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Report 1

IIW Qualification Scheme for Welding Personnel vs. Japanese One

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1. Introduction

An international scheme for education, training, examination and qualification of welding personnel which was well harmonized and recognized in EN/EFTA areas has been developed and implemented by EWF (European Welding Federation) in the last few years. The background of the establishment was based on the approval and implementation of ISO-9000 series of standards (ISO-9000s) for the manufactures/constructors of welded products.

ISO-9000s requires that manufacturer shall establish quality systems, that is, quality management and assurance systems for customers.

Within the ISO-9000s, welding is to be treated as a "Special process" since welds cannot be fully verified by subsequent inspection and testing of the product to ensure that the required quality standards have been met (adapted from ISO-9001: 1994, subclause 4.9 and ISO-9002: 1994, subclause 4.9). Quality cannot be inspected into a product, it has to be built into it. Even the most extensive and sophisticated non-destructive testing does not improve the quality of welds[1].

2. ISO Standards related to Welding Coordination

In 1994, ISO-3834: 1994 has canceled and replaced ISO-3834: 1978 as well as ISO-6213: 1989 which have been technically revised so as to gather all quality requirements for welding in one standard and to be in alignment with the principles for quality systems given in the ISO-9000s[1].

ISO-3834: 1994, which is equivalent to EN-729, consists of the following parts, under the general title "Quality requirements for welding – Fusion welding of metallic materials -- [2]:

- Part 1: Guideline for selection and use
- Part 2: Comprehensive quality requirements
- Part 3: Standard quality requirements
- Part 4: Elementary quality requirements

Welding quality requirements may be selected to suit the type of welded construction concerned in accordance with Table 1. Fig. 1 and Table 2 also give further information on the selection and content of ISO-3834, Part 2, 3 and 4 as Annex A and B in Part 1[2].

ISO-3834: 1994 also requires welding coordination personnel. For example, he/she is required in subclause 6.3 of part 2 as followings[2]: "The manufacturer shall have at his disposal appropriate welding coordination personnel, e.g. according to EN 719, such that the welding personnel can be supplied with the necessary welding procedure specification or work instructions and that the work can be properly performed and controlled. Such persons having responsibility for quality activities shall have sufficient authority to enable any necessary action

to be taken. The duties, interrelationships and limits of responsibility of such persons should be clearly defined."

EN 719 has now adapted to ISO/DIS (Draft International Standard) 14731 "Welding coordination – Tasks and responsibilities". Voting of ISO/DIS 14731 has been casted in Dec. of 1995. The result of voting was as following:

- Approval: 19
- Disapproval: 3 (Japan, USA and Belgium)
- Abstention: 1

The standard of ISO/DIS 14731 has been now approved.

The comments from Japan and USA were quite similar, expressing that the certification of welding personnel should be based on the individual job competence/experiences, and not on the amount of training hours/knowledge.

3. EWF and IIW Schemes

The specification of tasks and responsibilities required for welding coordination personnel is given in Table 3.

As mentioned in another article by Tim Jessop[3)], the European Welding Federation (EWF) has, on a voluntary basis, prepared recommendations for minimum requirements for education, examination and certification of welding coordination personnel.

In Annex A of the ISO/DIS 14731 the following statement is given as only "Informative" as following.

- Welding coordination personnel fulfilling the requirements of these documents (European Welding Engineer, Technologist and Specialist) or holding acceptable national qualifications may be considered to satisfy relevant requirement of :

- 5.2.2 Comprehensive technical knowledge
- 5.2.3 Specific technical knowledge
- 5.2.4 Basic technical knowledge

In IIW, IIW scheme for education, examination and qualification of welding coordination personnel has been discussed and established, based on the EWF scheme. However, the following modification has been adopted as given in the resolutions which made at the Commission XIV in 1996 annual assembly in Budapest.

- Resolution 1.

"It is resolved that Commission XIV approves the proposal that the post degree (bachelor) requirement for candidates to enter the training program(s) be waived for specific Authorized Training Bodies (ATB). Details will be developed and approved by Commission XIV later. This applies only to G-1."

- Resolution 2.

"It is resolved by Commission XIV that as an alternative to mandatory minimum number of classroom teaching hours, ATBs are free to develop courses based on other teaching methologies, for example, performance objectives, distance learning, etc. Such courses require the specific

approval of relevant ANB and of IIW Commission XIV. This applies to G1 through G3 programs".

- Resolution 3

"It is resolved by Commission XIV that a candidate with the necessary IIW access condition who has no evidence of formal IIW approved welding training may choose to take a special more comprehensive examination to achieve the same qualification courses. The special examination and rules will be developed and approved by Commission XIV of IIW.

- Resolution 4

"It is resolved that Commission XIV approves the proposal that the access qualification requirement for candidates to enter the training program(s) be waived for specific Authorized Training Bodies (ATB). Details will be developed and approved by Commission XIV later, this applies to G2-G3.

Although the details will be developed and approved by Commission XIV later, IIW scheme will be more flexible than those of EWF.

4. Necessity of Reconstruction for JWES certification scheme

IIW scheme as well as EWF scheme is based on qualification and issue of diploma. Meanwhile, JWES scheme which has been continued for the last twenty four years is based on the certification of Welding Engineers (SWE, Level 1, Level 2), Welding Instructors, Welding Inspection Engineers (three levels) and Welders.

However, in order to harmonize JWES scheme to ISO Welding Coordination Personnel level, that is IIW scheme, JWES Certification Scheme should be reconstructed. The problems to be considered are as followings.

1) Education and Training Hours

JWES scheme is based on the individuals job competence. The examination has been considered important. On the contrary, the education and training for candidates has been treated lightly so far. Education and training conducted in the universities and schools, even in vocational schools, are now decreasing remarkably.

The importance of welding education and training should be emphasized. The syllabus of the welding course in the universities and schools should be examined in more detailed corresponding to that specified in the IIW minimum requirements. It is very relating to the Resolution 1 and 4 of Commission XIV above-mentioned.

2) Accreditation of the Japanese universities.

For Welding Engineers the engineering degrees (academic career) is important as access conditions. Universities and colleges of which the candidates graduate should be accredited internationally. In USA and Europe every university recognized each other by accreditation boards such as FEANI and the Washington Accords. Engineering accreditation board or Institution of Engineers should be established in Japan and it should be approved by the Washington Accords.

3) Establishments of ANB and ATB

The training establishment who can conduct training and education of the course for IWE, IWT and IWS specified in IIW scheme is called as ATB (Approved Training Body). ATB is to be approved by ANB (Authorized National Body). Only one ANB is able to be approved for each IIW member country according to the Rule and procedures of IIW Commission VII.

In Japan, not only JWES but also the other association and society, such as the Light Metal Structures Association, JNDI, Stainless Association, etc. is related to IIW syllabus. Furthermore, if JWES would be an ATB, it should not be ANB. JWES should organize a new federation as Japanese ANB collaborating with the other related organizations.

At the discretion of the ANB, an ATB can be approved to conduct specific topics or parts of the course. Also a company's training establishment can be approved as an ATB provided that all the requirements are met.

4) Examination

JWES position is based on serious consideration of examination. However, the examination system is too simple, even if the level is equivalent to those of IIW requirements.

The number of the examination questions and times of examination should be increase more. The oral examination should be mandatory.

Although the examination questions are different, similar questions and answers are sold and used as a text. The examination data base should make consisting at least 800 to 900 questions for each course and shall be kept strictly confidential.

5) Teaching materials

Text book for teachers should be prepared. OHP sheets for use in education should be prepared sufficiently. Number of OHP required is considered 2000 to 3000.

6) Transition arrangements

IIW recognizes that there are many JWES certified welding engineers and they are actively achieving a satisfactory job related to welding engineering. IIW put in place a transition period for them to provide for appropriated existing personnel to give one of the qualification of IIW. However, there should be many cases to adapt a person for a qualification. The system for transition arrangements should be investigated and established. Some additional education and training, and examination are necessitate.

5. Conclusion

IIW scheme for education, examination and qualification of welding coordination personnel has been discussed. Its outline has been clarified. The certification scheme of JWES should be reconstructed as soon as possible in order to be recognized as an international scheme. The role of JWS as an academic institution for welding technology is expected remarkably.

Table 1 — Selection of welding quality requirements

Contract welding requirements	Quality requirements	
	When quality system[1] conforming to ISO 9001 or ISO 9002 is required	When quality system conforming to ISO 9001 or ISO 9002 is not required
	use	use
Comprehensive quality requirements	ISO 3834-2[1]	ISO 3834-2
Standard quality requirements	ISO 3834-2[1]	ISO 3834-3
Elementary quality requirements	ISO 3834-2[1]	ISO 3834-4

1) Within the scope of ISO 9001 and ISO 9002, the requirements of ISO 3834-2 may be minimized to an appropriate level to suit the type of welded construction.

Fig. 1 Flow diagram for selection of welding quality requirements

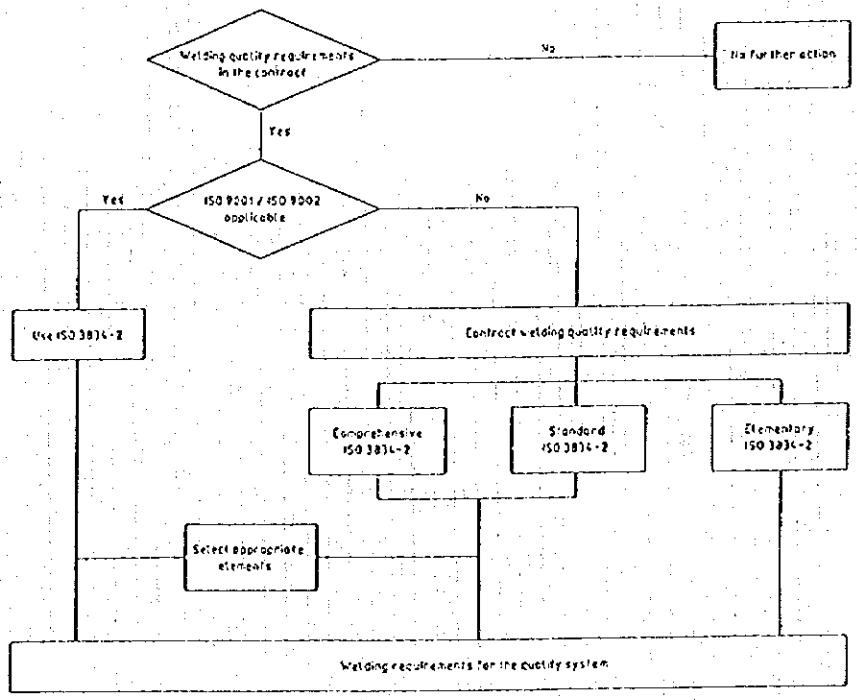

Table 2 Summary comparison of welding quality requirements with regard to ISO 3834-2, ISO 3834-3 and ISO 3834-4

Table B.1 — Summary comparison

Elements	ISO 3834-2 (comprehensive quality requirements)	ISO 3834-3 (standard quality requirements)	ISO 3834-4 (elementary quality requirements)
Contract review	Full documented review	Less extensive review	Establish that capability and information is available
Design review	Design for welding to be confirmed		
Subcontractor	Treat like a main fabricator		Shall comply with all requirements
Welders, operators	Approved in accordance with ISO 9606		
Welding coordination	Welding coordination personnel with appropriate technical knowledge, e.g. EN 719 (see annex C), or persons with similar knowledge		Not required but personal responsibility of manufacturer
Inspection personnel	Sufficient and competent personnel to be available		Sufficient and competent, access for third parties, as needed
Production equipment	Required to prepare, cut, weld, transport, lift, together with safety equipment and protective clothes		No specific requirements
Equipment maintenance	Shall be carried out, maintenance plan necessary	No specific requirements, shall be adequate	No requirements
Production plan	Necessary	Restricted plan necessary	No requirements
Welding procedure specification (WPS)	Instructions to be available to welder (ISO 9956-2)		No requirements
Welding procedure approval	In accordance with the appropriate part of ISO 9956, approved as application standard or contract demands		No specific requirements
Work instructions	Welding procedure specification (WPS) or dedicated work instructions to be available		No requirements
Documentation	Necessary	Not specified	No requirements
Batch testing of consumables	Only if specified in contract	Not specified	No requirements
Storage and handling of welding consumables	According to supplier's recommended minimum		
Storage of parent materials	Protection required from influence by the environment, identification shall be maintained		No requirements
Post-weld heat treatment	Specification and complete record necessary	Confirmation to specification necessary	No requirements
Inspection before, during, after welding	As required for specified operations		Responsibilities as specified in contract
Nonconformances	Procedures shall be available		
Calibration	Procedures shall be available	Not specified	
Identification	Required, when appropriate	Required, when necessary	Not specified
Traceability			Not specified
Quality records	Shall be available to meet the rules for product liability		As required by contract
	Retained for five years minimum		

Table 3 Welding related activities to be considered when appropriate

No.	Activities
1.1	Contract review - Welding capability and associated activities of the manufacturing organization
1.2	Design review - Relevant welding standards - Joint location with relation to the design requirements - Access for welding, inspection and testing - Weld joint details - Quality and acceptance requirements for welds
1.3	Materials
1.3.1	Parent metal - Weldability of the parent metal - Any supplementary requirements in the material purchasing specifications including the type of material certificate - Identification, storage and handling of parent metal - Traceability
1.3.2	Consumables - Compatibility - Delivery conditions - Any supplementary requirements in consumable purchasing specifications including the type of consumables certificate - Identification, storage and handling of consumables
1.4	Subcontracting - Suitability of any subcontractor
1.5	Production planning - Suitability of welding procedure specification (WPS) and approvals (WPAR) - Work instruction - Welding jigs and fixtures - Suitability and validity of welder approvals - Welding and assembly sequences for the structure - Production weld test requirements - Welding inspection requirements - Environmental conditions - Health and safety
1.6	Equipment - Suitability of welding and associated equipment - Auxiliaries and equipment supply, identification and handling - Health and safety

No.-	Activities
1.7	Welding operations
1.7.1	Preliminary activities - Issue of work instruction - Joint preparation, fit up and cleaning - Preparation of production weld tests - Suitability of the work area including the environment
1.7.2	Welding - Assignment and instruction of welders - Use or function of equipment and accessories - Welding consumables and auxiliaries - Application of tack welding - Application of welding process parameters - Application of any intermediate testing - Application and method of preheating and post weld heat treatment - Welding sequence - Post weld treatment
1.8	Testing
1.8.1	Visual examination - Completeness of welding - Weld dimensions - Shape, dimensions and tolerance of the welded components - Joint appearance
1.8.2	Destructive and non-destructive testing - Application of destructive and non-destructive testing - Special tests
1.9	Weld acceptance - Assessment of inspection and test results - Weld repairs - Re-assessment of repaired welds - Corrective action
1.10	Documention - Preparation and maintenance of the necessary records (including subcontracted activities)

THE PROSPECT OF WELDING TECHNOLOGY IN MALAYSIA

SUBJECT	1960 - 1975		1976 - 1990		1991 - 2005	
TECHNOLOGY	Welding processes avialable are:		Welding processes avialable are:		Welding processes avialable are:	
	Gas welding	Common	Gas welding	Common	Gas welding	Common
	SMAW, SAW and TIG	Avialable	SMAW, SAW, CO2/mig and TIG	Common	SMAW, SAW, CO2/MIG and TIG	Common
	Spot welding	Avialable	Spot welding, projection welding	Common	Spot welding, projection welding	Common
	Projection welding	New	Mechanised or automatic control	Avialable	Mechanised or automatic control	Common
	Mechanised	New	Robotic control welding system 5 ~ 6 sets	New	Robotic control welding system	Avialable
					Computerised system	New

THE PROSPECT OF WELDING TECHNOLOGY IN MALAYSIA

SUBJECT	1960 - 1975		1976 - 1990		1991 - 2005	
WELDING SKILL	Low level of skill	Among SMI (small and medium industries)	Skill through working experience	Welders from fabrication contractors	Skill through working experience	Welders from fabrication contractors
	Medium level of skill	Working with foreign contractors	Skill through guided training	Graduates from vocational schools	Skill through guided training	Graduates from vocational schools
	Local skill welders are scarce	Trained by foreign supervison	Large pool of local skill welder	Trained by local supervision	Large pool of local skill welder	Trained by local supervision
			Demand for welding supervisor	Trained by foreign engineers	Demand for welding supervisor	Trained by local engineers
			Demand for operator of mechanised and automatic welding system	Trained by machinery supplier	Demand for operator of mechanised and automatic welding system	Trained by machinery supplier
					Demand for foreign skill welder	Local training the foreign workers from neighbouring countries

THE PROSPECT OF WELDING TECHNOLOGY IN MALAYSIA

SUBJECT	1960 - 1975		1976 - 1990		1991 - 2005	
EDUCATION	Limited opportunity to learn welding	Training by foreign supervisor among welders from foreign contractors	Increasing opportunities to learn welding	Training by skill local welding supervisor and instructors Training by local and foreign institutes	Increasing opportunities to learn welding	Training by skill local welding supervisor and instructors Training by local institutes
	Qualified welders	Very few avialable	Qualified welders	Guided training and certification scheme	Qualified welders	Guided training and certification scheme
	Very few welding inspectors	Duties fulfilled by foreign welding inspectors	Demand for local welding inspectors and NDT inspectors	Trained by foreign institutes Posses foreign qualifications	Increasing number of local welding inspectors and NDT inspectors	Trained by local institutes Posses local or foreign qualifications
	Very few welding engineers	Duties fulfilled by foreign engineers	Some welding engineers with bachelor and master degrees	Trained by foreign universities	Many welding engineers with bachelor, master and doctrate degrees	Trained by local and foreign universities

THE PROSPECT OF WELDING TECHNOLOGY IN MALAYSIA

SUBJECT	1960 - 1975		1976 - 1990		1991 - 2005	
WELDING QUALITY	Norminal quality on simple welding	Among SMI	Good quality on general welding	Large pool of skill welders avialable	Good quality on general welding	Large pool of skill welders avialable (local and foreign)
	Good quality on general welding	By welders working with foreign contractors	Capable of welding most materials	Among the experienced and skilled welders	Capable of welding all materials	Among the experienced and skilled welders
			Machine quality welding	Increasing application of mechanised and automatic welding	Machine quality welding	Common application of mechanised and automatic welding
	Welding standard not widely used	Unknown to many	Welding standard increasingly used	Increasing demand in quality production	Welding standard commonly used	Essential requirement for local and export goods
	eg. BS, ASME		BS, ASME, DIN, JIS	Commonly used	BS, ASME, DIN, JIS ISO 9001, 9002	Commonly used

THE PROSPECT OF WELDING TECHNOLOGY IN MALAYSIA

SUBJECT	1960 - 1975		1976 - 1990		1991 - 2005	
INDUSTRIAL PROSPECT	Beginning of industrialisation	Depend on imported goods Most machines are imported	Developing stage of industrialisation	Goods are produced locally for export Machines are generally imported Several industries are manufacturing them locally under foreign licenceship	Rapid growth of the industrial sector	Locally manufactured goods are exported Machines, cars, components are exported worldwide
	Beginnng of construction and fabrication	Managed by foreign contractors	Wide scale of construction and fabrication activities	Managed by local and foreign joint-venture	Major construction and fabrication activities going on nationwide	Managed by local joint-venture
	Establishment of basic industrial needs	Manufacturing of common products for local needs	Intennse foreign investment and joint-venture	Import of technology from world-wide sources	Investment of technology-based industries in foreign nations	Export of technology

THE PROSPECT OF WELDING TECHNOLOGY IN MALAYSIA

SUBJECT	BEYOND 2000	
THE FUTURE	Achievement of the VISION 2020 and beyond if there are:	
	1. Continual effort of industrialisation	Effort in research and development Effort in exporting product, technology and investment
	2. Continual effort to find alternative source of energy	Conservation of oil and gas Good management of hydro-energy
	3. Continual effort to maintain peaceful enviroment	Continual friendship and cooperation with all nations Sharing and help toward development Effort to maintain economic and social justice Fulfills the rights of every mankind without demand for return Effort for healthy lifestyle Among the youth, the middle age and the elders
	4. Continual effort toward maintaining blessing of the Creator and ward-off calamity	Effort for spiritual health Fulfill the rights of the Creator and the creations Knowledge of the future life and how to achieve it Threading along the right path with the right effort and vehicle Continual effort to practise good deeds and prevent evil deeds - the effort to maintain a lifestyle that pleases the Owner and the Creator of the universes

SIRIM

JICA

SEMINAR
IN
WELDING TECHNOLOGY
5 MARCH 1997

This

CERTIFICATE OF PARTICIPATION

is awarded

to

for attending the Seminar

organized by

Japan International Cooperation Agency (JICA)

in collaboration with

Standards and Industrial Research Institute of Malaysia (SIRIM), Malaysia

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(4) 各種質問票

帰国研修員用

FOLLOW--UP SURVEY FOR EX-PARTICIPANTS OF TRAINING PROGRAMS
at
NAGOYA INTERNATIONAL TRAINING CENTRE (NITC)
JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)

No.73,2-chome Kamenoi,Meito-ku,Nagoya 465 JAPAN

QUESTIONNAIRE

I. Personal Data:

1. Name in Full: _____ Age_____
(Please underline family name)

2. Name of organization where currently employed: _____

_____

Address: _____
(Street and Number) (City) (State/Country)

_____
(Zip code) (Cable/Telex) (Telephone)

3. Current home address: _____
(Street and Number) (City)

_____
(State/Country) (Zip code) (Telephone)

4. Year of your participation to JICA Welding Technology course:

19 _____

II. Educatinal data

5. Have you ever attended any other training course sponsored by donors other thanJICA? Yes, _____ No, _____
   If yes, which donor _____

6. Comment by comparing the above mentioned training course with the one sponsored by JICA, if any.

   _____
   _____
   _____

7. Education/Training (Degree/non-degree) before attending training at JICA

Name, education/ training inst.	Location of institution	Years attended from～to	Certificate/Diploma/ Degree & Major in

8. Education/Training (Degree/non-degree) after attending training at JICA

Name, education/ training inst.	Location of instituion	Years attended from～to	Certificate/Diploma/ Degree & Major in

III. Present Work and Effect of Training:

9. Work experience: Please describe briefly what kind of work/job you have had since you returned home, including the present one.

Work/Job Position	Dates (from-to-)	Responsibilities

10. Nature of your present job: Indicate by an(x)mark in the corresponding box.

Activities	Full aprox. 85%	Major aprox. 75%	Partly aprox.50%	Slightly aprox. 25 %
Research & Devel				
Instruction				
Production				
Administration				
Others,specify				

11. Is there any personal improvement in your job/work after JICA training?

_____ (yes) improved (___a lot) (___somewhat)
_____ (no) improvement

If,yes,please check below where applicable;

_____ work conditions
_____ responsibility
_____ for future prospects
_____ salary rise
_____ for other better jobs
_____ content of work
_____ professional recognition
_____ international contact

12. What do you consider to be the biggest problems in the performance of your present job, if any ? (Check 4 or less in each row below;)

Lack of

_____ trained personnel
_____ equipment
_____ funds
_____ foreign experts
_____ research facilities
_____ other,specify;
_____ support of supervisor
_____ technical literature
_____ national training institutes
_____ transport facilities
_____ career perspective

Please explain them briefly. _____

_____

_____

_____

Various constraints:

____ economic situation
____ poor management
____ too much foreign influence
____ political situation
____ other,specify;
____ brain drain
____ promotion structure
____ no suitable training
____ poor maintenance of equipment

Please explain them briefly.

_____

_____

IV. Training Programme: 1

13. Were there specific objectives set before attendance of course?
Yes, _____ No, _____
If yes,who by _____
what are they _____

14. How did you evaluate the Welding Technology course ?

	Excellent	Good	Fair	Not good	Poor

Please explain your answer briefly.

15. Usefulness of the training you had in Japan (in relation to your subsequent position and responsibility): Indicate by an (X) mark in the corresponding box. In case you select "not useful", please mention its reasons.

SUBJECT	very useful	useful	not useful	REASON
1) Lectures	-	-	-	-
a) Welding Methallurgy				
b) Welding Processes and equipment				
c) Strength & Dynamics of Welding Mechanics & Design				
d) Welding Procedure amd Control				
e) Non-Destructive Testing				
f) Applications of Welding Technology				
2) Practice in Laboratories				
3) Observation of Industries				
4) Indivisual Practice in the Industry				

16. To what extent can you apply the knowledge/experiences acquire through JICA training to your job?

	Full aprox. 85%	Major aprox. 75%	Partly aprox. 50%	Slightly aprox. 25 %	Non 0%

- Please explain some exemple in which you have been able to use the knowledge/experiences, if you have.

17. Have you been able to transfer to anyone any of the knowledge/ experiences that you acquired ?

	Full aprox.85%	Major aprox.75%	Partly aprox.50%	Slightly aprox. 25 %	Non 0%

-Please explain what part of your training you could do this and how ?

-If you answered 'Slightly' or 'No', please explain why.

18. JICA has been conducting group training course in Welding Technology every year since 1974 and to make up the curriculum, we have put emphasis on how to show the participants the overall present situation in this field in Japan, therefore the curriculum was consisted of lectures by first-class lecturers, observations and practices in the actual industrial plants.
As we always wish to improve this course, if you have any comments or suggestions, please state them below.

V. Present situation of Welding Technology in your country:

19. Please explain in detail about welding technology and problem in your country.

(1) Application Field

(2) Welding Process

(3) Material

(4) Standard, Speck

(5) Education, Training System

(6) Qualification of Welding Person

VI. After-care service of JICA:

20. Have you ever contacted Japanese expert after the training?
If you have, Please explain how was that.

21. As after-care services, JICA conducts for ex-participants the followings: -to dispatch follow up team for the purpose of further improvement of training courses (survey of training effects & future tecnnical needs, technical guidance and provision of up-to-date technological information)
-to send magazine "KENSHU-IN" to ex-participants
-to assist ex-participants to organize alumni associations.
If you have any opinions or request concerning these servies, please explain them.

Thank you very much for your cooperation.

QUESTIONNAIRE TO THE RELATED ORGANIZATION

(関連機関用)

I. Present Situation :

1.Please indicate the most serious problems which impede the improvement of welding technology (1) in your country (2) in your organization?

(1) _____

_____

(2) _____

_____

2.Please describe the training programs and staff development systems inside your organization. (place, equipments, number of instructors and students, kinds of class, duration of training, e.t.c.)

_____

_____

_____

_____

_____

_____

II. Others :

3.Please attach the pamphlet, or an organization chart which shows the activities of your organization.

4.Please write down any requests or suggestions to Japan International Cooperation Agency (JICA)

_____

_____

_____

_____

_____

_____

Thank you very much for your cooperation.!

QUESTIONNAIRE TO THE PARTICIPANTS NOMINATING GOVERNMENT
(技協窓口機関用)

1. Please tell us the processes of nominating the participants after you received the *Information* on Group Training Course in Welding Technology II sent from the Embassy of Japan or the JICA Office in your country, and also the time required until a nomination is made. (Please attach a flow chart, if you have.)

2. Do you finalize the nomination (1)on the basis of *Information* or (2)on the related organization's criteria ?

   (1) _____ (2) _____

3. Do you think the *Information* of this course is clearly described about the objectives, contents and level ?

   YES _____ NO _____

4. How long does it take till a participant to finish all the procedures needed for departure after he/she received the notification of his/her acceptance ?

   (1)More than 1 month __ (2)More than 2 weeks __
   (3)Less than 2 weeks __

5. Does the participant present his/her report to your office on his/her return from the training in Japan ?

   Usually yes _____ Usually no _____

   Is it compulsory ?

   YES _____ NO _____

6. Concerning on the field of Welding Technology, do you have a chance to get an assistance from donors other than JICA (Japan International Cooperation Agency) ?

   YES _____ NO _____

   If yes, what kind of assistance are they ?

   _____
   _____
   _____

7. If you have any opinion about this training course in comparison with other similar trainings inside or outside of your country, please state below ;

   _____
   _____
   _____

Thank you very much for your cooperation.

セミナー質問票

Japan International Cooperation Agency

Questionnaire on the Seminar in Welding Technology II

The Follow-up Team would appreciate it if you could kindly answer the following questions.

1. Name of attendant : _____

2. Name of organization : _____

_____

3. Your position : _____

4. Have you ever attended any JICA training course ?

Yes ____ No ____

If yes, please write down the name of the course and the year.

Name of the course _____

Year _____

5 Was the seminar useful to you ?

Yes ____ Not much ____

Please explain more about your answer. And what kind of subject (or theme) are you most interested in among the field?

_____

_____

_____

_____

_____

6. Please write down the name of subject you would like to have a training in Japan if you have such a chance.

_____

_____

_____

Thank you very much for your cooperation.

（5）持ち帰り資料

1．マレイシア

M-1: Application and Nomination Procedures and Processes (PSD)*
M-2: Public Service Department MALAYSIA (PSD)
M-3: LATIHAN KEMAHIRAN MARA (MARA)
M-4: MARA Vocational Training (MARA)
M-5: GIATMARA Malysia (MARA)
M-6: マレーシア国家計量センターの活動 (SIRIM)
M-7: Laporan Tahunan 1995 Annual Report (SIRIM)
M-8: Laporan Tahunan 1995 Annual Report (Universiti Teknologi Malaysia)
M-9: Malaysia Shipyard and Engineering (MSE)
M-10: The Future in Here (K.L. International Airport)

2．スリ・ランカ

S-1: 研修員選考手続き資料 (Department of External Resources)*
S-2: 溶接コース教科書 (Ratmalana Technical College)*
S-3: 溶接コースカリキュラム内容 (Ratmalana Technical College)*
S-4: Training Centre Prospect (Colombo Dockyard Ltd.)*
S-5: 会社概要 (Colombo Dockyard Ltd.)
S-6: Information Cell (Industrial Development Board)
S-7: 'Launching Pad' to New Heights of Technological Excellence
(Automobile Engineering Training Institute Sri Lanka)

（注）*は添付資料

Appendix 'A'

APPLICATION AND NOMINATION PROCEDURES AND PROCESSES

i. Distributed the General Information brochures of the course to the relevant Ministries/Agencies immediately after receive from JICA (Usually at least two weeks before the closing date).

ii. The relevant Ministries/Agencies advertise for candidate based on certain criteria and then submit to the Public Service Department for further action.

iii. Public Service Department then scrutinize the application based on certain criteria such as confirmation in service, no disciplinary action, the course is relevant with the candidate as well as department concern.

iv. The final list will be submitted to JICA for final selection at least a week before the closing date.

දුරකථනය
தொலைபேசி
Telephone } 421251

විදේශ පණිවුඩ
தந்தி
Telegrams } FORAID

ටෙලෙක්ස්
தெலெக்ஸ்
Telex } FORAID Colombo 21232

ෆැක්ස්
தொலைநகல்
Fax } 447633

විදේශ සම්පත් දෙපාර්තමේන්තුව
நிதி மற்றும் திட்டமிடல் அமைச்சு
வெளிநாட்டு வளத் திணைக்களம்
நிதி திட்டமிடல் அமைச்சு
DEPARTMENT OF EXTERNAL RESOURCES
Ministry of Finance and Planning

මගේ අංකය
எனது இல.
My No.
ඔබේ අංකය
உமது இல.
Your No.

S-1

මහලේකම් කාර්යාලය (3 වැනි මහල)
செயலகம், (3 ஆம் மாடி)
The Secretariat, (3rd Floor)
පැ. අං. 277, කොළඹ 1.
அ. பெ. இல. 277, கொழும்பு 1
P. O. Box 277, Colombo 1.

19.....

S/.....

JICA GROUP TRAINING COURSE/SEMINAR NO:.....

With reference to your letter dated ..... forwarding t nomination of ...../...../..... I am glad to inform you that the nominee for the above mentioned Group Training Course/Seminar, which will be held from .....to .....in Japan, has been accepted by the JICA authorities.

In this connection, I would like to know, whether you are agreeable to release the nominee, and if so, kindly advise him/her to contact the JICA office and also the Japanese Embassy in Colombo, in accordance with the instructions given in the annexure, to complete the final arrangements. The nominee should present a copy of the "letter of release" to the JICA office for this purpose.

It is also necessary that the nominee should note the contents of the brochure sent to you along with my letter calling for nominations.

Please note that the Trainee should submit an evaluation report to me on completion of this Training Course/Seminar within two weeks.

B.H. Passaperuna,
Deputy Director,
for DG/ERD

CC: 1. Resident Representative - JICA Ref. .....
2. D/Ch/Com.....
3. Nominee.....

දුරකථනය
தொலைபேசி
Telephone } 421251

පැලි ලිපිනය
தந்தி
Telegrams } විදෙස්
FORAID

ටෙලෙක්ස්
தொலைநகல்
Telex } FORAID
Colombo
21232

ෆැක්ස්
தொலைநகல்
Fax } 447633

විදේශ සම්පත් දෙපාර්තමේන්තුව
මිල් සහ ක්‍රමසම්පාදන අමාත්‍යාංශය
வெளிநாட்டு வளத் திணைக்களம்
நிதி திட்டமிடல் அமைச்சு
DEPARTMENT OF EXTERNAL RESOURCES
Ministry of Finance and Planning

මගේ අංකය
எனது இல.
My No.
ඔබේ අංකය
உமது இல.
Your No.

මහලේකම් කාර්යාලය (3වැනි මහල)
செயலகம், (3ம் மாடி)
The Secretariat, (3rd Floor)
තැ. පෙ. 277, කොළඹ 1.
அ. பெ. இல. 277, கொழும்பு 1.
P. O. Box 277, Colombo 1.

19.....

Mr. Yoshiaki Kano,
Resident Representative,
Japan International Co-operation Agency (JICA),
Colombo.

Dear Mr. Kano,

JICA - COLOMBO PLAN GROUP TRAINING COURSE NO. ..... 199..
.....
.....

Thank you for your letter No..... dated ..... inviting nominations from the Government of Sri Lanka for the above mentioend training course.

I am glad to forward herewith ..... set/s the Colombo Plan Form A2-3 in respect of the undermentioned candidate/s nominated by our Government for this training.

1. ....
.....
.....

2. ....
.....
.....

I shall be most grateful if you will kindly transmit the above nomination/s to your authorities with your recommendation for their favourable consideration and keepme informed of further developments.

With kind regards,
Yours faithfuly,

(B.H.Passaperuma),
Deputy Director,
for DG/ERD.

cc: H.E. the Ambassador for Sri Lanka in Tokyo
copy of each nomination is/are attached
2. Director, Colombo Plan Bureau, Colombo.
3. S/.....

දුරකථනය
தொலைபேசி
Telephone } 421251

විදුලි පණිවුඩ
தந்தி
Telegrams } විදෙස්
FORAID

ටෙලෙක්ස්
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Colombo
21232

ෆැක්ස්
பெக்ஸ்
Fax } 447633

විදේශ සම්පත් දෙපාර්තමේන්තුව
මුදල් සහ ක්‍රමසම්පාදන අමාත්‍යාංශය
வெளிநாட்டு வளத் திணைக்களம்
நிதி திட்டமிடல் அமைச்சு
DEPARTMENT OF EXTERNAL RESOURCES
Ministry of Finance and Planning

මගේ අංකය
எனது இல
My No.
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உமது இல.
Your No.

මහලේකම් කාර්යාලය (3 වැනි මහල)
செயலகம், (3 ஆம் மாடி)
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තැ. පෙ. 277, කොළඹ 1.
த. பெ. இல. 277, கொழும்பு 1
P. O. Box 277, Colombo 1.

19.....

S/.....

S/.....

JICA - COLOMBO PLAN GROUP TRAINING COURSE NO : ...../199

The Japan International Co-operation Agency (JICA) has invited nomination for the above mentioned Group Training Course : the details of which are given in the annexed brochure.

In the event of your availing of this opportunity you are kindly requested to strictly adhere to the guidelines stipulated in the brochure as selections will be done purely in accordance with the required qualifications.

It is necessary that the nominee should see this letter and must be provided with a copy of the brochure so that she/he may go through the contents thoroughly before filling up the application forms and preparing the country reports.

You may submit nomination/s along with the under mentioned documents to reach this office immediately/on or before ...../...../.....199....

1. Nine copies of C Plan A 2 - 3 forms (attached)
2. Four copies of a recent photograph.
3. A Medical certificate (attached)
4. Country Report (if specified in the brochure)
5. Questionare (" " ")

In case you require more time to submit the complete set/s of nomination forms, you may at least intimate me the name/s of your candidate/s, early.

Please note that if no intimation or acknowledgement is received prior to the closing date, it will be presumed that you are not interested in availing of this offer, and action will be taken accordingly.

A. Sooriyagoda
Asst. Director

Sgd/(B.H.Passaperuma)
Deputy Director
for DG/ERD.

c.c. 1..... (Copies of the above documents are attached for his early/immediate action through the Secretary of the Ministry concerned).

2..... - do -

3..... - do -

wics

වෙල්ඩින් ක්‍රමය

ශක්තිය අනුව වෙල්ඩින් ක්‍රම වර්ගීකරණය කිරීම.

Classification of welding processes by the kind of energy

- Metal welding (ලෝහ පැස්සුම)
  - Electrical energy (විද්‍යුත් ශක්තිය)
    - Arc (චාප)
      - Coated electrode arc welding
      - Gas-shielded arc welding
      - Non-shielded arc welding
      - Submerged arc welding
    - Electroslag welding
    - Resistance welding
    - Induction welding
    - Electron beam welding
    - Plasma welding
  - Chemical energy (රසායනික ශක්තිය)
    - Gas welding
    - Thermit welding
    - Explosive welding
    - Furnace welding (Brazing)
  - Mechanical energy (යාන්ත්‍රික ශක්තිය)
    - Pressure (පීඩන)
      - Friction welding
      - Hot pressure welding
      - Cold pressure welding
      - Solid state welding
  - Ultrasonic energy (අල්ට්‍රාසොනික් ශක්තිය)
    - Ultrasonic welding
  - Light energy (ආලෝක ශක්තිය)
    - Solar energy welding
    - Laser welding

I. K. PERERA
Senior Instructor
Technical College
Ratmalana.

වෙල්ඩින් ප්‍රගුණව

WELDING PRACTICE

Health And Safety In Welding And Cutting

ලෝහ පැස්සීමේදී හා කැපීමේ දී සෞඛ්‍යය හා ආරක්ෂාව

ලෝහ පැස්සුම් හා කැපුම් අවස්ථා වලදී සෞඛ්‍යය හා ආරක්ෂාව සම්බන්ධයෙන් පහත සඳහන් කරුණු ප්‍රධාන වශයෙන් බලපායි.

1. Respiratory trouble and poisoning by fume and toxic gas.

   (දුමෙන් ඇති වන විෂවීම් වලින් ශ්වසන පද්ධතියට ඇති වන බලපෑම්.)

2. Inflammation of eyes and burn of skin by the radiation of arc and gas flame.

   (චාප කිරන සහ ගෑස් වලින් ඇස් වලට සිදුවන හානි සහ සමට සිදුවන පිළිස්සීම්.)

3. Burn and death by electric shock.

   (විද්‍යුතයෙන් සිදුවන පිළිස්සීම් සහ මරණ.)

4. Burn by spatter, hot slag and hot materials.

   (ස්පැටර්ස් , රත් වූ බොර හා රත් වූ යකඩ වලින් සිදුවන පිළිස්සීම්.)

5. Lack of oxygen.

   (ඔක්සිජන් උනතාව.)

6. Hearing loss by noise.

   (ශබ්දය නිසා ඇති වන ඇසීමේ දුබලතා.)

7. Fire and Explosion.

   (ගිනි ගැනීම් සහ පිපිරවීම්)

L. K. PERERA
Senior Instructor
Technical College
Hikkaduwa.

පැස්සුම් ශිල්පයේ සංවර්ධනය

Development Of Welding Processes.

මු.ව. 2000	-	ආදිකාලීන මිසියා තඹ රත්තරන් සහ රයම් - ටින් මිශ්‍ර ලෝහ පාස්සන ලදී.
මු.ව. 1000	-	ලෝහ රත්තරන් එකට හැලීමෙන් අව්-ආයුධ, කලාත්මක භාණ්ඩ නිපදවන ලදී. (Forge Welding)
කි.ව. 1600	-	ඉංග්‍රීසි ක්‍රමයන්ට ජපානයේ කාෂ්කරී ආවුද, කඩු සහ කුවන්කු බට නිපදවන ලදී.
		නූතන ක්‍රම වලින්
1881	-	ප්‍රංශ ජාතික බෙන්ට්‍රි මෙන්ස්යන් කාබන් චාප ප්‍රයෝජනයට ගනිමින් ලෝහ උණු කරණ ලදී.
1885	-	රුසියන් ජාතික බර්කාටොව් එය ඉදිරියට ගෙනයමින් කාබන් චාප පැස්සුම කරන ලදී. ඊට ටික කලකට පස් තවත් රුසියානු ජාතික ස්ලාවියනෝව් ලෝහ චාප පැස්සුම අන්තදා බැලීම් කරන ලදී.
1886	-	ඇමෙරිකානු ජාතික එලිහු තොම්සන් ප්‍රතිරෝදක වෙල්ඩින් ක්‍රමය (Resistance Welding) හඳුන්වන ලදී.
1889	-	ඇමෙරිකානු ජාතික චාල්ස් ඒ. කොෆින් විසින් ප්‍රථම වරට ලෝහ චාප වෙල්ඩින් ක්‍රමය පටන් ගන්න ලදී.
1892	-	ඇමෙරිකානු ජාතික තෝමස් එල්. විල්සන් අයටලන් සඳහා කාබයිඩ් සාර්ථකව නිපදවන ලදී.
1895	-	ප්‍රංශ ජාතික ලී වැටල්යර් ඔක්සි ඇසිටලීන් ලාම්පුව (Blowpipe) නිපදවන ලදී.
1900	-	කාර්ල්, වොන් ලින්ඩේ දියර වායුවෙන් ඔක්සිජන් නිපදවාගන්න ලදී.
1902	-	ප්‍රංශ ජාතික ජෝර්ජ් ක්ලෝද, කාර්ල් වොන් ලින්ඩේ මෙන් ඔක්සිජන් නිපදවන ලදී.
1903	-	ප්‍රංශ ජාතික පිකාඩ් ඔක්සි ඇසිටලීන් මිශ්‍ර පස්ප්පය ගෑස් පැස්සුම සම්බන්ධව දියුණු කිරීමෙන් එය ප්‍රගෝපය පුරා පැතිර යන ලදී.
1904	-	සර්මිකය විසින් ජපානයට කාබන් චාප වෙල්ඩින් ක්‍රමය හඳුන්වා දෙන ලදී.
1907	-	ස්විඩන් ජාතික ඔස්කා කෙජල්බර්ග් ආවරණ සහිත ඉලෙක්ට්‍රොඩ් (Covered Electrode) නිපදවන ලදී.
1918-1920	-	ඇමෙරිකාව, ඉංග්‍රීසිය, ප්‍රංශය විසින් සම්පූර්ණ වෙල්ඩින් කර නිපදවන ලද බොක් 398 ක් බිරිසි නැව ලිවර්පූල් තැව් තටාකයේ දියත් කරන ලදී.

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1927 – ස්වයංක්‍රීයව වයරය කැපීමේ උපකරණ දියුණු කරන ලදි.
(automatic wire feeding device)

1930 – කොබර්ට් සහ ඩේවර් ටිග් (TIG) වෙල්ඩින් ක්‍රමය දියුණු කරන ලදි.

1935 – ඇමරිකානු ජාතික කැරි ඊ කෙනඩි සබ්මර්ජ් චාප වෙල්ඩිං ක්‍රමය (Submerged Arc Welding) නිපදවන ලදි. 1936 ආපසු මේ ක්‍ර ඇමරිකානු නැව් කර්මාන්තවල ප්‍රයෝජනයට ගන්න ලදි.

1939 – ස්ටඩ් වෙල්ඩිම (stad welding) සහ (Arc air G වැඩි දියුණු කරන ලදි.

1940 – ඇමරිකානු ජාතික රැයෙල් මෙරිඩින් ටිග් (MIG) වෙල්ඩින් ක්‍රමය නිපදවන ලදි.

1948 – බටහිර ජර්මන් ජාතික ස්ටෙයිගර්වෝල්ඩ් අධිවෝල්ටීයතාව ඉලෙක්ට්‍රන් බීම් වෙල්ඩින් ක්‍රමය (Electron Beem welding) දියුණු කරන ලදි.

1951 – රුසියාවේ ඉලෙක්ට්‍රික් වෙල්ඩින් ආයතනය විස්ත් ඉලෙක්ට්‍රෝ ස්ලැග් (Electroslag Welding) ක්‍රමය වැඩි දියුණු කරන ලදි.

1953 – රුසියාවේ දියුණුවූවක් විශේෂ වෙල්ඩින් වයර් එකක් ප්‍රයෝජනයට ගනිමින් (Co2 Welding) ක්‍රමයෙන් ඉතා හොඳ වෙල්ඩිමක කරන ලදි.

1953 – රුසියන් ජාතික ඇන්.එප්.කසකෝව් විස්ත් Diffuslon Bonding වෙල්ඩින් ක්‍රමය සොයාගා දෙන ලදි.

1955 – ජපානයේ මහාචාර්ය සෙකුගුචි හා මසුමොටෝ විස්ත් CO2 – O2 චාප වෙල්ඩින් ක්‍රමය වැඩි දියුණු කරන ලදි.

1959 – රුසියාවේ ෆ්‍රිල් විස්ත් Friction Welding ක්‍රමය වැඩි දියුණු කරන ලදි.

1960 – ඇමරිකානු ජාතික මැයිමන් විස්ත් රුබි ලේසර් වැඩි දියුණු කරන ලදි.

1964 – ඇමරිකානු ජාතික පාමෙල් Co2 ලේසර් ක්‍රමය වැඩිදියුණු කරන ලදි. ඊට පසු මේ ක්‍රමය කාර්මික ක්ෂේත්‍රයේ භාවිතයට ගන්න ලදි.

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ගෑස් පැස්සුමේ මූලාරම්භය

Origin Of Flame Process

1774 -- ප්‍රංශ ජාතික ලැවොයිසියර් ඔක්සිජන් සමඟ යකඩ දහනය කරන ලදි.

1776 -- ඉංග්‍රීසි ජාතික එච්.කැවෙන්ඩිස් රසායනික විද්‍යාඥයා හයිඩ්‍රජන්වල ප්‍රභේද විස්තර කරන ලදි.

1836 -- ඉංග්‍රීසි ජාතික රසායනික විද්‍යාඥ එඩ්මන්ඩ් ඩේවි ඇසිටිලීන් වල ප්‍රභේද විස්තර කරන ලදි.

1840 -- ප්‍රංශ ජාතික හරේ කැල්සියම් කාබයිට් නිපදවන ලදි.

1841 -- ප්‍රංශ ජාතික බී.ඩී.රිච්මන්ඩ් එයාර් හයිඩ්‍රජන් ටෝච් එක නිපදවන ලදි.

1851 -- ප්‍රංශ ජාතික බවුස්ත්ගන්ගල්ට් වාතයෙන් ඔක්සිජන් නිපදවීම යොදා ගන්නා ලදි.

1860 -- ප්‍රංශ රසායනික විද්‍යාඥ බර්ත්ලොට් C2H2 සමීකරණය (ඇසිටිලීන් වායුව) ඉදිරිපත් කරන ලදි.

1862 -- ටෝලර් ඒසින් CaC2 (Calciam Corbide) සමීකරණය ඉදිරිපත් කරන ලදි.

1887 -- ප්‍රීතාන්‍ය ජාතික T. ජේරෙවර් ඔක්සිජන් යොදා ගන්නා ලදි.

1892 -- ජර්මන් ජාතික කාල් වෙයන්ලිත්ඩේ වාතය දියරබවට සාර්ථකව පරිවර්තනය කරන ලදි.

1896 -- ජර්මානු ඉංජිනේරු අර්නස්ට් ලිස් ලිසින් ලීන් වලින් යැදූ ටැංකියක් හයිඩ්‍රජන් ටෝච් එකක් භාවිත කරමින් පිලියකර කරන ලදි.

1897 -- ප්‍රංශ රසායනික බර්ත්ලොට් ඇසිටලීන් ජෙනරේටරයක් සහ ඇසටලීන් ටෝච් එකක් නිපදවන ලදි.

1901 -- බෙල්ජියන් ජාතික F. ගොඩ්ලෑන්ඩ් ඔක්සි-හයිඩ්‍රජන් ටෝච් එක සංවර්ධනය කරන ලදි.

1902 -- කාල් වොන් ලින්ඩේ වාතයෙන් ඔක්සිජන් ලබාගැනීම සඳහා උපකරණයක් නිපදවන ලදි.

1904 -- ගොඩ්ලන්ඩ් සහ ලිලි එක්සිජන් කම්න් ටෝච් එකක් නිර්මාණය කරන ලදි.

1905 -- ජර්මන් ජාතික ජ.එච්.ඔසිජන් කම්ත් ටෝච් එක නිර්මාණය කරන ලදි.

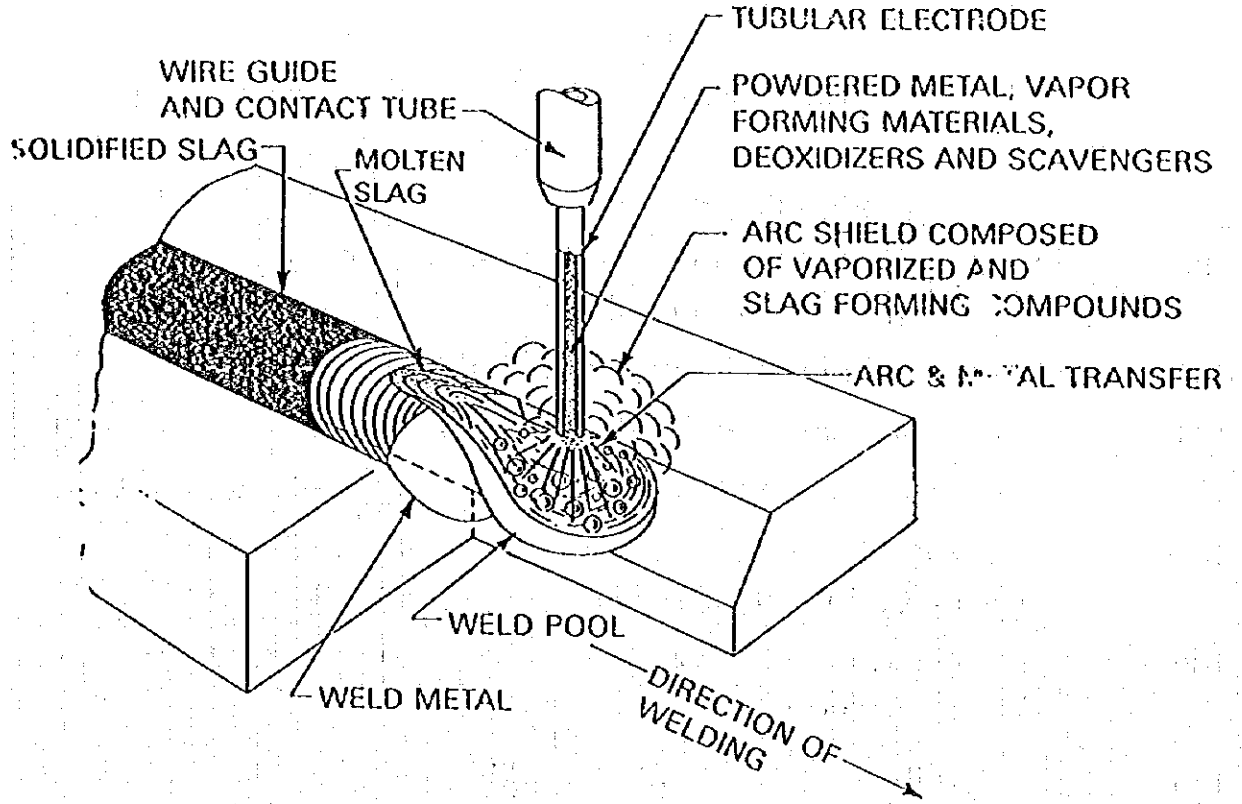

Figure 1.5—Self-Shielded Flux Cored Arc Welding

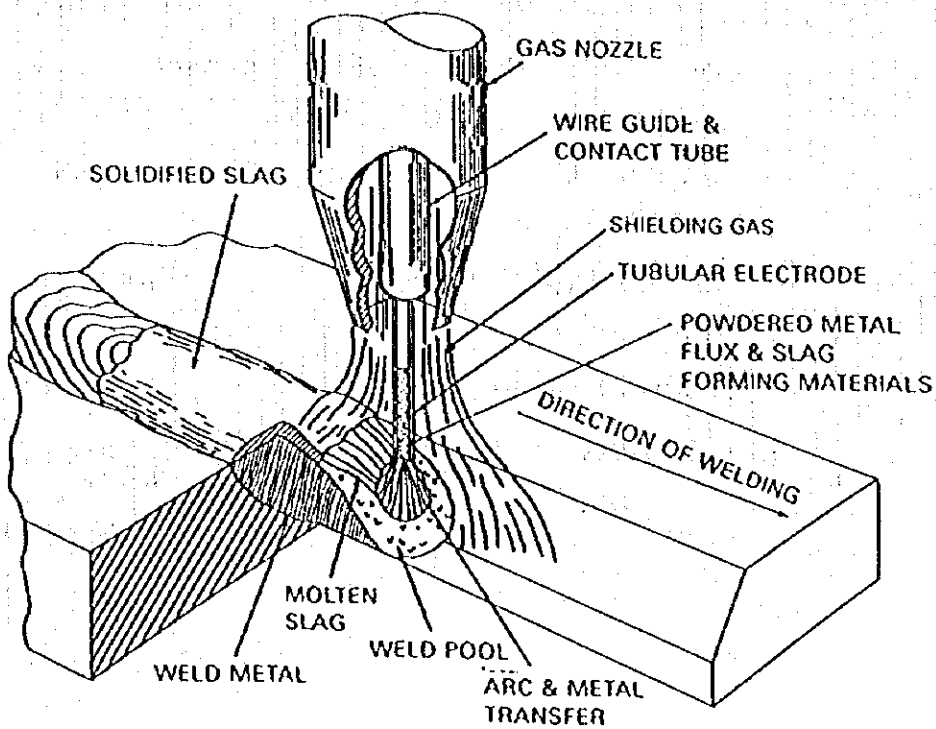

Figure 1.4—Gas Shielded Flux Cored Arc Welding

වෙල්ඩින් තාක්ෂණය

වෙල්ඩින් Welding Technology කිල්පයේදී පැස්වුම් සහ කැපුම් යටිමතයන් හඳුන්වා දෙන්නේ විවිධ ක්‍රියාවලියන්ගේ වෙනස් ලක්ෂණ, ඒවායේ ගුණාංග සහ සීමාවන් (Limitation) එක් එක් ක්‍රියාවලියන්ට යොදා ගැනීම හා සංසන්දනය කිරීම ඉතා වැදගත්ය. මෙහිදී ක්‍රියාකාරීත්වයේ තත්ත්ව ලක්ෂණ, ඉන්ජිනේරු යොදා ගැනීම අදාල පැස්වුම් කුසලතාව (pertinent welding skill) සහ පිරිවැය යටතා බැලීම උචිත ලෝහයන් සහ ලෝහවල ගුණකම අනුව යොදා ගැනීම කළ යුතුයි.

වාප පැස්වුම් ක්‍රියාවලිය ඉතා මූල වශයෙන් කර්මාන්ත ක්ෂේත්‍රයේ ප්‍රයෝජනයට ගනු ලැබේ. වායු පැස්වුම, (Oxy fuel gas welding) Resistance Welding, Flash welding, Brazing & Soldering සහ (මෘදු ලෝහයෙන් පැස්සීම) කිසර හාවිත කරන පැස්වුම් ක්‍රියාවලියන්ද Diffusion, Friction, Electron Beam සන්ඝනනය පැස්වුම් ක්‍රියාවලියන්ද සමත Adhesive bonding ක්‍රියාවලියද කර්මාන්ත ක්ෂේත්‍රයේ යොදා ගැනීමේ සාමාන්‍ය වැඩිය Ultrasonic සහ Explosive පැස්වුම් ක්‍රියාවලිය Thermal Spraying ක්‍රියාවලිය මෙන්ම ඉතාම අඩු ක්ෂේත්‍රවල හාවිත වේ.

වාප පැස්වුම

විද්‍යුත් වාපයෙන් ඇති කරන උෂ්ණත්වයෙන් ලෝහ උණු වී එකට සම්බන්ධ කිරීම විවිධ විද්‍යුත් වාප පැස්වුම් ක්‍රියාවලියෙන් සිදු කරන්නෙහි. මෙම ලෝහ සම්බන්ධයේදී උණු ලෝහ එකට එක කළ කිරීමෙන් [illegible] යෙන් වෙනත් පිරවුම් ලෝහයක් උපයෝගී කරගනිමින් ලෝහ සම්බන්ධ කරගනු ලැබේ. විද්‍යුත් වාපයේ පතර පාස්‍යත ලෝහය සහ ඉලෙක්ට්‍රෝඩයේ අග අතර අතවෙයි. මෙම ඉලෙක්ට්‍රෝඩ ක්ෂය වන කූරු හෝ වයර් වෙන්ද ක්ෂය නොවන කාබන් හෝ ටන්ග්ස්ටන් කූරු වෙන් [illegible]. පැස්වුම් ධාරාව මේ තුලින් ගමන් කරයි. මෙම ඉලෙක්ට්‍රෝඩය අතින් හෝ යාන්ත්‍රිකව මුට්ටුව දිගේ ගමන් කිරීම හෝ මුට්ටුව ගමන් කිරීම සිදුවේ. ක්ෂය නොවන ඉලෙක්ට්‍රෝඩයක් පාවිච්චි කිරීමේදී අවශ්‍ය අවස්ථාවල පිරවුම් කූරක් ප්‍රයෝජනයට ගනු ලැබේ. ක්ෂයවන ඉලෙක්ට්‍රෝඩය සැලසුම් කර ඇත්තේ ඇතිවන වාපයෙන් මුට්ටුව උණුවී ඒ මත ලෝහ තැන්පත් වන අයුරිනි. කෝරවලින් මුට්ටුවෙහි මැස්මක් ඇතිවනුයේ උණුවුම් පැස්වුම් කලාපය ඔක්සිකරණයෙන් ආරක්ෂාවීම සඳහාය.

1. <u>Shielded Metal Arc Welding</u>

මේ ඉතාමත් පැරණි පැස්වුම් ක්‍රියාවලියකි. පෙරත් ගතයේ සහ කිරරත් ගතයේ සමතරක් ලෝහ පාස්‍ය ඇතිම සඳහා හාවිත කරන වටිනා පැස්වුම් ක්‍රමයකි. මේ සඳහා ආලේපිත ඉලෙක්ට්‍රෝඩ හාවිත කරති. මෙද වයරයේ ආලේපිත ද්‍රව්‍ය ස්ලිකේට් වදාම සහ ලෝහ මිශ්‍රය.

(fluorides, carbonates, oxides, Metal alloys, Cellulose)

මේ ආලේපිතය වාපය නොවෙනස්ව තබා ගැනීමට Arc Stabilizer ගෑස් එකින් පැස්වුම් කලාපයේ වාතය ඉවත් කිරීමට Gasses to displace air සහ කොර පැස්වෙන් පැස්වුම් ලෝහය පරණ කිරීමට Metal & Slag to protect, Insulate weld Metal උපකාරී වේ. ඉලෙක්ට්‍රෝඩ ප්‍රමාණ මි.මී. 2 මි.මී.08 දක්වා ප්‍රමාණවලට ඇත. පරිමාණයේ පරිසරය 50 ඇම්. සිට 300 ඇම්. වේ. සාමාන්‍යයෙන් මතුපිට පැස්වුමේදී උණු ලෝහ තැන්පත් වන ප්‍රමාණය ඇයතට කි.ග්‍රෑ.1 සිට 08 කි.ග්‍රෑ.පමණ වේ.

M. PERERA
Senior Instructor
Technical College
Homagama.

CONTENTS

			Page No.
1.	Training Programme Structure and time distribution		0
	FOUNDATION COURSE		
2.	Course structure and time distribution - Foundation course for Mechanical Trades		02
	Module Code	**Name of Module**	
3.	450.01	Workshop safety	03
4.	450.02	Measuring	05
5.	450.03	Bench work (fitting)	18
6.	450.04	Metals and their Properties	27
7.	450.05	Sheet metal work	31
8.	450.06	Welding	35
9.	450.07	Forging	40
10.	450.08	Machine tools and equipment maintenance	49
	SPECIALIZED COURSE		
11.	Course structure and time distribution Gas and Arc welding		59
	Module Code	**Name of Module**	
12.	455.01	Oxy-acetylene welding of steel plate	60
13.	455.02	Oxy-acetylene welding of steel pipes, bars and angles	70
14.	455.03	Oxy-acetylene welding of non-ferrous metal	74
15.	455.04	Oxy-acetylene gas cutting	81
16.	455.05	Metal arc welding of steel plate	83
17.	455.06	Hard surfacing	96
18.	455.07	Metal arc welding of pipes, bars and angles	99
19.	455.08	Cast iron welding	103
20	455.09	Brazing and hard soldering	106
21.	455.10	Machine components	110
22.	455.11	Materials and costing	113
23.	455.12	Testing of welds	117

COLOMBO DOCKYARD (PTE) LIMITED.

TRAINING CENTRE PROSPECTUS

1991/92

COLOMBO DOCKYARD (PTE) LIMITED.
P. O. Box 906,
PORT OF COLOMBO 15
Telephone: 521461 - 5

A. (3) Welders Course

For whom : For manual arc-welders who have completed an apprenticeship course in welding.

Duration : 12 weeks

Contents : *Use of Hand Tools* - 2 weeks

Introduction to hand tools, workshop safety, use of measuring equipment, methods of joining metals, identification of common metals, practical exercises involving filing, sawing, chiselling, hammering, marking, punching, scribing, drilling, countersinking, threading, rivetting and grinding of basic tools.

Welding I - 3 weeks

Welding safety, arc-welding principles, arc welding equipment, types of electrodes, introduction to welding techniques, tacking, use of rutile and high efficiency electrodes.

Practicals - Fillet weld exercises in all positions.

Welding II - 3 weeks

Design of weld joints, controlling distrotion, classification of welding electrodes and polarity of welding current.

Practicals- Butt joint exercises with sealing runs in all positions.

Welding III - 3 weeks

Welding faults, quality tests (destructive and non-destructive) use of basic and special electrodes.

Practicals- Butt weld full penetration exercises in all positions.

Flame cutting - 1 week

Flame cutting principles and techniques. Use of flame cutting equipment, central gas supply systems, cutting faults and safety measures, flames cutting of alloy steels, gas gouging, Arc-air gouging and the use of semi-automatic flame cutting equipment.

Total No. of trainees per batch : 10

Media of Instruction : English & Sinhala

A. (4) **Special Training Programmes in Welding & Cutting**

Special training programmes could be arranged in our welding section in the following areas.

Welding processes : Tig welding
Mig welding
Gas welding

Cutting Processes : Gas cutting
Gas gouging
Arc gouging
Arc air gouging