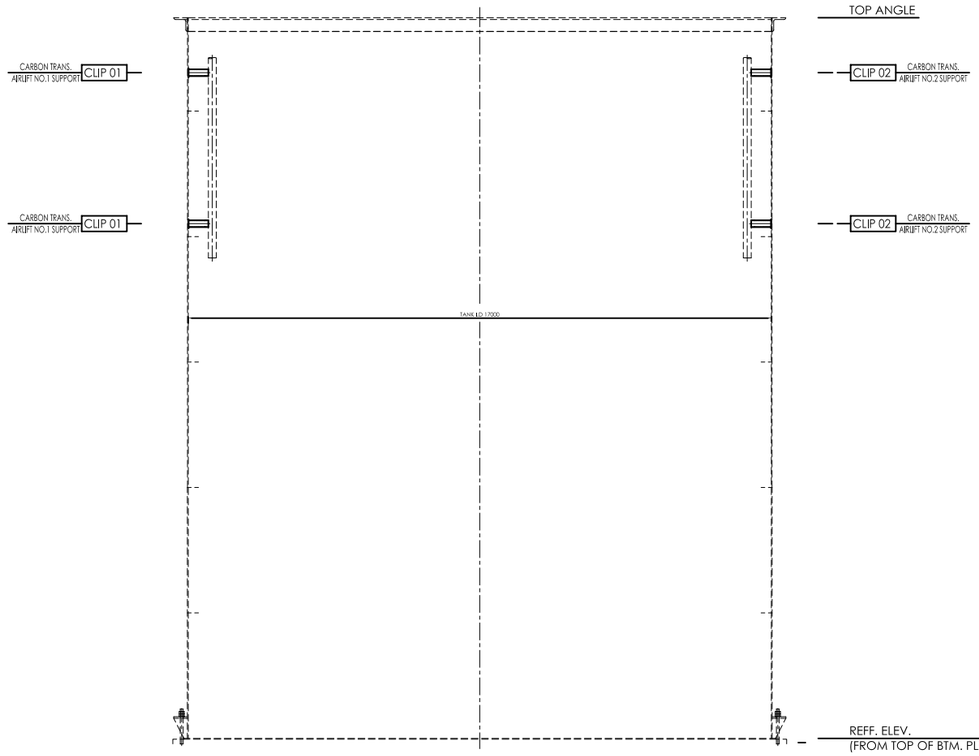
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

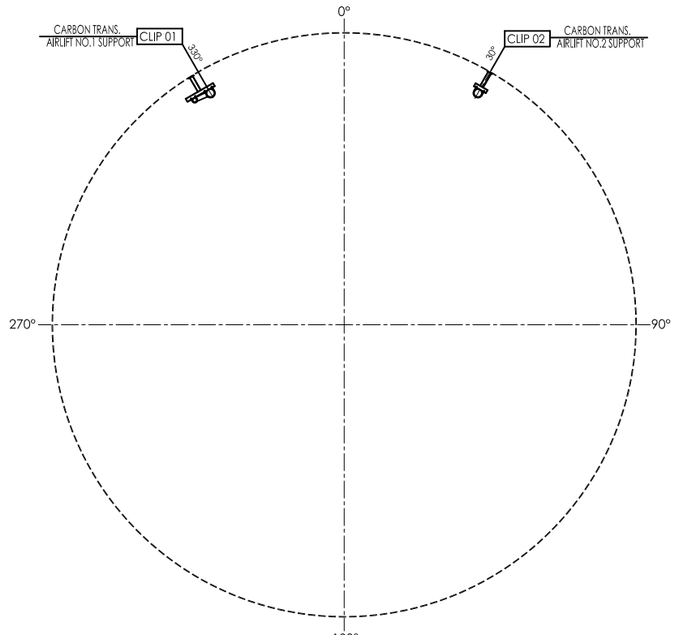
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

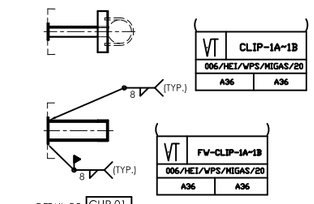
   # NOZZLE ATTACHMENT WELDING OF DUCTING



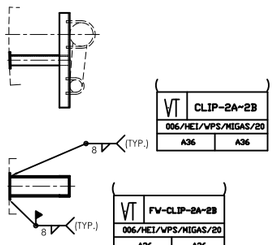
PIPE SUPPORT ELEVATION



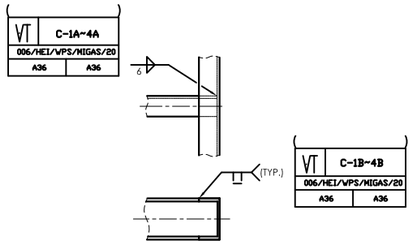
PIPE SUPPORT PLAN



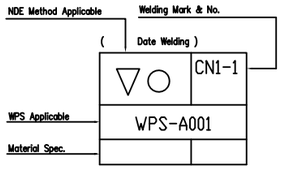
DETAIL OF CLIP 01
(CARBON TRANS. AIRLIFT NO.1 SUPPORT)



DETAIL OF CLIP 02
(CARBON TRANS. AIRLIFT NO.2 SUPPORT)



DETAIL JOINT CHANNEL



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
SUPPORT CHANNEL	A36
REINF. PAD	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale : NTS		

Name

NDE MAP INTERNAL SUPPORT
ADSORPTION TANK 3

Sheet No./Total sheets	8/10
Size of memory	
PT. HANAZONO Engineering Indonesia — We are always partner with you	
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 3
REFER DWG NO.	: E2502-000-DWG-409
NDE Map No.	E2502-NDE-PBY-004
REV.	0

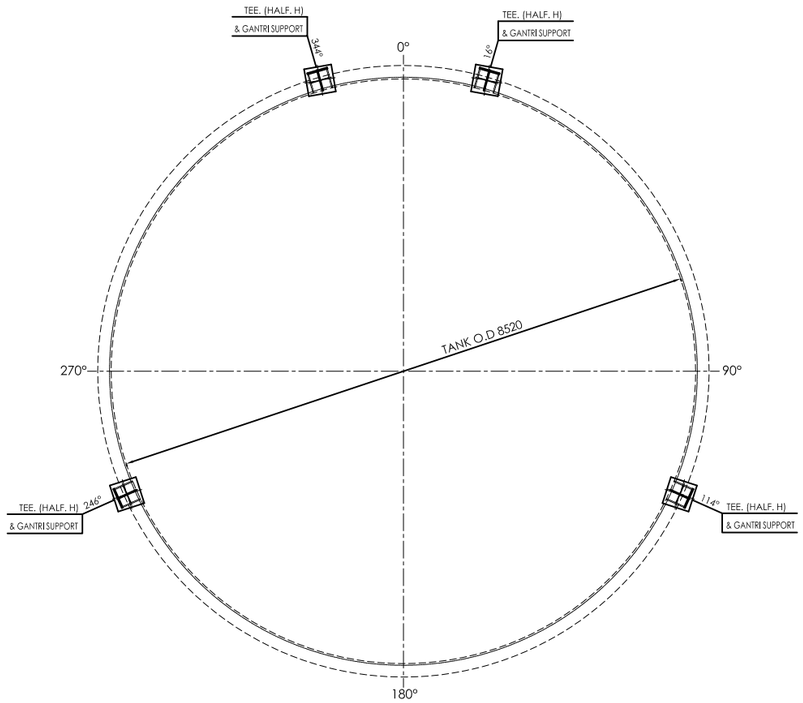
GENERAL NOTES :

1. BOLT HOLE ORIENTATION

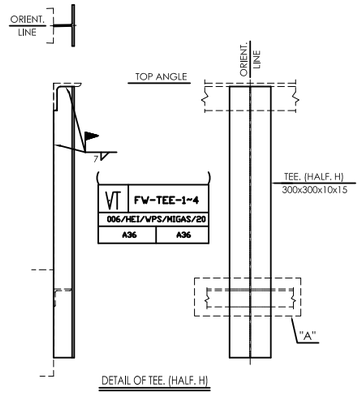
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

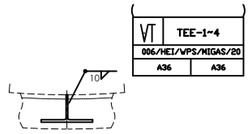
   # NOZZLE ATTACHMENT WELDING OF DUCTING

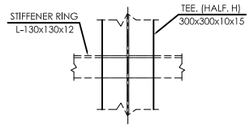


EXTERNAL SUPPORT ORIENTATION

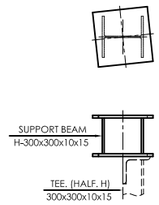


DETAIL OF TEE. (HALF. H)

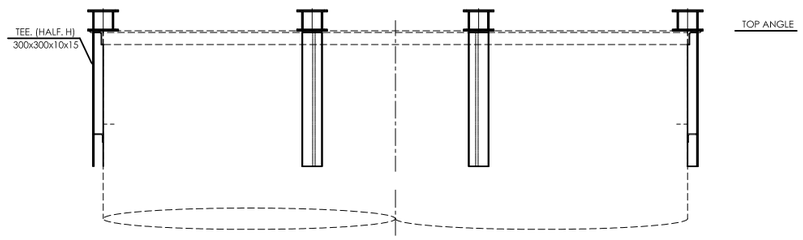




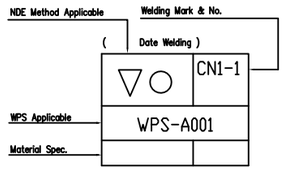
DETAIL "A"



DETAIL OF GANTRI SUPPORT



EXTERNAL SUPPORT ELEVATION



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
TEE HALF	A36
SUPPORT BEAM	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR			
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

1	2

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name

NDE MAP EXTERNAL SUPPORT
ADSORPTION TANK 3

Sheet No./Total sheets	9/10
Size of memory	

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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 3
REFER DWG NO.	: E2502-000-DWG-410

NDE Map No.: E2502-NDE-PBY-004

REV.: 0

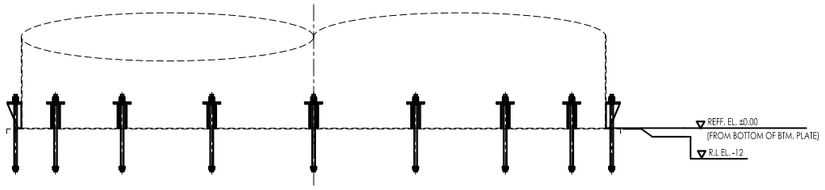
GENERAL NOTES :

1. BOLT HOLE ORIENTATION

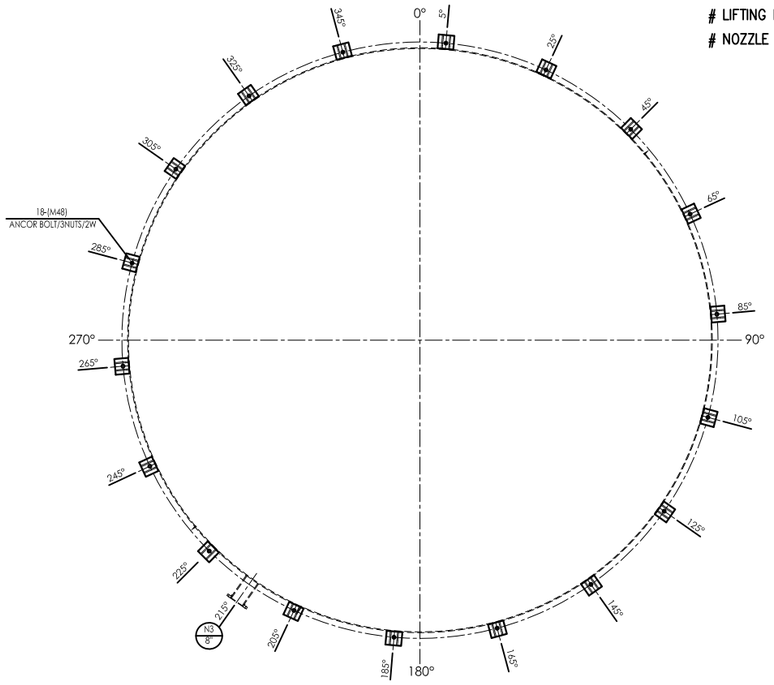
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

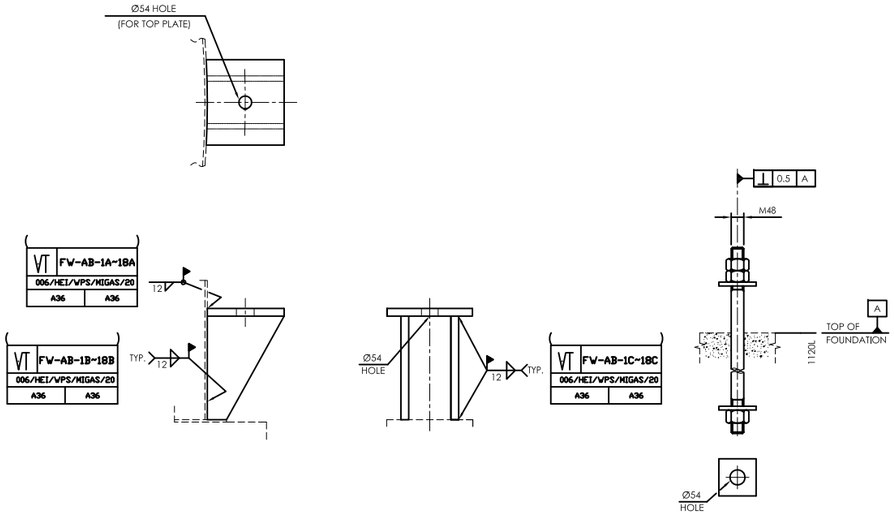
   # NOZZLE ATTACHMENT WELDING OF DUCTING



ANCHOR BOLT ELEVATION

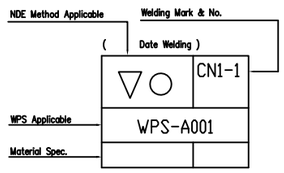


ANCHOR BOLT ORIENTATION
(PLAN VIEW)



DETAIL OF ANCHOR BOLT CHAIR

ANCHOR BOLT/3N/2W
(BY OTHERS)



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION		LEGEND :
TOP PLATE	A36	WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1
GUSSET PLATE	A36	

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name: NDE MAP ANCHOR BOLT ADSORPTION TANK 3

Sheet No./Total sheets: 10/10

Size of memory:

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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 3
REFER DWG NO.	: E2502-000-DWG-411

NDE Map No.: E2502-NDE-PBY-004

REV.: 0

1. NDE MAP NO. : E2502-NDE-PBY-005

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

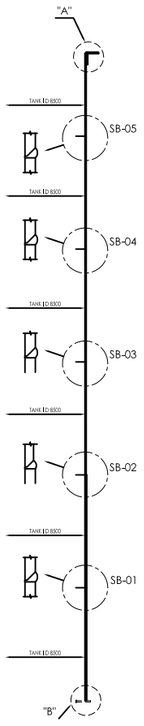
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

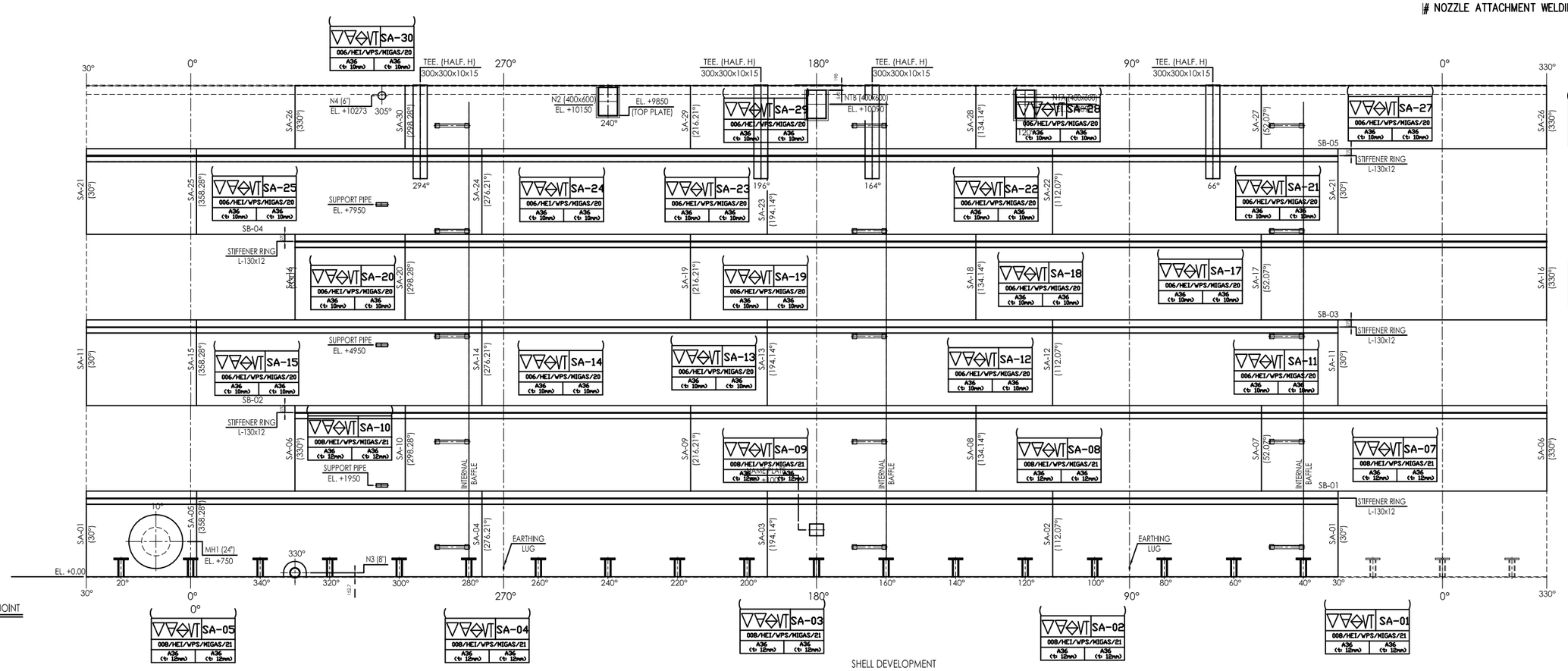
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

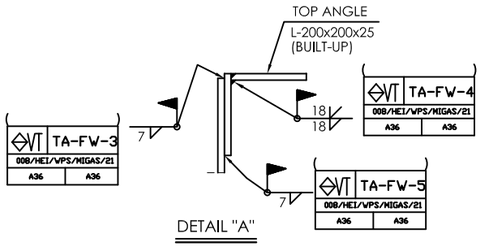
   # NOZZLE ATTACHMENT WELDING OF DUCTING



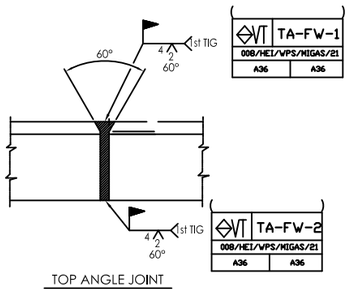
SHELL HORIZONTAL JOINT



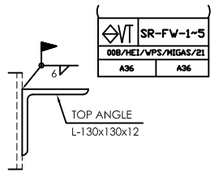
SHELL DEVELOPMENT



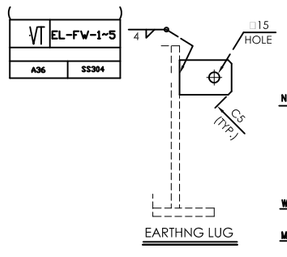
DETAIL "A"



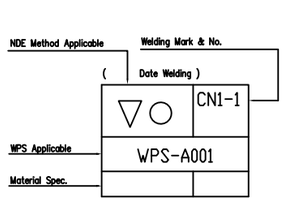
TOP ANGLE JOINT



DETAIL OF STIFFENER RING

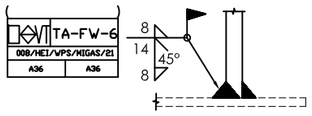


EARTHNG LUG



NDE METHOD SYMBOL

- □ VACUUM BOX
- ▽ UT SPOT
- ▽̄ UT SPOT LAMINATION CHECK FOR SHELL
- ◇ MPI 10%
- VT VISUAL 100%



DETAIL "B"

MATERIAL SPECIFICATION	
SHELL	A36
TOP ANGLE	A36
STIFFENER RING	A36

LEGEND :

WPS NO :	008/HEI/WPS/MIGAS/21	SMAW	P1 to P1
	006/HEI/WPS/MIGAS/20	GTAW & SMAW	P1 to P1

File name :

REV	DATE	APPR
0	29/09/25	

CHANGE BY CAD SYSTEM ONLY

1	2

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name

NDE MAP SHELL ADSORPTION TANK 4

NDE Map No.

E2502-NDE-PBY-005

REV.

0

Sheet No./Total sheets : 1/10

Size of memory

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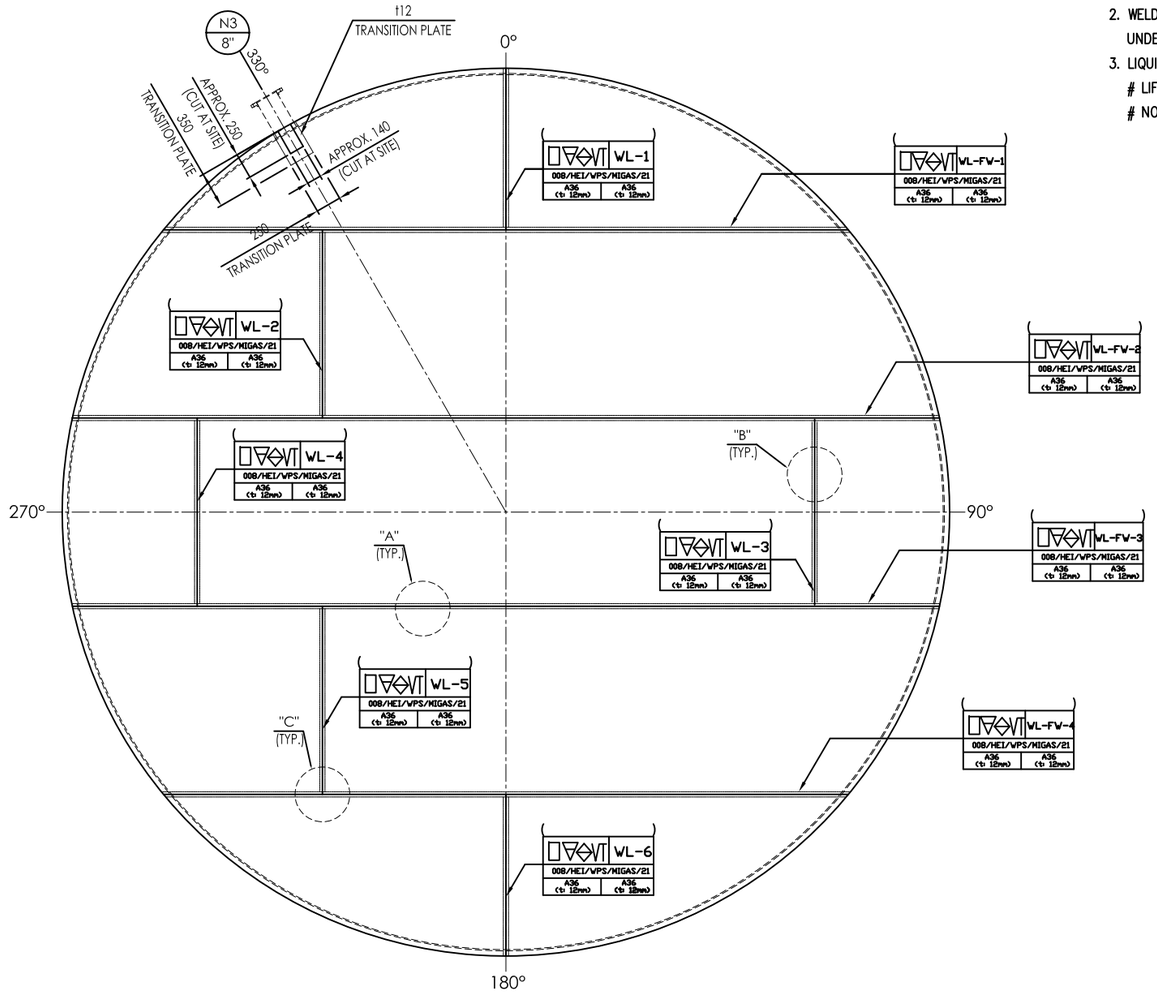
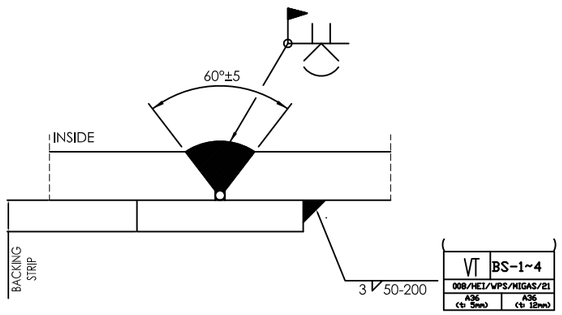
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 4
REFER DWG NO.	: E2502-000-DWG-502

GENERAL NOTES :

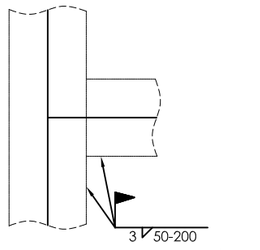
1. BOLT HOLE ORIENTATION
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT
   # LIFTING LUG AND REMOVING OF JIG
   # NOZZLE ATTACHMENT WELDING OF DUCTING

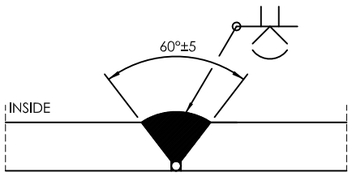


BOTTOM PLATE ARRANGEMENT

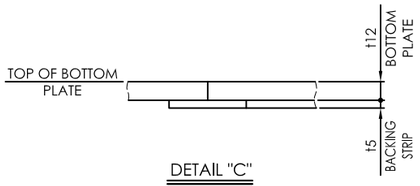


DETAIL "A"

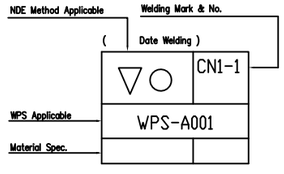




DETAIL "B"



DETAIL "C"



NDE METHOD SYMBOL

- □ VACUUM BOX
- ▽ UT SPOT LAMINATION CHECK FOR BOTTOM
- ◇ MPI 10%
- VT VISUAL 100%

MATERIAL SPECIFICATION	
BOTTOM PLATE	A36
BACKING STRIPE	A36

LEGEND :

WPS NO : 008/HEI/WPS/MIGAS/21 SMAW P1 to P1

File name :

REV	DATE	APPR
0	29/09/25	

CHANGE BY CAD SYSTEM ONLY

1	2

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

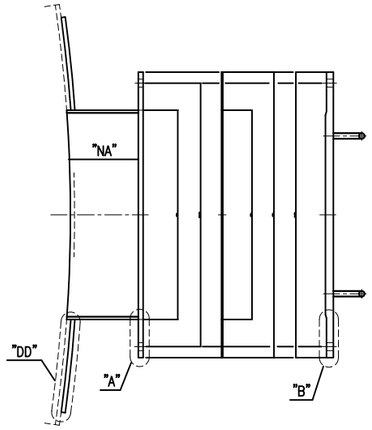
	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale : NTS		

Name
NDE MAP BOTTOM ADSOPTION TANK 4

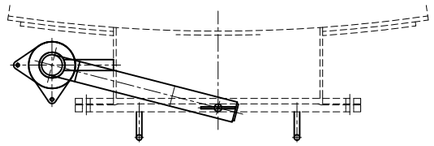
Sheet No./Total sheets	2/10
Size of memory	
PT. HANAZONO Engineering Indonesia — We are always partner with you	
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 4
REFER DWG NO.	: E2502-000-DWG-503
NDE Map No.	E2502-NDE-PBY-005
REV.	0

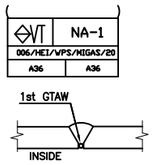
GENERAL NOTES :

1. BOLT HOLE ORIENTATION
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT
   # LIFTING LUG AND REMOVING OF JIG
   # NOZZLE ATTACHMENT WELDING OF DUCTING

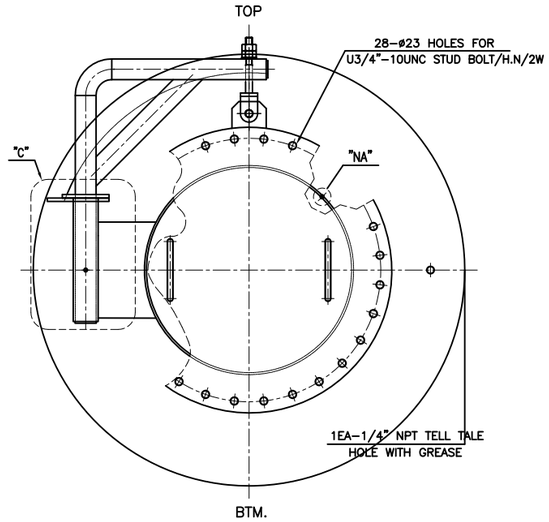


DETAIL OF NOZZLE (MH1) 24"

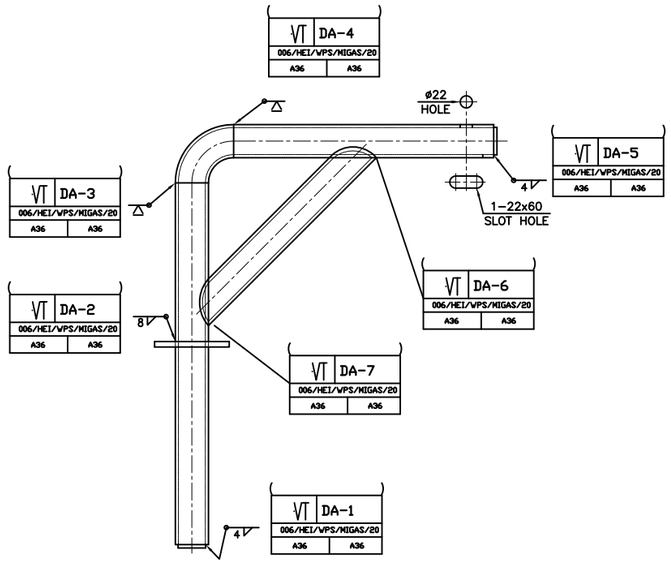




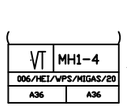
DETAIL "NA"



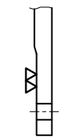
DAVIT ASSEMBLY
(DAVIT ORIENT. SEE ASS'Y DWG)



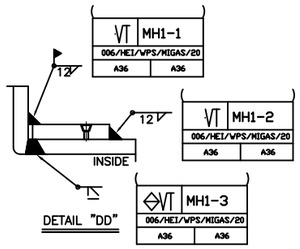
DAVIT DETAIL



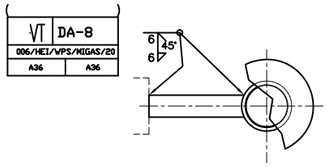
DETAIL "A"



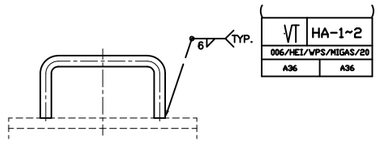
DETAIL "B"



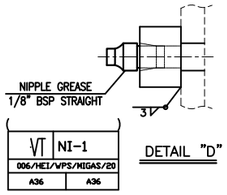
DETAIL "DD"



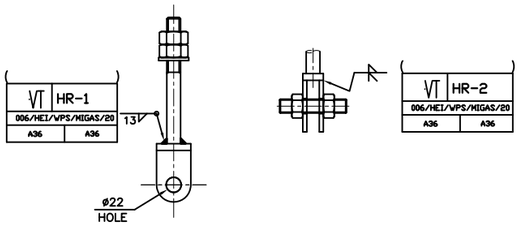
DETAIL "C"



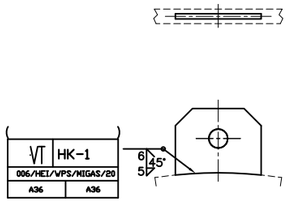
HANDLE DETAIL



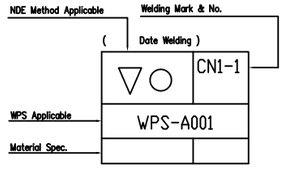
DETAIL "D"



HANGER DETAIL



HOOK



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
HOOK	A36
PIPE DAVIT	A53 Gr.B
HANDLE	A36
NOZZLE NECK	A36
PLATE FLANGE	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name
NDE MAP MANHOLE ADSORPTION TANK 4

NDE Map No.
E2502-NDE-PBY-005

REV.
0

Sheet No./Total sheets : 3/10
Size of memory

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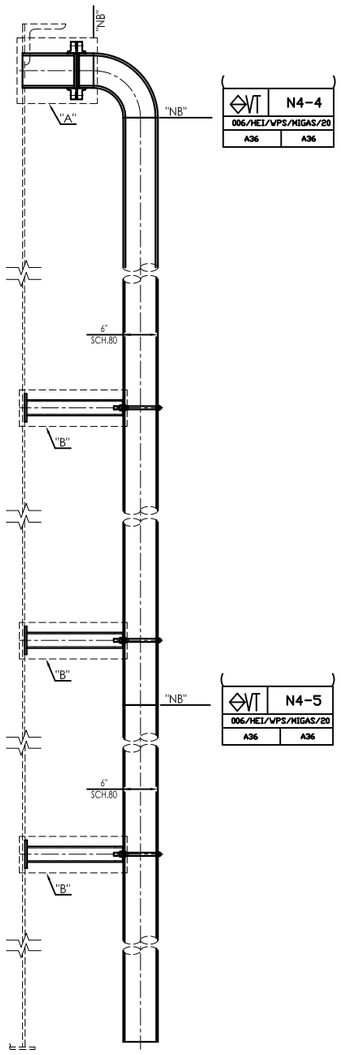
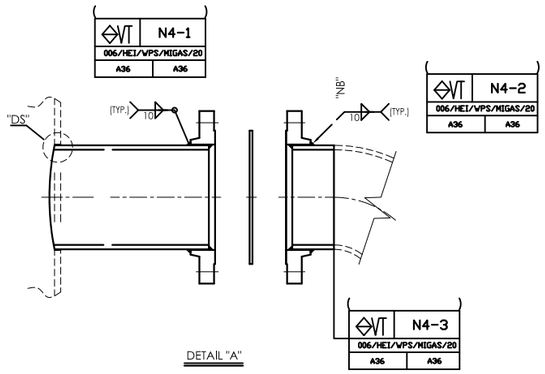
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 4
REFER DWG NO.	: E2502-000-DWG-504

GENERAL NOTES :

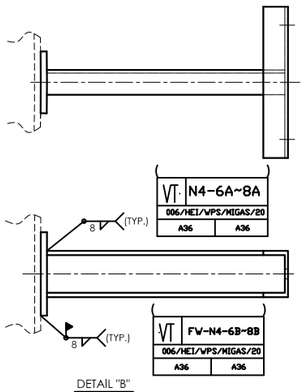
1. BOLT HOLE ORIENTATION
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT
   # LIFTING LUG AND REMOVING OF JIG
   # NOZZLE ATTACHMENT WELDING OF DUCTING



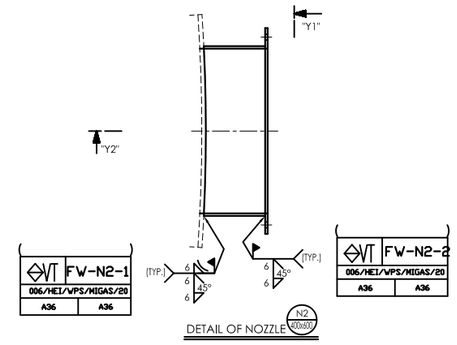
DETAIL OF NOZZLE N4 6"



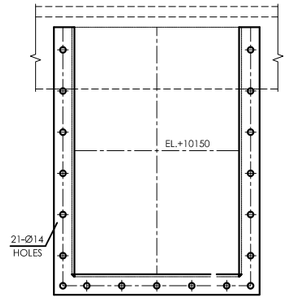
DETAIL "A"



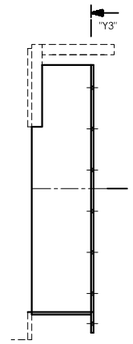
DETAIL "B"



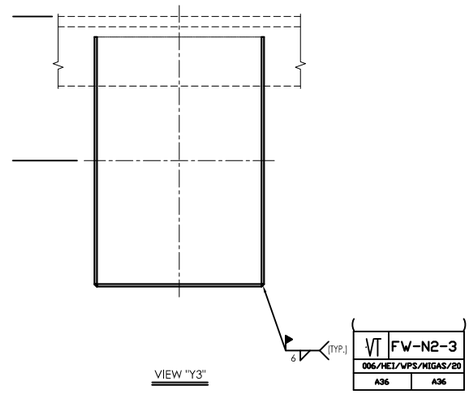
DETAIL OF NOZZLE N2 300x600



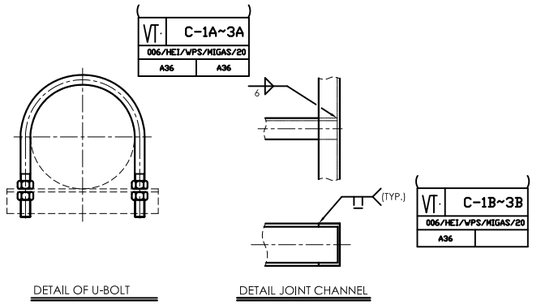
VIEW "Y1"



VIEW "Y2"

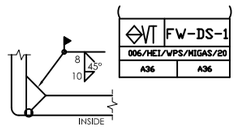


VIEW "Y3"

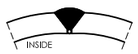


DETAIL OF U-BOLT

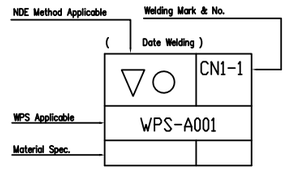
DETAIL JOINT CHANNEL



DETAIL "DS"



DETAIL "NB"



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
FLANGE	A105
NOZZLE NECK	A106 Gr.B
REINF. PAD	A36
CHANNEL	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name
NDE MAP NOZZLE 1-3 ADSORPTION TANK 4

Sheet No./Total sheets	4/10
Size of memory	
PT. HANAZONO Engineering Indonesia — We are always partner with you	
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 4
REFER DWG NO.	: E2502-000-DWG-505
NDE Map No.	E2502-NDE-PBY-005
REV.	0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

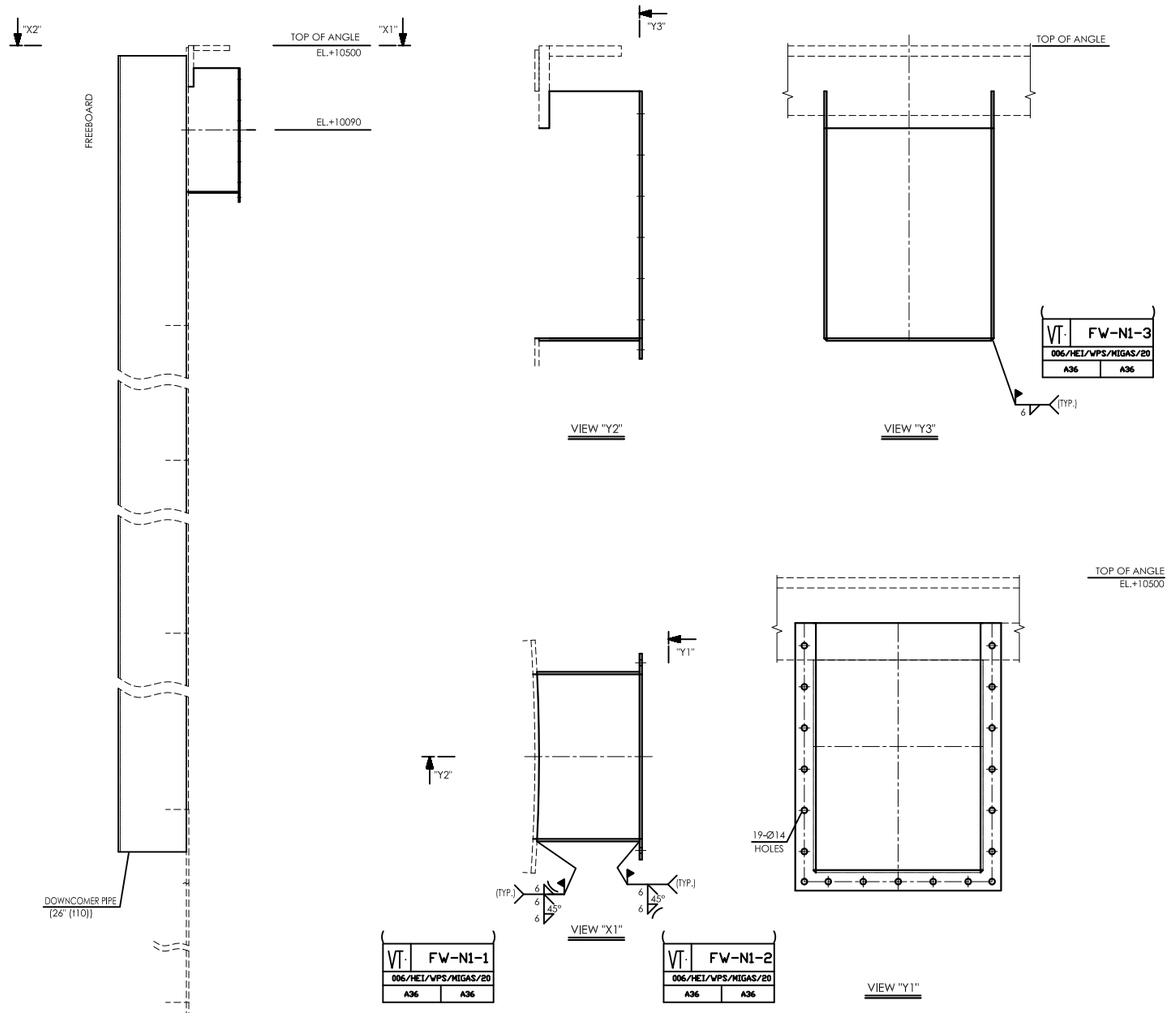
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

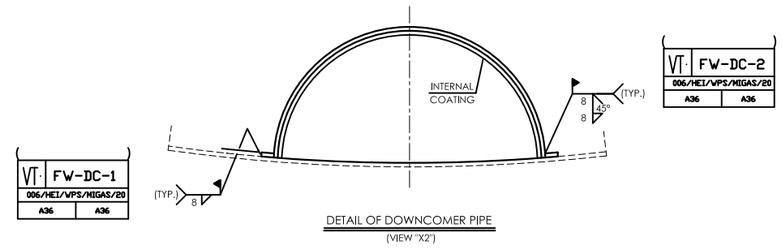
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

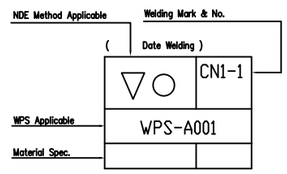
   # NOZZLE ATTACHMENT WELDING OF DUCTING



DETAIL OF NOZZLE N1 (100x50)



DETAIL OF DOWNCOMER PIPE
(VIEW "X2")



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
FLANGE	A105
NOZZLE NECK	A106 Gr.B
REINF. PAD	A36
CHANNEL	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

CHANGE BY CAD SYSTEM ONLY

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name

NDE MAP NOZZLE 2-3 ADSORPTION TANK 4

Sheet No./Total sheets	5/10
Size of memory	

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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 4
REFER DWG NO.	: E2502-000-DWG-506

NDE Map No. E2502-NDE-PBY-005

REV. 0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

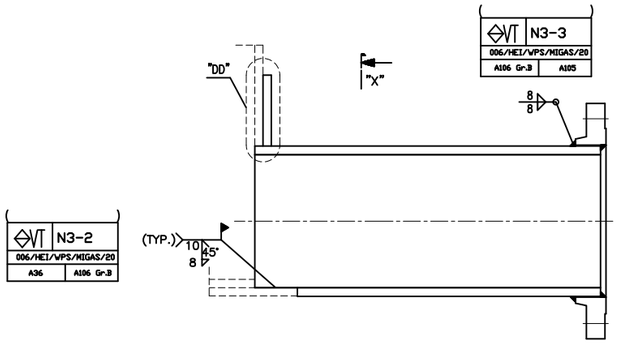
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

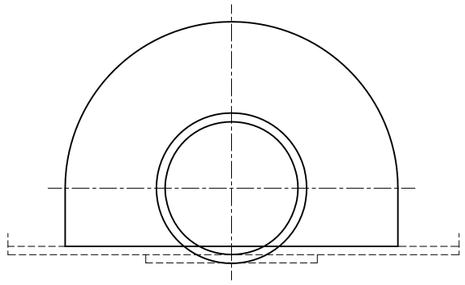
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

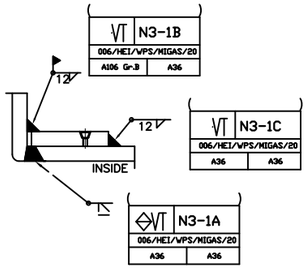
   # NOZZLE ATTACHMENT WELDING OF DUCTING



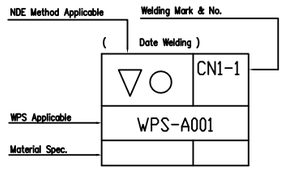
DETAIL OF NOZZLE N3 8"



DETAIL OF REINF. PAD



DETAIL "DD"



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
FLANGE	A105
NOZZLE NECK	A106 Gr.B
REINF. PAD	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name

NDE MAP NOZZLE 3-3 ADSORPTION TANK 4

Sheet No./Total sheets 6/10

Size of memory

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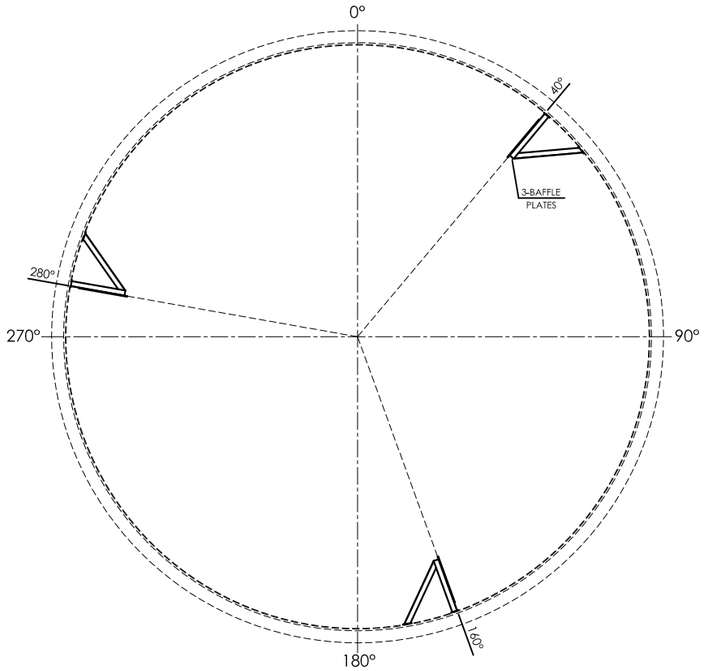
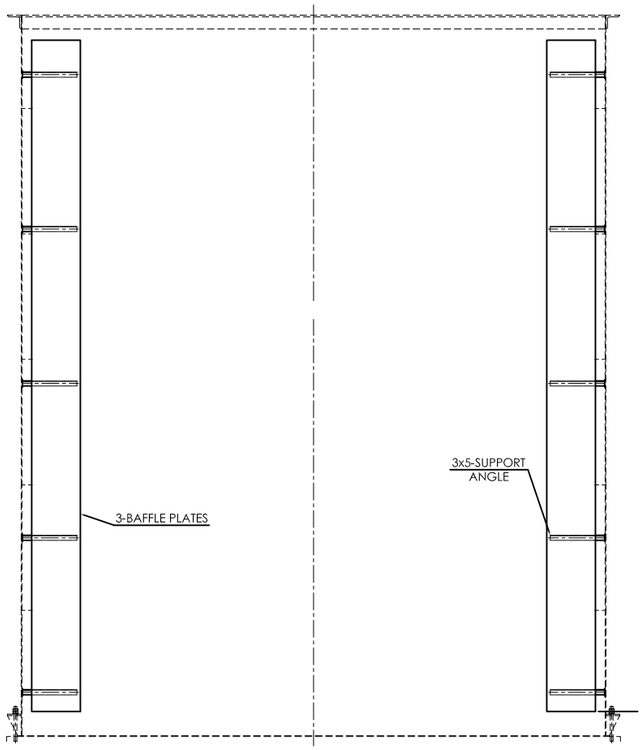
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 4
REFER DWG NO.	: E2502-000-DWG-507

NDE Map No. E2502-NDE-PBY-005

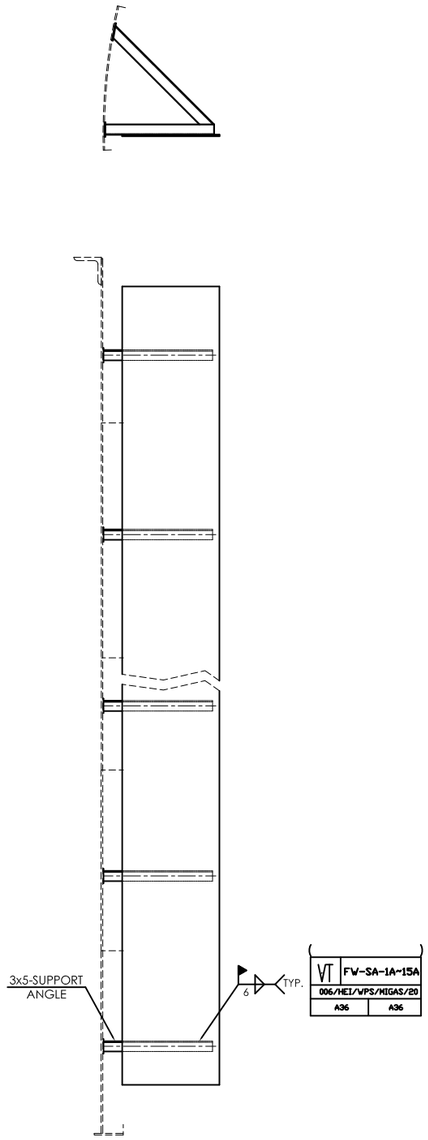
REV. 0



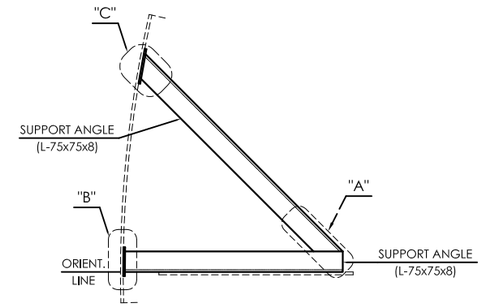
ORIENTATION OF INTERNAL BAFFLE

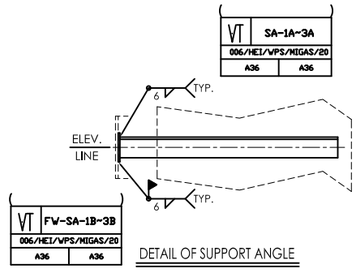


ELEVATION OF INTERNAL BAFFLE

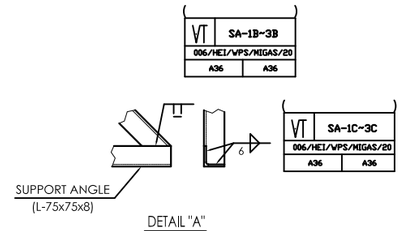


DETAIL OF INTERNAL BAFFLE





DETAIL OF SUPPORT ANGLE



DETAIL "A"

DETAIL "B"

DETAIL "C"

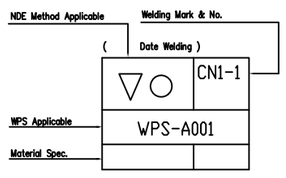
GENERAL NOTES :

1. BOLT HOLE ORIENTATION

   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

   # NOZZLE ATTACHMENT WELDING OF DUCTING



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
INTERNAL BAFFLE	A36
SUPPORT ANGLE	A36
SUPPORT PAD	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name

NDE MAP INTERNAL BAFFLE
ADSORPTION TANK 4

Sheet No./Total sheets	7/10
Size of memory	
PT. HANAZONO Engineering Indonesia — We are always partner with you	
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 4
REFER DWG NO.	: E2502-000-DWG-508
NDE Map No.	E2502-NDE-PBY-005
REV.	0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

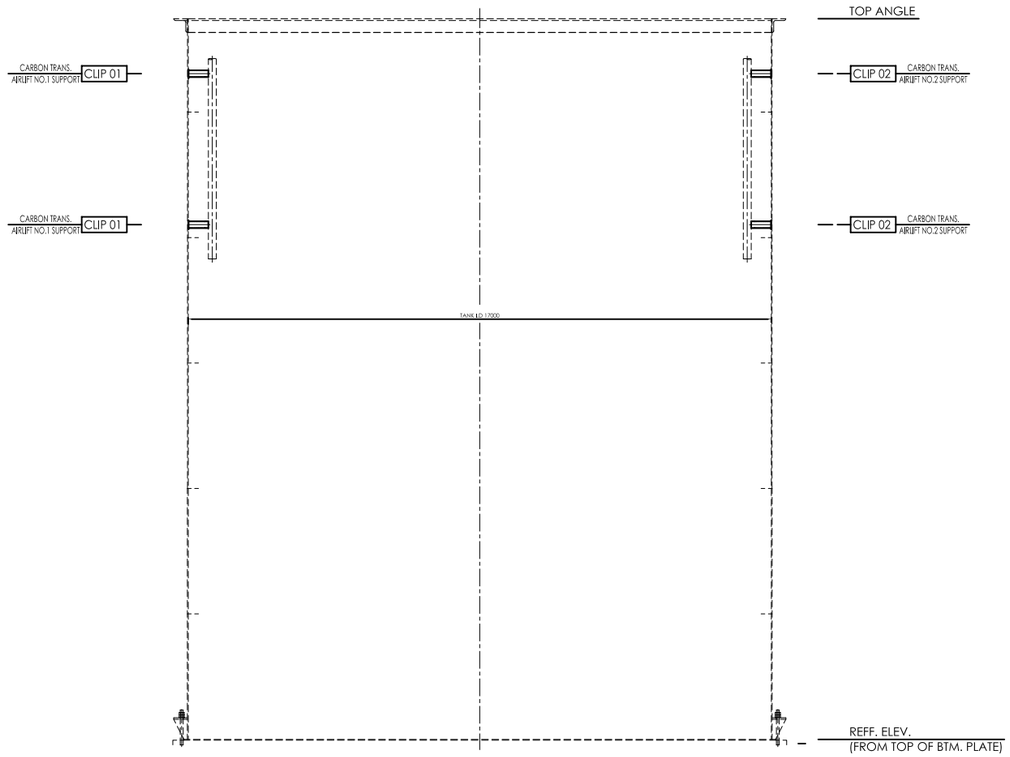
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

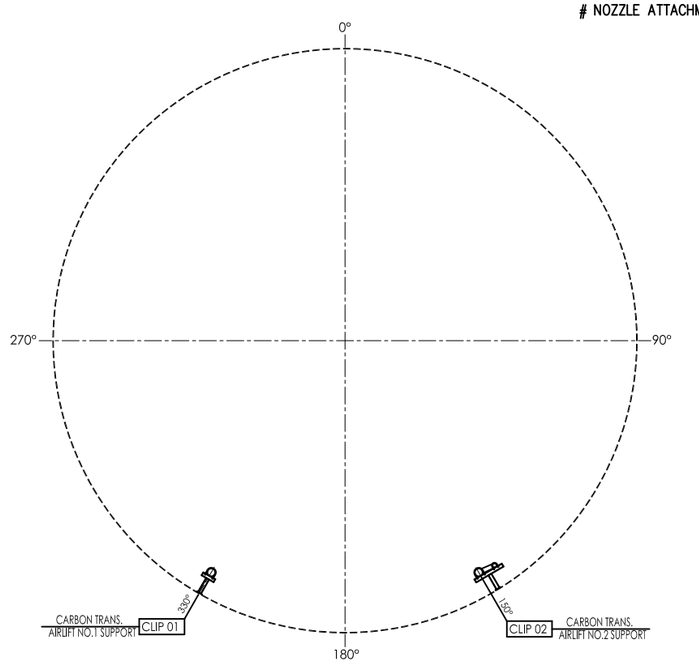
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

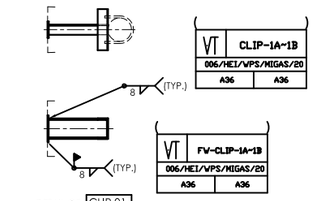
   # NOZZLE ATTACHMENT WELDING OF DUCTING



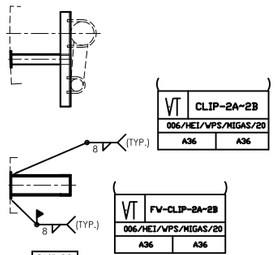
PIPE SUPPORT ELEVATION



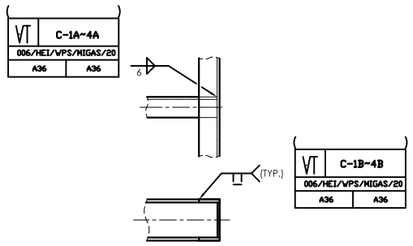
PIPE SUPPORT PLAN



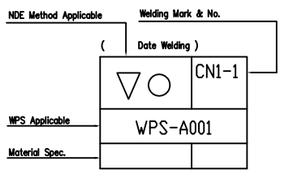
DETAIL OF CLIP 01
(CARBON TRANS. AIRLIFT NO.1 SUPPORT)



DETAIL OF CLIP 02
(CARBON TRANS. AIRLIFT NO.2 SUPPORT)



DETAIL JOINT CHANNEL



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION		LEGEND :
SUPPORT CHANNEL	A36	WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1
REINF. PAD	A36	

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name

NDE MAP INTERNAL SUPPORT
ADSORPTION TANK 4

Sheet No./Total sheets 8/10

Size of memory

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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 4
REFER DWG NO.	: E2502-000-DWG-509

NDE Map No. E2502-NDE-PBY-005

REV. 0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

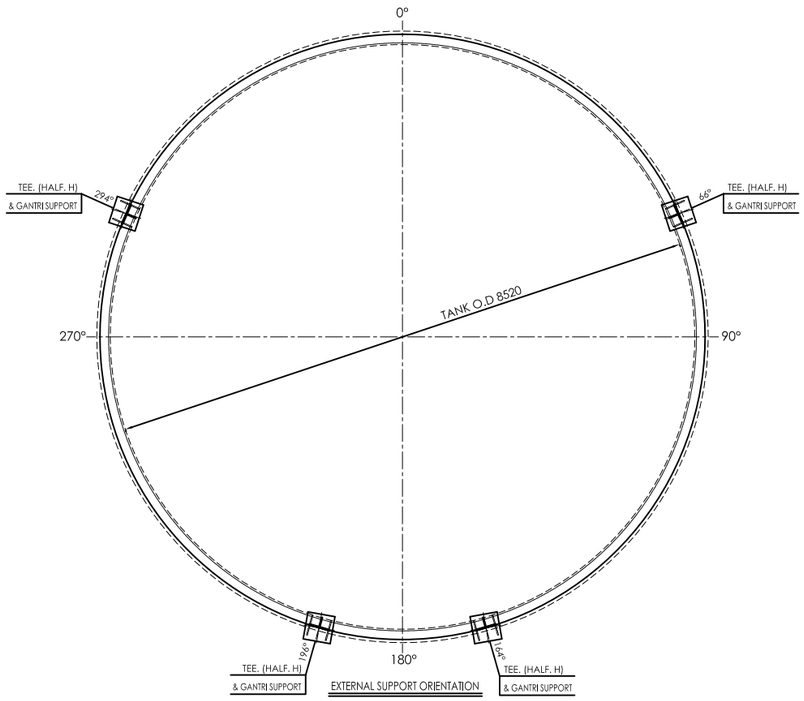
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

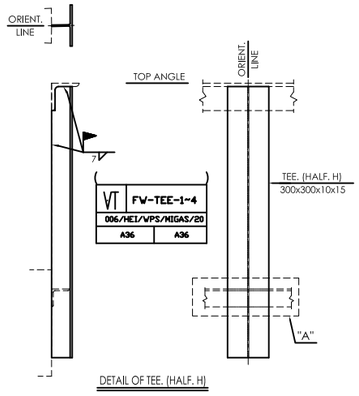
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

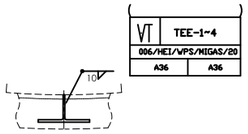
   # NOZZLE ATTACHMENT WELDING OF DUCTING

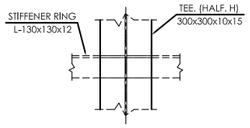


EXTERNAL SUPPORT ORIENTATION

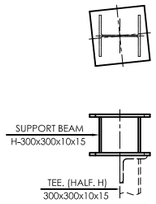


DETAIL OF TEE. (HALF. H)

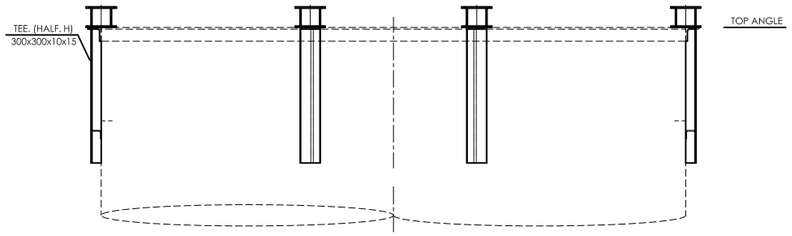




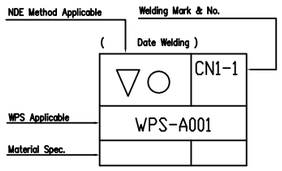
DETAIL "A"



DETAIL OF GANTRI SUPPORT



EXTERNAL SUPPORT ELEVATION



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
TEE HALF	A36
SUPPORT BEAM	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name

NDE MAP EXTERNAL SUPPORT
ADSORPTION TANK 4

Sheet No./Total sheets	9/10
Size of memory	

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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 4
REFER DWG NO.	: E2502-000-DWG-510

NDE Map No.: E2502-NDE-PBY-005

REV.: 0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

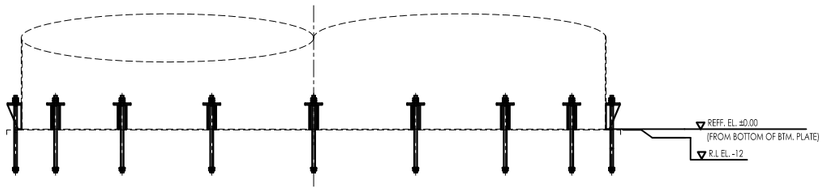
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

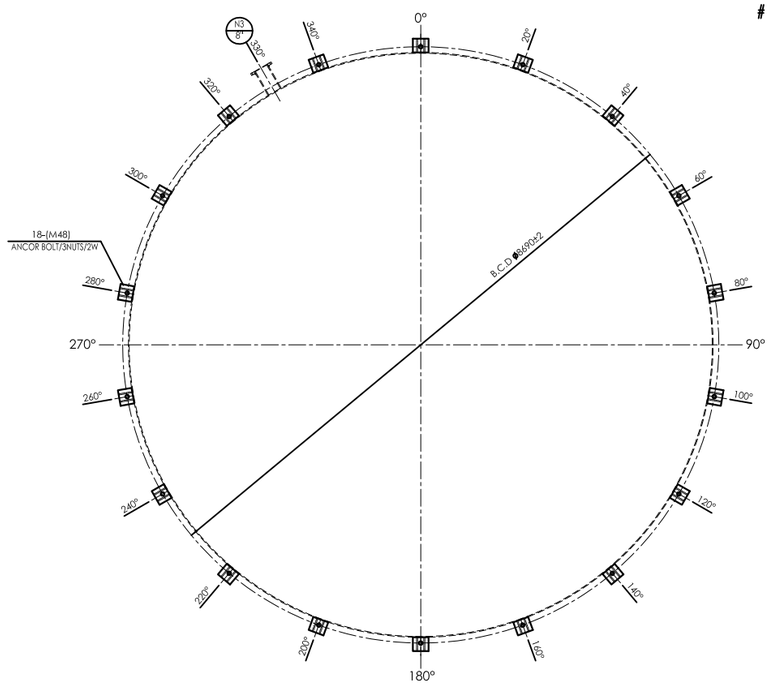
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

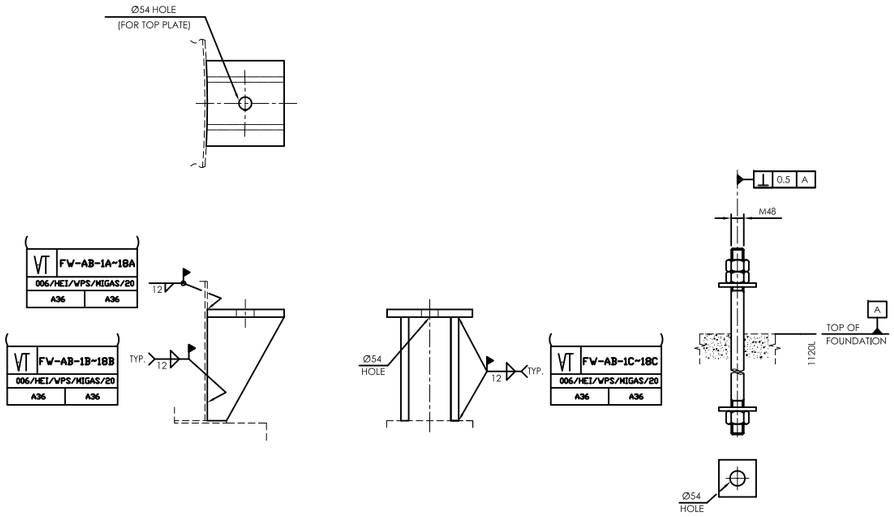
   # NOZZLE ATTACHMENT WELDING OF DUCTING



ANCHOR BOLT ELEVATION

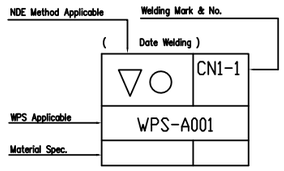


ANCHOR BOLT ORIENTATION
(PLAN VIEW)



DETAIL OF ANCHOR BOLT CHAIR

ANCHOR BOLT/3N/2W
(BY OTHERS)



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
TOP PLATE	A36
GUSSET PLATE	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Sheet No./Total sheets 10/10

Size of memory

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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 4
REFER DWG NO.	: E2502-000-DWG-511

Name

NDE MAP ANCHOR BOLT ADSORPTION TANK 4

NDE Map No.

E2502-NDE-PBY-005

REV.

0

1. NDE MAP NO. : E2502-NDE-PBY-006

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

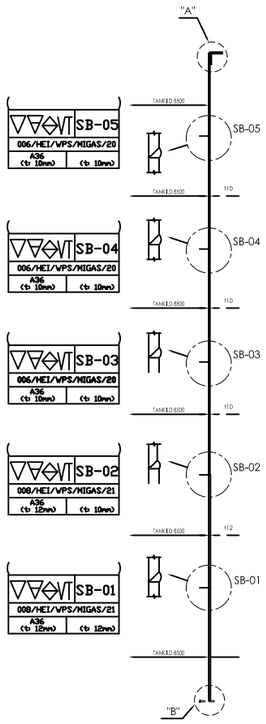
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

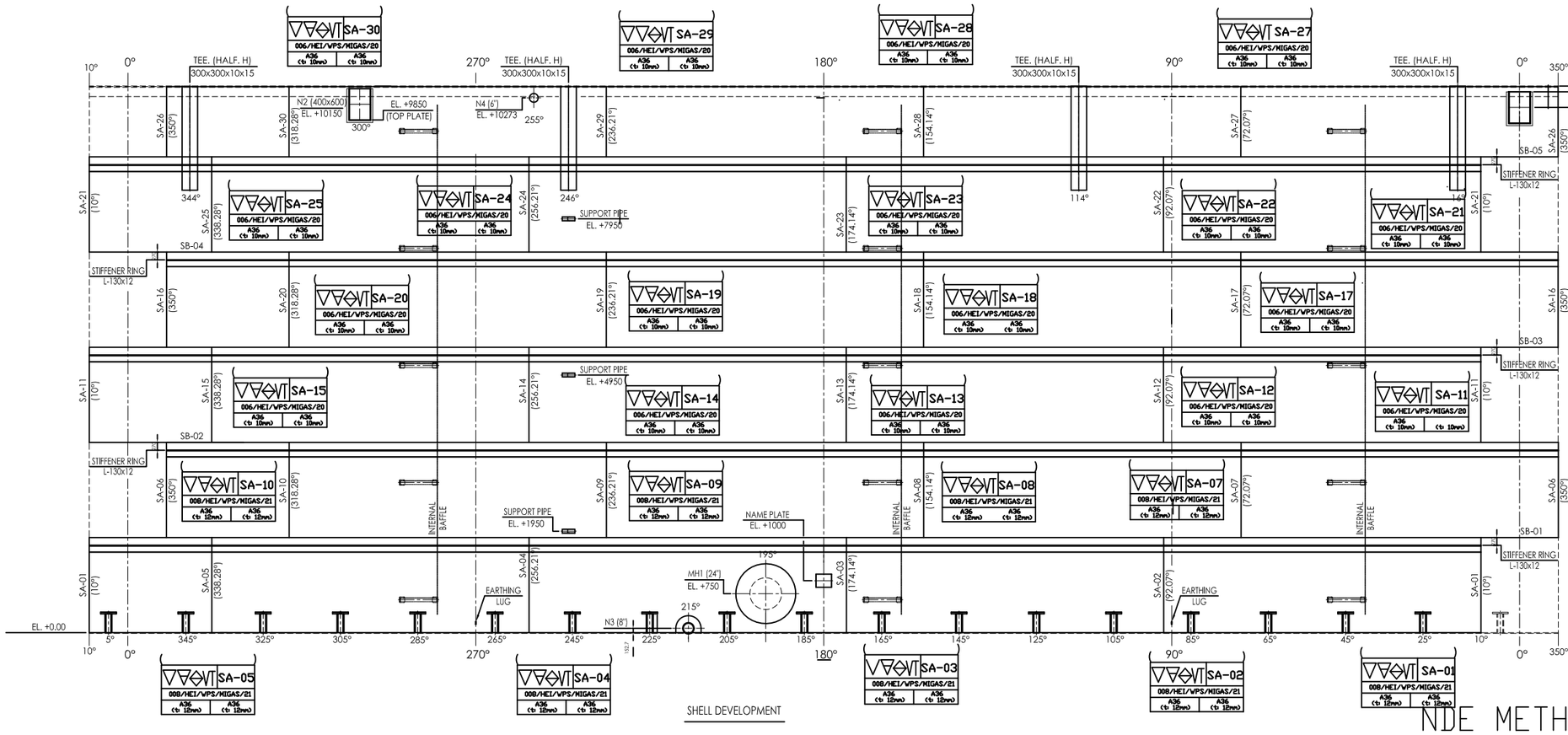
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

   # NOZZLE ATTACHMENT WELDING OF DUCTING



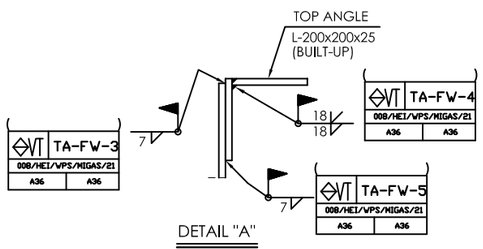
SHELL HORIZONTAL JOINT



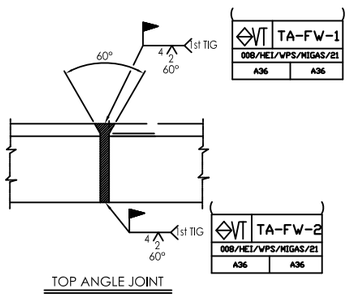
SHELL DEVELOPMENT

NDE METHOD SYMBOL

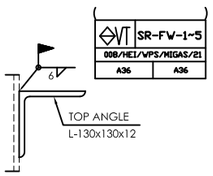
- □ VACUUM BOX
- ▽ UT SPOT
- ▽ UT SPOT LAMINATION CHECK FOR SHELL
- ◇ MPI 10%
- VT VISUAL 100%



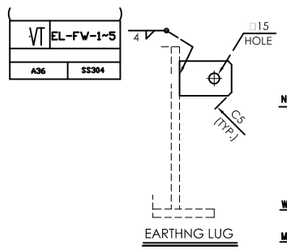
DETAIL "A"



TOP ANGLE JOINT

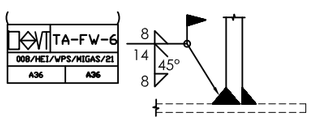


DETAIL OF STIFFENER RING



EARTHNG LUG

NDE Method Applicable	Welding Mark & No.
(Date Welding)	CN1-1
WPS Applicable	WPS-A001
Material Spec.	



DETAIL "B"

MATERIAL SPECIFICATION	
SHELL	A36
TOP ANGLE	A36
STIFFENER RING	A36

LEGEND :

WPS NO :	008/HEI/WPS/MIGAS/21	SMAW	P1 to P1
	006/HEI/WPS/MIGAS/20	GTAW & SMAW	P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name: NDE MAP SHELL ADSORPTION TANK 5

NDE Map No.: E2502-NDE-PBY-006

REV.: 0

Sheet No./Total sheets: 1/10

Size of memory

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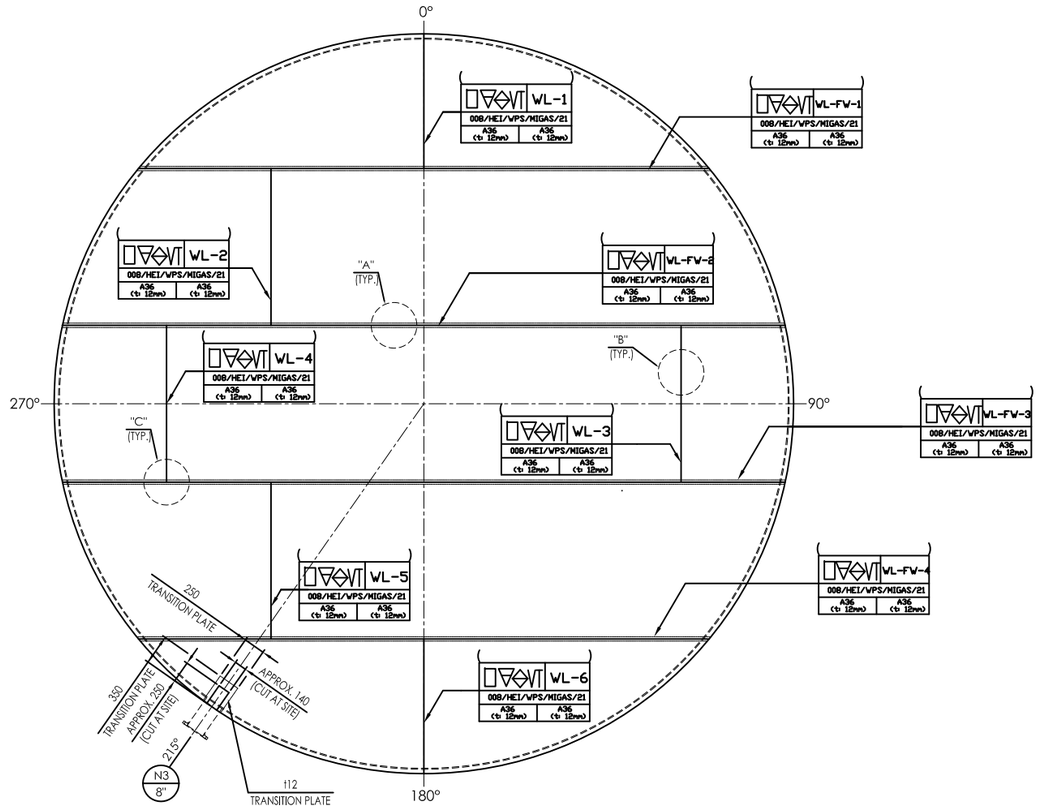
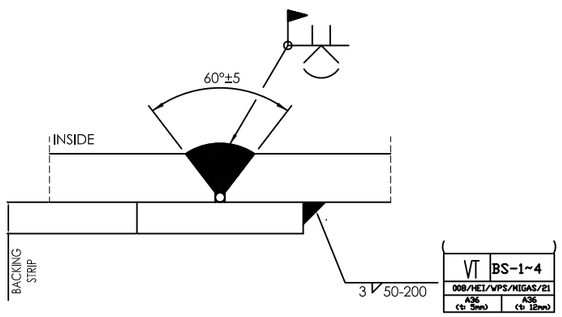
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 5
REFER DWG NO.	: E2502-000-DWG-602

GENERAL NOTES :

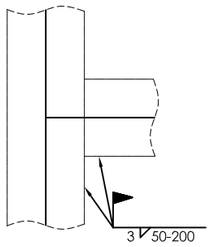
1. BOLT HOLE ORIENTATION
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT
   # LIFTING LUG AND REMOVING OF JIG
   # NOZZLE ATTACHMENT WELDING OF DUCTING

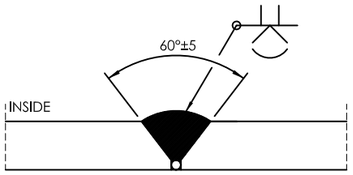


BOTTOM PLATE ARRANGEMENT

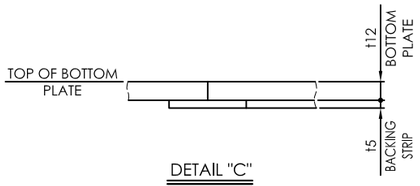


DETAIL "A"

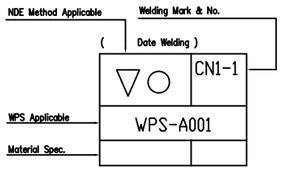




DETAIL "B"



DETAIL "C"



NDE METHOD SYMBOL

- □ VACUUM BOX
- ▽ UT SPOT LAMINATION CHECK FOR BOTTOM
- ◇ MPI 10%
- VT VISUAL 100%

MATERIAL SPECIFICATION	
BOTTOM PLATE	A36
BACKING STRIPE	A36

LEGEND :

WPS NO : 008/HEI/WPS/MIGAS/21 SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale : NTS		

Name
NDE MAP BOTTOM ADSORPTION TANK 5

Sheet No./Total sheets	2/10
Size of memory	
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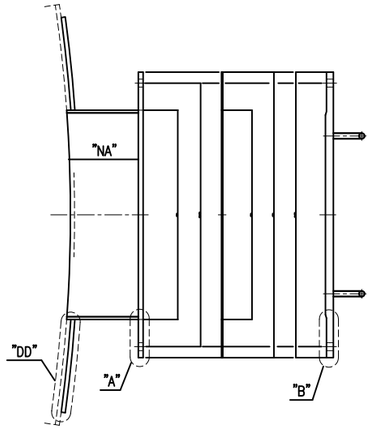
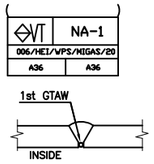
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 5
REFER DWG NO.	: E2502-000-DWG-603
NDE Map No.	E2502-NDE-PBY-006
REV.	0

GENERAL NOTES :

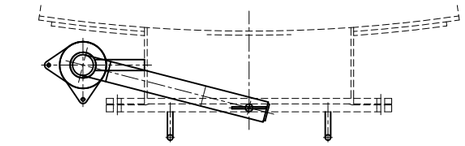
1. BOLT HOLE ORIENTATION
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT
   # LIFTING LUG AND REMOVING OF JIG
   # NOZZLE ATTACHMENT WELDING OF DUCTING

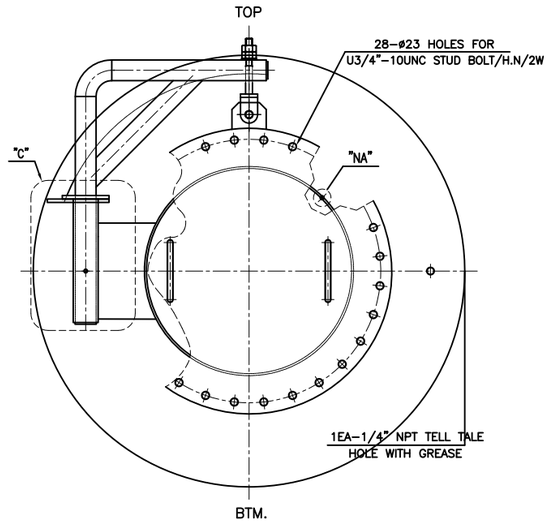


DETAIL OF NOZZLE (MH1) 24"

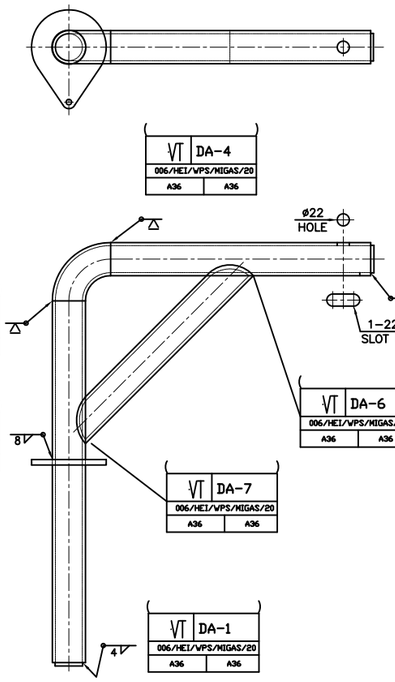


DETAIL "NA"

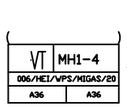




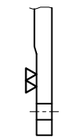
DAVIT ASSEMBLY
(DAVIT ORIENT. SEE ASS'Y DWG)



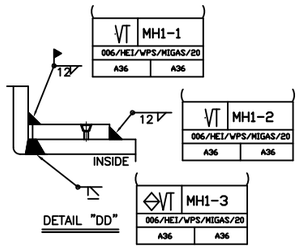
DAVIT DETAIL



DETAIL "A"



DETAIL "B"



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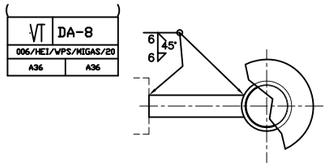
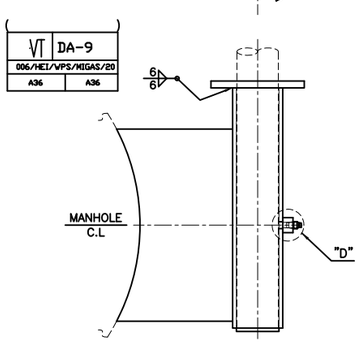
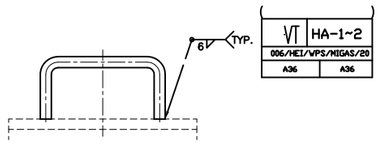
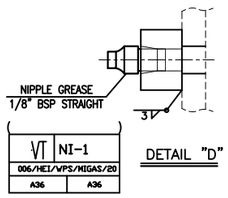




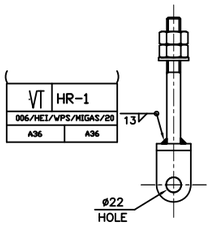
DETAIL "C"



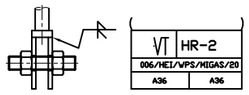
HANDLE DETAIL

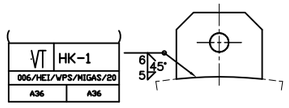


DETAIL "D"

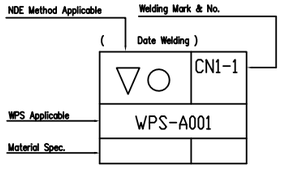


HANGER DETAIL





HOOK



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
HOOK	A36
PIPE DAVIT	A53 Gr.B
HANDLE	A36
NOZZLE NECK	A36
PLATE FLANGE	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name
NDE MAP MANHOLE ADSORPTION TANK 5

Sheet No./Total sheets : 3/10
Size of memory

PT. HANAZONO Engineering Indonesia
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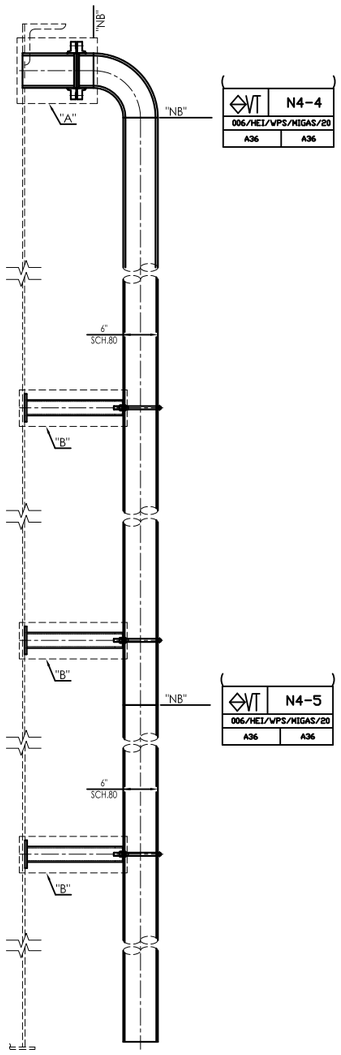
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 5
REFER DWG NO.	: E2502-000-DWG-604

NDE Map No.
E2502-NDE-PBY-006

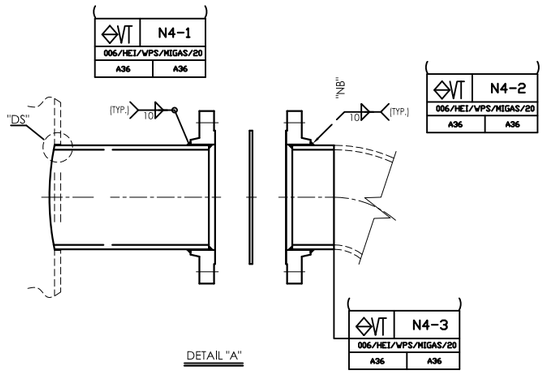
REV.
0

GENERAL NOTES :

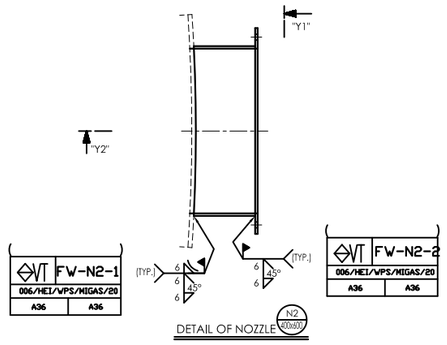
1. BOLT HOLE ORIENTATION
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT
   # LIFTING LUG AND REMOVING OF JIG
   # NOZZLE ATTACHMENT WELDING OF DUCTING



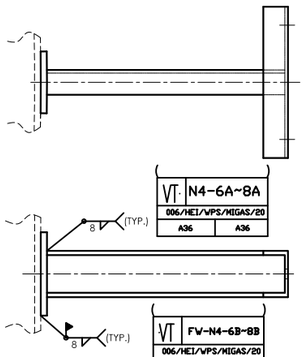
DETAIL OF NOZZLE N4 6"



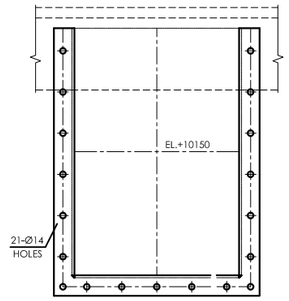
DETAIL "A"



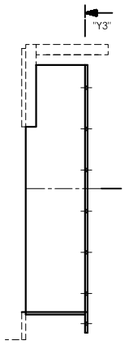
DETAIL OF NOZZLE N2 300x600



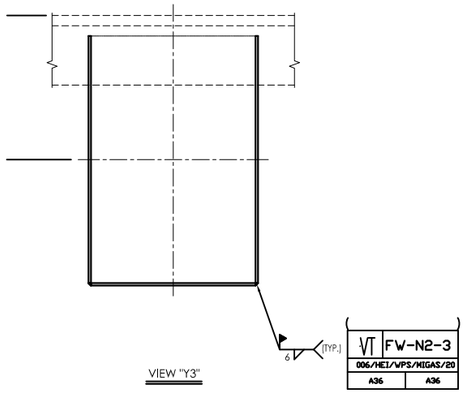
DETAIL "B"



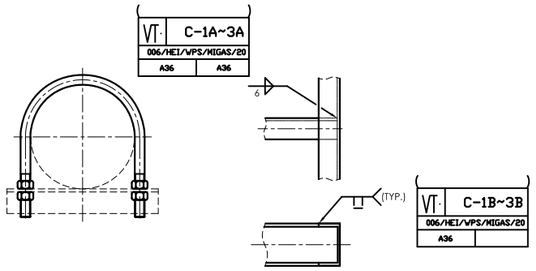
VIEW "Y1"



VIEW "Y2"

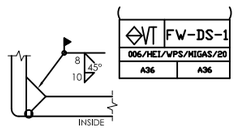


VIEW "Y3"



DETAIL OF U-BOLT

DETAIL JOINT CHANNEL



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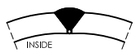
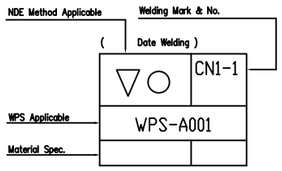


DETAIL "NB"



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
FLANGE	A105
NOZZLE NECK	A106 Gr.B
REINF. PAD	A36
CHANNEL	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name
NDE MAP NOZZLE 1-3 ADSORPTION TANK 5

Sheet No./Total sheets	4/10
Size of memory	
PT. HANAZONO Engineering Indonesia — We are always partner with you	
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 5
REFER DWG NO.	: E2502-000-DWG-605
NDE Map No.	E2502-NDE-PBY-006
REV.	0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

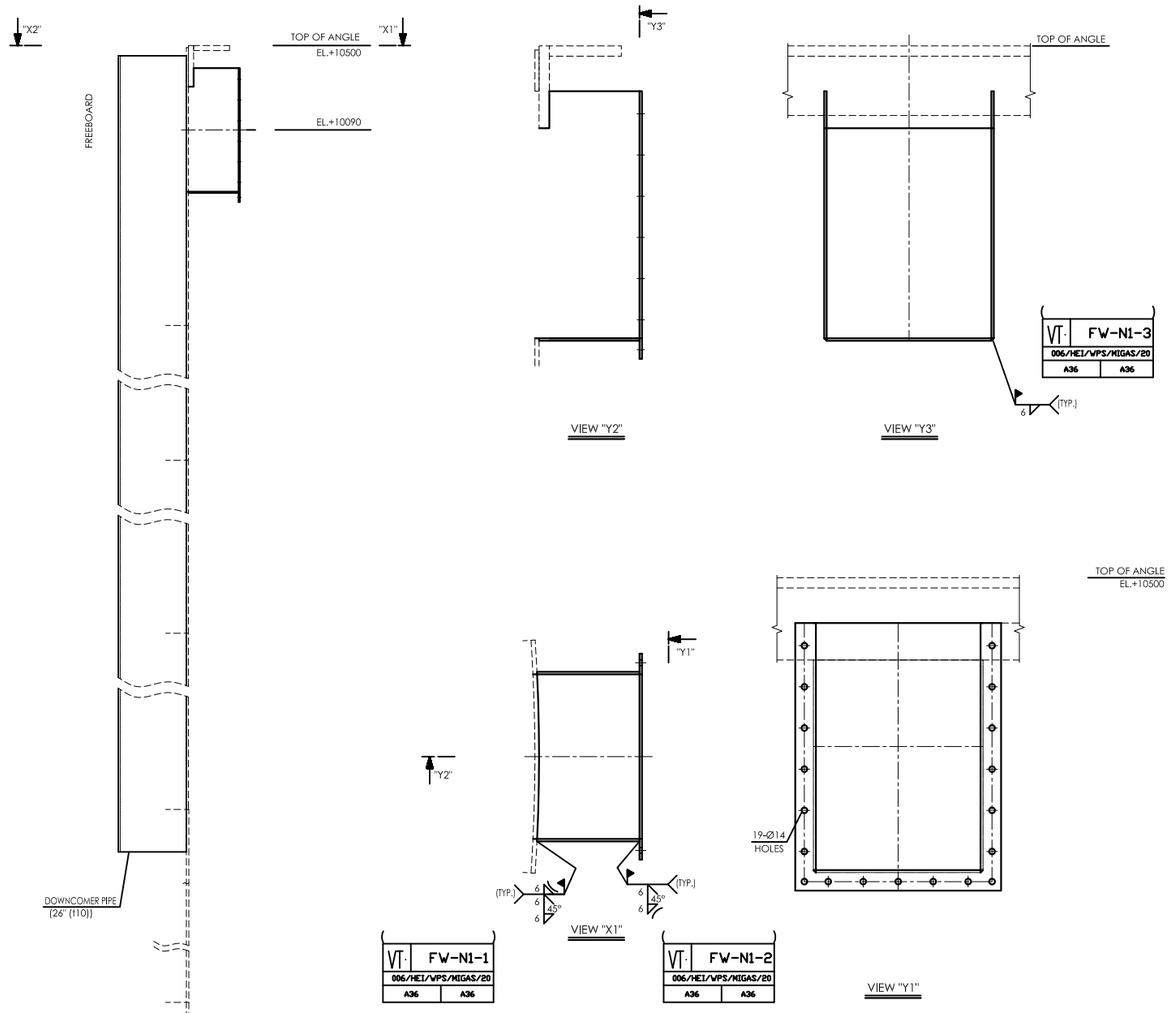
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

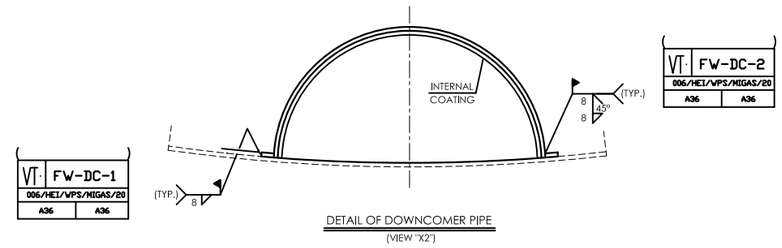
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

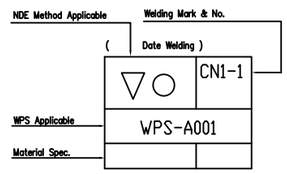
   # NOZZLE ATTACHMENT WELDING OF DUCTING



DETAIL OF NOZZLE N1 (100x50)



DETAIL OF DOWNCOMER PIPE
(VIEW "X2")



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
FLANGE	A105
NOZZLE NECK	A106 Gr.B
REINF. PAD	A36
CHANNEL	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

CHANGE BY CAD SYSTEM ONLY

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name
NDE MAP NOZZLE 2-3 ADSORPTION TANK 5

Sheet No./Total sheets 5/10

Size of memory

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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 5
REFER DWG NO.	: E2502-000-DWG-606

NDE Map No.
E2502-NDE-PBY-006

REV.
0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

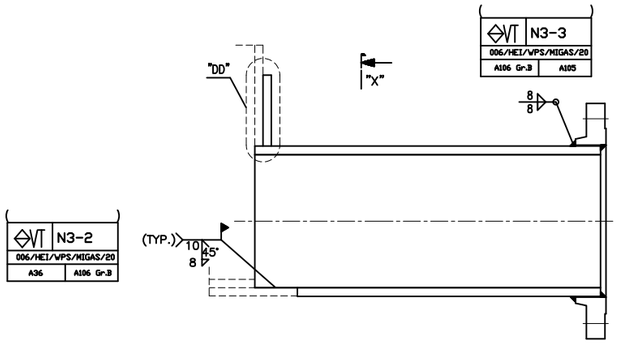
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

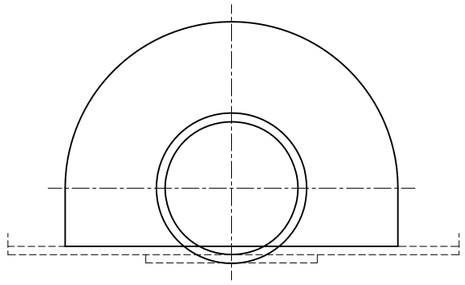
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

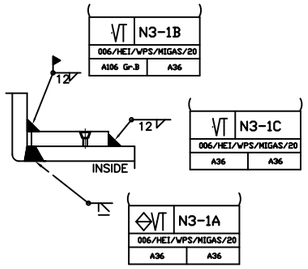
   # NOZZLE ATTACHMENT WELDING OF DUCTING



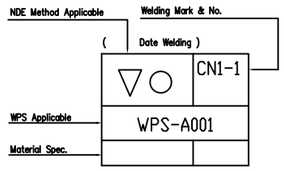
DETAIL OF NOZZLE N3 8"



DETAIL OF REINF. PAD



DETAIL "DD"



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
FLANGE	A105
NOZZLE NECK	A106 Gr.B
REINF. PAD	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name

NDE MAP NOZZLE 3-3 ADSORPTION TANK 5

Sheet No./Total sheets 6/10

Size of memory

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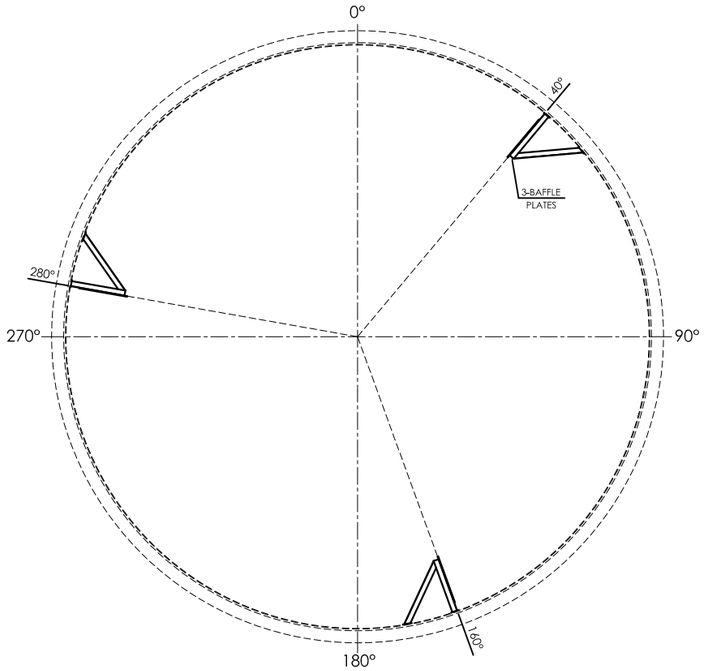
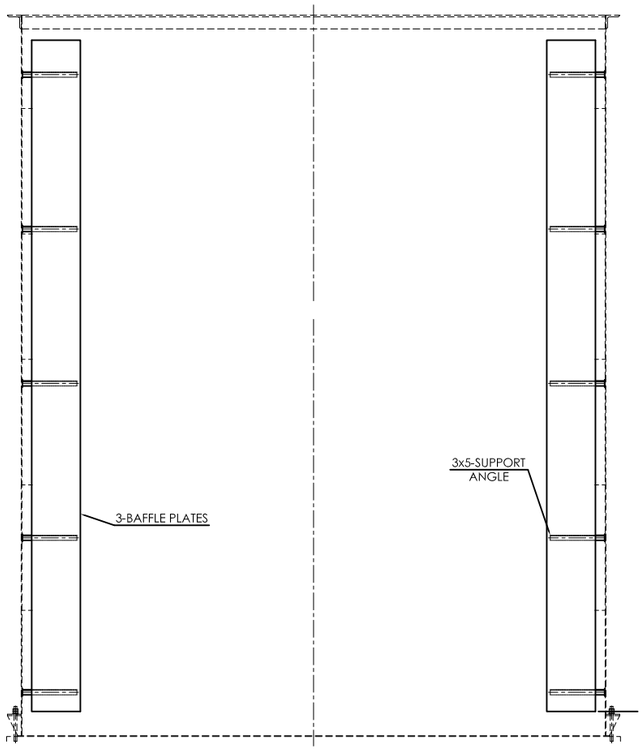
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 5
REFER DWG NO.	: E2502-000-DWG-607

NDE Map No. E2502-NDE-PBY-006

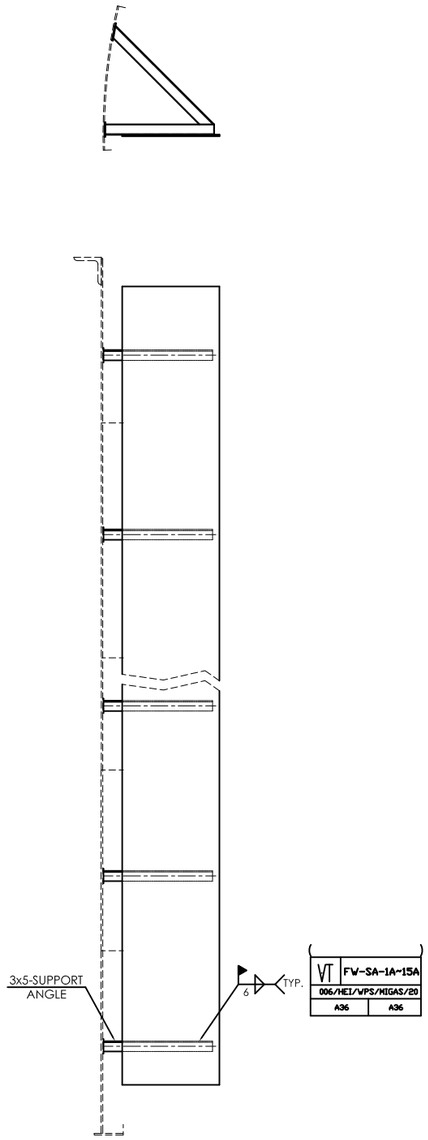
REV. 0



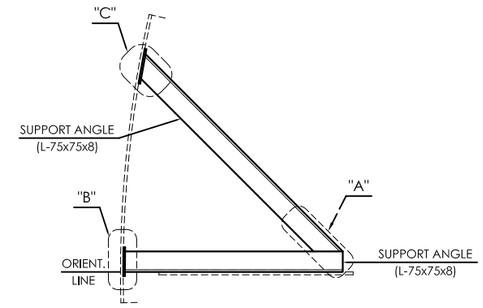
ORIENTATION OF INTERNAL BAFFLE

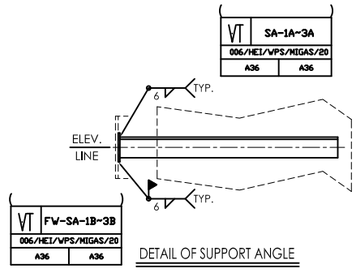


ELEVATION OF INTERNAL BAFFLE

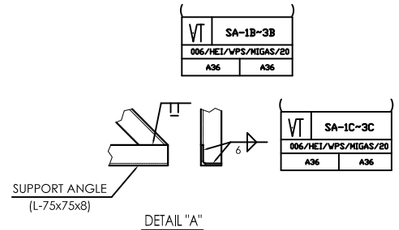


DETAIL OF INTERNAL BAFFLE





DETAIL OF SUPPORT ANGLE



DETAIL "A"

DETAIL "B"

DETAIL "C"

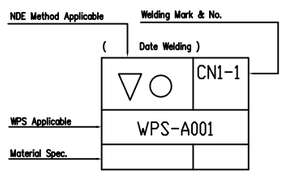
GENERAL NOTES :

1. BOLT HOLE ORIENTATION

   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

   # NOZZLE ATTACHMENT WELDING OF DUCTING



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
INTERNAL BAFFLE	A36
SUPPORT ANGLE	A36
SUPPORT PAD	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name

NDE MAP INTERNAL BAFFLE
ADSORPTION TANK 5

Sheet No./Total sheets	7/10
Size of memory	

PT. HANAZONO Engineering Indonesia
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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 5
REFER DWG NO.	: E2502-000-DWG-608

NDE Map No. E2502-NDE-PBY-006

REV. 0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

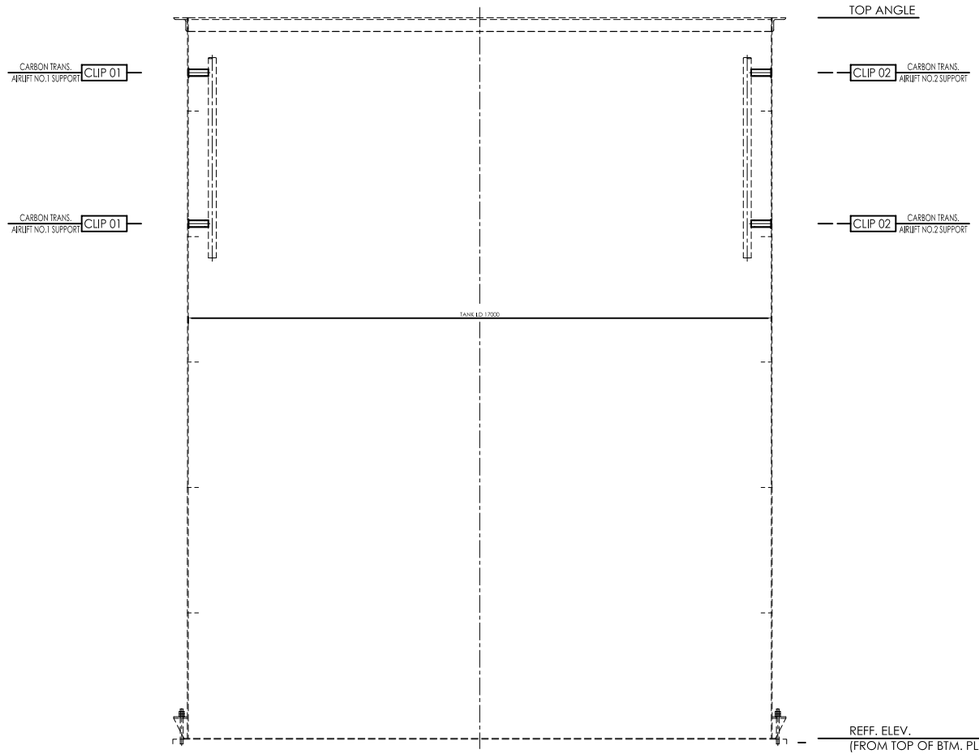
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

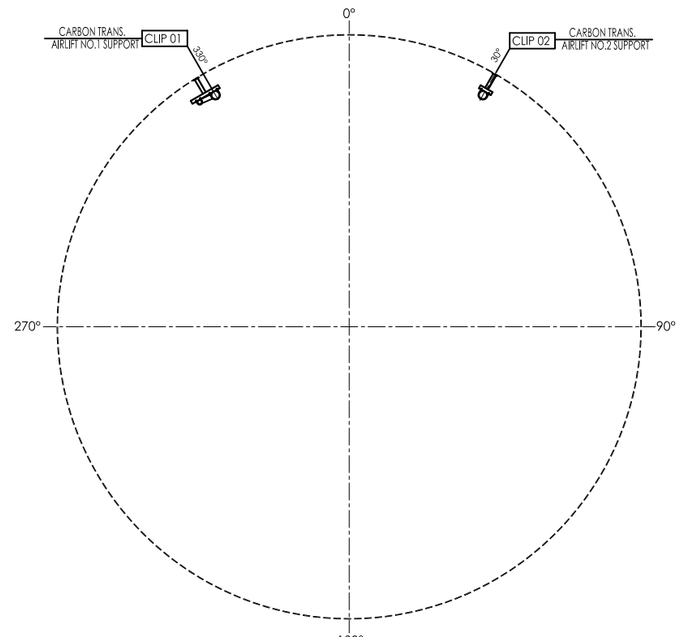
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

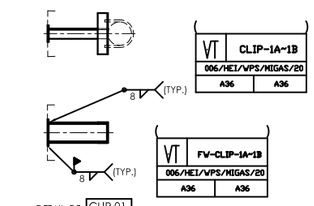
   # NOZZLE ATTACHMENT WELDING OF DUCTING



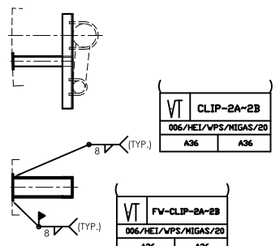
PIPE SUPPORT ELEVATION



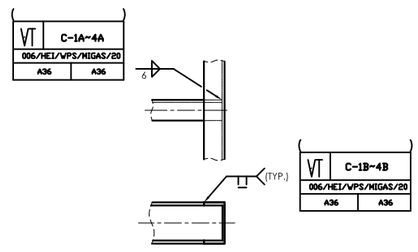
PIPE SUPPORT PLAN



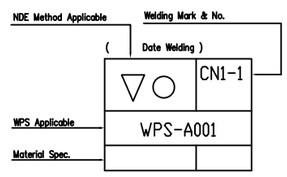
DETAIL OF CLIP 01
(CARBON TRANS. AIRLIFT NO.1 SUPPORT)



DETAIL OF CLIP 02
(CARBON TRANS. AIRLIFT NO.2 SUPPORT)



DETAIL JOINT CHANNEL



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
SUPPORT CHANNEL	A36
REINF. PAD	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name

NDE MAP INTERNAL SUPPORT
ADSORPTION TANK 5

Sheet No./Total sheets	8/10
Size of memory	
PT. HANAZONO Engineering Indonesia — We are always partner with you	
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 5
REFER DWG NO.	: E2502-000-DWG-609
NDE Map No.	E2502-NDE-PBY-006
REV.	0

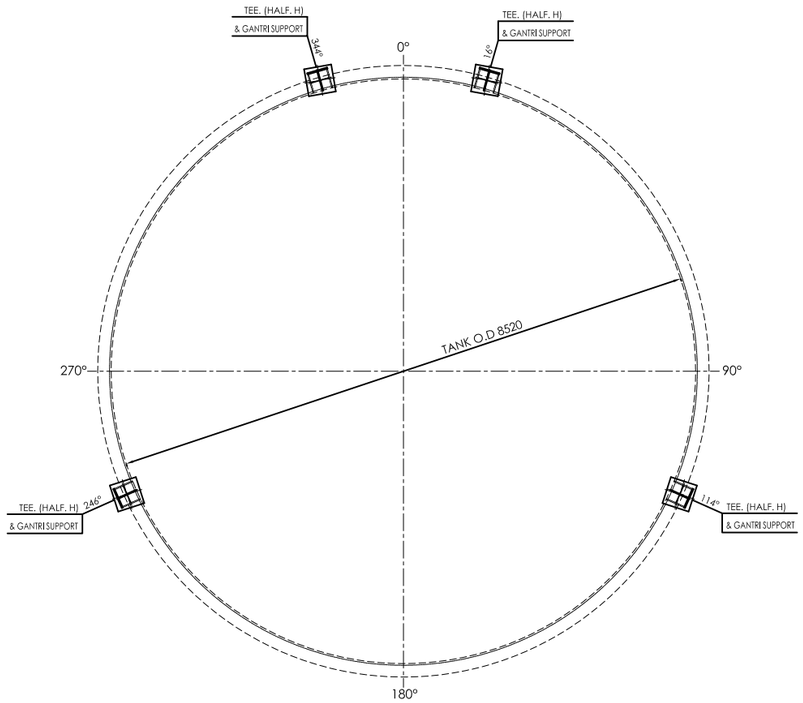
GENERAL NOTES :

1. BOLT HOLE ORIENTATION

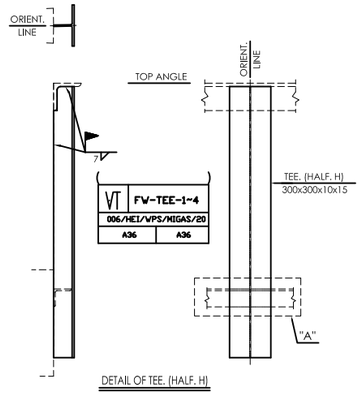
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

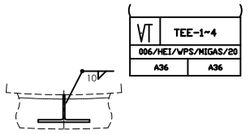
   # NOZZLE ATTACHMENT WELDING OF DUCTING

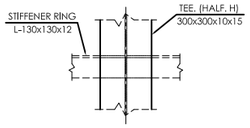


EXTERNAL SUPPORT ORIENTATION

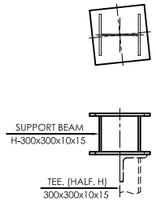


DETAIL OF TEE. (HALF. H)

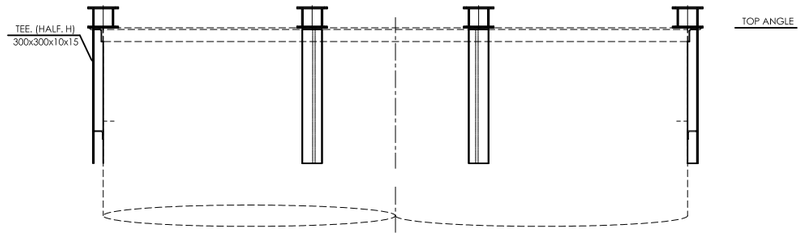




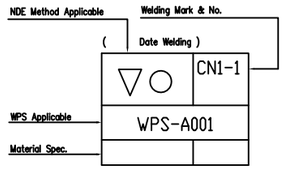
DETAIL "A"



DETAIL OF GANTRI SUPPORT



EXTERNAL SUPPORT ELEVATION



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
TEE HALF	A36
SUPPORT BEAM	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name

NDE MAP EXTERNAL SUPPORT
ADSORPTION TANK 5

Sheet No./Total sheets 9/10

Size of memory

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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 5
REFER DWG NO.	: E2502-000-DWG-610

NDE Map No. E2502-NDE-PBY-006

REV. 0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

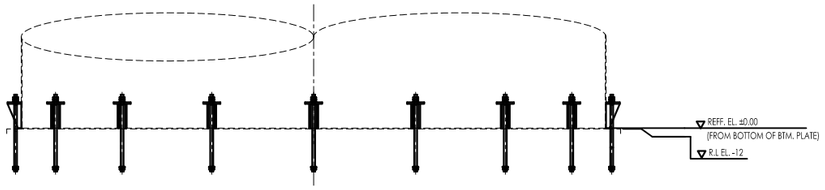
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

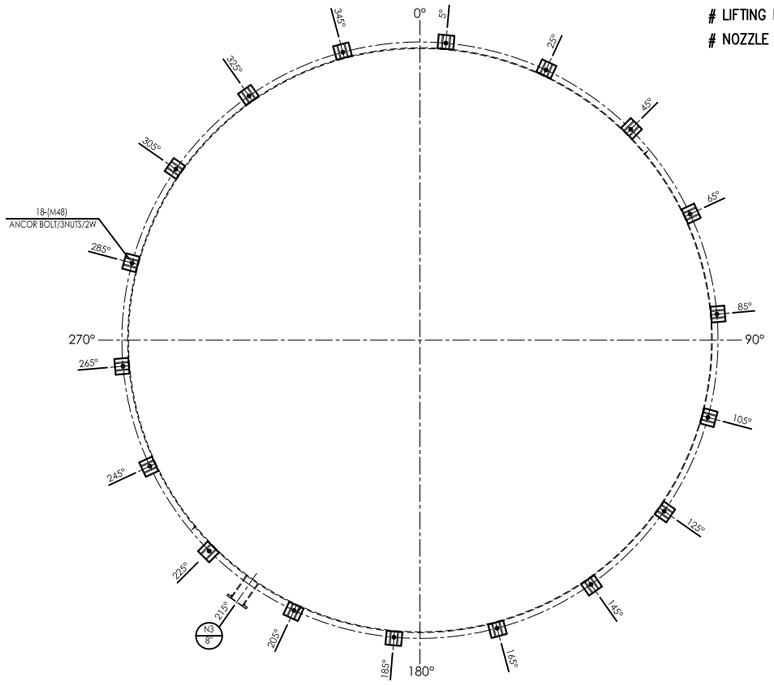
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

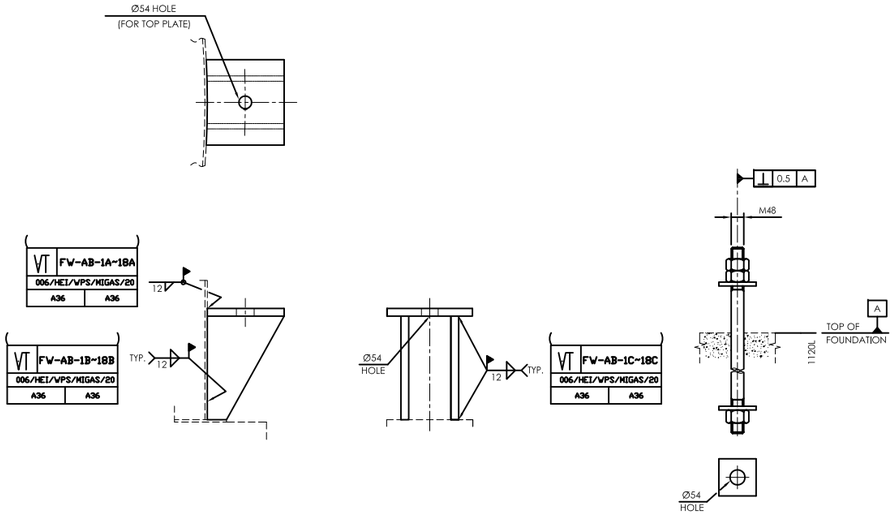
   # NOZZLE ATTACHMENT WELDING OF DUCTING



ANCHOR BOLT ELEVATION

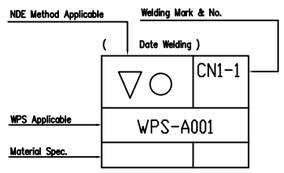


ANCHOR BOLT ORIENTATION
(PLAN VIEW)



DETAIL OF ANCHOR BOLT CHAIR

ANCHOR BOLT/3N/2W
(BY OTHERS)



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION		LEGEND :
TOP PLATE	A36	WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1
GUSSET PLATE	A36	

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name: NDE MAP ANCHOR BOLT ADSORPTION TANK 5

Sheet No./Total sheets	10/10
Size of memory	

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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 5
REFER DWG NO.	: E2502-000-DWG-611

NDE Map No.: E2502-NDE-PBY-006

REV.: 0

1. NDE MAP NO. : E2502-NDE-PBY-007

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

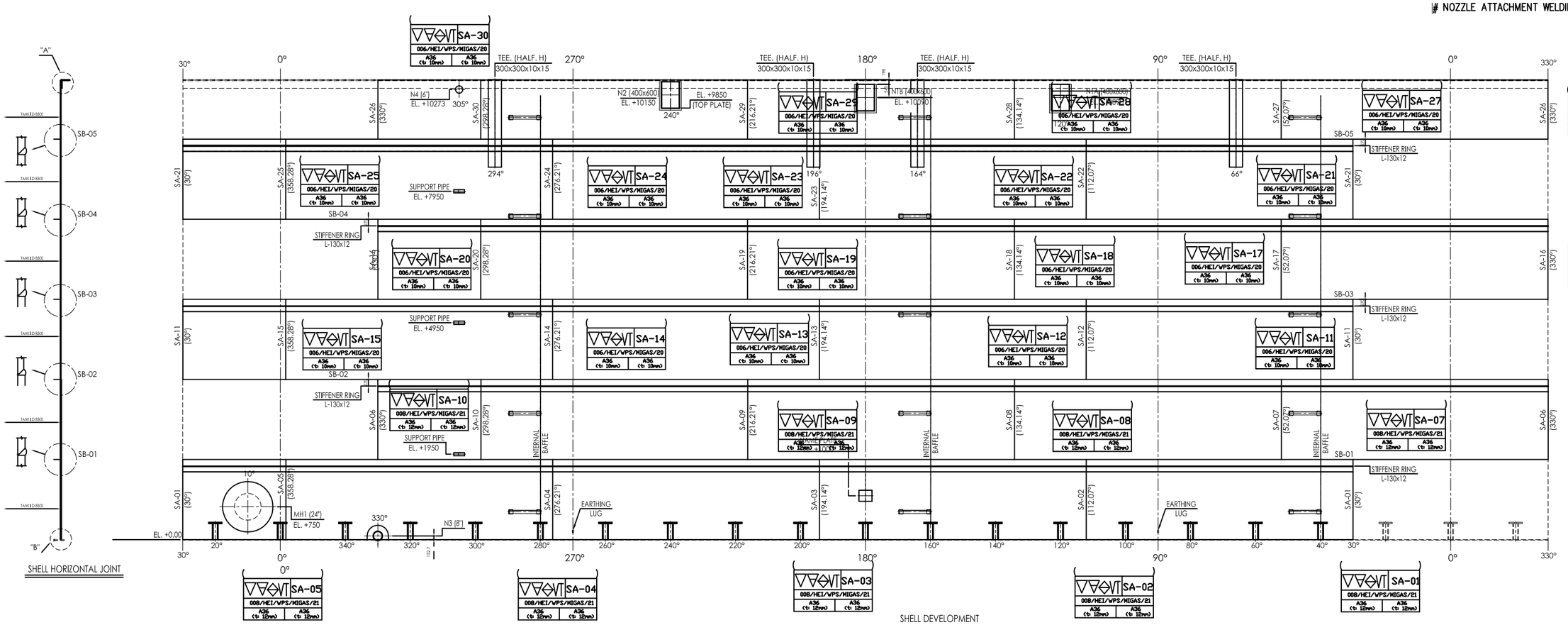
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

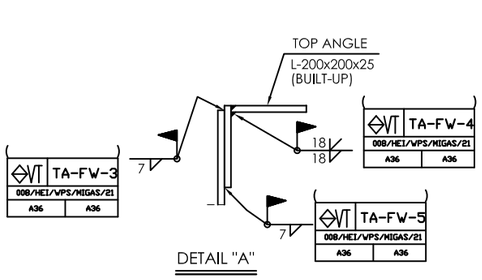
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

3. LIQUID PENETRANT

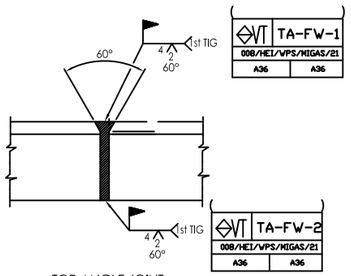
   # LIFTING LUG AND REMOVING OF JIG

   # NOZZLE ATTACHMENT WELDING OF DUCTING

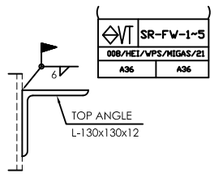




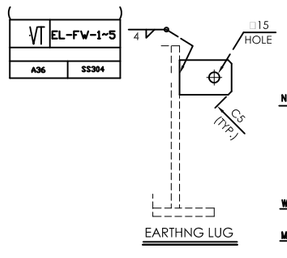
DETAIL "A"



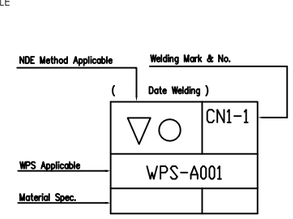
TOP ANGLE JOINT

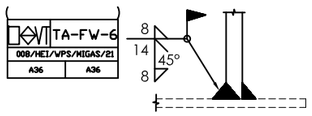


DETAIL OF STIFFENER RING



EARTHNG LUG





DETAIL "B"

NDE METHOD SYMBOL

- □ VACUUM BOX
- ▽ UT SPOT
- ▽̄ UT SPOT LAMINATION CHECK FOR SHELL
- ◇ MPI 10%
- VT VISUAL 100%

MATERIAL SPECIFICATION	
SHELL	A36
TOP ANGLE	A36
STIFFENER RING	A36

LEGEND :

WPS NO :	008/HEI/WPS/MIGAS/21	SMAW	P1 to P1
	006/HEI/WPS/MIGAS/20	GTAW & SMAW	P1 to P1

File name :

REV	DATE	APPR	
0	29/09/25		

CHANGE BY CAD SYSTEM ONLY

1	2

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name: NDE MAP SHELL ADSORPTION TANK 6

NDE Map No.: E2502-NDE-PBY-007

REV.: 0

Sheet No./Total sheets: 1/10

Size of memory:

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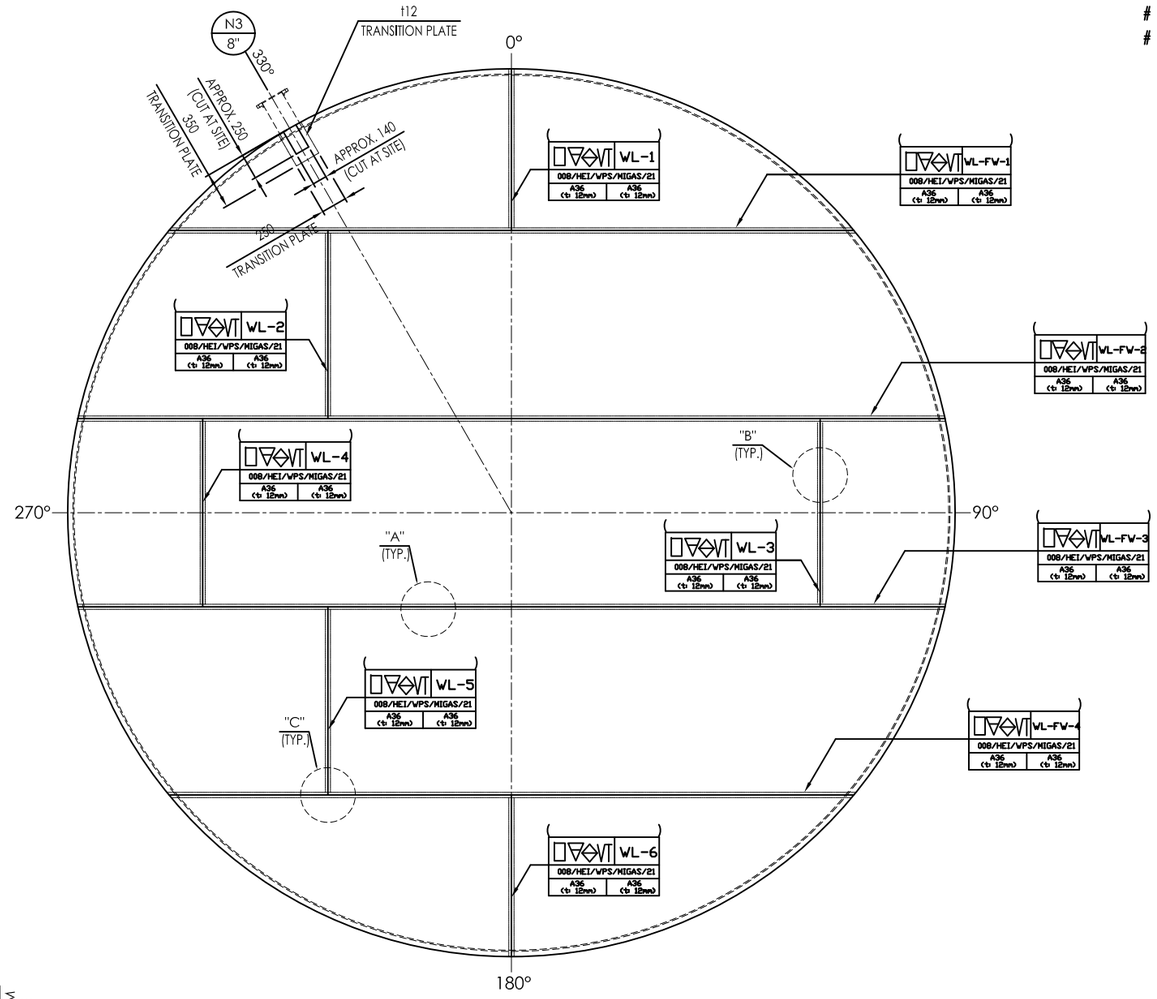
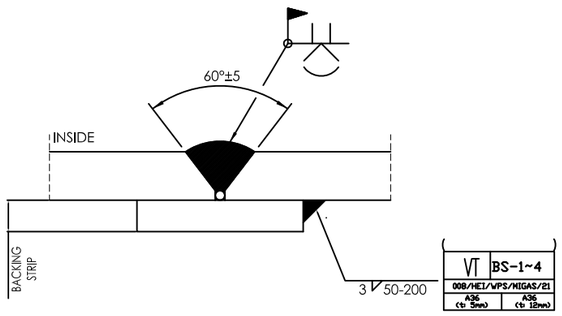
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 6
REFER DWG NO.	: E2502-000-DWG-702

GENERAL NOTES :

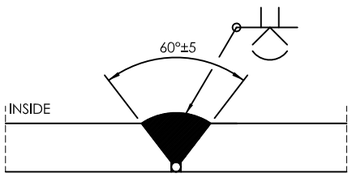
1. BOLT HOLE ORIENTATION
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT
   # LIFTING LUG AND REMOVING OF JIG
   # NOZZLE ATTACHMENT WELDING OF DUCTING



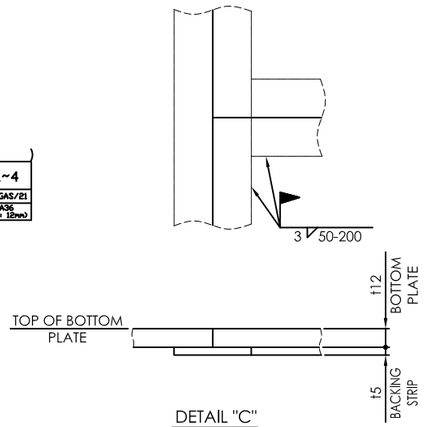
BOTTOM PLATE ARRANGEMENT



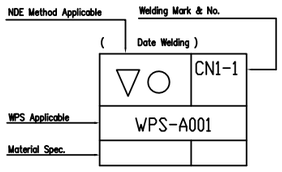
DETAIL "A"



DETAIL "B"



DETAIL "C"



NDE METHOD SYMBOL

- □ VACUUM BOX
- ▽ UT SPOT LAMINATION CHECK FOR BOTTOM
- ◇ MPI 10%
- VT VISUAL 100%

MATERIAL SPECIFICATION	
BOTTOM PLATE	A36
BACKING STRIPE	A36

LEGEND :

WPS NO : 008/HEI/WPS/MIGAS/21 SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name
NDE MAP BOTTOM ADSORPTION TANK 6

Sheet No./Total sheets 2/10
Size of memory

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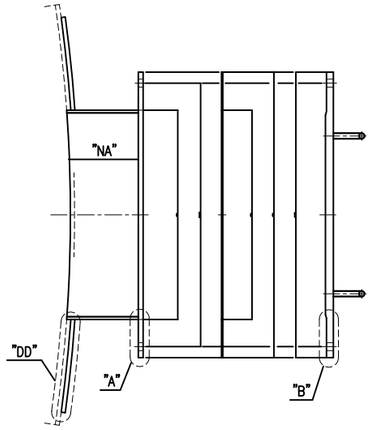
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 6
REFER DWG NO.	: E2502-000-DWG-703

NDE Map No.
E2502-NDE-PBY-007

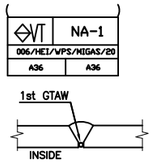
REV.
0

GENERAL NOTES :

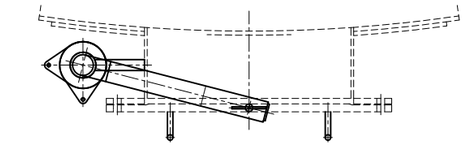
1. BOLT HOLE ORIENTATION
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT
   # LIFTING LUG AND REMOVING OF JIG
   # NOZZLE ATTACHMENT WELDING OF DUCTING

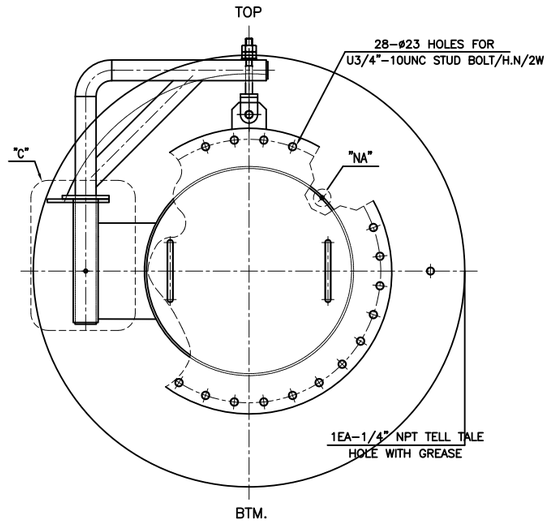


DETAIL OF NOZZLE (MH1) 24"

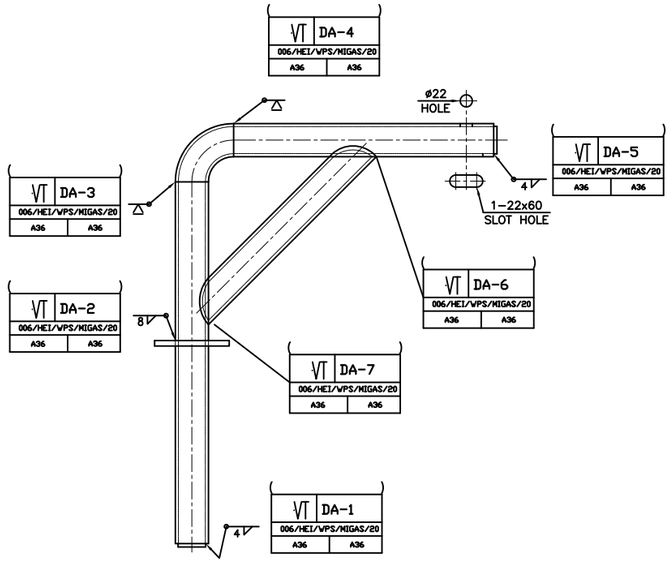


DETAIL "NA"

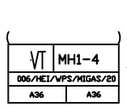




DAVIT ASSEMBLY
(DAVIT ORIENT. SEE ASS'Y DWG)



DAVIT DETAIL



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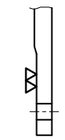
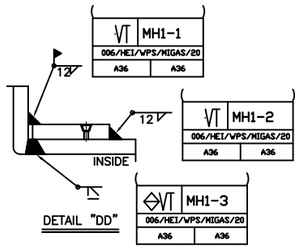
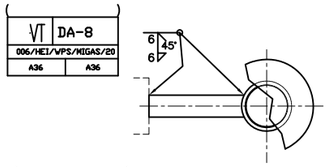
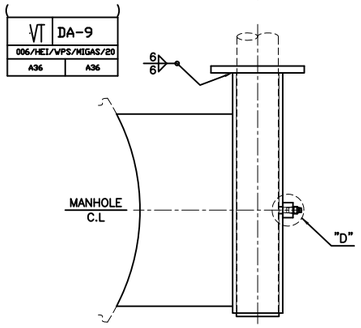


DETAIL "B"



DETAIL "DD"





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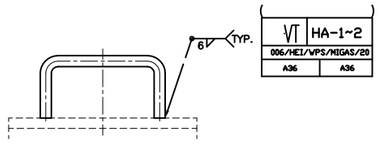
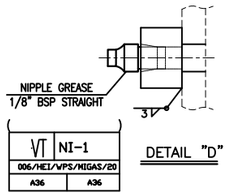


HANDLE DETAIL



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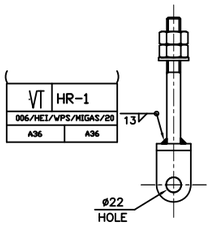
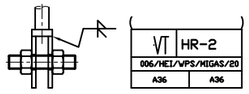
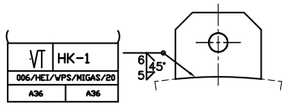
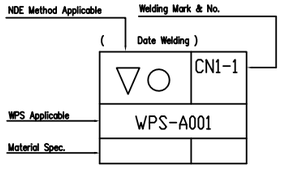


HANGER DETAIL





HOOK



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
HOOK	A36
PIPE DAVIT	A53 Gr.B
HANDLE	A36
NOZZLE NECK	A36
PLATE FLANGE	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

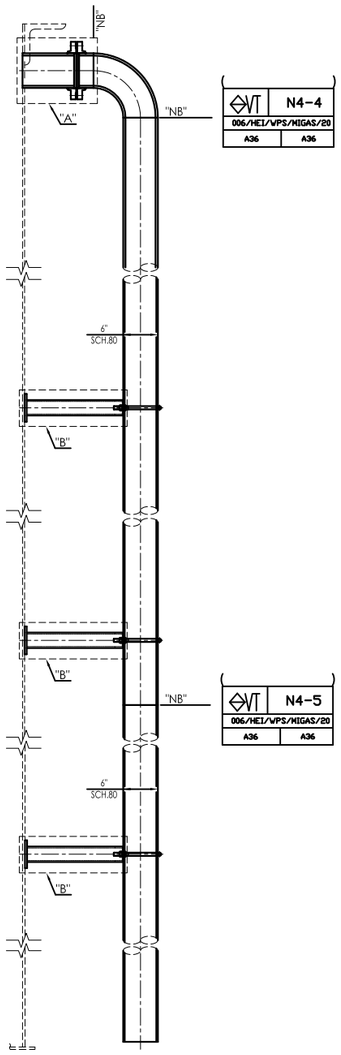
	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name
NDE MAP MANHOLE ADSORPTION TANK 6

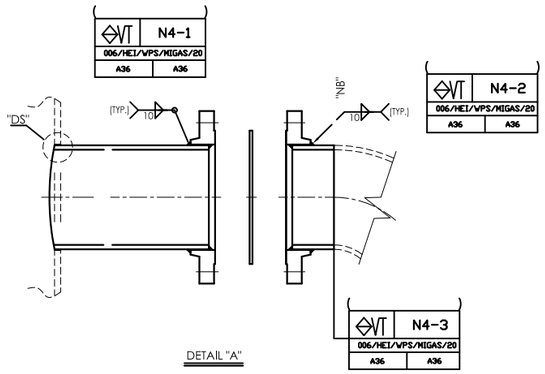
Sheet No./Total sheets	3/10
Size of memory	
PT. HANAZONO Engineering Indonesia — We are always partner with you	
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 6
REFER DWG NO.	: E2502-000-DWG-704
NDE Map No.	E2502-NDE-PBY-007
REV.	0

GENERAL NOTES :

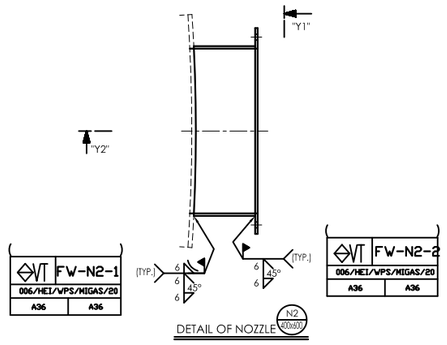
1. BOLT HOLE ORIENTATION
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT
   # LIFTING LUG AND REMOVING OF JIG
   # NOZZLE ATTACHMENT WELDING OF DUCTING



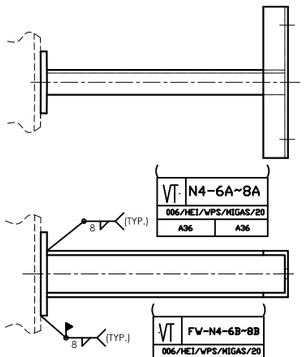
DETAIL OF NOZZLE N4 6"



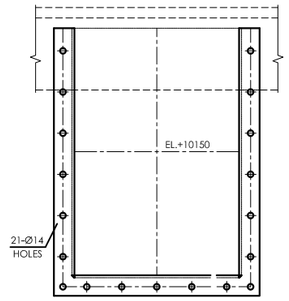
DETAIL "A"



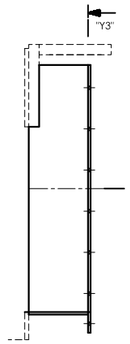
DETAIL OF NOZZLE N2 300x600



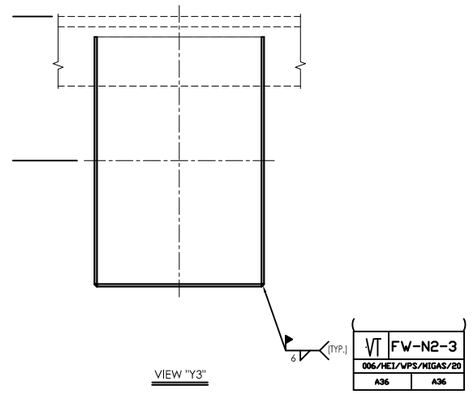
DETAIL "B"



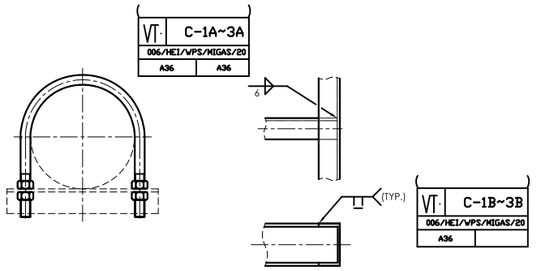
VIEW "Y1"



VIEW "Y2"

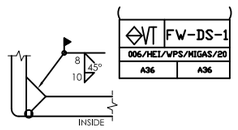


VIEW "Y3"



DETAIL OF U-BOLT

DETAIL JOINT CHANNEL



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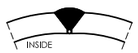
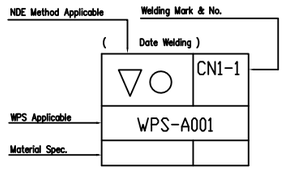


DETAIL "NB"



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
FLANGE	A105
NOZZLE NECK	A106 Gr.B
REINF. PAD	A36
CHANNEL	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name
NDE MAP NOZZLE 1-3 ADSORPTION TANK 6

Sheet No./Total sheets	4/10
Size of memory	
PT. HANAZONO Engineering Indonesia — We are always partner with you	
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 6
REFER DWG NO.	: E2502-000-DWG-705
NDE Map No.	E2502-NDE-PBY-007
REV.	0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

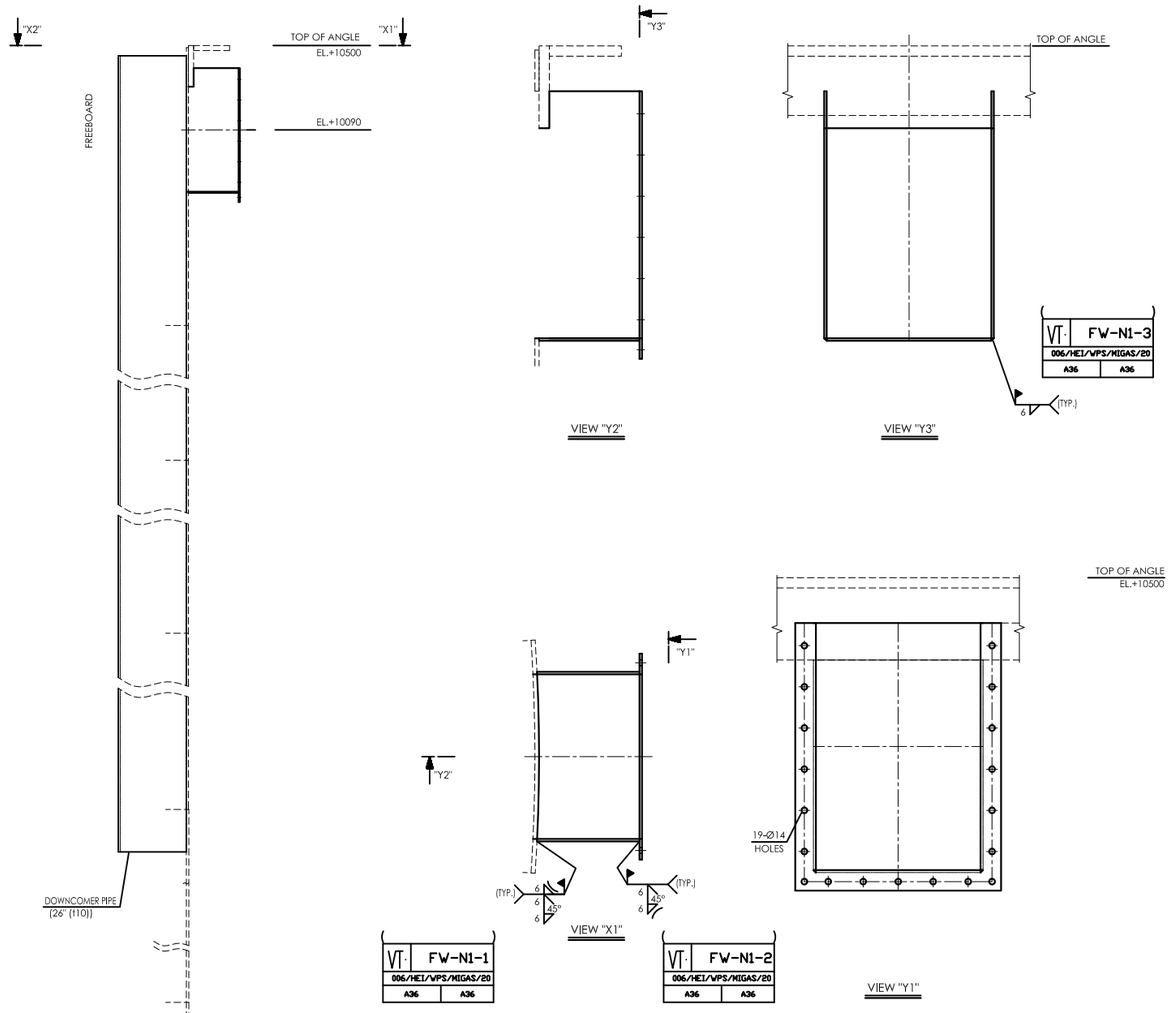
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

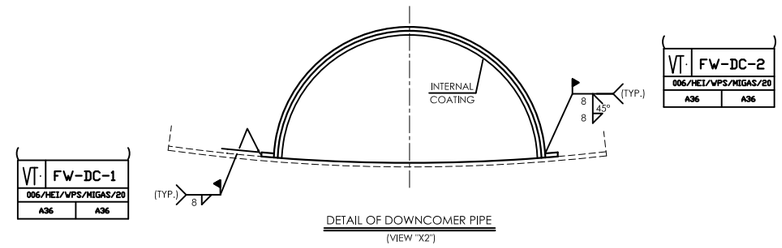
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

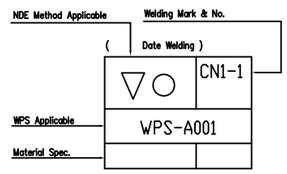
   # NOZZLE ATTACHMENT WELDING OF DUCTING



DETAIL OF NOZZLE N1 (100x50)



DETAIL OF DOWNCOMER PIPE
(VIEW "X2")



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
FLANGE	A105
NOZZLE NECK	A106 Gr.B
REINF. PAD	A36
CHANNEL	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name
NDE MAP NOZZLE 2-3 ADSORPTION TANK 6

Sheet No./Total sheets 5/10

Size of memory

PT. HANAZONO Engineering Indonesia
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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 6
REFER DWG NO.	: E2502-000-DWG-706

NDE Map No.
E2502-NDE-PBY-007

REV.
0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

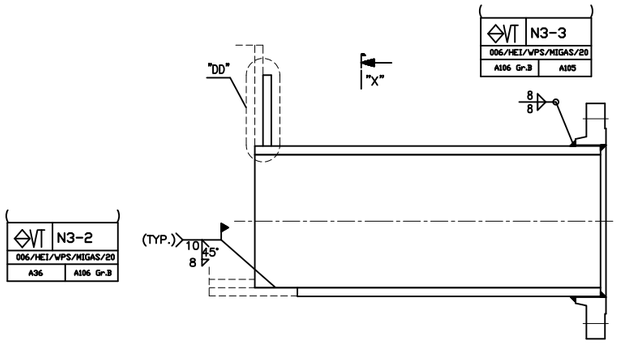
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

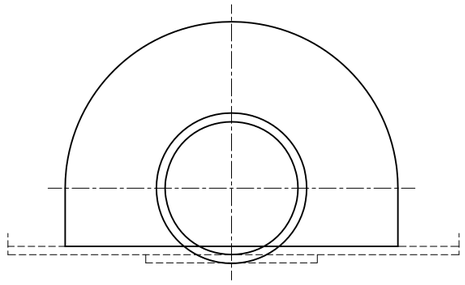
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

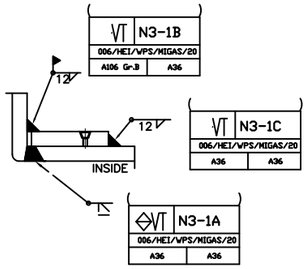
   # NOZZLE ATTACHMENT WELDING OF DUCTING



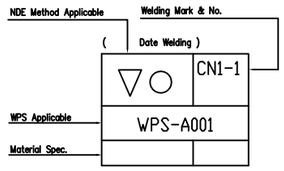
DETAIL OF NOZZLE N3 8"



DETAIL OF REINF. PAD



DETAIL "DD"



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
FLANGE	A105
NOZZLE NECK	A106 Gr.B
REINF. PAD	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name
NDE MAP NOZZLE 3-3 ADSORPTION TANK 6

Sheet No./Total sheets 6/10

Size of memory

PT. HANAZONO Engineering Indonesia
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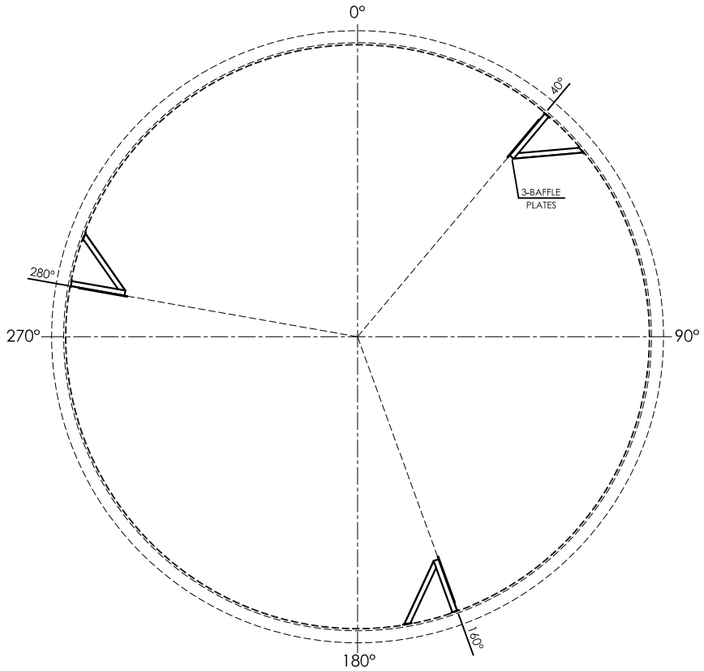
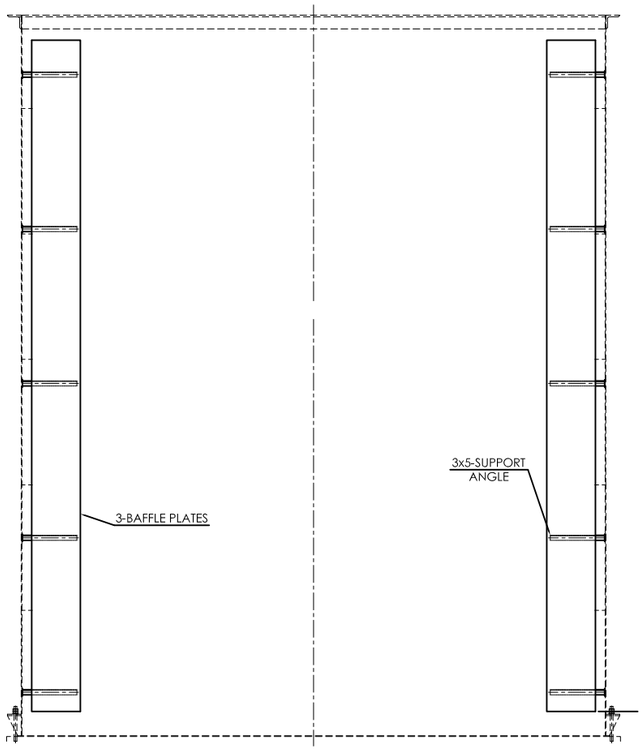
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 6
REFER DWG NO.	: E2502-000-DWG-707

NDE Map No.
E2502-NDE-PBY-007

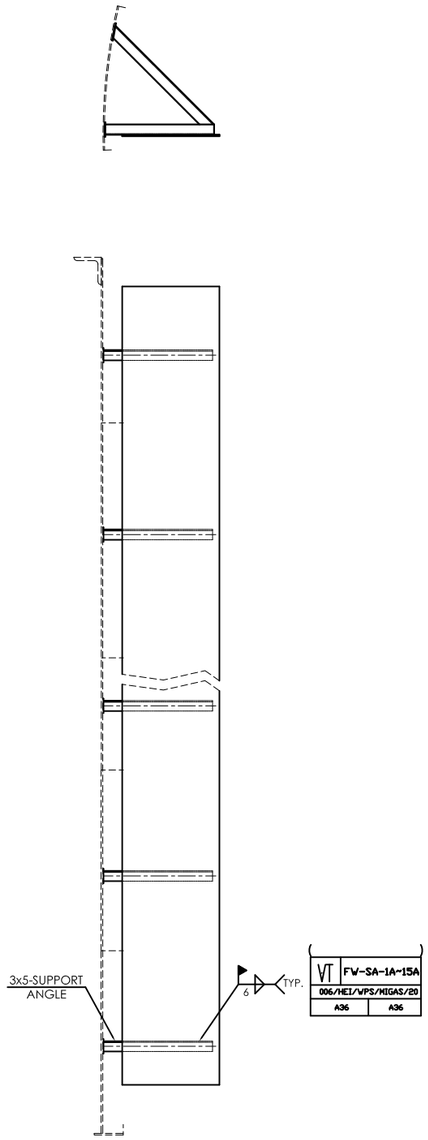
REV.
0



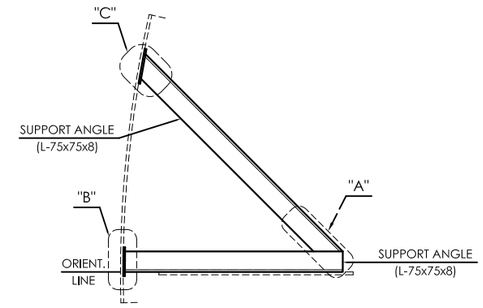
ORIENTATION OF INTERNAL BAFFLE

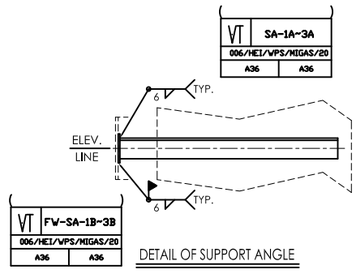


ELEVATION OF INTERNAL BAFFLE

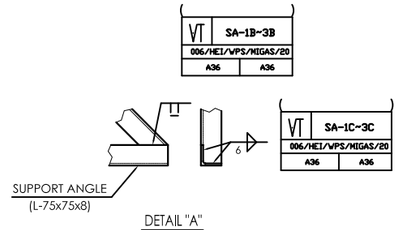


DETAIL OF INTERNAL BAFFLE





DETAIL OF SUPPORT ANGLE



DETAIL "A"

DETAIL "B"

DETAIL "C"

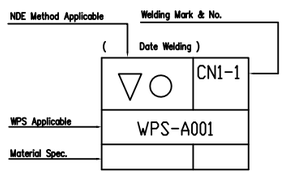
GENERAL NOTES :

1. BOLT HOLE ORIENTATION

   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).
2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

   # NOZZLE ATTACHMENT WELDING OF DUCTING



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
INTERNAL BAFFLE	A36
SUPPORT ANGLE	A36
SUPPORT PAD	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		

Scale : NTS

Name

NDE MAP INTERNAL BAFFLE
ADSORPTION TANK 6

Sheet No./Total sheets	7/10
Size of memory	
PT. HANAZONO Engineering Indonesia — We are always partner with you	
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 6
REFER DWG NO.	: E2502-000-DWG-708
NDE Map No.	E2502-NDE-PBY-007
REV.	0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

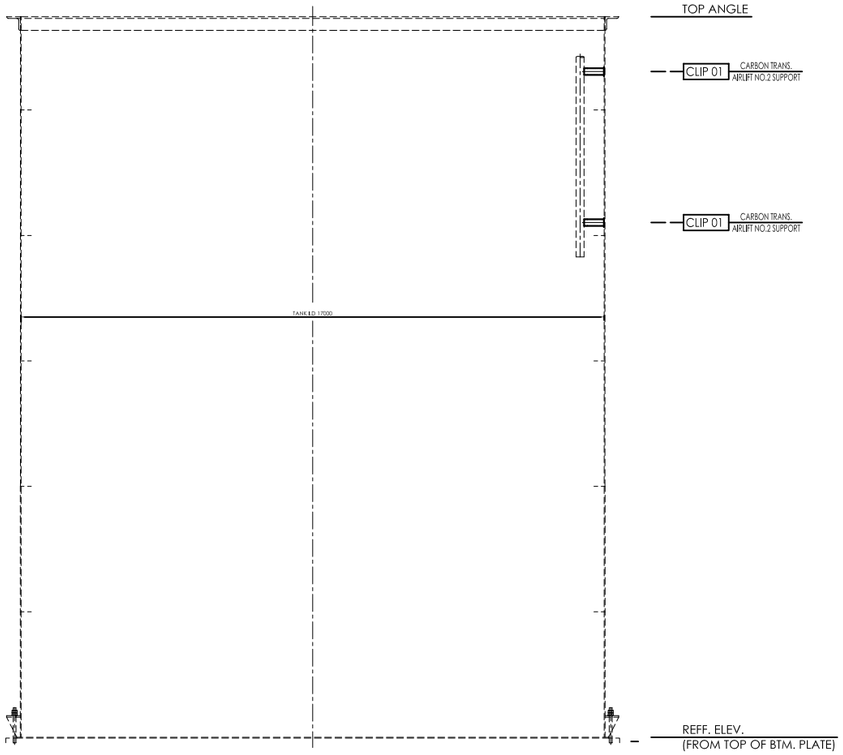
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

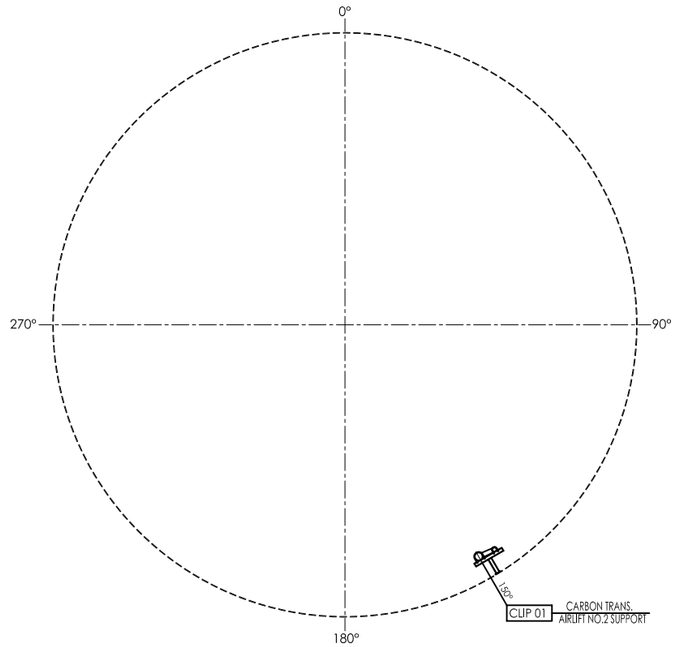
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

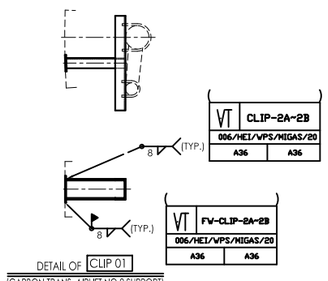
   # NOZZLE ATTACHMENT WELDING OF DUCTING



PIPE SUPPORT ELEVATION



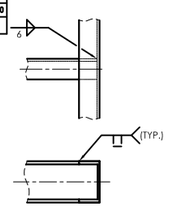
PIPE SUPPORT PLAN



VT	CLIP-2A-2B	
	006/HEI/WPS/MIGAS/20	
	A36	A36

VT	FV-CLIP-2A-2B	
	006/HEI/WPS/MIGAS/20	
	A36	A36

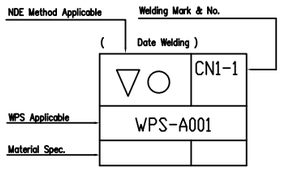
DETAIL OF CLIP 01
(CARBON TRANS. AIRLIFT NO.2 SUPPORT)



VT	C-1A-4A	
	006/HEI/WPS/MIGAS/20	
	A36	A36

VT	C-1B-4B	
	006/HEI/WPS/MIGAS/20	
	A36	A36

DETAIL JOINT CHANNEL



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
SUPPORT CHANNEL	A36
REINF. PAD	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR	
0	29/09/25		

CHANGE BY CAD SYSTEM ONLY

1	2

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale : NTS		

Name

NDE MAP INTERNAL SUPPORT
ADSORPTION TANK 6

Sheet No./Total sheets	8/10
Size of memory	

PT. HANAZONO Engineering Indonesia
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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 6
REFER DWG NO.	: E2502-000-DWG-709

NDE Map No. E2502-NDE-PBY-007

REV. 0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

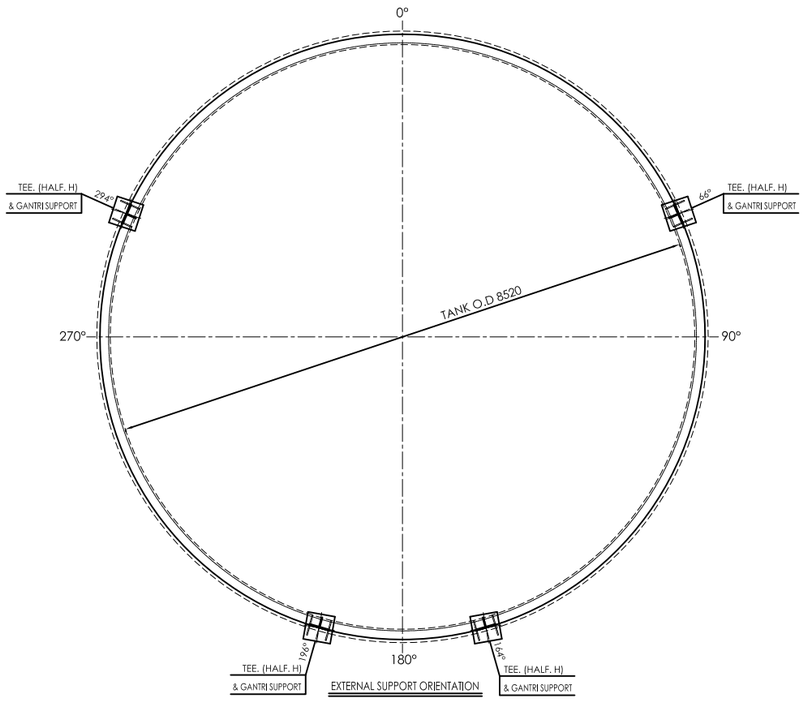
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

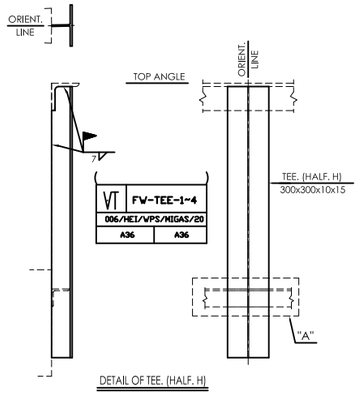
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

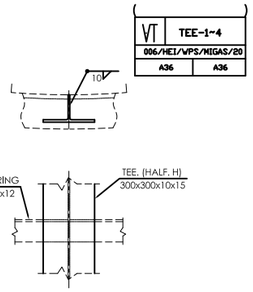
   # NOZZLE ATTACHMENT WELDING OF DUCTING



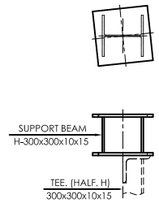
EXTERNAL SUPPORT ORIENTATION



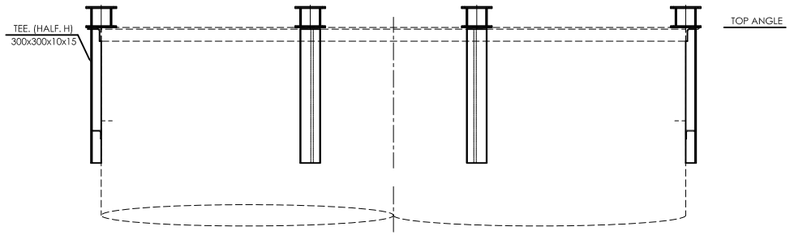
DETAIL OF TEE. (HALF. H)



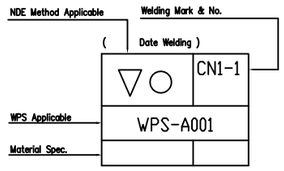
DETAIL "A"



DETAIL OF GANTRI SUPPORT



EXTERNAL SUPPORT ELEVATION



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
TEE HALF	A36
SUPPORT BEAM	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR			
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

1	2

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name

NDE MAP EXTERNAL SUPPORT
ADSORPTION TANK 6

Sheet No./Total sheets	
Size of memory	
PT. HANAZONO Engineering Indonesia — We are always partner with you	
JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 6
REFER DWG NO.	: E2502-000-DWG-710
NDE Map No.	REV.
E2502-NDE-PBY-068	0

GENERAL NOTES :

1. BOLT HOLE ORIENTATION

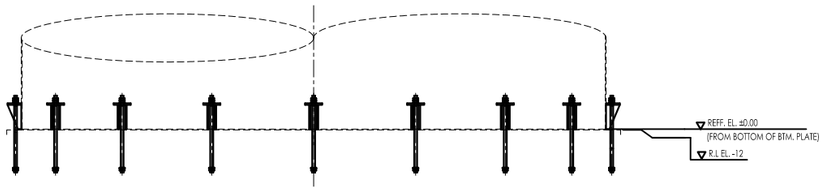
   BOLT HOLE ORIENTATION IN NOZZLE FLANGE SHALL BE STRADDLE THE PRINCIPAL CENTER LINE OF THE DUCTING (AXIS 0° & 90°).

2. WELD SHALL BE NEAT IN APPEARANCE, FREE ON SLAG UNDERCUTS AND OTHER DEFECTS.

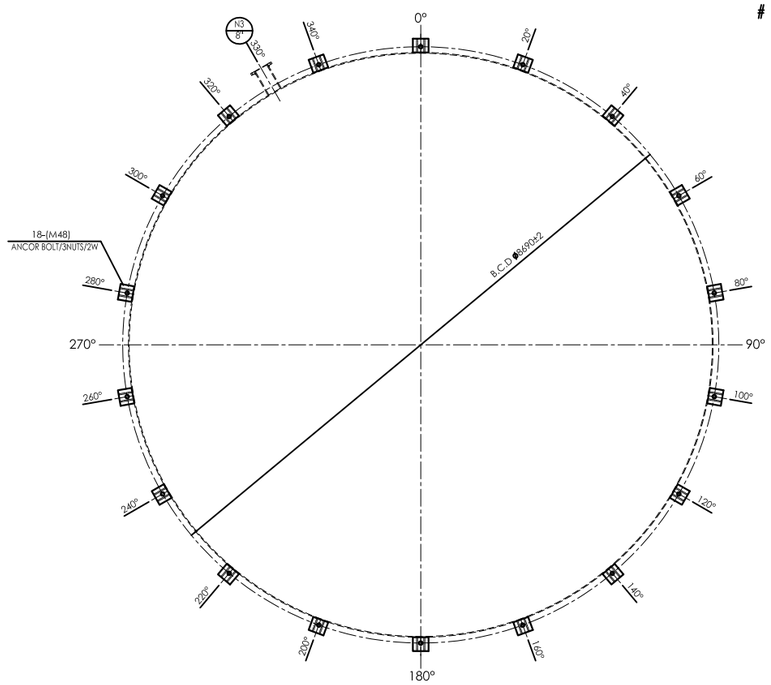
3. LIQUID PENETRANT

   # LIFTING LUG AND REMOVING OF JIG

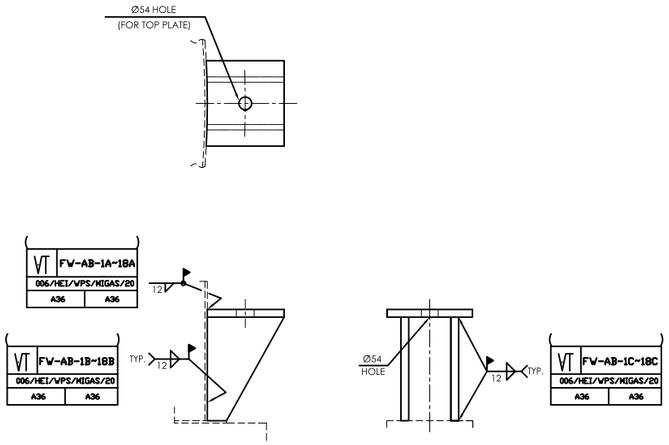
   # NOZZLE ATTACHMENT WELDING OF DUCTING



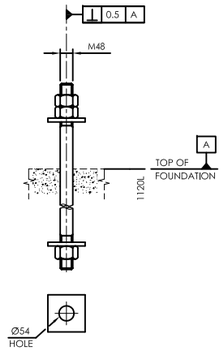
ANCHOR BOLT ELEVATION



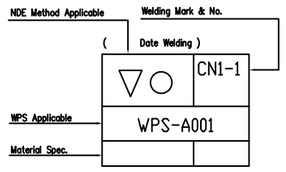
ANCHOR BOLT ORIENTATION
(PLAN VIEW)



DETAIL OF ANCHOR BOLT CHAIR



ANCHOR BOLT/3N/2W
(BY OTHERS)



NDE METHOD SYMBOL

▽ UT SPOT

◇ MPI 10%

VT VISUAL 100%

MATERIAL SPECIFICATION	
TOP PLATE	A36
GUSSET PLATE	A36

LEGEND :

WPS NO : 006/HEI/WPS/MIGAS/20 GTAW & SMAW P1 to P1

File name :

REV	DATE	APPR		1	2
0	29/09/25				

CHANGE BY CAD SYSTEM ONLY

Deviation for dimensions without indication of tolerance in mm
1) cutting + non cutting machining
2) WELDMENT conecting + forging

	DATE	SIGN
DRAFT		BENRIDHO
CHECK		RUSNANDI
APPR		
Scale :	NTS	

Name

NDE MAP ANCHOR BOLT ADSORPTION TANK 6

Sheet No./Total sheets	10/10
Size of memory	

PT. HANAZONO Engineering Indonesia
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JOB NO.	: E2502
DESIGN FOR PRODUCT	: POBOYA 2000 TPD EXPANSION
TAG NO./LINE NO.	: ADSORPTION TANK 6
REFER DWG NO.	: E2502-000-DWG-711

NDE Map No.: E2502-NDE-PBY-069

REV.: 0