



DEPARTMENT OF BUILDING
UNIVERSITI TEKNOLOGI MARA
(PERAK)

DESIGN AND CONSTRUCTION OF STEEL CONNECTION

PREPARED BY:

MUHAMAD NAJMUDDIN BIN HASRI

2012621772

DEPARTMENT OF BUILDING
FACULTY OF ARCHITECTURE, PLANNING AND SURVEYING
UNIVERSITI TEKNOLOGI MARA
(PERAK)

SEPTEMBER 2014

It is recommended that the report of this practical training provided

By

Muhamad Najmuddin Bin Hasri

2012621772

entitled

Design & Construction of Steel Jointing (Welding)

accepted in partial fulfillment of requirement has for obtaining Diploma In Building

Report Supervisor

En: Mohd Najib B. Abd Rashid

Practical Training Coordinator

Puan Wan Nordiana Bt. Wan Ali

Faculty Coordinator

Dr. Mohd Rofdzi Abdullah

DEPARTMENT OF BUILDING
FACULTY ARCHITECTURAL PLANNING AND SURVEYING
UNIVERSITY TECHNOLOGY MARA
(PERAK)

SEPTEMBER 2014

STUDENT'S DECLARATION

I hereby declare that this report is my own work, except for extract and summaries for which the original references stated herein. I've completed my practical training for 4 months started from 12 Mei 2014 until 29 September 2014 by the side of Preserver Bina Sdn. Bhd. This practical training report is also as a part of my duty to complete my practical training. Furthermore, it is also as one of my requirements towards this course DBN307 of Diploma in Building.

Name : Muhamad Najmuddin Bin Hasri

ID No. UiTM : 2012621772

Date : 29 SEPTEMBER 2014

ACKNOWLEDGEMENT

Alhamdulillah, thank you Allah S.W.T with His greaters allow me to completed my practical training in about 5 month with under Preserver Bina Sdn. Bhd.. Beside that, i would like to thanks to all individuals involved directly or indirectly in Preserver Bina Sdn. Bhd. whom help me to completing this practical training report especially my practical supervisor, En. Nur Rahmat Zainuddin as site engineer at site construction KL-Kepong Oleomas Sdn. Bhd., Pulau Indah, Klang. My acknowledge is also to my entire senior staff and supervisor in Preserver Bina Sdn Bhd because had thought me all about being supervisor in site and making decision to solve all problem produce in site. Thanks to Preserver Bina Sdn Bhd because allow me to be as their practical trainee from 12 May 2014 until 29 September 2014. Last but not least, to my report supervisor, En. Mohd Najib b. Abdul Rashid because support me at every single time, build my strength, give an idea in every single things to make this practical training report completely done.

Thank you very much

ABSTRACT

This report will review a general procedure on the erection of steel connection in construction and design. It is one of report that comes with complete guidance in every aspect of steel connection for specific project needs. Almost 5 months in practical training at Preserver Bina Sdn. Bhd. I have learnt so much about all steps, proper procedure and all requirements of steel jointing especially on site. Objective of this practical training report is to identify more precisely on how steel jointing are installed at site which is to study the method of steel jointing using the welding method (welding SMAW machine) and to identify welding method used for a few type of steel connection. Many methodology had been used to ensure this report completed, which is Primary Data and Secondary data. As a conclusion, A proper work of installation will definitely need a proper skill of labour and sufficient tools and machineries to do it. As we know all these tools will need to be sufficient enough to make a work become more easy and fast. This is because, not only the installation of work will requires the tools and machineries.

CONTENT	PAGES
Acknowledgement	i
Abstract	ii
Content	iii-iv
List of Tables	v
List of Diagrams	vi
List of Photo	vii
List of Short forms	viii

CHAPTER 1.0 INTRODUCTION

1.1	Introduction	1
1.2	Objective reports	2
1.3	Scope of report	2
1.4	Methodology	3

CHAPTER 2.0 COMPANY BACKGROUND

2.1	Introduction	4
2.2	Company Profile	5
2.2.1	Information establishment	6-7
2.2.2	Company Awards	7
2.3	Company Objectives	8
2.4	Company Organizational Chart	9
2.5	List of Project	
2.5.1	Project On-going	10- 11
2.5.2	Project has completed	12-15

CHAPTER 3.0 INSTALLATION OF STEEL JOINTING USING WELDING METHOD

3.1	Introduction	16-17
3.2	Background of project	17-18
3.3	Case Study	
3.3.1	Welding Work Procedure	18-19
3.3.2	Welder Qualification	20
3.3.3	Consumables	20-21
3.3.4	Permissible Condition For Welding	22
3.3.5	Preparation For Welding	22
3.3.6	Edge Preparation	23
3.3.7	Preheating	23
3.3.8	Tack Welding	23-24
3.3.9	Welding Sequence & ‘Waiting’	24
3.3.10	Executive Of Butt Welding	24-25
3.3.11	Repairing Of Other Defects	25
3.3.12	Acceptance Criteria	26
3.3.13	Inspection	26
3.3.14	Documentation	26
3.3.15	Tools Of Welding	27-28

CHAPTER 4.0 CONCLUSION AND RECOMMENDATION

4.1	Recommendation	29
4.2	Conclusion	30

REFERENCES	31
------------	----

APPENDIX	32
----------	----

LIST OF TABLE

Table 2.5.1	List of On-Going Projects	10-11
Table 2.5.2	List of completed projects	12-15
Table 3.3.3	Electrodes Dry Condition	21
Table 3.3.10	The height of reinforcement of weld	25

LIST OF DIAGRAM

Diagram 3.3.16	SMAW system setup	27
----------------	-------------------	----

LIST OF IMAGE

Photo 3.1	Steel Structure	16
Photo 3.2	Site Project	17
Photo 3.3.3	Electrode	20
Photo 3.3.6	Welder with the safety tools	22
Photo 3.3.13	Painting or finishing	26
Photo 3.3.16	SMAW	27
Photo 3.3.16.3	Electrode	27
Photo 3.3.16.1	The Welder	28
Photo 3.3.16.2	Face cover	28
Photo 3.3.16.4	Hand Cover	28

LIST OF SHORT-FORMS

SMAW	Shield metal arc welding
QA/QC	Quality Approve/Quality Control

CHAPTER 1

INTRODUCTION

1.1 Introduction

For an introduction, steel structure are the most easier method used in any kind of construction industrial in entire world. If we see for example Eiffel tower at Paris, it's completely shown to us that the steel structure can make the building done faster, tougher and stronger, taller and make the symbol of engineering to the Paris. For another example, the Malaysian Penang Bridges structure is completely use steel structure. Penang bridges are the glory symbol for the Malaysia.

But in this report is directly shown only the steel jointing or steel erection using welding method. Installation method and the tools that related with this things.

What make this report different from others are, all the contents in this report are hereby provided by using a types of methodology which is an observation works, research or revision works and interview sessions from individuals involved. There are few type of methodology is done to help collect crucial information by practical method on proper step of installing steel jointing using welding method which is no other books or articles had written before.

Besides review on procedures of installation, this report will help to understand all the components function and tools needs for completing this installation work. All the problems relate to of steel jointing also will be generally review along with its recommendation on how to solve it.

1.2 Objective Reports

Objective of this practical training report is to identify more precisely on how steel jointing are installed at site. Other objectives are:

- a. To study the method of steel jointing using the welding method (welding SMAW machine)
- b. To identify welding method used for a few type of steel connection

1.3 Scope of Report

Scope of study for this report are practically review on methodology of installing an steel jointing. Besides getting more knowledge on components function and tools needed to complete the whole step of installation, it also will help to provide crucial information why steel is used as a beam that hold the load from above compared to other material used in construction field these days.

Therefore, this scope of study is done only under project named, KL-Kepong Oleomas Sdn. Bhd., which is to “Propose to Developed Additional Factory from ‘Oleo Chemical’ that included the SME Dry Plant, cooling room, SME Wet, Storage & Tower Room, Pipe Rack, Hydrogenation 7 storey and ME Distillation 6 Storey” is located at Section 5, Fasa 2D, Pulau Indah Industrial Park, Jalan Sungai Pinang 5/18, 42920 Pulau Indah, Selangor, Darul Ehsan. The actual owner of this land for KL-Kepong Oleomas Sdn. Bhd. project is KL-Kepong Oleomas Sdn. Bhd.

1.4 Methodology

1.4.1 Primary Data

Many methodology had been used to ensure this report completed, one of the method are reconnaissance. This project is developed a “Propose to Developed Additional Factory from ‘Oleo Chemical’ that included the SME Dry Plant, cooling room, SME Wet, Storage & Tower Room, Pipe Rack, Hydrogenation 7 storey and ME Distillation 6 Storey” for KL-Kepong Oleomas Sdn. Bhd.. This project is one of the biggest project for Preserver Bina Sdn Bhd. Therefore, method statement is needed to ensure all the details work are supervised properly. Pictures is taken for this report to showing the precise work of installation of steel using two method as mentioned. . This report interview session is need to be done to collect more information about installation of steel installation. This interview sessions is done with many individuals at Preserver Bina Sdn Bhd. Some of the interview individuals are site supervisor, engineer, and workers.

1.4.2 Secondary Data

Next is revision. All files, documents and drawing plan is needed as one of the methodology of this report. This documents and files is revised as revision to ensure that all the works are done according to its step. Most of the revision had been done from drawing plan, because that plan give completed view about design and specification of the steel jointing. Besides, some of the documents give more information about Preserver Bina Sdn Bhd profile and achievements. Therefore, revision is important to ensure this report is complete.

CHAPTER 2

COMPANY BACKGROUND

2.1 Introduction

Preserver Bina Sdn. Bhd. is one of the General contractors with a Steel fabrication factory. This company is specialize in construction including the Construction of factories and warehouse, Power generation, Petrochemical and Oleo Chemical Plants, Heavy Equipment Installation, Bridge and Infrastructural Steel Structures, Commercial Buildings and High-Rise Buildings, High-Ends show Units, Bungalows and Residential Building.

Preserver Bina Sdn. Bhd. had a multi-talented team of experts who works cohesively as a single force to provide technical expertise and consultancy. This company can design and tailor-make solutions according what clients needed. Besides have their own Steel Fabrication factory at No.22A, Jalan Tiara 5, Bandar Baru Klang, 41150, Klang, Selangor Darul Ehsan. Therefore, this company will match every factory specifications, locally and overseas.

In 17 April 2009, Preserver Bina Sdn. Bhd. had cooperated with its own partner business as known as Alubina Sdn. Bhd. to listed services included fabricated and installed an Aluminum components for General construction and Infrastructural projects as well as Residential divisions. Alubina Sdn. Bhd. services are backed by very experienced technicians and professional knowledge to ensure high quality products to fulfill client's needs.

2.2 Company Profile

Company Name : PRESERVER BINA SDN. BHD. (610805-M)
Partner Name : ALUBINA SDN. BHD.
ROC Registration No : 853439-K
Incorporated on : 17 April 2009
Paid-Up Capital : RM 100,000.00
Authorized Capital : RM 100,000.00
Address (Office) : Lot 8292, No.2, Tingkat 1, Jalan Istimewa, Kg.
Batu Belah, 41050, Klang, Selangor Darul
Ehsan
(Factory) : Lot 4977 & 4978, Jalan Dahlia, Off Jalan Meru,
41050 Klang, Selangor Darul Ehsan.
Directors : Khoo Beng Aun, Wong Kok Meng, Soon Kian
Eng, Khoo Beng Seong
Bankers : United Overseas Bank (UOB)
Tel. No. :
Fax No. : +603-33447013
Email Address : pbinasb@gmail.com

2.2.1 Information Establishment

Preserver Bina Sdn. Bhd. was incorporated in April 2003. This company is also known as a general contractor with a steel fabrication factory. Preserver Sdn. Bhd. had a long list of services. This company has registered as a Grade 7 Contractor with the Construction Industry Development Board (CIDB). After a decade, this company has secured the prestigious ISO 900 1:2009 Award.

Preserver Bina Sdn. Bhd. has successfully completed significant projects in general construction, Infrastructural projects and Steel Fabrication. . Therefore, this company had won an awards and recognition by clients and the industry's authorities by tailor-making better solution, locally and overseas. For residential division's Preserver Bina Sdn. Bhd. specialize in bungalows, transforming homes, townships and gated communities. This includes designing and constructing the residential building. Preserver Bina Sdn. Bhd. have their own steel fabrication factory, with the latest machinery to maintain the high quality standards and to ensure the steel products is the in a best condition. With these standards Preserver Bina Sdn. Bhd. leaves their factory matches international specifications.

Besides that Alubina Sdn. Bhd. is also a business partner with Preserver Bina Sdn Bhd. Alubina Sdn. Bhd. is a leading contractor for Aluminum & Glazing works includes Aluminum Composite Panels, Glass Canopy, Curtain Wall, Skylight Glass Canopy, Box Louvers, Sun Louvers, Aluminum Windows, and Aluminum Doors. This partnership is incorporated almost 6 years with Preserver Bina Sdn Bhd. this partnership also had established itself as a reputable and reliable business partner in all related projects

Preserver Bina Sdn. Bhd. assures that the best performance to deliver results as promised and works towards win-win deals. This company ensures every output in a high quality standards, overall quality control, cost effectiveness, and efficiency will

speed up projects and meet the deadlines as promised. Preserver Bina Sdn Bhd aims to get better in future and stay ahead in the industry, so that they can remain the preferred choice in General Construction, Infrastructure projects and Steel

2.2.2 Company Awards

The Awards and accolades Preserver Bina Sdn. Bhd. has won over the years prove their capabilities. Among the significant ones are:

- 2 Awards from the Malaysia Architects Association (MAA) – Excellence in Architecture – Winning Showroom Building PAM 2007 for the Ameera Residences Sales Gallery.
- Honorary Mention Showroom Building PAM 2007 Awards for excellence in Architecture for the ONE Menerung Showroom & BRDS Sales Gallery Project.
- Achieved 3,000,000 and 2,000,000 Man Hours Without A Lost Time Incident in its Coal Fired Power Plant from TAISEI CORPORATION (in 30th September 2007 and 21st February 2008 respectively).
- Special Recognition as a Specialist Sub-contractor for the SUNCON GROUP OF COMPANIES' Overseas Projects (Sunway Construction).
- Achieved 2,500,000 Man Hours Without Lost Time Accident Safety Performance For the Superstructure Works – 3A University Technology Petronas, Tronoh, Perak. Recognition by NAMFATT-ZAQ JV (31st March 2004)
- ISO 900 1:2008, CONSTRUCTION OF STEEL STRUCTURE.
- Preserver Bina also won numerous Recognition for Architectural excellence, outstanding reliability and superior performance from numerous other leading developers.

2.3 Company Objectives

Preserver Bina Sdn. Bhd. aims to get better and stay ahead from other companies in the industries, so that they can remain as the preferred choice in General Construction, Infrastructural projects and Steel Fabrication.

2.3.1 Mission

Preserver Bina Sdn. Bhd. dedication is to constantly improve in all aspects of operations more than just a daily lived philosophy. It's what keeps Preserver Bina Sdn. Bhd. ahead. This company goes the extra mile, design and delivers what clients expect, and it is backed by a great multi-talented team with ultimate potentials. Together this company will drive to take on the most challenging of projects.

Within a short span of less than a decade, this company has made it mission and become one of the most reliable forces in the industry, by mobilizing they edge of technical expertise to transform every projects assigned into a benchmark of excellence.

2.3.2 Vision

Preserver Bina Sdn. Bhd. aims to keep getting better and stay ahead.

2.4 Company Organizational Chart

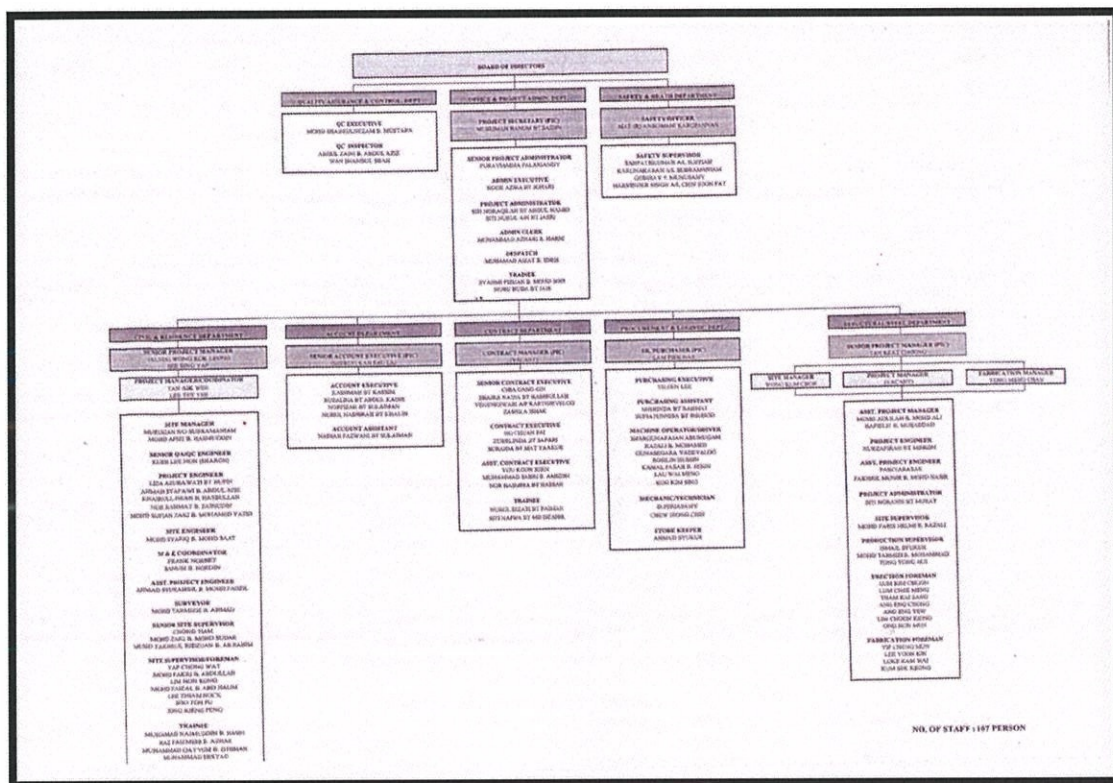


Diagram 2.1: Company Preserver Sdn. Bhd. Organizational chart

2.5 List of Projects

2.5.1 Projects On-going

Table 2.5.1 List of On-Going Projects

Bil	Project	Contract Value (RM)	Completion Date
1.	Nilam Tekad Sdn. Bhd. Proposed Developed The Process Plant & Warehouse At Jln. Sg. Pinang 4/2 Pulau Indah Industrial Zone, Pulau Indah, Klang, Selangor, Darul Ehsan.	700,000.00	30.04.2013
2.	DRB-Hicom Defence Technologies Sdn. Bhd Proposed Upgrading Of Manufacturing Maintenance Repair And Overhaul (MRO) And Office Facalities At Deftech Pekan, Pekan, Pahang Darul Makmur.	265,000.00	07.04.2013
3.	Defense Services Sdn. Bhd, Nilai Proposed Upgrading Pf Manufacturing Maintenance Repair & Overhaul (MRO) And Office Facalities At DSSB Nilai, Negeri Sembilan Darul Khusus.	183,000.00	29.03.2013
Bil	Project	Contract Value (RM)	Completion Date

4.	<p>Datin Sri Azian bt.Abdul Talib</p> <p>Proposed To Build A 3 Storey Bungalow House With Swimming Pool At Pt 2995 And Pt 2669 (Lot 6056), Jln. 7 Kemensah Height, Mukim Ulu Kelang, Daerah Gombak, Selangor Darul Ehsan.</p>	550,000.00	01.03.2013
5.	<p>Hicom- Automotive Manufacturers (M) Sdn. Bhd.</p> <p>Proposed Development Volkswagen Facilities for Hicom Automotive, Pekan, Pahang Darul Makmur</p>	250,000.00	12.12.2012

Sources: Preserver Bina Sdn. Bhd. (2012)

2.5.2 Projects completed

Table 2.5.2 List of completed projects

Bil	Project	Contract Value (RM)	Completion Date
1.	Pentamaster Perlis Northern Corridor Factory Proposed Single Storey Factory On Plot, Taman Teknologi Pauh, Kurong Anai District, Perlis.	RM 22.60 Million	June 2011
2.	APM Spring- Pendamaran Proposed Development of Single Storey Factory, with an Electric Sub-Station, a Sewage Treatment Plant, at Jln Raja Lumu, Kg Baru Perdamaran, Klang Selangor	460,000.00	30.03.2012
3.	Port Dickson Learning Centre (PDLIC) Proposed Development Learning Center At Lot 1888, Mukim Pasir Panjang, Daeran Port Dickson, Negeri Sembilan, Darul Khusus.	380,000.00	12.02.2007

Bil	Project	Contract Value (RM)	Completion Date
4.	Management Science University (MSU) Proposed Construction At MSU (Management Science University) At No.4 Persiaran Olahraga, Seksyen 13, 40100, Shah Alam, Selangor, Darul Khusus.	2,700,000.00	12.01.2012
5.	Valser Oil & Gas Factory, Nilai Proposed Valser HQ Office And Factory At PT 1082 (Lot 3), Nilai Utama, Mukim Sentul, Daerah Seremban, Negeri Sembilan, Darul Khusus.	400,000.00	30.12.2011
6.	Samudera Kimia Industries Proposed Construction At Open Warehouse At Pt 49766, Jln Lengkuk Keluli 2 (KU2). Mukim Kapar, Daerah Klang, Selangor Darul Ehsan.	200,000.00	30.10.2011

Bil	Project	Contract Value (RM)	Completion Date
7.	Auto Part Manufacturers Co. Sdn.Bhd. Proposed Construction For Office Renovation At Lot 600, Jln Raja Lumu, Kws. 12, Kaw. Perindustrian Pendamaran, Pelabuhan Klang, Selangor, Darul Ehsan.	150,000.00	01.08.2011
8.	Barny Callebaut Factory Proposed Factory At Lot 2, Lebuah Sultan Muhammed 1, Kaw. Perindustrian Bandar Sultan Sulaiman Pelabuhan Klang, Selangor, Darul Ehsan.	350,000.00	30.17.2011
9.	Sipro Plastic Industries Sdn. Bhd. Proposed Construction Office And Factory At Pt 7422, Lot 9399, Jln. Jasmine, Kaw. Perindustrian Bukit Beruntung, Mukim Serendah, Section 20, Daerah Hulu Selangor, Selangor Darul Ehsan.	100,000.00	25.05.2011

Bil	Project	Contract Value (RM)	Completion Date
10.	Madam Esther Ng Proposed To Build 1 Unit Of 2storey Bungalow At No.13, Jalan BK 6B/13, Banfar Kinrara, Puchong, Selangor Darul Ehsan.	250,000.00	25.03.2011
11.	Madam Lai Shuh Bin Proposed To Build 1 Unit Of 2 Storey Bungalow At Jalan Setia Nusantara U13/22C, Setia Eco Park, Section U13, Shah Alam, Selangor Darul Ehsan.	320,000.00	15.01.2011
12.	Proposed To Build 4 Units 3 storey Semi-Detached House, Lot 27695, 27696, 27697, 27698, Taman Gembira, Jalan Kuchai Lama, Petaling Jaya, Selangor, Darul Ehsan.	550,000.00	04.03.2011
13.	Proposed To Build Bungalow 1 Storey Above Street Level Which Contains A Swimming Pool And Guard House At Lot 27978, Junction Tunku, Bukit Tunku, Kuala Lumpur.	250,000.00	03.01.2010

Sources: Preserver Bina Sdn. Bhd. (2012)

CHAPTER 3

INSTALLATION OF STEEL JOINTING USING WELDING METHOD

3.1 Introduction



Image 3.1 Steel Structure

Steel are one of important elements in construction fields. It shares the same root of function for better infrastructure value, strong structure, simple and light weight within a building. As we know steel have various type of design, function and others. But, this report will only review on the method of steel installation such as welding.

Through the method mentioned above, the completeness and strength of steel structures can survive for a long time without affecting other civil structures. Besides, bolts and nuts this is the familiar use of the world market. While welding is a method that is simple, but there are also dangerous because it requires a safety device

especially the eyes and hands. This is because the rate of electrical welding using very high voltage and light or sparks fire can harm the eyes and other body parts.

In addition, this report will comprehensive guide to all aspects of welding or bolts and nut work from initial planning to finish work. This report will also come out with complete guidance and understanding the tools needed to be used in every aspect of procedure to get a proper installation of steel in site using welding.

3.2 Background of project



Image 3.2 Site Project

Project name is Preserver Bina Sdn. Bhd. This project which is to to “Propose to Developed Additional Factory from ‘Oleo Chemical’ that included the SME Dry Plant, cooling room, SME Wet, Storage & Tower Room, Pipe Rack, Hydrogenation 7 storey and ME Distillation 6 Storey” is located at Section 5, Fasa 2D, Pulau Indah Industrial Park, Jalan Sungai Pinang 5/18, 42920 Pulau Indah, Selangor, Darul Ehsan.

It is contain 1 block of single-storey warehouse including workshop, 1 block of single-storey warehouse with Mezzanine floor and 5-storey Tipping tower, 1 block of

4-storey Administration building, 1 unit of Canteen/ Surau/ and Driver's room, 2 unit of Guardhouse and Weighbridge, 1 unit of TNB (Tenaga Nasional Berhad) building, 1 unit of Effluent Treatment Plant block, 1 unit of Recycleable Material block, 1 unit of Effluent Treatment Material block, 1 unit of Natural Gas Storage, 1 unit of Hydrogen Gas Storage, 1 unit of Refuse Chamber, and last but not least Parking lot for car and motorcycles with roofing.

3.3 CASE STUDY

3.3.1 Welding work procedure

Detailed welding procedures for typical structural welding of plates, shapes and tubular members are to be established and qualified in accordance with the specified standards / codes for WPQ, the requirements of AWS shall prevail. All non-qualified welding procedure shall be submitted for the Engineer's approval. Upon receipt of Engineers Approval, these welding procedures with the relevant test data are to be submitted for approval. Submission shall be made on standard "Request for Alternate Material or method of Construction" forms in triplicate. The procedures for qualification are to simulate as far as is practicable, the conditions and materials to be used for production welding. Limitation imposed by the essential variable of the procedure qualification is to be adhered to in production welding. Parameters in welding procedures specifications. Welding Procedures Specifications (WPS) shall contain the following parameters:-

- a) Material specification of the base metal to be joined by welding
- b) Welding process, manual or machine
- c) Plate thickness range for which the procedure is approved
- d) Geometry of welding groove showing allowable tolerances including sketch
- e) Welding position and direction for vertical welding

- f) Filler metal specifications, composition and size
- g) Temperature and time adopted for drying and baking of welding consumables before use
- h) Gas shielding – Flow, mixture, composition
- i) Number and arrangement of runs and weld dimensions (Sketch)
- j) Welding current, voltage polarity
- k) Travel speed or electrode run-out length for each pass and range
- l) Back-gouging and method
- m) Pre-heat and inter pass temperature
- n) Post weld heat treatment
- o) Other variables as specified in AWS D1.1

The essential variables in WPQ is the welding procedure qualifications are to be set up as new WPS and be re-qualified when and changes in the essential variable list in AWS D1.1 are affected. Inspection of weld for WPQ test :-

- a) Dimensions of test pieces shall be sufficient to provide for all the required tests as per specified codes / standards or as per AWS requirements.
- b) The inspection and test shall be to the required specifications or in the absence of these specifications to AWS D1.1

Procedure Qualification Records is the specific facts from the WPQ and the test results are to be submitted to the endorsement and then to QA/QC section for documentation.

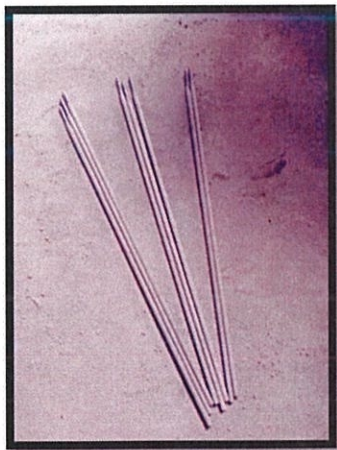
3.3.2 Welder qualifications

All welders and welding operators are to be qualified in accordance with the requirements of the specified standards / codes qualification will be to AWS specification for welders' qualification. Tests to AWS specifications will be as required in actual production works. No welders are to be allowed to proceed with production welding work on a specific project unless he had been qualified to weld on the project. Welders and welding operators are to be re-qualified to the specified standards /codes. The records of welders' qualification test, including a reference to the corresponding WPS and the test results are to be submitted to the QA/QC Person In charge for endorsement and to QA/QC section for documentation

3.3.3 Consumables

Consumables used for production welding are to comply with the following unless client's requirements differ in which case the client's specified. Handling of Electrodes and flux:-

- Electrodes



Images 3.3.3 Electrode

Table 3.3.3 Electrodes Dry Condition

Electrodes Drying Conditions		
Electrodes	Drying Temperature	Keep Period
E 6013	70° - 100°C	30 - 60 minutes

Welding rods shall be used immediately after opening. If leaving in the air for a long time (more than 4 hours for low hydrogen type and more than 8 hours for another type), welding rod shall be dried up again. Re-drying of electrodes shall be no more than one time. Electrodes that have been wet shall not be used. Welders shall take out only such an amount of welding rods that they can use and put into a clean case. All Hermetically sealed electrodes shall be stored in a cool dry area and before being used, take care not to mistake the type of electrode.

- Wire and Flux

When flux is collected, take care not to enter foreign material, such as rust, dirt, etc. Flux being left more than eight hours in the sir shall be dried up again. Rusted wire must not be used. Custody condition of welding rod :-

Temperature : 16° to 38° C

Humidity : Less than 50%

3.3.4 Permissible Conditions For Welding

Welding work shall not be permitted under the following circumstances are atmospheric temperature is lower than O F (- 17.8 C), the surface of weld joint is wet, the surface of weld joint is exposed to rain or snow or strong wind, welders are exposed to a bad weather condition (Mainly inclement weather), weld joints are not preheated sufficiently, electrodes or flux are not dried sufficient.

3.3.5 Preparation For Welding



Figure 3.3.6 welder with the safety tools

For the first is cleaning of weld joint. Each weld joint shall be cleaned and free of foreign material such as paint, oil, rust, dirt, mill scale, slag, moisture, etc. Gas-notches and scale due to gas cutting shall be removed by wire-brush and grinder. Next is drying up of weld joint. The weld joints shall be dried up (by using gas burner, if necessary) before welding, and shall be kept in dry condition throughout welding operation.

3.3.6 Edge Preparation

Edge preparation surface shall be ground smooth. Tolerance of groove angle, root opening and misalignment of butt joint shall be in accordance with the specified standards/ codes. Root opening of fillet weld joints. Root opening shall be less than 1.5mm. In case root opening is 1.5mm to 4.5mm; leg length shall be increased equally.

3.3.7 Preheating

In the case of both tack welding and final welding by manual arc welding, the temperature for preheating shall be selected from the following table based on the thickness plate of weld joints. In case the temperature of base metal is lower than 41°F (5°C), the weld joint shall be preheated more than 70°F (21°C). Preheating the temperature are minimum and temperature above the minimum shown is required for highly restrained welds.

3.3.8 Tack Welding

Assembles of weld joints shall be aligned and held in place by tack welding. In the case of assembling of important strength members, it is desirable that strong backs instead of tack welding shall be fitted to maintain proper alignment of weld joint. Edge surface shall be always cleaned and free of oil, paint, rust, moisture, etc. Any defects by tack welding such as undercut, blowhole, crack, etc. shall be avoided. Qualification for tack welding technique is tack welding shall also be executed by the qualified welders (For high tensile & Special plates) as per item 2. The electrodes for tack welding where the electrodes having smaller diameter (4mm dia. or 3.2mm dia.) than the electrodes to be used for final welding shall be applied to tack welding.

For length and pitch of tack welding bead, especially for avoiding tack welds from rapid cooling and causing a defect, tack welding bead shall be intermittent – welded 30mm long minimum for mild steel and 50mm long minimum for high strength steel. Preheating shall be executed for tack welding. Refer to section 7 about the temperature for preheating.

3.3.9 WELDING SEQUENCE AND ‘WAITING’

All weld joints shall be welded in sequence so as to let shrinkage due to welding heat escape from joint. Best welding sequence shall be considered in order not to restrain shrinking within the same plane. Weld joint considered as most shrinkage shall be welded in advance and less shrinkage joint shall be welded last.

3.3.10 EXECUTION OF BUTT WELDING

Tab pieces shall be fitted up at both ends of butt weld joints so as to avoid any defect that is apt to come out at the starting point and the terminal point of welding bead. Back running (root running) of butt weld joint by means of manual metal arc welding shall be done after back chipping as far as sound penetration appears. A crack and slag inclusion should not be developed.

Back chipping shall be done by means of arc-air gouging. Back chipped groove where slag remains shall be ground and wire-brushed so as to remove slag completely. Pay attention to avoid bending especially to butt weld joints. All slag of primary layer shall be removed completely, then the next bead shall be run. The height of reinforcement of weld shall be as follows :-

Table 3.3.10 The height of reinforcement of weld

Base Metal Thickness	Reinforcement (Max)
$T < 9.5\text{mm}$	2.4mm
$T > 9.5\text{mm}$	3.2mm

3.3.11 Repairing Of Other Defects

All weld defects such as slag inclusion, blowhole, insufficient fusion, overlap, etc. shall be removed by arc-air gouging and welded again. Electrodes for repair welding shall be less than 4mm in diameter. Preheating shall comply with the requirements. There are two of repairing of harmful uniform bead and reinforcement:-

(a) Acceptable weld bead

Reinforcement of weld (Excess metal) shall comply with section AWS D1.1. Excess metal height of welded bead shall be limited to the extent as stated in item (i) above. Ruggedness of welded bead height shall be within plus or minus 3mm. Roughness or welded bead height shall be within plus and minus 1mm.

- (b) Weld beads deviated from the above requirements shall be corrected by means of grinding, etc.
- (c) Weld bead having insufficient width or height shall be welded additionally where necessary. Applicable diameter of welding rods shall be less than 4mm dia.. Preheating shall comply with the requirements.

3.3.12 Acceptance Criteria

Acceptance Criteria are to conform to the specified standard codes.

3.3.13 Inspection



Image 3.3.13 Painting or Finishing

Inspection on all production weldment are to be carried out in accordance to Client's requirements. Usually client is really the welder do the finishers like the picture above.

3.3.14 Documentation

All welding inspection records whether in-house or third party is to be submitted to the QA/QC Person In charge for endorsement. QA/QC section shall collect the inspection records duly endorsed by the QA/QC Person In charge for filing in the Project Inspection File.

3.3.15 Tools of Welding



Images 3.3.16 SMAW

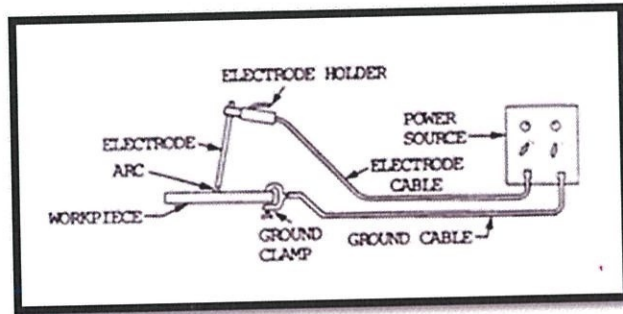
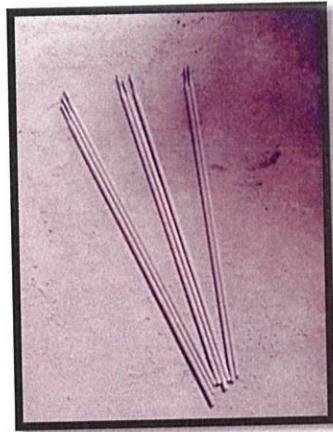


Diagram 3.3.16 SMAW system setup



Images 3.3.16.3 Electrode

Shielded metal arc welding equipment typically consists of a constant current welding power supply and an electrode, with an electrode holder, a ground clamp, and welding cables (also known as welding leads) connecting the two.



Figure 3.3.16.1 Welder

A welder or welder operator is a tradesman who specializes in welding materials together. The term welder refers to the operator, the machine is referred to as the welding power supply. The materials to be joined can be metals (such as steel, aluminum, brass, stainless steel etc.) or varieties of plastic or polymer. Welders typically have to have good dexterity and attention to detail, as well as some technical knowledge about the materials being joined and best practices in the field.

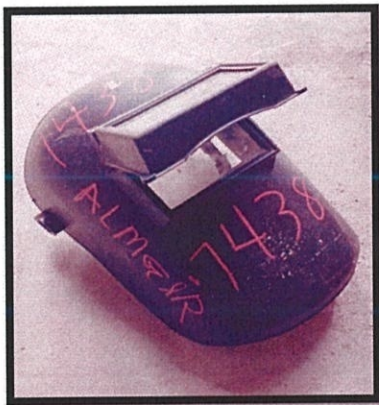


Image 3.3.16.2 Face cover



Image 3.3.16.4 Hand Cover

Welding are also need the safety equipment for a welder. As shown above, these are the several safety tools such as face cover and hand cover to avoid the spark from the welding process.

CHAPTER 4

CONCLUSION AND RECOMMENDATION

4.1 Recommendations

4.1.1 Provide a sufficient tools and machineries

A proper work of installation will definitely need a proper skill of labour and sufficient tools and machineries to do it. As we know all these tools will need to be sufficient enough to make a work become more easy and fast. This is because, not only the installation of work will requires the tools and machineries but some time the workers will be divided into two groups which is one for installation and the other one will need to do some repairing and modifying works if requires to do so. If the tools and machineries are not providing sufficiently enough therefore, all the works that should be complete early will be delayed or postpones.

4.1.2 Provide more workers, which half is for fabrication work and the other half is for site installation work

In this company, I'm aware that the time schedules for workers are not properly organized by supervisor due to lack of workers recruited. This company should be more aware and provide more workers with a proper time schedule work. As we know this kind of work will need a two group of workers which can be divided into fabrication work at factory and site installation work at site. So with a proper time schedule work and sufficient workers the installation work now can be more ease and without any problems.

4.2 Conclusion

As a conclusion, from this case study the writer can literally discuss the details information about installation of steel using the welding method are more better and tougher. As we know steel erection likely welding is one of important element in any kind of projects that's using steel structure. The main function of this element is to provide better and maintain of steel structure for a long time.

But to provide this kind of proper steel erection, components and elements will become the greatest factor that may affect the main function of steel. For an example, the skills of workers must be consider so that the quality is better. Meanwhile, selecting the material used for weld will give a long lasting durability against corrosion and corrupt. Therefore, with this report content I can understand more about components and elements which will be used for this specific type of steel erection.

Moreover, during the observations almost 5 months at site work, the writer learn that some problems related to our works may come from other people who does it purposely or not, but sometimes with improper installation work from our workers itself could also bring problems or damages towards steel joint or erection. However, this report will help to understand all these problems and solved it by how to use welding for steel erection as well.

REFERENCES

BOOK

Badron Jahiman, (2007). Teknologi Binaan Bangunan, Versi Pertama, Malaysia: Selangor.

Frick Heinz, (1980). Ilmu Konstruksi Bangunan 1, Indonesia: Yogyakarta.

Foster Jack Stroud, (1973). Structure and Fabric, Part 1, London: 4 Fitzhardinge Street.

INTERNET

Scott adams (1974), petervaldivia. January ,27,2012,from <http://www.petervaldivia.com/eso/index.php>

JKR(2007) Jabatan Kerja Raya Negeri Terengganu, Disember,29,2011, from http://www.jkr.terengganu.gov.my/index.php?mod=viewinfotek&id_itk=7

INTERVIEW

Pani (2010-now), Steel Engineer Department, Preserver Bina Sdn Bhd.

Iranawati (2009-now), Steel Engineer Department, Preserver Bina Sdn Bhd.

APPENDIX

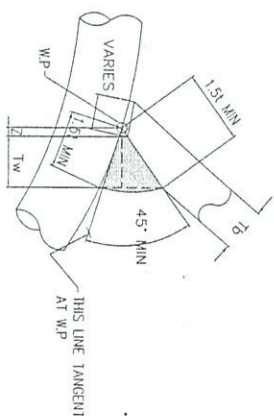
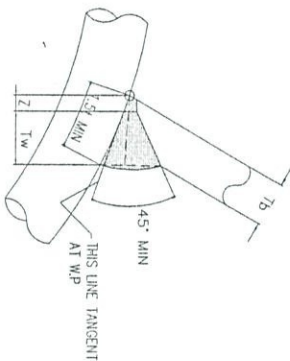
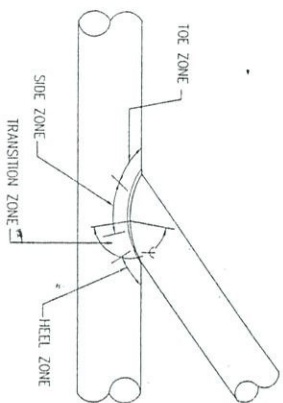
WELDING STANDARD-1

CIRCULAR CONNECTION

TRANSITION A

TRANSITION B

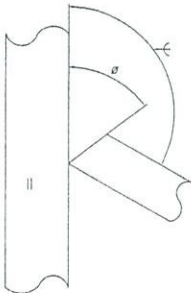
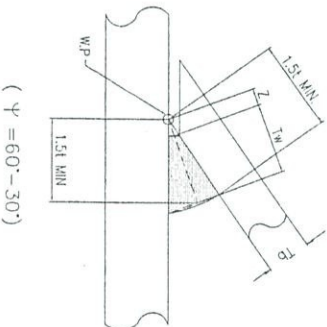
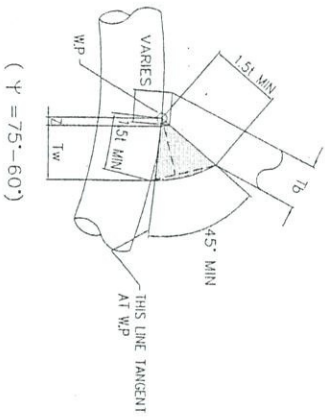
P 310



TRANSITION OR HEEL

HEEL

SKETCH FOR ANGULAR DEFINITION



(150° ≥ γ ≥ 30°)
(90° > φ > 30°)

Attn: Mr. Chan

1/2

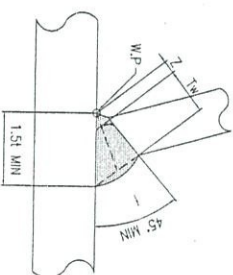
THIS DRAWING IS A CONTRACT DOCUMENT
IT IS THE PROPERTY OF THE ARCHITECT
AND SHOULD BE KEPT IN THE ARCHITECT'S OFFICE
AND NOT BE LOANED, REPRODUCED, COPIED, OR
IN ANY MANNER USED FOR ANY OTHER PROJECT
WITHOUT THE WRITTEN PERMISSION OF THE ARCHITECT

SHOP DWG

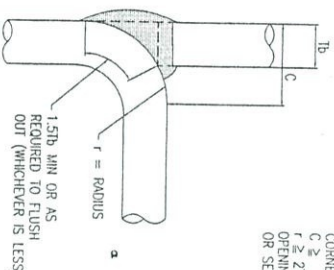
1. GROUND FLOOR
2. FIRST FLOOR
3. SECOND FLOOR
4. THIRD FLOOR
5. FOURTH FLOOR
6. FIFTH FLOOR
7. SIXTH FLOOR
8. SEVENTH FLOOR
9. EIGHTH FLOOR
10. NINTH FLOOR
11. TENTH FLOOR
12. ELEVENTH FLOOR
13. TWELFTH FLOOR
14. THIRTEENTH FLOOR
15. FOURTEENTH FLOOR
16. FIFTEENTH FLOOR
17. SIXTEENTH FLOOR
18. SEVENTEENTH FLOOR
19. EIGHTEENTH FLOOR
20. NINETEENTH FLOOR
21. TWENTIETH FLOOR
22. TWENTY-FIRST FLOOR
23. TWENTY-SECOND FLOOR
24. TWENTY-THIRD FLOOR
25. TWENTY-FOURTH FLOOR
26. TWENTY-FIFTH FLOOR
27. TWENTY-SIXTH FLOOR
28. TWENTY-SEVENTH FLOOR
29. TWENTY-EIGHTH FLOOR
30. TWENTY-NINTH FLOOR
31. THIRTIETH FLOOR
32. THIRTY-FIRST FLOOR
33. THIRTY-SECOND FLOOR
34. THIRTY-THIRD FLOOR
35. THIRTY-FOURTH FLOOR
36. THIRTY-FIFTH FLOOR
37. THIRTY-SIXTH FLOOR
38. THIRTY-SEVENTH FLOOR
39. THIRTY-EIGHTH FLOOR
40. THIRTY-NINTH FLOOR
41. FORTIETH FLOOR
42. FORTY-FIRST FLOOR
43. FORTY-SECOND FLOOR
44. FORTY-THIRD FLOOR
45. FORTY-FOURTH FLOOR
46. FORTY-FIFTH FLOOR
47. FORTY-SIXTH FLOOR
48. FORTY-SEVENTH FLOOR
49. FORTY-EIGHTH FLOOR
50. FORTY-NINTH FLOOR
51. FIFTIETH FLOOR
52. FIFTY-FIRST FLOOR
53. FIFTY-SECOND FLOOR
54. FIFTY-THIRD FLOOR
55. FIFTY-FOURTH FLOOR
56. FIFTY-FIFTH FLOOR
57. FIFTY-SIXTH FLOOR
58. FIFTY-SEVENTH FLOOR
59. FIFTY-EIGHTH FLOOR
60. FIFTY-NINTH FLOOR
61. SIXTIETH FLOOR
62. SIXTY-FIRST FLOOR
63. SIXTY-SECOND FLOOR
64. SIXTY-THIRD FLOOR
65. SIXTY-FOURTH FLOOR
66. SIXTY-FIFTH FLOOR
67. SIXTY-SIXTH FLOOR
68. SIXTY-SEVENTH FLOOR
69. SIXTY-EIGHTH FLOOR
70. SIXTY-NINTH FLOOR
71. SEVENTIETH FLOOR
72. SEVENTY-FIRST FLOOR
73. SEVENTY-SECOND FLOOR
74. SEVENTY-THIRD FLOOR
75. SEVENTY-FOURTH FLOOR
76. SEVENTY-FIFTH FLOOR
77. SEVENTY-SIXTH FLOOR
78. SEVENTY-SEVENTH FLOOR
79. SEVENTY-EIGHTH FLOOR
80. SEVENTY-NINTH FLOOR
81. EIGHTIETH FLOOR
82. EIGHTY-FIRST FLOOR
83. EIGHTY-SECOND FLOOR
84. EIGHTY-THIRD FLOOR
85. EIGHTY-FOURTH FLOOR
86. EIGHTY-FIFTH FLOOR
87. EIGHTY-SIXTH FLOOR
88. EIGHTY-SEVENTH FLOOR
89. EIGHTY-EIGHTH FLOOR
90. EIGHTY-NINTH FLOOR
91. NINETY FLOOR
92. NINETY-FIRST FLOOR
93. NINETY-SECOND FLOOR
94. NINETY-THIRD FLOOR
95. NINETY-FOURTH FLOOR
96. NINETY-FIFTH FLOOR
97. NINETY-SIXTH FLOOR
98. NINETY-SEVENTH FLOOR
99. NINETY-EIGHTH FLOOR
100. NINETY-NINTH FLOOR
101. HUNDRED FLOOR
102. HUNDRED-FIRST FLOOR
103. HUNDRED-SECOND FLOOR
104. HUNDRED-THIRD FLOOR
105. HUNDRED-FOURTH FLOOR
106. HUNDRED-FIFTH FLOOR
107. HUNDRED-SIXTH FLOOR
108. HUNDRED-SEVENTH FLOOR
109. HUNDRED-EIGHTH FLOOR
110. HUNDRED-NINTH FLOOR
111. ONE HUNDRED FLOOR
112. ONE HUNDRED-FIRST FLOOR
113. ONE HUNDRED-SECOND FLOOR
114. ONE HUNDRED-THIRD FLOOR
115. ONE HUNDRED-FOURTH FLOOR
116. ONE HUNDRED-FIFTH FLOOR
117. ONE HUNDRED-SIXTH FLOOR
118. ONE HUNDRED-SEVENTH FLOOR
119. ONE HUNDRED-EIGHTH FLOOR
120. ONE HUNDRED-NINTH FLOOR
121. TWO HUNDRED FLOOR
122. TWO HUNDRED-FIRST FLOOR
123. TWO HUNDRED-SECOND FLOOR
124. TWO HUNDRED-THIRD FLOOR
125. TWO HUNDRED-FOURTH FLOOR
126. TWO HUNDRED-FIFTH FLOOR
127. TWO HUNDRED-SIXTH FLOOR
128. TWO HUNDRED-SEVENTH FLOOR
129. TWO HUNDRED-EIGHTH FLOOR
130. TWO HUNDRED-NINTH FLOOR
131. THREE HUNDRED FLOOR
132. THREE HUNDRED-FIRST FLOOR
133. THREE HUNDRED-SECOND FLOOR
134. THREE HUNDRED-THIRD FLOOR
135. THREE HUNDRED-FOURTH FLOOR
136. THREE HUNDRED-FIFTH FLOOR
137. THREE HUNDRED-SIXTH FLOOR
138. THREE HUNDRED-SEVENTH FLOOR
139. THREE HUNDRED-EIGHTH FLOOR
140. THREE HUNDRED-NINTH FLOOR
141. FOUR HUNDRED FLOOR
142. FOUR HUNDRED-FIRST FLOOR
143. FOUR HUNDRED-SECOND FLOOR
144. FOUR HUNDRED-THIRD FLOOR
145. FOUR HUNDRED-FOURTH FLOOR
146. FOUR HUNDRED-FIFTH FLOOR
147. FOUR HUNDRED-SIXTH FLOOR
148. FOUR HUNDRED-SEVENTH FLOOR
149. FOUR HUNDRED-EIGHTH FLOOR
150. FOUR HUNDRED-NINTH FLOOR
151. FIVE HUNDRED FLOOR
152. FIVE HUNDRED-FIRST FLOOR
153. FIVE HUNDRED-SECOND FLOOR
154. FIVE HUNDRED-THIRD FLOOR
155. FIVE HUNDRED-FOURTH FLOOR
156. FIVE HUNDRED-FIFTH FLOOR
157. FIVE HUNDRED-SIXTH FLOOR
158. FIVE HUNDRED-SEVENTH FLOOR
159. FIVE HUNDRED-EIGHTH FLOOR
160. FIVE HUNDRED-NINTH FLOOR
161. SIX HUNDRED FLOOR
162. SIX HUNDRED-FIRST FLOOR
163. SIX HUNDRED-SECOND FLOOR
164. SIX HUNDRED-THIRD FLOOR
165. SIX HUNDRED-FOURTH FLOOR
166. SIX HUNDRED-FIFTH FLOOR
167. SIX HUNDRED-SIXTH FLOOR
168. SIX HUNDRED-SEVENTH FLOOR
169. SIX HUNDRED-EIGHTH FLOOR
170. SIX HUNDRED-NINTH FLOOR
171. SEVEN HUNDRED FLOOR
172. SEVEN HUNDRED-FIRST FLOOR
173. SEVEN HUNDRED-SECOND FLOOR
174. SEVEN HUNDRED-THIRD FLOOR
175. SEVEN HUNDRED-FOURTH FLOOR
176. SEVEN HUNDRED-FIFTH FLOOR
177. SEVEN HUNDRED-SIXTH FLOOR
178. SEVEN HUNDRED-SEVENTH FLOOR
179. SEVEN HUNDRED-EIGHTH FLOOR
180. SEVEN HUNDRED-NINTH FLOOR
181. EIGHT HUNDRED FLOOR
182. EIGHT HUNDRED-FIRST FLOOR
183. EIGHT HUNDRED-SECOND FLOOR
184. EIGHT HUNDRED-THIRD FLOOR
185. EIGHT HUNDRED-FOURTH FLOOR
186. EIGHT HUNDRED-FIFTH FLOOR
187. EIGHT HUNDRED-SIXTH FLOOR
188. EIGHT HUNDRED-SEVENTH FLOOR
189. EIGHT HUNDRED-EIGHTH FLOOR
190. EIGHT HUNDRED-NINTH FLOOR
191. NINE HUNDRED FLOOR
192. NINE HUNDRED-FIRST FLOOR
193. NINE HUNDRED-SECOND FLOOR
194. NINE HUNDRED-THIRD FLOOR
195. NINE HUNDRED-FOURTH FLOOR
196. NINE HUNDRED-FIFTH FLOOR
197. NINE HUNDRED-SIXTH FLOOR
198. NINE HUNDRED-SEVENTH FLOOR
199. NINE HUNDRED-EIGHTH FLOOR
200. NINE HUNDRED-NINTH FLOOR
201. TEN HUNDRED FLOOR
202. TEN HUNDRED-FIRST FLOOR
203. TEN HUNDRED-SECOND FLOOR
204. TEN HUNDRED-THIRD FLOOR
205. TEN HUNDRED-FOURTH FLOOR
206. TEN HUNDRED-FIFTH FLOOR
207. TEN HUNDRED-SIXTH FLOOR
208. TEN HUNDRED-SEVENTH FLOOR
209. TEN HUNDRED-EIGHTH FLOOR
210. TEN HUNDRED-NINTH FLOOR
211. ELEVEN HUNDRED FLOOR
212. ELEVEN HUNDRED-FIRST FLOOR
213. ELEVEN HUNDRED-SECOND FLOOR
214. ELEVEN HUNDRED-THIRD FLOOR
215. ELEVEN HUNDRED-FOURTH FLOOR
216. ELEVEN HUNDRED-FIFTH FLOOR
217. ELEVEN HUNDRED-SIXTH FLOOR
218. ELEVEN HUNDRED-SEVENTH FLOOR
219. ELEVEN HUNDRED-EIGHTH FLOOR
220. ELEVEN HUNDRED-NINTH FLOOR
221. TWELVE HUNDRED FLOOR
222. TWELVE HUNDRED-FIRST FLOOR
223. TWELVE HUNDRED-SECOND FLOOR
224. TWELVE HUNDRED-THIRD FLOOR
225. TWELVE HUNDRED-FOURTH FLOOR
226. TWELVE HUNDRED-FIFTH FLOOR
227. TWELVE HUNDRED-SIXTH FLOOR
228. TWELVE HUNDRED-SEVENTH FLOOR
229. TWELVE HUNDRED-EIGHTH FLOOR
230. TWELVE HUNDRED-NINTH FLOOR
231. THIRTEEN HUNDRED FLOOR
232. THIRTEEN HUNDRED-FIRST FLOOR
233. THIRTEEN HUNDRED-SECOND FLOOR
234. THIRTEEN HUNDRED-THIRD FLOOR
235. THIRTEEN HUNDRED-FOURTH FLOOR
236. THIRTEEN HUNDRED-FIFTH FLOOR
237. THIRTEEN HUNDRED-SIXTH FLOOR
238. THIRTEEN HUNDRED-SEVENTH FLOOR
239. THIRTEEN HUNDRED-EIGHTH FLOOR
240. THIRTEEN HUNDRED-NINTH FLOOR
241. FOURTEEN HUNDRED FLOOR
242. FOURTEEN HUNDRED-FIRST FLOOR
243. FOURTEEN HUNDRED-SECOND FLOOR
244. FOURTEEN HUNDRED-THIRD FLOOR
245. FOURTEEN HUNDRED-FOURTH FLOOR
246. FOURTEEN HUNDRED-FIFTH FLOOR
247. FOURTEEN HUNDRED-SIXTH FLOOR
248. FOURTEEN HUNDRED-SEVENTH FLOOR
249. FOURTEEN HUNDRED-EIGHTH FLOOR
250. FOURTEEN HUNDRED-NINTH FLOOR
251. FIFTEEN HUNDRED FLOOR
252. FIFTEEN HUNDRED-FIRST FLOOR
253. FIFTEEN HUNDRED-SECOND FLOOR
254. FIFTEEN HUNDRED-THIRD FLOOR
255. FIFTEEN HUNDRED-FOURTH FLOOR
256. FIFTEEN HUNDRED-FIFTH FLOOR
257. FIFTEEN HUNDRED-SIXTH FLOOR
258. FIFTEEN HUNDRED-SEVENTH FLOOR
259. FIFTEEN HUNDRED-EIGHTH FLOOR
260. FIFTEEN HUNDRED-NINTH FLOOR
261. SIXTEEN HUNDRED FLOOR
262. SIXTEEN HUNDRED-FIRST FLOOR
263. SIXTEEN HUNDRED-SECOND FLOOR
264. SIXTEEN HUNDRED-THIRD FLOOR
265. SIXTEEN HUNDRED-FOURTH FLOOR
266. SIXTEEN HUNDRED-FIFTH FLOOR
267. SIXTEEN HUNDRED-SIXTH FLOOR
268. SIXTEEN HUNDRED-SEVENTH FLOOR
269. SIXTEEN HUNDRED-EIGHTH FLOOR
270. SIXTEEN HUNDRED-NINTH FLOOR
271. SEVENTEEN HUNDRED FLOOR
272. SEVENTEEN HUNDRED-FIRST FLOOR
273. SEVENTEEN HUNDRED-SECOND FLOOR
274. SEVENTEEN HUNDRED-THIRD FLOOR
275. SEVENTEEN HUNDRED-FOURTH FLOOR
276. SEVENTEEN HUNDRED-FIFTH FLOOR
277. SEVENTEEN HUNDRED-SIXTH FLOOR
278. SEVENTEEN HUNDRED-SEVENTH FLOOR
279. SEVENTEEN HUNDRED-EIGHTH FLOOR
280. SEVENTEEN HUNDRED-NINTH FLOOR
281. EIGHTEEN HUNDRED FLOOR
282. EIGHTEEN HUNDRED-FIRST FLOOR
283. EIGHTEEN HUNDRED-SECOND FLOOR
284. EIGHTEEN HUNDRED-THIRD FLOOR
285. EIGHTEEN HUNDRED-FOURTH FLOOR
286. EIGHTEEN HUNDRED-FIFTH FLOOR
287. EIGHTEEN HUNDRED-SIXTH FLOOR
288. EIGHTEEN HUNDRED-SEVENTH FLOOR
289. EIGHTEEN HUNDRED-EIGHTH FLOOR
290. EIGHTEEN HUNDRED-NINTH FLOOR
291. NINETEEN HUNDRED FLOOR
292. NINETEEN HUNDRED-FIRST FLOOR
293. NINETEEN HUNDRED-SECOND FLOOR
294. NINETEEN HUNDRED-THIRD FLOOR
295. NINETEEN HUNDRED-FOURTH FLOOR
296. NINETEEN HUNDRED-FIFTH FLOOR
297. NINETEEN HUNDRED-SIXTH FLOOR
298. NINETEEN HUNDRED-SEVENTH FLOOR
299. NINETEEN HUNDRED-EIGHTH FLOOR
300. NINETEEN HUNDRED-NINTH FLOOR
301. TWENTY HUNDRED FLOOR
302. TWENTY HUNDRED-FIRST FLOOR
303. TWENTY HUNDRED-SECOND FLOOR
304. TWENTY HUNDRED-THIRD FLOOR
305. TWENTY HUNDRED-FOURTH FLOOR
306. TWENTY HUNDRED-FIFTH FLOOR
307. TWENTY HUNDRED-SIXTH FLOOR
308. TWENTY HUNDRED-SEVENTH FLOOR
309. TWENTY HUNDRED-EIGHTH FLOOR
310. TWENTY HUNDRED-NINTH FLOOR
311. TWENTY-ONE HUNDRED FLOOR
312. TWENTY-ONE HUNDRED-FIRST FLOOR
313. TWENTY-ONE HUNDRED-SECOND FLOOR
314. TWENTY-ONE HUNDRED-THIRD FLOOR
315. TWENTY-ONE HUNDRED-FOURTH FLOOR
316. TWENTY-ONE HUNDRED-FIFTH FLOOR
317. TWENTY-ONE HUNDRED-SIXTH FLOOR
318. TWENTY-ONE HUNDRED-SEVENTH FLOOR
319. TWENTY-ONE HUNDRED-EIGHTH FLOOR
320. TWENTY-ONE HUNDRED-NINTH FLOOR
321. TWENTY-TWO HUNDRED FLOOR
322. TWENTY-TWO HUNDRED-FIRST FLOOR
323. TWENTY-TWO HUNDRED-SECOND FLOOR
324. TWENTY-TWO HUNDRED-THIRD FLOOR
325. TWENTY-TWO HUNDRED-FOURTH FLOOR
326. TWENTY-TWO HUNDRED-FIFTH FLOOR
327. TWENTY-TWO HUNDRED-SIXTH FLOOR
328. TWENTY-TWO HUNDRED-SEVENTH FLOOR
329. TWENTY-TWO HUNDRED-EIGHTH FLOOR
330. TWENTY-TWO HUNDRED-NINTH FLOOR
331. TWENTY-THREE HUNDRED FLOOR
332. TWENTY-THREE HUNDRED-FIRST FLOOR
333. TWENTY-THREE HUNDRED-SECOND FLOOR
334. TWENTY-THREE HUNDRED-THIRD FLOOR
335. TWENTY-THREE HUNDRED-FOURTH FLOOR
336. TWENTY-THREE HUNDRED-FIFTH FLOOR
337. TWENTY-THREE HUNDRED-SIXTH FLOOR
338. TWENTY-THREE HUNDRED-SEVENTH FLOOR
339. TWENTY-THREE HUNDRED-EIGHTH FLOOR
340. TWENTY-THREE HUNDRED-NINTH FLOOR
341. TWENTY-FOUR HUNDRED FLOOR
342. TWENTY-FOUR HUNDRED-FIRST FLOOR
343. TWENTY-FOUR HUNDRED-SECOND FLOOR
344. TWENTY-FOUR HUNDRED-THIRD FLOOR
345. TWENTY-FOUR HUNDRED-FOURTH FLOOR
346. TWENTY-FOUR HUNDRED-FIFTH FLOOR
347. TWENTY-FOUR HUNDRED-SIXTH FLOOR
348. TWENTY-FOUR HUNDRED-SEVENTH FLOOR
349. TWENTY-FOUR HUNDRED-EIGHTH FLOOR
350. TWENTY-FOUR HUNDRED-NINTH FLOOR
351. TWENTY-FIVE HUNDRED FLOOR
352. TWENTY-FIVE HUNDRED-FIRST FLOOR
353. TWENTY-FIVE HUNDRED-SECOND FLOOR
354. TWENTY-FIVE HUNDRED-THIRD FLOOR
355. TWENTY-FIVE HUNDRED-FOURTH FLOOR
356. TWENTY-FIVE HUNDRED-FIFTH FLOOR
357. TWENTY-FIVE HUNDRED-SIXTH FLOOR
358. TWENTY-FIVE HUNDRED-SEVENTH FLOOR
359. TWENTY-FIVE HUNDRED-EIGHTH FLOOR
360. TWENTY-FIVE HUNDRED-NINTH FLOOR
361. TWENTY-SIX HUNDRED FLOOR
362. TWENTY-SIX HUNDRED-FIRST FLOOR
363. TWENTY-SIX HUNDRED-SECOND FLOOR
364. TWENTY-SIX HUNDRED-THIRD FLOOR
365. TWENTY-SIX HUNDRED-FOURTH FLOOR
366. TWENTY-SIX HUNDRED-FIFTH FLOOR
367. TWENTY-SIX HUNDRED-SIXTH FLOOR
368. TWENTY-SIX HUNDRED-SEVENTH FLOOR
369. TWENTY-SIX HUNDRED-EIGHTH FLOOR
370. TWENTY-SIX HUNDRED-NINTH FLOOR
371. TWENTY-SEVEN HUNDRED FLOOR
372. TWENTY-SEVEN HUNDRED-FIRST FLOOR
373. TWENTY-SEVEN HUNDRED-SECOND FLOOR
374. TWENTY-SEVEN HUNDRED-THIRD FLOOR
375. TWENTY-SEVEN HUNDRED-FOURTH FLOOR
376. TWENTY-SEVEN HUNDRED-FIFTH FLOOR
377. TWENTY-SEVEN HUNDRED-SIXTH FLOOR
378. TWENTY-SEVEN HUNDRED-SEVENTH FLOOR
379. TWENTY-SEVEN HUNDRED-EIGHTH FLOOR
380. TWENTY-SEVEN HUNDRED-NINTH FLOOR
381. TWENTY-EIGHT HUNDRED FLOOR
382. TWENTY-EIGHT HUNDRED-FIRST FLOOR
383. TWENTY-EIGHT HUNDRED-SECOND FLOOR
384. TWENTY-EIGHT HUNDRED-THIRD FLOOR
385. TWENTY-EIGHT HUNDRED-FOURTH FLOOR
386. TWENTY-EIGHT HUNDRED-FIFTH FLOOR
387. TWENTY-EIGHT HUNDRED-SIXTH FLOOR
388. TWENTY-EIGHT HUNDRED-SEVENTH FLOOR
389. TWENTY-EIGHT HUNDRED-EIGHTH FLOOR
390. TWENTY-EIGHT HUNDRED-NINTH FLOOR
391. TWENTY-NINE HUNDRED FLOOR
392. TWENTY-NINE HUNDRED-FIRST FLOOR
393. TWENTY-NINE HUNDRED-SECOND FLOOR
394. TWENTY-NINE HUNDRED-THIRD FLOOR
395. TWENTY-NINE HUNDRED-FOURTH FLOOR
396. TWENTY-NINE HUNDRED-FIFTH FLOOR
397. TWENTY-NINE HUNDRED-SIXTH FLOOR
398. TWENTY-NINE HUNDRED-SEVENTH FLOOR
399. TWENTY-NINE HUNDRED-EIGHTH FLOOR
400. TWENTY-NINE HUNDRED-NINTH FLOOR
401. THIRTY HUNDRED FLOOR
402. THIRTY HUNDRED-FIRST FLOOR
403. THIRTY HUNDRED-SECOND FLOOR
404. THIRTY HUNDRED-THIRD FLOOR
405. THIRTY HUNDRED-FOURTH FLOOR
406. THIRTY HUNDRED-FIFTH FLOOR
407. THIRTY HUNDRED-SIXTH FLOOR
408. THIRTY HUNDRED-SEVENTH FLOOR
409. THIRTY HUNDRED-EIGHTH FLOOR
410. THIRTY HUNDRED-NINTH FLOOR
411. THIRTY-ONE HUNDRED FLOOR
412. THIRTY-ONE HUNDRED-FIRST FLOOR
413. THIRTY-ONE HUNDRED-SECOND FLOOR
414. THIRTY-ONE HUNDRED-THIRD FLOOR
415. THIRTY-ONE HUNDRED-FOURTH FLOOR
416. THIRTY-ONE HUNDRED-FIFTH FLOOR
417. THIRTY-ONE HUNDRED-SIXTH FLOOR
418. THIRTY-ONE HUNDRED-SEVENTH FLOOR
419. THIRTY-ONE HUNDRED-EIGHTH FLOOR
420. THIRTY-ONE HUNDRED-NINTH FLOOR
421. THIRTY-TWO HUNDRED FLOOR
422. THIRTY-TWO HUNDRED-FIRST FLOOR
423. THIRTY-TWO HUNDRED-SECOND FLOOR
424. THIRTY-TWO HUNDRED-THIRD FLOOR
425. THIRTY-TWO HUNDRED-FOURTH FLOOR
426. THIRTY-TWO HUNDRED-FIFTH FLOOR
427. THIRTY-TWO HUNDRED-SIXTH FLOOR
428. THIRTY-TWO HUNDRED-SEVENTH FLOOR
429. THIRTY-TWO HUNDRED-EIGHTH FLOOR
430. THIRTY-TWO HUNDRED-NINTH FLOOR
431. THIRTY-THREE HUNDRED FLOOR
432. THIRTY-THREE HUNDRED-FIRST FLOOR
433. THIRTY-THREE HUNDRED-SECOND FLOOR
434. THIRTY-THREE HUNDRED-THIRD FLOOR
435. THIRTY-THREE HUNDRED-FOURTH FLOOR
436. THIRTY-THREE HUNDRED-FIFTH FLOOR
437. THIRTY-THREE HUNDRED-SIXTH FLOOR
438. THIRTY-THREE HUNDRED-SEVENTH FLOOR
439. THIRTY-THREE HUNDRED-EIGHTH FLOOR
440. THIRTY-THREE HUNDRED-NINTH FLOOR
441. THIRTY-FOUR HUNDRED FLOOR
442. THIRTY-FOUR HUNDRED-FIRST FLOOR
443. THIRTY-FOUR HUNDRED-SECOND FLOOR
444. THIRTY-FOUR HUNDRED-THIRD FLOOR
445. THIRTY-FOUR HUNDRED-FOURTH FLOOR
446. THIRTY-FOUR HUNDRED-FIFTH FLOOR
447. THIRTY-FOUR HUNDRED-SIXTH FLOOR
448. THIRTY-FOUR HUNDRED-SEVENTH FLOOR
449. THIRTY-FOUR HUNDRED-EIGHTH FLOOR
450. THIRTY-FOUR HUNDRED-NINTH FLOOR
451. THIRTY-FIVE HUNDRED FLOOR
452. THIRTY-FIVE HUNDRED-FIRST FLOOR
453. THIRTY-FIVE HUNDRED-SECOND FLOOR
454. THIRTY-FIVE HUNDRED-THIRD FLOOR
455. THIRTY-FIVE HUNDRED-FOURTH FLOOR
456. THIRTY-FIVE HUNDRED-FIFTH FLOOR
457. THIRTY-FIVE HUNDRED-SIXTH FLOOR
458. THIRTY-FIVE HUNDRED-SEVENTH FLOOR
459. THIRTY-FIVE HUNDRED-EIGHTH FLOOR
460. THIRTY-FIVE HUNDRED-NINTH FLOOR
461. THIRTY-SIX HUNDRED FLOOR
462. THIRTY-SIX HUNDRED-FIRST FLOOR
463. THIRTY-SIX HUNDRED-SECOND FLOOR
464. THIRTY-SIX HUNDRED-THIRD FLOOR
465. THIRTY-SIX HUNDRED-FOURTH FLOOR
466. THIRTY-SIX HUNDRED-FIFTH FLOOR
467. THIRTY-SIX HUNDRED-SIXTH FLOOR
468. THIRTY-SIX HUNDRED-SEVENTH FLOOR
469. THIRTY-SIX HUNDRED-EIGHTH FLOOR
470. THIRTY-SIX HUNDRED-NINTH FLOOR
471. THIRTY-SEVEN HUNDRED FLOOR
472. THIRTY-SEVEN HUNDRED-FIRST FLOOR
473. THIRTY-SEVEN HUNDRED-SECOND FLOOR
474. THIRTY-SEVEN HUNDRED-THIRD FLOOR
475. THIRTY-SEVEN HUNDRED-FOURTH FLOOR
476. THIRTY-SEVEN HUNDRED-FIFTH FLOOR
477. THIRTY-SEVEN HUNDRED-SIXTH FLOOR
478. THIRTY-SEVEN HUNDRED-SEVENTH FLOOR
479. THIRTY-SEVEN HUNDRED-EIGHTH FLOOR
480. THIRTY-SEVEN HUNDRED-NINTH FLOOR
481. THIRTY-EIGHT HUNDRED FLOOR
482. THIRTY-EIGHT HUNDRED-FIRST FLOOR
483. THIRTY-EIGHT HUNDRED-SECOND FLOOR
484. THIRTY-EIGHT HUNDRED-THIRD FLOOR
485. THIRTY-EIGHT HUNDRED-FOURTH FLOOR
486. THIRTY-EIGHT HUNDRED-FIFTH FLOOR
487. THIRTY-EIGHT HUNDRED-SIXTH FLOOR
488. THIRTY-EIGHT HUNDRED-SEVENTH FLOOR
489. THIRTY-EIGHT HUNDRED-EIGHTH FLOOR
490. THIRTY-EIGHT HUNDRED-NINTH FLOOR
491. THIRTY-NINE HUNDRED FLOOR
492. THIRTY-NINE HUNDRED-FIRST FLOOR
493. THIRTY-NINE HUNDRED-SECOND FLOOR
494. THIRTY-NINE HUNDRED-THIRD FLOOR
495. THIRTY-NINE HUNDRED-FOURTH FLOOR
496. THIRTY-NINE HUNDRED-FIFTH FLOOR
497. THIRTY-NINE HUNDRED-SIXTH FLOOR
498. THIRTY-NINE HUNDRED-SEVENTH FLOOR
499. THIRTY-NINE HUNDRED-EIGHTH FLOOR
500. THIRTY-NINE HUNDRED-NINTH FLOOR
501. FORTY HUNDRED FLOOR
502. FORTY HUNDRED-FIRST FLOOR
503. FORTY HUNDRED-SECOND FLOOR
504. FORTY HUNDRED-THIRD FLOOR
505. FORTY HUNDRED-FOURTH FLOOR
506. FORTY HUNDRED-FIFTH FLOOR
507. FORTY HUNDRED-SIXTH FLOOR
508. FORTY HUNDRED-SEVENTH FLOOR
509. FORTY HUNDRED-EIGHTH FLOOR
510. FORTY HUNDRED-NINTH FLOOR
511. FORTY-ONE HUNDRED FLOOR
512. FORTY-ONE HUNDRED-FIRST FLOOR
513. FORTY-ONE HUNDRED-SECOND FLOOR
514. FORTY-ONE HUNDRED-THIRD FLOOR
515. FORTY-ONE HUNDRED-FOURTH FLOOR
516. FORTY-ONE HUNDRED-FIFTH FLOOR
517. FORTY-ONE HUNDRED-SIXTH FLOOR
518. FORTY-ONE HUNDRED-SEVENTH FLOOR
519. FORTY-ONE HUNDRED-EIGHTH FLOOR
520. FORTY-ONE HUNDRED-NINTH FLOOR
521. FORTY-TWO HUNDRED FLOOR
522. FORTY-TWO HUNDRED-FIRST FLOOR
523. FORTY-TWO HUNDRED-SECOND FLOOR
524. FORTY-TWO HUNDRED-THIRD FLOOR
525. FORTY-TWO HUNDRED-FOURTH FLOOR
526. FORTY-TWO HUNDRED-FIFTH FLOOR
527. FORTY-TWO HUNDRED-SIXTH FLOOR
528. FORTY-TWO HUNDRED-SEVENTH FLOOR
529. FORTY-TWO HUNDRED-EIGHTH FLOOR
530. FORTY-TWO HUNDRED-NINTH FLOOR
531. FORTY-THREE HUNDRED FLOOR
532. FORTY-THREE HUNDRED-FIRST FLOOR
533. FORTY-THREE HUNDRED-SECOND FLOOR
534. FORTY-THREE HUNDRED-THIRD FLOOR
535. FORTY-THREE HUNDRED-FOURTH FLOOR
536. FORTY-THREE HUNDRED-FIFTH FLOOR
537. FORTY-THREE HUNDRED-SIXTH FLOOR
538. FORTY-THREE HUNDRED-SEVENTH FLOOR
539. FORTY-THREE HUNDRED-EIGHTH FLOOR
540. FORTY-THREE HUNDRED-NINTH FLOOR
541. FORTY-FOUR HUNDRED FLOOR
542. FORTY-FOUR HUNDRED-FIRST FLOOR
543. FORTY-FOUR HUNDRED-SECOND FLOOR
544. FORTY-FOUR HUNDRED-THIRD FLOOR
545. FORTY-FOUR HUNDRED-FOURTH FLOOR
546. FORTY-FOUR HUNDRED-FIFTH FLOOR
547. FORTY-FOUR HUNDRED-SIXTH FLOOR
548. FORTY-FOUR HUNDRED-SEVENTH FLOOR
549. FORTY-FOUR HUNDRED-EIGHTH FLOOR
550. FORTY-FOUR HUNDRED-NINTH FLOOR
551. FORTY-FIVE HUNDRED FLOOR
552. FORTY-FIVE HUNDRED-FIRST FLOOR
553. FORTY-FIVE HUNDRED-SECOND FLOOR
554. FORTY-FIVE HUNDRED-THIRD FLOOR
555. FORTY-FIVE HUNDRED-FOURTH FLOOR
556. FORTY-FIVE HUNDRED-FIFTH FLOOR
557. FORTY-FIVE HUNDRED-SIXTH FLOOR
558. FORTY-FIVE HUNDRED-SEVENTH FLOOR
559. FORTY-FIVE HUNDRED-EIGHTH FLOOR
560. FORTY-FIVE HUNDRED-NINTH FLOOR
561. FORTY-SIX HUNDRED FLOOR
562. FORTY-SIX HUNDRED-FIRST FLOOR
563. FORTY-SIX HUNDRED-SECOND FLOOR
564. FORTY-SIX HUNDRED-THIRD FLOOR
565. FORTY-SIX HUNDRED-FOURTH FLOOR
566. FORTY-SIX HUNDRED-FIFTH FLOOR
567. FORTY-SIX HUNDRED-SIXTH FLOOR
568. FORTY-SIX HUNDRED-SEVENTH FLOOR
569. FORTY-SIX HUNDRED-EIGHTH FLOOR
570. FORTY-SIX HUNDRED-NINTH FLOOR
571. FORTY-SEVEN HUNDRED FLOOR
572. FORTY-SEVEN HUNDRED-FIRST FLOOR
573. FORTY-SEVEN HUNDRED-SECOND FLOOR
574. FORTY-SEVEN HUNDRED-THIRD FLOOR
575. FORTY-SEVEN HUNDRED-FOURTH FLOOR
576. FORTY-SEVEN HUNDRED-FIFTH FLOOR
577. FORTY-SEVEN HUNDRED-SIXTH FLOOR
578. FORTY-SEVEN HUNDRED-SEVENTH FLOOR
579. FORTY-SEVEN HUNDRED-EIGHTH FLOOR
580. FORTY-SEVEN HUNDRED-NINTH FLOOR
581. FORTY-EIGHT HUNDRED FLOOR
582. FORTY-EIGHT HUNDRED-FIRST FLOOR
583. FORTY-EIGHT HUNDRED-SECOND FLOOR
584. FORTY-EIGHT HUNDRED-THIRD FLOOR
585. FORTY-EIGHT HUNDRED-FOURTH FLOOR
586. FORTY-EIGHT HUNDRED-FIFTH FLOOR
587. FORTY-EIGHT HUNDRED-SIXTH FLOOR
588. FORTY-EIGHT HUNDRED-SEVENTH FLOOR
589. FORTY-EIGHT HUNDRED-EIGHTH FLOOR
590. FORTY-EIGHT HUNDRED-NINTH FLOOR
591. FORTY-NINE HUNDRED FLOOR
592. FORTY-NINE HUNDRED-FIRST FLOOR
593. FORTY-NINE HUNDRED-SECOND FLOOR
594. FORTY-NINE HUNDRED-THIRD FLOOR
595. FORTY-NINE HUNDRED-FOURTH FLOOR
596. FORTY-NINE HUNDRED-FIFTH FLOOR
597. FORTY-NINE HUNDRED-SIXTH FLOOR
598. FORTY-NINE HUNDRED-SEVENTH FLOOR
599. FORTY-NINE HUNDRED-EIGHTH FLOOR
600. FORTY-NINE HUNDRED-NINTH FLOOR
601. FIFTY HUNDRED FLOOR
602. FIFTY HUNDRED-FIRST FLOOR
603. FIFTY HUNDRED-SECOND FLOOR
604. FIFTY HUNDRED-THIRD FLOOR
605. FIFTY HUNDRED-FOURTH FLOOR
606. FIFTY HUNDRED-FIFTH FLOOR
607. FIFTY HUNDRED-SIXTH FLOOR
608. FIFTY HUNDRED-SEVENTH FLOOR
609. FIFTY HUNDRED-EIGHTH FLOOR
610. FIFTY HUNDRED-NINTH FLOOR
611. FIFTY-ONE HUNDRED FLOOR
612. FIFTY-ONE HUNDRED-FIRST FLOOR
613. FIFTY-ONE HUNDRED-SECOND FLOOR
614. FIFTY-ONE HUNDRED-THIRD FLOOR
615. FIFTY-ONE HUNDRED-FOURTH FLOOR
616. FIFTY-ONE HUNDRED-FIFTH FLOOR
617. FIFTY-ONE HUNDRED-SIXTH FLOOR
618. FIFTY-ONE HUNDRED-SEVENTH FLOOR
619. FIFTY-ONE HUNDRED-EIGHTH FLOOR
620. FIFTY-ONE HUNDRED-NINTH FLOOR
621. FIFTY-TWO HUNDRED FLOOR
622. FIFTY-TWO HUNDRED-FIRST FLOOR
623. FIFTY-TWO HUNDRED-SECOND FLOOR
624. FIFTY-TWO HUNDRED-THIRD FLOOR
625. FIFTY-TWO HUNDRED-FOURTH FLOOR
626. FIFTY-TWO HUNDRED-FIFTH FLOOR
627. FIFTY-TWO HUNDRED-SIXTH FLOOR
628. FIFTY-TWO HUNDRED-SEVENTH FLOOR
629. FIFTY-TWO HUNDRED-EIGHTH FLOOR
630. FIFTY-TWO HUNDRED-NINTH FLOOR
631. FIFTY-THREE HUNDRED FLOOR
632. FIFTY-THREE HUNDRED-FIRST FLOOR
633. FIFTY-THREE HUNDRED-SECOND FLOOR
634. FIFTY-THREE HUNDRED-THIRD FLOOR
635. FIFTY-THREE HUNDRED-FOURTH FLOOR
636. FIFTY-THREE HUNDRED-FIFTH FLOOR
637. FIFTY-THREE HUNDRED-SIXTH FLOOR
638. FIFTY-THREE HUNDRED-SEVENTH FLOOR
639. FIFTY-THREE HUNDRED-EIGHTH FLOOR
640. FIFTY-THREE HUNDRED-NINTH FLOOR
641. FIFTY-FOUR HUNDRED FLOOR
642. FIFTY-FOUR HUNDRED-FIRST FLOOR
643. FIFTY-FOUR HUNDRED-SECOND FLOOR
644. FIFTY-FOUR HUNDRED-THIRD FLOOR
645. FIFTY-FOUR HUNDRED-FOURTH FLOOR
646. FIFTY-FOUR HUNDRED-FIFTH FLOOR
647. FIFTY-FOUR HUNDRED-SIXTH FLOOR
648. FIFTY-FOUR HUNDRED-SEVENTH FLOOR
649. FIFTY-FOUR HUNDRED-EIGHTH FLOOR
650. FIFTY-FOUR HUNDRED-NINTH FLOOR
651. FIFTY-FIVE HUNDRED FLOOR
652. FIFTY-FIVE HUNDRED-FIRST FLOOR
653. FIFTY-FIVE HUNDRED-SECOND FLOOR
654. FIFTY-FIVE HUNDRED-THIRD FLOOR
655. FIFTY-FIVE HUNDRED-FOURTH FLOOR
656. FIFTY-FIVE HUNDRED-FIFTH FLOOR
657. FIFTY-FIVE HUNDRED-SIXTH FLOOR
658. FIFTY-FIVE HUNDRED-SEVENTH FLOOR
659. FIFTY-FIVE HUNDRED-EIGHTH FLOOR
660. FIFTY-FIVE HUNDRED-NINTH FLOOR
661. FIFTY-SIX HUNDRED FLOOR
662. FIFTY-SIX HUNDRED-FIRST FLOOR
663. FIFTY-SIX HUNDRED-SECOND FLOOR
664. FIFTY-SIX HUNDRED-THIRD FLOOR
665. FIFTY-SIX HUNDRED-FOURTH FLOOR
666. FIFTY-SIX HUNDRED-FIFTH FLOOR
667. FIFTY-SIX HUNDRED-SIXTH FLOOR
668. FIFTY-SIX HUNDRED-SEVENTH FLOOR
669. FIFTY-SIX HUNDRED-EIGHTH FLOOR
670. FIFTY-SIX HUNDRED-NINTH FLOOR
671. FIFTY-SEVEN HUNDRED FLOOR

THIS DOCUMENT IS CONFIDENTIAL
 THE INFORMATION IS TO BE CONTROLLED AND NOT TO BE RELEASED TO THE PUBLIC
 WITHOUT THE WRITTEN PERMISSION OF THE DIRECTOR, FBI
 ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED
 DATE 10-10-2001 BY 60322 UCBAW

SIDE OR HEEL

 $(\psi = 90^\circ - 75^\circ)$

NOTE



CORNER DIMENSION
C \geq Tb+3mm AND
r \geq 2Tb OR ROOT
OPENING \geq 1.6mm IN.
OR SEE 3.12.4.1

1. t = THICKNESS OF THINNER SECTION
2. BEVEL TO TEATHER EDGE EXCEPT IN TRANSITION AND HEEL ZONES
3. ROOT OPENING : 0 TO 5mm
4. NOT PREQUALIFIED FOR UNDER 30°
5. WELD SIZE (EFFECTIVE THROAT) $T_w \geq t : 2$ LOSS DIMENSIONS SHOWN IN TABLE 2.8
6. CALCULATIONS PER 2.24, 1.3(AWS D.1.1) SHALL BE DONE FOR LEG LENGTH LESS THAN 1.5t AS SHOWN
7. FOR BOX SECTION JOINT PREPARATION FOR CORNER TRANSITIONS SHALL PROVIDE A SMOOTH TRANSITION FROM ONE DETAIL TO ANOTHER WELDING SHALL BE CARRIED CONTINUOUSLY AROUND CORNERS WITH CORNERS FULLY BUILT UP AND ALL WELD STARTS AND STOPS WITHIN FLAT FACES
8. SEE ANNEX B FOR DEFINITION OF LOCAL DIHEDRAL ANGLE γ
9. WP = WORK POINT

Table 2.8

Z Loss Dimensions for Calculating Prequalified PJP T-, Y-, and K-Tubular Connection Minimum Weld Sizes (see 2.23.2.1)

Geometrical angle ϕ	Position of Rotating V or OH		Position of Rotating H or F	
	Precession 3 (min)	2 (frames)	Precession 2 (min)	2 (frames)
SHAW	0	0	SHAW	0
FCM-S	0	0	FCM-S	0
FCM-G	0	0	FCM-G	0
CLAW	0	0	CLAW	0
CLAW-S	N/A	N/A	CLAW-S	0
SHAW	1/8	3	SHAW	1/8
FCM-S	1/8	3	FCM-S	0
FCM-G	1/8	3	FCM-G	0
CLAW	N/A	N/A	CLAW	0
CLAW-S	1/8	3	CLAW-S	1/8
SHAW	1/4	6	SHAW	1/4
FCM-S	1/4	6	FCM-S	1/4
FCM-G	1/4	10	FCM-G	1/4
CLAW	N/A	N/A	CLAW	1/4
CLAW-S	3/8	10	CLAW-S	1/4

CADANGAN MEPEK BENTUK DAN MEMBINA 1 BU
PUSAT PAMERAN MATRAPE 3 TINGKAT (DOUBLE
VOLUME) DENGAN 1% TINGKAT BASEMENT TEMP
LETAK KEREA 1 ATAS SEBAYANGIAN LOT 50978
JALAN DUTAMAS 2, MUKIM BATU
WILAYAH PERSEKUTUAN KUALA LUMPUR

TETUAN TDI KL METROPOLIS SDN BHD

**BOOKS BY CAROL ANN HUNTER, MAJOR A
THOMAS TOLSON, 1941-1971**
BACKE TO THE FRONT: FURTHER REMINISCENCES OF
CAROL ANN HUNTER
July 20-22nd 2002 Price \$6-000 2002
PUBLISHER


 THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
 1801 Alexander Bell Drive
 Fairfield, CT 06424-1196
 Tel: 203-261-2000 Fax: 203-261-2001

NEW ARCHITECTS: 25th EAD
PALLADIUM PIA, LLC
300 N. PULASKI, SUITE 1000
CHICAGO, IL 60607
Tel: 312.467.1000
Fax: 312.467.1001
www.palladiumpia.com

RSP

TY-LIN
11100 100th Ave. N., #200, E. Fridley, MN 55424
800-368-3636, 612-941-1100
Fax: 612-941-1100

ADVERTISING INFORMATION: Write to: **COLT**,
 10000 N. 10th Ave., Suite 100, Denver, CO 80231.
 Phone: (303) 751-1000. Fax: (303) 751-1001.

THE REG. GROUP AREA NEW FHC. From 1980, the area was 12.7 km² and the population was 12,000. The area was 12.7 km² and the population was 12,000. The area was 12.7 km² and the population was 12,000.

DE **2000** **Supplement**
JUNE 2000

DAVECO Engineering & Construction Co. Ltd.
100, Queen's Road West, Hong Kong


 100% FULL GRAIN, 100%
 ALL GRAIN
 100%

THE JOURNAL OF THE
AMERICAN
PSYCHOLOGICAL ASSOCIATION

Volume 114, Number 1, February 2009

ISSN: 0021-9010

Copyright © 2009 by the American Psychological Association

0021-9010(200902)114:01;1-1

DOI: 10.1037/a0014811

Printed in the United States of America

Published by the American Psychological Association

4000 Macmillan Avenue, N.W., Washington, D.C. 20007-1300

Phone: 202-336-6500 Fax: 202-336-6501

Web: www.apa.org/journals

Subscription Information: Single copies are \$12.00. Subscriptions are \$35.00 per year (6 issues) for individuals and \$100.00 for libraries. Subscriptions are available in print, electronic, or combined format. Subscriptions outside the United States add \$10.00 per year. Subscriptions are entered on a non-refundable basis. Payment in U.S. dollars only. Please allow 4-6 weeks for delivery of new subscriptions. Claims for missing issues will be considered only if received within 6 months of publication. Payment by check or money order should be made payable to the American Psychological Association. Payment by credit card (VISA, MasterCard, American Express) may be made through the APA website at www.apa.org/journals. Subscriptions are entered on a non-refundable basis. Payment in U.S. dollars only. Please allow 4-6 weeks for delivery of new subscriptions. Claims for missing issues will be considered only if received within 6 months of publication. Payment by check or money order should be made payable to the American Psychological Association. Payment by credit card (VISA, MasterCard, American Express) may be made through the APA website at www.apa.org/journals.

Advertising Information: Advertising rates and information are available on the APA website at www.apa.org/journals.

Reprints: Reprints are available for purchase. Contact the APA website at www.apa.org/journals for more information.

Permissions: Permissions to reproduce articles from this journal may be obtained from the Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923. Phone: 978-750-8400. Fax: 978-750-4744. Web: www.copyright.com.

Microfilm and microfiche editions of this journal are available from University Microfilms International, 300 North Zeeb Road, Ann Arbor, MI 48106. Phone: 734-761-7000. Fax: 734-761-7001. Web: www.umi.com.

Postmaster: Please send address changes in the United States to The Journal of the American Psychological Association, 4000 Macmillan Avenue, N.W., Washington, D.C. 20007-1300. Outside the United States, send address changes to The Journal of the American Psychological Association, P.O. Box 9, Hove, East Sussex TN11 9PS, United Kingdom. Please allow 6-8 weeks for delivery of new subscriptions. Claims for missing issues will be considered only if received within 6 months of publication. Payment by check or money order should be made payable to the American Psychological Association. Payment by credit card (VISA, MasterCard, American Express) may be made through the APA website at www.apa.org/journals.

Subscription Information: Single copies are \$12.00. Subscriptions are \$35.00 per year (6 issues) for individuals and \$100.00 for libraries. Subscriptions are available in print, electronic, or combined format. Subscriptions outside the United States add \$10.00 per year. Subscriptions are entered on a non-refundable basis. Payment in U.S. dollars only. Please allow 4-6 weeks for delivery of new subscriptions. Claims for missing issues will be considered only if received within 6 months of publication. Payment by check or money order should be made payable to the American Psychological Association. Payment by credit card (VISA, MasterCard, American Express) may be made through the APA website at www.apa.org/journals.

Advertising Information: Advertising rates and information are available on the APA website at www.apa.org/journals.

Reprints: Reprints are available for purchase. Contact the APA website at www.apa.org/journals for more information.

Permissions: Permissions to reproduce articles from this journal may be obtained from the Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923. Phone: 978-750-8400. Fax: 978-750-4744. Web: www.copyright.com.


Microfilm and microfiche editions of this journal are available from University Microfilms International, 300 North Zeeb Road, Ann Arbor, MI 48106. Phone: 734-761-7000. Fax: 734-761-7001. Web: www.umi.com.

Postmaster: Please send address changes in the United States to The Journal of the American Psychological Association, 4000 Macmillan Avenue, N.W., Washington, D.C. 20007-1300. Outside the United States, send address changes to The Journal of the American Psychological Association, P.O. Box 9, Hove, East Sussex TN11 9PS, United Kingdom. Please allow 6-8 weeks for delivery of new subscriptions. Claims for missing issues will be considered only if received within 6 months of publication. Payment by check or money order should be made payable to the American Psychological Association. Payment by credit card (VISA, MasterCard, American Express) may be made through the APA website at www.apa.org/journals.

WELDING STANDARD-2

I. NAME :		NAME :		PERSON IN CHARGE :	
II. DATE :		DATE :		DATE :	
III. NO. :		PAGE NO. :		REMARKS :	

GENERAL NOTES AND LEGENDS OF STEEL STRUCTURES

1. THE FABRICATION AND INSTALLATION OF STEEL TRUSSES UNDER THIS CONTRACT SHALL COMPLY WITH THE CONSTRUCTION SPECIFICATION.
2. STRUCTURAL STEEL MEMBERS AND PLATES SHALL BE NEW PRODUCTS OF BS 4360 GRADE 43A AS SPECIFIED IN THE DESIGN DRAWINGS UNLESS NOTED OTHERWISE. STEEL PIPE AND STEEL TUBING SHALL COMPLY TO BS 1772.
3. STEEL SHALL BE SELECTED TO SATISFY THE BRITTLE FRACTURE REQUIREMENTS IN SECTION 2.4.4 OF BS 5696-1:2000. THE MINIMUM SERVICE TEMPERATURES, THE PLATE THICKNESS FOR STEEL GRADES WITH PRODUCER GUARANTEED IMPACT PROPERTIES, SHALL NOT EXCEED THE MAXIMUM THICKNESS CALCULATED ACCORDING TO THE PROVISIONS OF BS EN 10025 SECTION 2.4.4 FOR STEEL MATERIAL CLASS OF IMPACT PROPERTIES, REFER TO STEEL SPECIFICATION.
4. THE CONTRACTOR SHALL UNDERSTAND THE DESIGN DRAWINGS PRIOR TO THE BEGINNING OF THE WORK. IF THERE ARE ANY QUESTIONS OR INCONSISTENCIES ABOUT MEMBER SIZES, PLAN, ELEVATION AND DETAIL, HE SHALL SUBMIT THE QUERIES TO THE ENGINEER FOR EXPLANATION OR REVISION.
5. THE CONTRACTOR SHALL BEAR THE FULL RESPONSIBILITY AS A CONSEQUENCE OF MIS-INTERPRETING THE DRAWINGS.
6. THE CONTRACTOR SHALL COMPLY WITH THE CONSTRUCTION SPECIFICATIONS AND SUBMIT THE CONSTRUCTION DETAIL, PLANS/SHOP DRAWINGS BEFORE COMMENCING THE WORK. THE MEMBER SIZES OF ALL STEEL MEMBERS AND STEEL TRUSSES SHALL BE CALCULATED FROM THE VERTICAL & TRANSVERSE SLOPES OF THE TRUSS, ELEVATIONS AND CAMBERS. THE SHOP DRAWINGS SHALL SUBMIT THE SHOP DRAWINGS FOR ENGINEERS APPROVAL. DETAILS, MATERIAL SPECIFICATIONS, WELD SIZES AND LOCATIONS, CONNECTION TYPES OF CONNECTING MEMBERS, WELD STRENGTH, HIGH-STRENGTH BOLTS, SIZES AND THE CONTRACTOR SHALL ALSO SUBMIT THE ESTIMATE OF STEEL DISTORTION DUE TO WELDING AND INSTALLATION FOR ENGINEERS APPROVAL.
7. THE CONTRACTOR SHALL MAKE THE IMPROVEMENT PLAN TO PREVENT RESIDUAL STRAINS, DISTORTION, SHRINKAGE AND DEFECT OF THE WELD. THE CONTRACTOR SHALL SUBMIT ADEQUATE WELD METHOD, AND WELDING PROCEDURES FOR ENGINEERS APPROVAL TO INSURE GOOD WELD QUALITY PRIOR TO BEGINNING OF WORKS.
8. THE CUTTING AND WELDING WORKS OF THE STRUCTURAL MEMBERS SHALL BE DONE IN THE MANUFACTURER'S WELL EQUIPPED FACTORY PRIOR TO DELIVERING THE MEMBERS TO THE FIELD FOR INSTALLATION. FIELD WELDING IS GENERALLY NOT PERMITTED EXCEPT WHERE FIELD WELD SYMBOL, , IS INDICATED IN THE DRAWING, OR IS APPROVED BY THE ENGINEER IN WRITING.
9. WHERE DESIGN DRAWINGS INDICATE NO WELD SYMBOL, AND WELD SIZE AT THE CONNECTION, CONTRACTOR SHALL MAKE THE WELDING DETAILS IN THE SHOP DRAWINGS COMPLYING TO THE CONSTRUCTION SPECIFICATION AND SUBMIT TO THE ENGINEER FOR APPROVAL BEFORE COMMENCING THE WORKS.
10. CONTAINING TWO SHORT PLATES TO A SINGLE PLATE IS NOT PERMITTED, UNLESS OTHERWISE NOTED AS GROOVE WELD JOINT IN THE DRAWINGS. FOR PLATE WITH LENGTH LESS THAN 1.0M, THE PLATE CAN BE BUILT UP FROM TWO SHORT PLATES WITH ONE WELDED SPICE AT A PARTIAL JOINT SECTION. THE CONTRACTOR SHALL SUBMIT CUTTING PLAN TO ENGINEER FOR APPROVAL PRIOR TO THE BEGINNING OF WORKS.
11. THE CONTRACTOR SHALL CONSIDER CONSTRUCTION SCHEDULE, CONSTRUCTION PROGRESS, USE SITE ENVIRONMENT, ROAD CONDITIONS, TRAFFIC MAINTENANCE AND WEATHER EFFECT WHEN SUBMITTING INSTALLATION DETAIL PLAN FOR ENGINEERS APPROVAL. THE PLAN SHALL STORAGE PLAN, WELDING METHOD AND SEQUENCE, MECHANIC FUNCTION AND LOCATION OF INSTALLATION, AUXILIARY SUPPORTS, AND CONSTRUCTION SAFETY PROTECTION.
12. THE METHOD ON THE ASSEMBLAGE AND INSTALLATION OF THE TRUSSES SHALL BE DETERMINED BY THE CONTRACTOR WHICH DEPENDS ON THE FACTORS OF EQUIPMENT AND CONSTRUCTION, DEAD LOAD CAMBER AND DEAD LOAD STRESS IN THE DESIGN ARE CALCULATED IN THE FINISHED CONDITION OF THE TRUSS EXCEPT FOR THE COMPOSITE GIRDERS OR NOTED OTHERWISE. TEMPORARY SUPPORT SHALL TAKE THE SELF-WEIGHT OF THE TRUSSES. CHORD MEMBER SHALL BE SUPPORTED BY THE TEMPORARY SUPPORTS AT SUFFICIENT INTERVALS TO CREATE NO STRESS IN THE MEMBER UNDER ITS OWN WEIGHT DURING INSTALLATION. IF CONTRACTOR USE ALTERNATIVE METHOD TO INSTALL, THE CONTRACTOR SHALL SUBMIT INSTALLATION PROCEDURES, MEMBER STRESSES DURING INSTALLATION, AND CAMBER CALCULATION FOR THE ENGINEERS APPROVAL PRIOR TO THE BEGINNING OF THE WORK.
13. THE CONTRACTOR SHALL PAINT THE STEEL AND STRINGS COMPLYING TO THE CONSTRUCTION SPECIFICATION. HE SHALL SUBMIT THE SPECIFICATION OF THE PAINT TO THE ENGINEER FOR PRIOR APPROVAL.
14. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE NOTED IN THE DESIGN DRAWINGS.
15. ORDINARY BOLTS OF GRADE 4.6 AND GRADE 8.8 SHALL COMPLY TO BS 4190. HIGH-STRENGTH FRICTION GRIP BOLTS SHALL COMPLY TO BS 4395.
16. CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF BS 5690
17. WELDING SHALL BE IN ACCORDANCE WITH THE LATEST APPLICABLE BS REQUIREMENTS.
18. METHOD STATEMENT OF STEEL STRUCTURE ERECTION, DESIGN AND CALCULATION FOR RELATED TEMPORARY WORKS INCLUDING O.A./O.C. PROCEDURES MUST BE SUBMITTED ENGINEERS REVIEW PRIOR TO PHYSICAL WORKS ON SITE.
19. DESTRUCTION AND NON-DESTRUCTIVE TESTS TO STRUCTURAL STEELWORKS IS DEMAND INCLUDED IN THE STRUCTURAL STEEL FABRICATION SCHEDULE.
20. FIRE PROTECTION REQUIREMENTS TO ALL STRUCTURAL STEELWORKS SHOULD STRICTLY COMPLY TO RELEVANT BRITISH STANDARD OR ARCHITECTURAL / BOMA REQUIREMENT.
21. IN THE EVENT OF ANY CONFLICT OR INCONSISTENCIES BETWEEN THE STRUCTURAL STEEL SPECIFICATION AND THE PARTICULAR SPECIFICATION FOR STEEL STRUCTURE IN THE CONTRACT DOCUMENTS, THE PARTICULAR SPECIFICATION FOR STEEL STRUCTURE SHALL TAKE PRECEDENCE.

ALL SECTIONS SHALL CONFORM WITH BS 4 AND BS EN 10034 UNLESS NOTED OTHERWISE.

ABBREVIATIONS:

UC	UNIVERSAL BEAM
UC	UNIVERSAL COLUMN
RSC	ROLLED STEEL CHANNEL
RSJ	ROLLED STEEL JOIST
RHS	RECTANGULAR HOLLOW SECTION
SHS	SQUARE HOLLOW SECTION
CHS	CIRCULAR HOLLOW SECTION
RS4	ROLLED STEEL ANGLE
UON	UNION
CPV	CORNER OVERLAP JOINT
CPW	CORNER BUTT WELD
FPW	FULL PENETRATION BUTT WELD
THK	THICK
CE	CENTRELINE
8 FPW	PART PENETRATION BUTT WELD
LV	SIZE OF PART PENETRATION BUTT WELD IN mm
1	LENGTH VARIES
TOP	TOP LEVEL
S.O.P	SETTING OUT POINT

22. MEMBER NOTATIONS:

BEAM, COLUMN CHANNEL AND JOIST	100 X 50 X 6
100 X 50 X 6	WEIGHT (kg/m)
100 X 50 X 6	NOMINAL SIZE
100 X 50 X 6	SECTION SHAPE

23. UNLESS NOTED OTHERWISE, ALL FILLET WELDS SHALL BE FULL PROFILE, WITH A MINIMUM LEG LENGTH OF 25mm. UNLESS OTHERWISE SPECIFIED, WELDS SHALL PRODUCE DEPOSITED WELD METAL, HAVING MECHANICAL PROPERTIES NOT INFERIOR TO THE MINIMUM OF THE PARENT METALS.

24. ALL WELDING IS TO COMPLY WITH BS EN 1011-1 AND BS EN 1011-2.

25. UNLESS NOTED OTHERWISE, ALL BUTT WELDS SHALL BE FULL PENETRATION.

26. WELDERS SHALL BE TESTED IN ACCORDANCE WITH BS EN 287-1 APPROPRIATE TO THE TYPE OF WELDING THEY ARE REQUIRED TO PERFORM.

27. JOINT DESIGNATION

1) SYMBOLS FOR JOINT TYPES

B	BUTT JOINT
C	CORNER JOINT
T	T-JOINT
BC	BUTT OR CORNER JOINT
TC	T OR CORNER JOINT
BTC	BUTT, T, OR CORNER JOINT

2) SYMBOLS FOR BASE METAL THICKNESS AND PENETRATION

L	LIMITED THICKNESS-COMPLETE JOINT PENETRATION
U	UNLIMITED THICKNESS-COMPLETE JOINT PENETRATION
P	PARTIAL JOINT PENETRATION

3) SYMBOLS FOR WELD TYPES

1	SQUARE-GROOVE
2	SINGLE-V-GROOVE
3	DOUBLE-V-GROOVE
4	SINGLE-BEVEL-GROOVE
5	DOUBLE-BEVEL-GROOVE
6	SINGLE-U-GROOVE
7	DOUBLE-U-GROOVE
8	SINGLE-J-GROOVE
9	DOUBLE-J-GROOVE
10	FLARE-BEVEL-GROOVE

4) SYMBOLS FOR WELDING PROCESSES IF NOT SHIELDED METAL ARC WELDING

S	SUBMERGED ARC WELDING
G	GAS METAL ARC WELDING
F	FLUX CORED METAL ARC WELDING

5) WELDING PROCESSES

SHAW	SHAWED METAL ARC WELDING
GAUW	GAS METAL ARC WELDING
FCW	FLUX CORED METAL ARC WELDING
SAW	SUBMERGED ARC WELDING









6) WELDING PROCESSES

F	FLAT
H	HORIZONTAL
V	VERTICAL
OH	OVERHEAD
ALL	ALL

FIELD NOTE

- a) NOT PREQUALIFIED FOR GAS METAL ARC WELDING USING SHORT CIRCUITING TRANSFER AND GMAW
- b) JOINT IS WELDED FROM ONE SIDE ONLY.
- c) CYCLIC LOAD APPLICATION LIMITS THESE JOINTS TO THE HORIZONTAL WELDING POSITION.
- d) BACKGROOVE ROOT TO SOUND METAL BEFORE WELDING SECOND SIDE.
- e) BACKGROOVE JOINTS MAY BE USED FOR PREQUALIFIED GMAW.
- f) EXCEPT GMAW-S AND FCW.
- g) MINIMUM WELD SIZE (E) AS SHOWN IN 5.5 AS SPECIFIED ON DRAWING.
- h) IF FILLET WELDS ARE USED IN STATICALLY LOADED STRUCTURES TO REINFORCE GROOVE WELDS IN CORNER AND T-JOINTS, THESE SHALL BE EQUAL TO 1/4T, BUT NEED NOT EXCEED 10mm. GROOVE WELDS IN CORNER AND T-JOINTS OF CYCLICALLY LOADED STRUCTURES SHALL BE REINFORCED WITH FILLET WELDS EQUAL TO 1/4T, BUT NOT MORE THAN 10mm.
- i) DOUBLE-GROOVE WELDS MAY HAVE GROOVES OF UNEQUAL DEPTH, BUT THE DEPTH OF THE SHALLOWER GROOVE SHALL BE NO LESS THAN ONE-FOURTH OF THE THICKNESS OF THE THINNER PART JOINED.
- j) DOUBLE-GROOVE WELDS MAY HAVE GROOVE OF UNEQUAL DEPTH, PROVIDED THESE CONFORM TO THE LIMITATIONS OF NOTE E, ALSO THE WELD SIZE (E) APPLIES INDIVIDUALLY TO EACH GROOVE.
- k) THE ORIENTATION OF THE TWO MEMBERS IN THE JOINTS MAY VARY FROM 135° TO 180° FOR BUTT JOINTS OR 45° TO 90° FOR T-JOINTS.
- l) FOR CORNER JOINTS, THE OUTSIDE GROOVE PREPARATION MAY BE IN EITHER OR BOTH MEMBERS, PROVIDED THE BASIC GROOVE CONFIGURATION IS NOT CHANGED AND ADEQUATE EDGE DISTANCE IS MAINTAINED TO SUPPORT THE WELDING OPERATIONS WITHOUT EXCESSIVE EDGE MELTING.
- m) WELD SIZE (E) IS BASED ON JOINTS WELDED FLUSH.
- n) FOR FLARE-V-GROOVE WELDS AND FLARE-BEVEL-GROOVE WELDS TO RECTANGULAR TUBULAR SECTIONS, γ SHALL BE AS TWO TIMES THE WALL THICKNESS.
- o) FOR FLARE-V-GROOVE WELDS TO SURFACES WITH DIFFERENT RADIUS, THE SMALLER γ SHALL BE USED.

8) WELDING SYMBOL

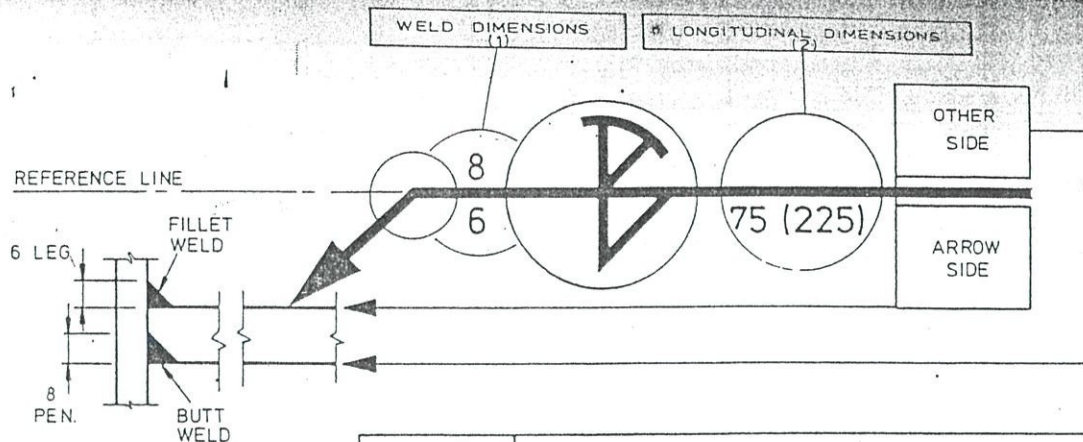
BASIC WELDING SYMBOL		ADDITIONAL WELDING SYMBOL	
TYPE	SYMBOL	NAME	SYMBOL
SQUARE		BACKING BAR	
GROOVE WELD		SPACER	
V SHAPE		WELD ALL AROUND	
GROOVE WELD		FIELD WELD	
BEVEL		FLUSH	
GROOVE WELD		CONVEX	
J SHAPE		CONCAVE	
GROOVE WELD		CHISEL	
U SHAPE		GRIND	
GROOVE WELD		MILLER	
FLARE-BEVEL		HAMMER	
FLARE V SHAPE		FREE	
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			
GROOVE WELD			
FLARE-BEVEL			
FLARE V SHAPE			

PERMITTED DEVIATIONS IN BOX SECTIONS

[illegible]

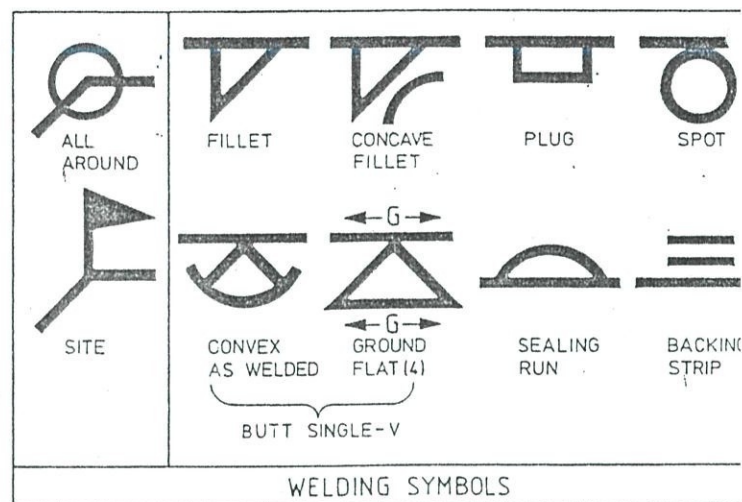
Figure 4.4 Weld symbols

THESE WELDING SYMBOLS ARE BASED UPON BS 499 AND ARE A SELECTION OF THOSE MOST COMMONLY USED. THEY SHOULD BE USED ON ENGINEERS' & WORKSHOP DRAWINGS.



NOTES -

- ① FILLET - LEG LENGTH
BUTT - PENETRATION
(NO DIMENSION INDICATES FULL PENETRATION)
- ② LENGTH OF WELD
(NO DIMENSION INDICATES FULL LENGTH)
- ③ FOR OTHER BUTT WELD SYMBOLS SEE TYPICAL BUTT WELD PREPARATIONS
- ④ —G— INDICATES GROUND FLAT AND DIRECTION



EXAMPLES

TYPE	DETAIL	SYMBOL	TYPE	DETAIL	SYMBOL
FILLET	ONE SIDE - THIS SIDE		BUTT (3)	DOUBLE V GROUND FLAT	
	ONE SIDE - HIDDEN SIDE			DOUBLE V PARTIAL PEN.	
	INTERMITTENT - BOTH SIDES STAGGERED		SLOT	WELD ALL AROUND	
	BOTH SIDES			WELDED FROM THIS SIDE	
FILLET & BUTT	ONE SIDE - FILLET OTHER SIDE PARTIAL PEN. BUTT + FILLET		PLUG		

Figure 4.5 Typical weld preparations

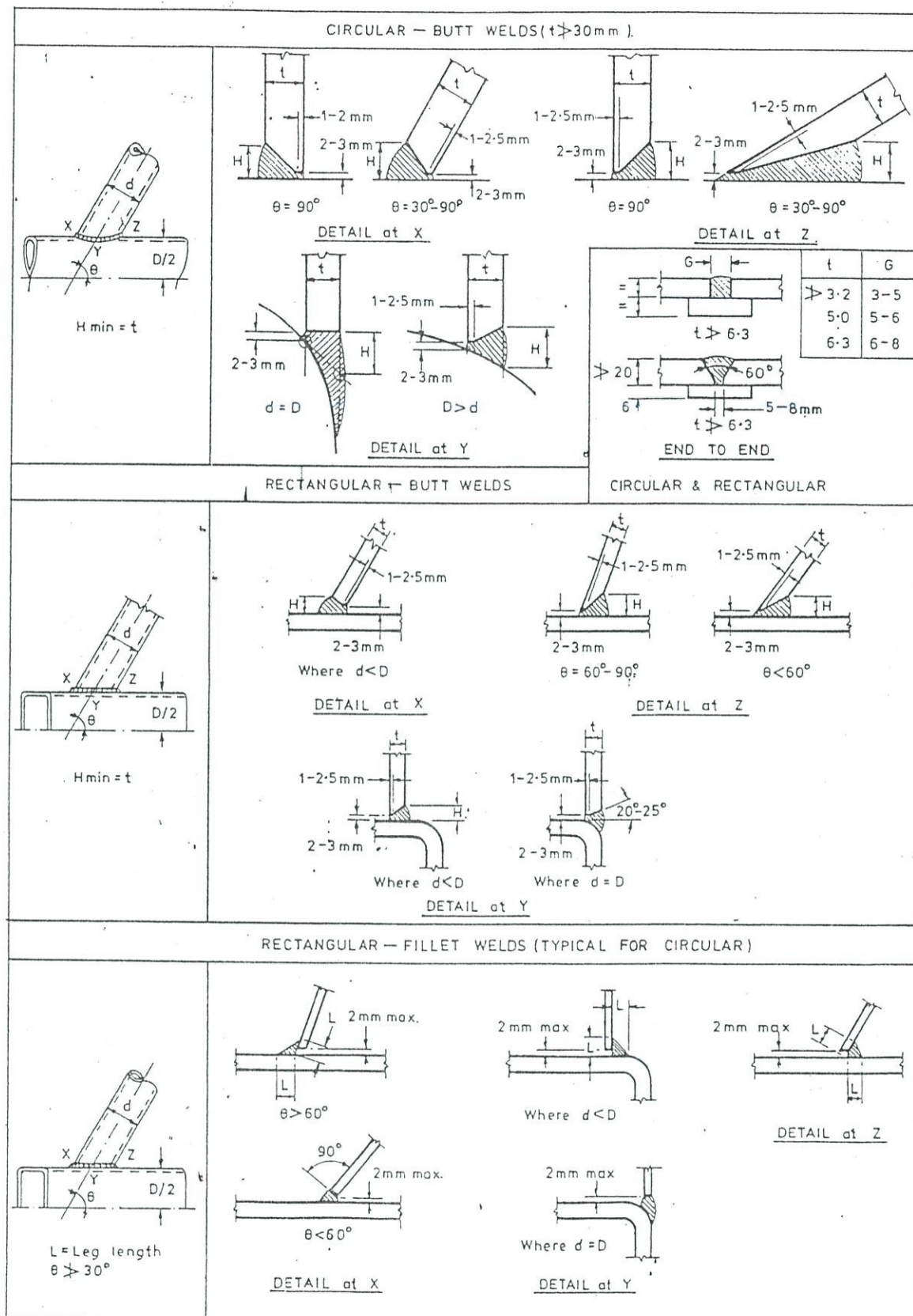
TYPICAL BUTT WELD PREPARATIONS - FULL PENETRATION

THESE DETAILS ARE A TYPICAL SELECTION ONLY CONFORMING WITH THE RECOMMENDED PREPARATIONS IN BS 5135. WELD PREPARATIONS SHOULD NOT BE DETAILED ON ENGINEERS DRAWINGS BUT ARE REQUIRED ON WORKSHOP DRAWINGS

WELD & SYMBOL	DETAIL	THICKNESS T	GAP G	ANGLE α	ROOT FACE R
		mm	mm		mm
OPEN SQUARE BUTT		0-3 3-6	0-3 3	— —	— —
OPEN SQUARE BUTT BACKED		3-5 5-8 8-16	5 8 10	— — —	— — —
SINGLE V BUTT		5-12 > 12	2 2	60° 60°	1 2
SINGLE V BUTT BACKED		> 10	5 10	45° 20°	0 0
DOUBLE V BUTT		> 12	3	60°	2
ASYMMETRIC DOUBLE V BUTT		> 12	3	60°	2
SINGLE J BUTT		> 20	—	20°	5
SINGLE U BUTT		> 20	—	20°	5
SINGLE BEVEL BUTT		5-12 > 12	3 3	45° 45	1 2
DOUBLE BEVEL BUTT		> 12	3	45	2

Figure 4.5 Contd

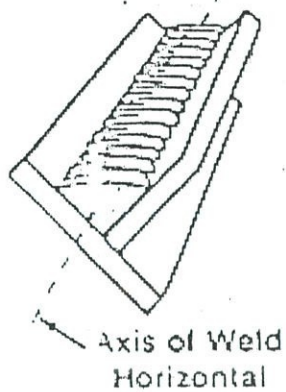
TYPICAL PREPARATIONS FOR HOLLOW SECTIONS



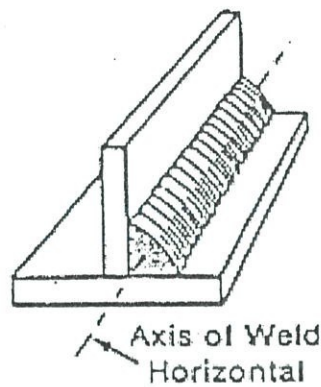
Welding positions

FILLET WELDS

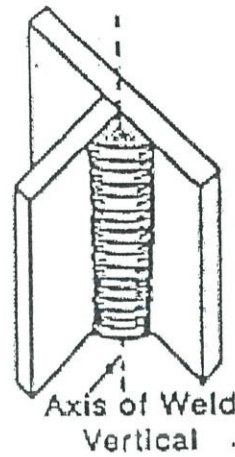
FLAT POSITION
1F



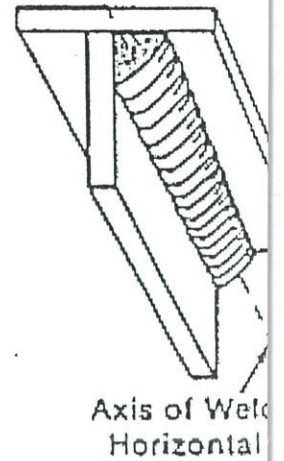
HORIZONTAL POSITION
2F



VERTICAL POSITION
3F

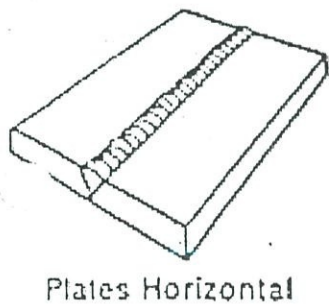


OVERHEAD POSITION
4F

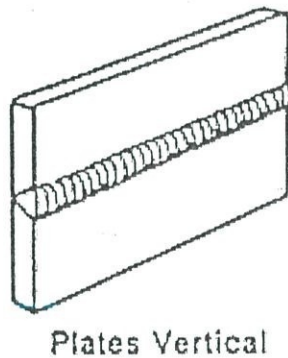


GROOVE WELDS

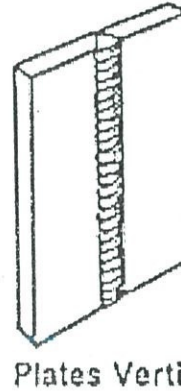
FLAT POSITION
1G



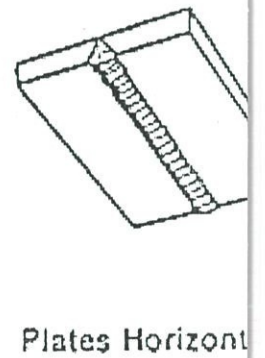
HORIZONTAL POSITION
2G



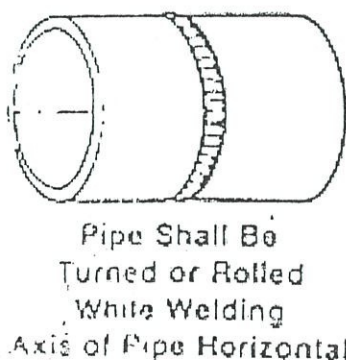
VERTICAL POSITION
3G



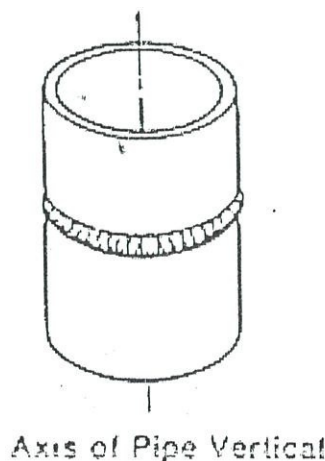
OVERHEAD POSITION
4G



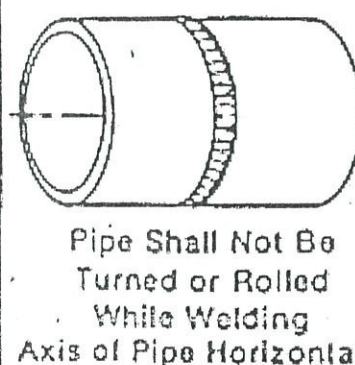
FLAT 1G



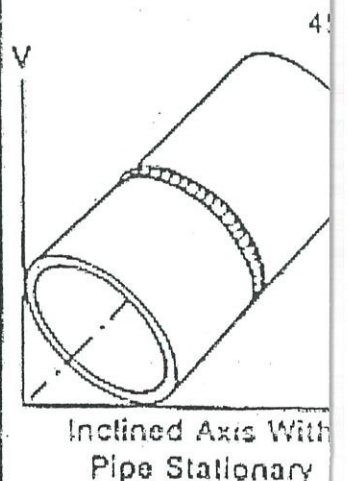
HORIZONTAL 2G



5G POSITION

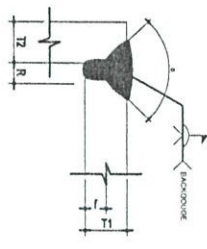


6G POSITION



10 SQUARE-V-GROOVE CJP WELD DETAIL

FOR CORNER JOINT(C)

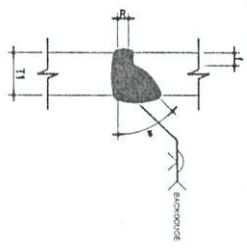


NOTE
1 ALL DIMENSIONS IN mm
2 SEE 6 FROM WELDED LEGEND
3 < F REINFORCE, X NOT REINFORCE

WELDING PROCESS	JOINT THICKNESS (UNWELDED)	BACKGROUSE	PREPARATION	TOLERANCE	PREPARED WELDING POSITION	WELDED NOTE
WELDING PROCESS	DESIGNATION	THICKNESS (UNWELDED)	ROOT FACE	TOLERANCE	PREPARED WELDING POSITION	WELDED NOTE
SWAW	CJ2	U	U	+2.0 -1.0	ALL	4, 6, 8, 1
SWAW	CJ2	U	U	+2.0 -1.0	ALL	4, 6, 8, 1
SWAW	CJ2	U	U	+2.0 -1.0	ALL	4, 6, 8, 1
SWAW	CJ2	U	U	+2.0 -1.0	ALL	4, 6, 8, 1

11 SINGLE-BEVEL-GROOVE CJP WELD DETAIL

FOR BUTT JOINT(B)

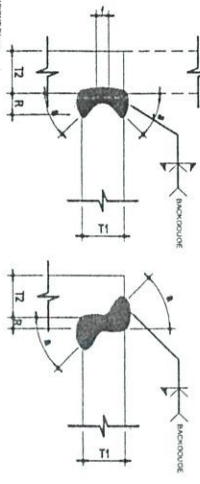


NOTE
1 ALL DIMENSIONS IN mm
2 SEE 6 FROM WELDED LEGEND
3 < F REINFORCE, X NOT REINFORCE

WELDING PROCESS	JOINT THICKNESS (UNWELDED)	BACKGROUSE	PREPARATION	TOLERANCE	PREPARED WELDING POSITION	WELDED NOTE
WELDING PROCESS	DESIGNATION	THICKNESS (UNWELDED)	ROOT FACE	TOLERANCE	PREPARED WELDING POSITION	WELDED NOTE
SWAW	B12	U	U	+2.0 -1.0	ALL	4, 6, 8, 1
SWAW	B12	U	U	+2.0 -1.0	ALL	4, 6, 8, 1
SWAW	B12	U	U	+2.0 -1.0	ALL	4, 6, 8, 1
SWAW	B12	U	U	+2.0 -1.0	ALL	4, 6, 8, 1

12 DOUBLE-BEVEL-GROOVE CJP WELD DETAIL

FOR T-JOINT(T), CORNER JOINT(C)

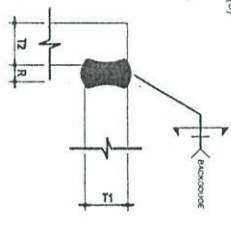


NOTE
1 ALL DIMENSIONS IN mm
2 SEE 6 FROM WELDED LEGEND
3 < F REINFORCE, X NOT REINFORCE

WELDING PROCESS	JOINT THICKNESS (UNWELDED)	BACKGROUSE	PREPARATION	TOLERANCE	PREPARED WELDING POSITION	WELDED NOTE
WELDING PROCESS	DESIGNATION	THICKNESS (UNWELDED)	ROOT FACE	TOLERANCE	PREPARED WELDING POSITION	WELDED NOTE
SWAW	T1	U	U	+2.0 -1.0	ALL	4, 6, 8, 1, 1
SWAW	T1	U	U	+2.0 -1.0	ALL	4, 6, 8, 1, 1
SWAW	T1	U	U	+2.0 -1.0	ALL	4, 6, 8, 1, 1
SWAW	T1	U	U	+2.0 -1.0	ALL	4, 6, 8, 1, 1

13 E-GROOVE CJP WELD DETAIL

FOR T-JOINT(T), CORNER JOINT(C)

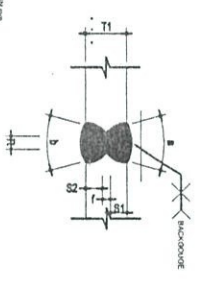


NOTE
1 ALL DIMENSIONS IN mm
2 SEE 6 FROM WELDED LEGEND
3 < F REINFORCE, X NOT REINFORCE

WELDING PROCESS	JOINT THICKNESS (UNWELDED)	BACKGROUSE	PREPARATION	TOLERANCE	PREPARED WELDING POSITION	WELDED NOTE
WELDING PROCESS	DESIGNATION	THICKNESS (UNWELDED)	ROOT FACE	TOLERANCE	PREPARED WELDING POSITION	WELDED NOTE
SWAW	E1	U	U	+2.0 -1.0	ALL	4, 6, 8, 1
SWAW	E1	U	U	+2.0 -1.0	ALL	4, 6, 8, 1
SWAW	E1	U	U	+2.0 -1.0	ALL	4, 6, 8, 1
SWAW	E1	U	U	+2.0 -1.0	ALL	4, 6, 8, 1

14 DOUBLE-V-GROOVE CJP WELD DETAIL

FOR BUTT JOINT(B)

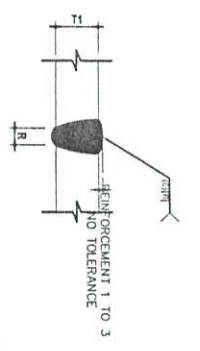


NOTE
1 ALL DIMENSIONS IN mm
2 SEE 6 FROM WELDED LEGEND
3 < F REINFORCE, X NOT REINFORCE

WELDING PROCESS	JOINT THICKNESS (UNWELDED)	BACKGROUSE	PREPARATION	TOLERANCE	PREPARED WELDING POSITION	WELDED NOTE
WELDING PROCESS	DESIGNATION	THICKNESS (UNWELDED)	ROOT FACE	TOLERANCE	PREPARED WELDING POSITION	WELDED NOTE
SWAW	B12	U	U	+2.0 -1.0	ALL	4, 6, 8, 1
SWAW	B12	U	U	+2.0 -1.0	ALL	4, 6, 8, 1
SWAW	B12	U	U	+2.0 -1.0	ALL	4, 6, 8, 1
SWAW	B12	U	U	+2.0 -1.0	ALL	4, 6, 8, 1

15 SQUARE-GROOVE PJP WELD DETAIL

FOR BUTT JOINT(B)

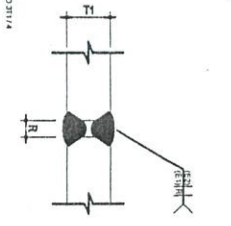


NOTE
1 ALL DIMENSIONS IN mm
2 SEE 6 FROM WELDED LEGEND
3 < F REINFORCE, X NOT REINFORCE

WELDING PROCESS	JOINT THICKNESS (UNWELDED)	BACKGROUSE	PREPARATION	TOLERANCE	PREPARED WELDING POSITION	WELDED NOTE
WELDING PROCESS	DESIGNATION	THICKNESS (UNWELDED)	ROOT FACE	TOLERANCE	PREPARED WELDING POSITION	WELDED NOTE
SWAW	B12	U	U	+2.0 -1.0	ALL	4, 6, 8, 1
SWAW	B12	U	U	+2.0 -1.0	ALL	4, 6, 8, 1
SWAW	B12	U	U	+2.0 -1.0	ALL	4, 6, 8, 1
SWAW	B12	U	U	+2.0 -1.0	ALL	4, 6, 8, 1

16 E-GROOVE PJP WELD DETAIL

FOR BUTT JOINT(B)

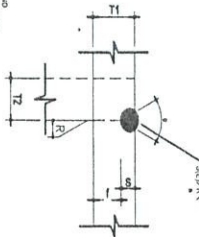


NOTE
1 ALL DIMENSIONS IN mm
2 SEE 6 FROM WELDED LEGEND
3 < F REINFORCE, X NOT REINFORCE

WELDING PROCESS	JOINT THICKNESS (UNWELDED)	BACKGROUSE	PREPARATION	TOLERANCE	PREPARED WELDING POSITION	WELDED NOTE
WELDING PROCESS	DESIGNATION	THICKNESS (UNWELDED)	ROOT FACE	TOLERANCE	PREPARED WELDING POSITION	WELDED NOTE
SWAW	E1	U	U	+2.0 -1.0	ALL	4, 6, 8, 1
SWAW	E1	U	U	+2.0 -1.0	ALL	4, 6, 8, 1
SWAW	E1	U	U	+2.0 -1.0	ALL	4, 6, 8, 1
SWAW	E1	U	U	+2.0 -1.0	ALL	4, 6, 8, 1

17 SINGLE-V-GROOVE PJP WELD DETAIL

FOR BUTT JOINT(B)

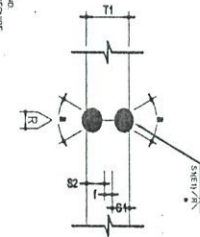


NOTE
1 ALL DIMENSIONS IN mm
2 SEE 6 FROM WELDED LEGEND
3 < F REINFORCE, X NOT REINFORCE

WELDING PROCESS	JOINT THICKNESS (UNWELDED)	BACKGROUSE	PREPARATION	TOLERANCE	PREPARED WELDING POSITION	WELDED NOTE
WELDING PROCESS	DESIGNATION	THICKNESS (UNWELDED)	ROOT FACE	TOLERANCE	PREPARED WELDING POSITION	WELDED NOTE
SWAW	B12	U	U	+2.0 -1.0	ALL	4, 6, 8, 1
SWAW	B12	U	U	+2.0 -1.0	ALL	4, 6, 8, 1
SWAW	B12	U	U	+2.0 -1.0	ALL	4, 6, 8, 1
SWAW	B12	U	U	+2.0 -1.0	ALL	4, 6, 8, 1

18 DOUBLE-V-GROOVE PJP WELD DETAIL

FOR BUTT JOINT(B)



NOTE
1 ALL DIMENSIONS IN mm
2 SEE 6 FROM WELDED LEGEND
3 < F REINFORCE, X NOT REINFORCE

WELDING PROCESS	JOINT THICKNESS (UNWELDED)	BACKGROUSE	PREPARATION	TOLERANCE	PREPARED WELDING POSITION	WELDED NOTE
WELDING PROCESS	DESIGNATION	THICKNESS (UNWELDED)	ROOT FACE	TOLERANCE	PREPARED WELDING POSITION	WELDED NOTE
SWAW	B12	U	U	+2.0 -1.0	ALL	4, 6, 8, 1
SWAW	B12	U	U	+2.0 -1.0	ALL	4, 6, 8, 1
SWAW	B12	U	U	+2.0 -1.0	ALL	4, 6, 8, 1
SWAW	B12	U	U	+2.0 -1.0	ALL	4, 6, 8, 1

CONSTRUCTION DRAWING

REVISIONS

NO. 1

DATE

GENERAL NOTES

STEEL STRUCTURE-3