

CWI—注册焊接检验工程师

第一单元

焊接检验及资格认证

概论

就当今世界而言，人们对质量的要求与日俱增，而焊接质量是整个质量活动的一个重要组成部分。人们对产品质量的关心主要由以下几个因素引起，这些因素包括：经济因素、安全因素、政府法律、法规因素、全球竞争因素以及减少保守设计的因素。尽管焊接检验师不仅限于对获得焊接质量负责，在任何成功的焊接质量控制活动中都扮演着一更为重要的角色。事实上，对一个高质量的焊接产品而言，许多人都参与了其形成过程中的许多活动。而焊接检验师是那些“前线”人员中的一员，他必须对所有要求的制作过程进行检查并证实每一活动是否按要求正确实现。

为了有效地开展焊接检验工作，焊接检验师必须具有较宽的知识面和检验技巧。因为焊接检验并不只是简单地看看焊缝。因此，本教材是专门为那些新手和有经验的焊接检验师设计的一本基础教材以备其急需时参考。但这并不意味着当一个检验师为某一专门公司工作时，他将会用到本教材所提供的所有信息，也不是指本教材能够根据每一个检验师的实际情况提供其所需的全部信息。本书的主题选择是基于满足检验师从事其通常焊接检验时所需的基本知识。

重要的一点是您必须认识到一个有效的焊接检验所包含的内容要远远多于只检查完工的焊缝。AWS QC1 (美国焊接协会焊接检验师资质认可标准) 第 4 节给出了焊接检验师的多种功能（参见图 1.1）。您应该了解并熟悉这些针对焊接检验师而言的各种职责，因为焊接检验是一个连续进行的过程。一个成功的质量控制活动在首次焊接起弧之前就已经开始。因此，焊接检验师必须熟悉和其制作过程相关的多方面的知识。在焊接检验开始以前，检验师应首先对相关的图纸和技术规范进行检查以确定部件的结构、特定焊缝的质量要求以及所要求的检验等级等内容。这种审阅将会向您提供有关制作过程是否包含有特殊工序的信息。焊接开始以后，焊接检验师可以对各种制作过程进行观察以确保这些过程或工艺步骤均按要求实施。如果所有的这些子过程均按要求并令人满意地完成，那么最终的检验只不过是对于这些成功的操作过程进行简单的确认。

本课程的另一好处是它经过专门设计，并为那些希望顺利通过美国焊接协会(AWS)注册焊接检验师(CWI)资格考试的检验人员提供了所需的信息。下面所列的十个章节中所给出的内容包括了该考试的原始资料。焊接检验师至少必须对这些章节中所包括的知识要点有所了解。本课程的主要特点是对这些知识进行简单的复习和回顾，尽管授课时可能会对某一新的专题进行一些讨论。

单元 1	焊接检验及资格认证
单元 2	焊接检验师安全注意事项
单元 3	金属连接和切割技术
单元 4	焊接接头的几何形状及焊接符号
单元 5	焊接检验及资格认可的有关资料
单元 6	金属的特性及破坏性试验
单元 7	焊接检验中的公制/英制单位制转换
单元 8	焊接金相学
单元 9	焊缝及母材缺陷
单元 10	目视及其它无损检验方法及其符号

此外,本教材所选择的参考资料也属于所要求的“知识要点”。这些资料包括:

- ♣ 一个可供选择的标准 (AWS D1.1, API 1104, 等)
- 焊接检验 (WI-80) ♣
- AWS A1.1, ♣ 焊接工程中实用公制单位使用指南
- AWS A2.4, 焊接、钎焊和无损探伤用标准符号 ♣
- ♣ AWS A3.0, 标准焊接术语及其定义

AWS B1.10,	焊缝无损检验指南♣
♣ AWS B1.11,	焊缝外观检验指南
ANSI Z49.1,	♣ 焊接、切割及其相关工序中的安全注意事项
AWS QC1,	AWS♣ 焊接检验师资格认可标准

焊接检验师

在我们的讨论切换到有关技术专题之前，让我们先谈一下作为个人的焊接检验师，以及根据其职位而应负的主要责任。焊接检验师是一个负责按照适用的规程或规范对焊缝质量进行评价和定级的人。依据其服务对象的不同，焊接检验师在执行焊接检验任务时会遇到许多不同的情况。因此，根据被检部件和结构的复杂程度不同，检验师所采用的检验规范也会有所区别。

检验师可包括破坏性试验人员、无损检验人员（NDE）、法律法规检验人员、军队或政府检验人员、业主代表、车间及其他检验人员等。当这些检验人员从事焊缝检验工作时，他们都可以把自己看成为“焊接检验师”。焊接检验师的工作职能可以分成以下三个大类：

- ♣ 监督检验人员
- 专业检验人员♣
- 监督和专业检验人员的结合♣

监督人员可以是一个或多个人员，对这些人员工作技能的要求将随被检对象的数量和类型的不同而发生相应的变化。对经济性和技术性的要求决定了检验人员的分类及其在不同领域内所发挥的作用。

专业人员是指在检验过程中从事某些特定检验工作的人员。专业检验人员可能、也可能不独立于监督人员开展检验工作。无损检验人员（NDE）就属于这类检验人员。这类检验人员在焊接检验过程中担负特定范围的职责。

我们通常所见到的检验师都是以监督和检验的双重身份工作的。这类检验人员既要对每一制造过程中的焊缝质量作出总体评价，而且在必要时对焊缝进行无损检验。制作商可能会根据需要雇佣几个监督类型的焊接检验人员并要求其对所负责区域的焊缝进行检验。因为在这种情况下，检验责任被分成了好几个部分，检验师此时就必须彼此合作，相互依赖以完成指定的检验任务。

在本课程的教学中，我们所讲的焊接检验人员是指通常概念上的检验师，而不是根据雇主使用检验师的情况对其进行分类。因此，在本课程的教学中，要想根据每一个人的具体情况展开讨论是不现实的。

为了强调不同领域内对检验工作要求的区别，让我们先来看以下需要用到焊接检验师的一些工业领域的情况。我们通常会看到在建筑、桥梁和结构工程中进行焊接检验的情况。能源工业应用的设备包括发电设备、压力容器、管道以及别的压力传输设备。在化工设备（通常为含有压力的加工装置和设备）的制作过程中也要大量地用到焊接。交通运输业要求确保焊缝质量以确保运输的安全，这些行业的设备包括：飞机、汽车、轮船、铁路运输装置及其维修设备。最后，还有我们日常生活中所使用的消费品，通常也对焊缝质量有其特定的要求。考虑到所列设备的千变万化，针对各种各样的情况显然要采取不同类型和级别的检验。

焊接检验师应具备的主要素质

美国焊接学会成立于 1919 年，为非赢利机构，是国际知名的焊接科学技术及其应用的领导者。

焊接检验师认证 Certified Welding Inspector

AWS 焊接检验师认证已被美国乃至世界各主要工业国家广泛接受，是专业从事焊接质量控制人员的专业资格认证。越来越多的跨国公司依赖于 AWS 的第三方认证，以保证焊接质量达到国际认可的最高水准。

焊接检验师资格考试包括三个部分：A. 焊接基础知识；B. 焊接检验操作；C. 焊接标准。在通过全部三个部分考试并合格后，AWS 将颁发“焊接检验师”资格证书。

焊接制造质量体系认证 Certified Welding Fabricator

愈来愈多的客户要求焊接制造商建立并有效贯彻焊接过程质量保证体系。AWS 焊接过程质量体系规范得到了广大客户和制造商的认可和采用。以此为依据对焊接制造商质量保证体系进行审核和认证将获得美国及西方主要国家的认

可。通过有效贯彻 AWS 焊接质量保证体系规范，焊接制造商具备了满足客户技术和质量要求的能力，提高了客户对其质量和交货能力的信心，为企业在市场竞争提供了保证条件。

文件化的操作程序和记录保证焊接材料、过程的可追溯各种类型、规模的企业均能从 AWS 质量保证体系倡导的持续追溯性及质量的一致性。

各种类型、规模的企业均能从 AWS 质量保证体系倡导的持续改进过程中受益。真正实现管理创造效益。

焊工资格认证 Welder Certification

焊工资格认证是对焊工操作技能的认证。这种认证不设置任何先决条件，也可向焊工个人提供资格证书。

AWS 焊工资格认证为企业、雇主和焊工个人提供了技能认定体系，减少了资格重复认定，增强了企业和客户在焊接人员资格方面的互相了解和认可。

焊工在获得认证后，每 6 个月向考试机构提交焊接工作记录，以证明其认证的技能不断得到维持。焊工资格将随每 6 个月操作记录证明，自动得到维持。

AWS 的 CWI 焊接检验师的考试，当然全是英文的啦，不过也有例外的，目前国内好像只有上海的“摩迪国际”有这个权利。你是去上海还是美国考？

建议查看一下 AWS D1.1、AWS D1.6、AWS D1.7 的相关焊接条款，质量要求！

还有 ISO 对焊接方面的质量要求！

当然了，NDT 方面的内容和焊接的相关基础知识和对 AWS 规范的熟悉应用也是你要做的工作！

注：上面这些都是从附件里贴下来的。为方便大家了解 CWI 培训考试。这都是 Moody 公司培训的大概内容。

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MI is the only authorised group of AWS CWI Certification program in China.

摩迪国际是美国焊接学会认证的焊接检验师认证程序中国地区的唯一授权机构

The Schedule Of Training And Examinations

(培训及考试计划)

􀁺 Detail training & exam schedules can be got from Moody International's web.The web will be updated monthly.

(<http://training.moodyint.com/schedule.cfm?id=30> for training ,
<http://training.moodyint.com/schedule.cfm?id=34> for exam).

CWI 培训及考试计划请登陆摩迪国际相关网站。摩迪公司将定时更新网站信息。

(培 训 计 划 <http://training.moodyint.com/schedule.cfm?id=30> , 考 试 计 划
<http://training.moodyint.com/schedule.cfm?id=34>)

􀁺 The exact date and location of each training and exam period will be advised 1 month in advance.

准确的考试培训日期及地点将提前 1 个月通知。

􀁺 Each training and exam location will require at least 10 candidates. If at one training and exam period, there is not enough candidates, this training and exam period will be rescheduled to suit. All candidates will be kept fully informed. 每次培训及考试的最少人数为 10 人。若少于此人数，那么当期的培训及考试将重新排期。我们会及时以通知参加人员。

Registration Information (报名信息)

1. By Phone: call 86-21-50273066, Monday through Friday, 9:00am – 5:30 pm.

电话：86-21-50273066，星期一至星期五 9:00am – 5:30pm

2. By Fax: complete the training or exam application form and fax to 86-21-50273503.

传真：86-21-50273501，完整的申请表

3. By Mail: send to Moody International: No. 5, 912 Bibo Road, Zhangjiang High-tech Zone, Shanghai 201203, China.(Contact Person: Flora Zhang [email]florazhang@moody.com.cn[/email])

邮寄：摩迪公司，上海浦东张江高科技园区碧波路 912 弄 5 号楼。邮编：201203(联系人:张春丽)

The Price Of Training & Examination (培训考试费用)

Training & Exam in Chinese (中文培训及考试)

Training Only (只参加培训)

RMB 5,215.00

Exam Only (只参加考试)

RMB 6,045.00

Both Training & Exam (同时参加培训及考试)

RMB 9,800.00

Purchasing <Structural Welding Code-Steel:AWS D1.1 2002(Chinese)>

购买<钢结构焊接规范：AWS D1.1 2002 (中文版)

RMB 120.00

Training & Exam in English (英文培训及考试)

Training Only (只参加培训)

N/A

Exam Only (只参加考试)

N/A

Both Training & Exam (同时参加培训及考试)

RMB 14,580.00 (USD 1800.00)

Moody account : 摩迪银行帐号:

Moody Shanghai Consulting Ltd. 摩迪(上海)咨询有限公司

Bank of China, Shanghai Branch, 23 Zhongshan Dong 1 Road 中国银行上海分行, 中山东一路 23 号

Shanghai 200002. 上海(邮编: 200002)

044036-8001-06595518091001 044036-8001-06595518091001

Swift Code: BKCH CN BJ 300 Swift Code: BKCH CN BJ 300

* Payment must be arranged at least 1 week before the training date.

请务必至少在培训开始前 1 周将款项汇入。

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Documents That Should Be Submitted (所需提交资料)

􀁺 A completed AWS CWI Exam Application Form providing details of your inspection experience and with company stamp. (Including Visual Acuity Record Form)

包含您详细检验经历且单位盖章的<AWS 焊接检验师考试申请表>(包括视力检查表)

􀁺 A completed Moody China Registration Form 一份填写完整的<摩迪中国报名表>

􀁺 1 copies of ID Card 壹份身份证复印件

􀁺 1 copies of deploma (translated into english overleaf)----this is required only for those who ask to substitute education for working experience (post high school graduate but has less than 5 years work experience in qualifying work perience).

一份毕业证书复印件(请在背面翻译成英文)----此要求仅限于需用学历充抵工作经历者(高中以上学历,但相关工作经历不足 5 年者).

* AWS CWI Exam Application Form and Moody China Registration Form must be scanned and emailed to Moody China at least 1 week before the first training day.

请务必在培训开始前 1 周将填写完整的<AWS 焊接检验师考试申请表><摩迪中国报名表>扫描并电邮至摩迪中国。

* All the above mentioned original documents must be submitted to Moody China at the first training day.

上述所有资料原件必须在培训开始当天提交至摩迪中国。

Note: Please bring with I.D. Card, 2 pencils (Type:2B) and a calculator when attending the CWI exam.

参加 CWI 考试时, 请携带签证原件, 2 支铅笔(2B 型)及 1 个计算器.

Note:

<AWS CWI Application Form> ,<Moody China Registration Form> and other related documents can be downloaded from Moody China's Website([url]www.moody.com.cn[/url])

注: <AWS 焊接检验师考试申请表> 及 <摩迪中国报名表> 等相关资料均可在摩迪中国网页 ([url]www.moody.com.cn[/url]) 上下载

1. 美国焊接学会(AWS) / 摩迪国际焊接检验技术培训及焊接检验师认证 (CWI) 考试

2. 摩迪中国<CWI 培训及考试>报名表

3. Application for Training & CWI Examination

4. CWI 相关信息(补考-升级-续证-9 年换证).pdf

可以到[url]http://www.moody.com.cn/chinese_ver/n3_xzzq/index.php[/url]下载

CWI

Exercise Questions

試題 A

1. (C) Which of the following is not considered to be essential knowledge for a welding inspector ? (下列哪項不是焊接檢驗員的主要知識？)
 - a. nondestructive testing (無損檢測)
 - b. welding symbols (焊接符號)
 - c. welding design (焊接設計)
 - d. welding processes (焊接方法)
 - e. destructive testing (破壞性試驗)

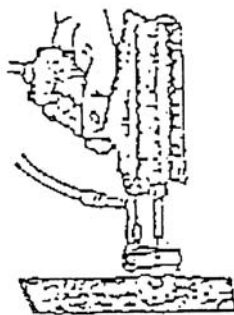
2. (D) Inclusions in a weld will appear on a radiograph as
(焊縫夾雜和夾渣在射線片上顯示為)
 - a. a dark spot (暗點)
 - b. a light spot (亮點)
 - c. a generalized gray area of varying contrast (不明顯的灰色區域)
 - d. either a dark or light spot or area depending on the relative absorption ration of the part material and the inclusion material (按夾雜物不同的相對射線吸收率顯示為亮點或暗點)
 - e. none of the above (以上均不對)

3. (C) Backing strips or bars should be removed from all welds : (襯墊應從所有焊縫上去除)
 - a. Always (總是)
 - b. Never (從不)
 - c. Optional (可選擇)

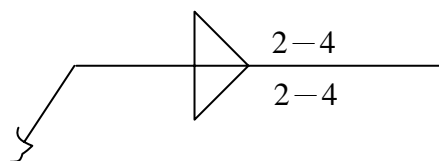
4. (E) Prior to starting the job assignment , the welding inspector should determine :
(在開始指定的工作前，焊接檢驗員應先確定：)
 - a. what code , standard, or specification applies (適用的法規，標準和規程)
 - b. when inspections should be conducted (何時開始檢驗)
 - c. what additional tests (inspections) are needed (什麼是附加的試驗和檢驗)
 - d. where records are maintained (記錄保存在何處)
 - e. all of the above (以上全對)

5. (E) The required spot weld size can be shown as : (點焊尺寸可表示為)
 - a. a dimension to the right of the symbol (焊接符號右側的尺寸)
 - b. a dimension of the required nugget diameter (熔核尺寸)
 - c. a value for the required shear strength (要求的剪切強度值)
 - d. a and b above (上述 a 和 b)
 - e. b and c above (上述 b 和 c)

6. (B) For the welding inspector, what are the most important means of gaining the cooperation and respect of fellow coworkers : (作為焊接檢驗員，什麼是獲得同事合作和尊重的最主要方法：)
- ability to be trained (學習能力)
 - professional attitude (專業的態度)
 - ability to complete and maintain inspection records (完成和保持檢驗記錄的能力)
 - good physical condition (良好的身體狀況)
 - ability to interpret drawings and specifications (解釋圖紙和標準的能力)
7. (D) Groove welds make without backup strip, with complete penetration must have : (無襯墊全焊透坡口焊縫必須：)
- The root of joint completely filled with weld metal (焊縫根部填滿焊縫金屬)
 - Root of first pass removed to sound metal before welding second side (在焊接另一面前，去除根部第一道焊縫，直至露出完好的焊縫金屬)
 - Use new electrode at start of weld (開始焊接時用新焊條施焊)
 - a or b above (以上 a 和 b)

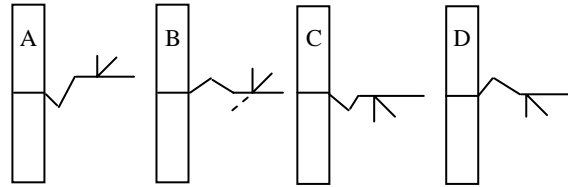


8. (D) The diagram above shows : (以上圖表表示)
- Shielded metal arc welding (手工電弧焊)
 - Plasma arc welding (等離子弧焊)
 - Submerged arc welding (埋弧焊)
 - Stud welding (螺柱焊)
 - Electrogas welding (電渣焊)
9. (B) The symbol below describes what type of weld ? (以下符號表示那種焊縫？)



- staggered intermittent fillet weld (交叉間斷角焊縫)

- b. chain intermittent fillet weld (對稱間斷焊縫)
- c. segmentad fillet weld (分段角焊縫)
- d. intermittent fillet weld (間斷角焊縫)
- e. none of the above (以上均不對)



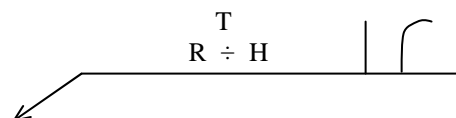
10. (C) Which of the welding symbols above correctly represents the welded joint shown below ?
(上面的焊接符號哪個能正確代表下面的焊接接頭)

- 1) A
- 2) B
- 3) C
- 4) D
- 5) None of these (以上均不對)



11. (B) In E7018 electrode the E designates : (E7081 焊條中的 E 表示)
- a. engineered (工程的)
 - b. electrode (焊條)
 - c. electricity (電)

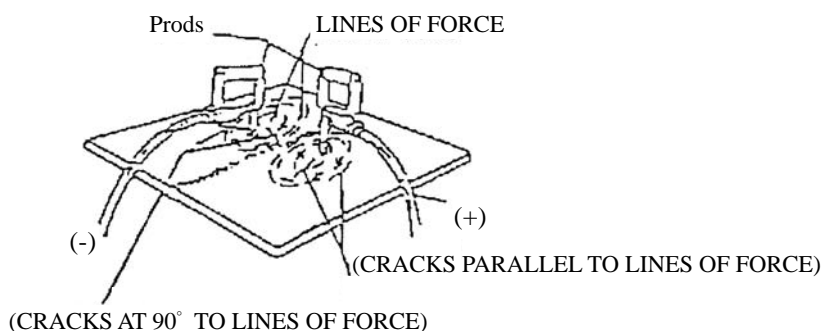
12. (A) In the symbol below, the “T” dimension describes : (下面符號中的“T”表示 :)



- a. weld size (焊縫尺寸)
- b. flange radius (翻邊半徑)
- c. flange length (翻邊尺寸)
- d. depth of penetration (焊透深度)
- e. none of the above (以上均不對)

13. (E) In reference to the below drawing, a magnetic field as shown will detect which of the following defects ? (下圖所示的磁場用於探查何種缺陷)

- A 、 Cracks parallel to lines of force (平行於磁力線的裂紋)
- B 、 Cracks at 90° to lines of force (垂直於磁力線的裂紋)
- C 、 Transverse cracks (橫向裂紋)
- D 、 Longitudinal cracks (縱向裂紋)
- E 、 B and C above (上述 B 和 C)



14. (A) What does the fourth digit (8) of an E7018 electrode indicate :

(E7018 焊條中的第 4 位數字(8)表示 :)

- A 、 The polarity and the type of coating (藥皮的極性)
- B 、 The strength of the weld material (焊接材料的強度)
- C 、 The type of material used in the electrode (焊條的材料類型)

15. (A) The third digit of an E6010 electrode indicates : (E6010 焊條的第 3 位數字表示)

- A 、 The weld may be made in the vertical position (可用於立焊位置)
- B 、 Maybe made in the overhead position (可用於仰焊)
- C 、 Maybe made in the horizontal position (可用於橫焊)
- D 、 Maybe made in all positions (可用於全位置焊)

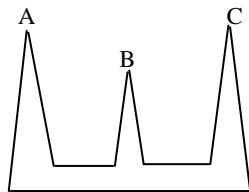
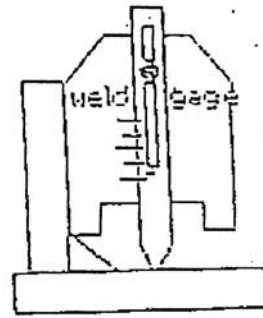
16. (C) Which of the following electrodes have low hydrogen coating ?

(下述哪中焊條是鹼性藥皮)

- A 、 E7024
- B 、 E6010
- C 、 E7016
- D 、 E6011

17. (C) The fillet weld gauge is measuring the : (焊規用於測量)

- A 、 Overlap (焊瘤)
- B 、 Excessive convexity (焊縫凸起)
- C 、 Convex fillet weld size (凸起角焊縫尺寸)
- D 、 Insufficient throat (焊喉不夠)
- E 、 None of the above (以上均不對)



18. (C) “B” above refers to which of the following ? (“B”表示 :)

- A 、 back reflection (底波)
- B 、 front surface (前表面)
- C 、 defect (缺陷)
- D 、 shear wave (剪切波)
- E 、 none of the above (以上均不對)

19. (A) “C” above refers to which of the following ? (“C”表示)

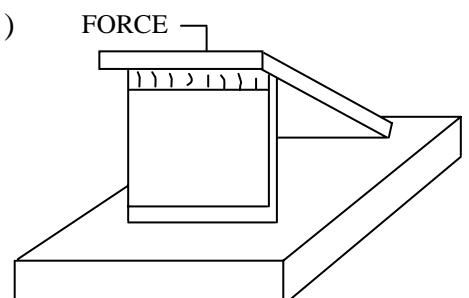
- A 、 back reflection (底波)
- B 、 front surface (前表面)
- C 、 defect (缺陷)
- D 、 shear wave (剪切波)
- E 、 none of the above (以上均不對)



20. (B) “A” above refers to which of the following ? (“A”表示)

- A 、 Back reflection (底波)
- B 、 Initial pulse (前表面)
- C 、 Defect (缺陷)
- D 、 Shear wave (剪切波)
- E 、 None of the above (以上均不對)

21. (D) What type of qualification test is this ? (這是什麼試驗 ?)

- A 、 Tension test (拉伸試驗)
- B 、 Root bend test (根部彎曲試驗)
- C 、 Side bend test (側彎試驗)
- D 、 Fillet weld break test (角焊縫斷裂試驗)
- E 、 Compression test (壓斷試驗)

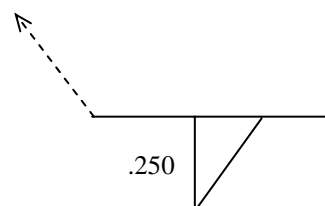


22. (C) This symbol “” was changed to the following “” in 1968. What does this symbol represent ? (該符號在 1968 年更改為下文的含義，哪一個是對的？)

- A 、 weld all around (周邊全焊)
- B 、 backing weld (封底焊)
- C 、 field weld (現場焊)
- D 、 melt thru (全焊透)
- E 、 convex contour (凸起輪廓)

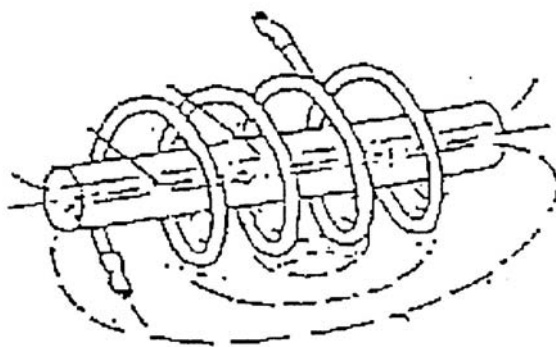
23. (A) What is the leg length of this fillet weld ? (該角焊縫的焊腳高是多少)

- A 、 1/4
- B 、 3/16
- C 、 1/8
- D 、 5/16
- E 、 7/8



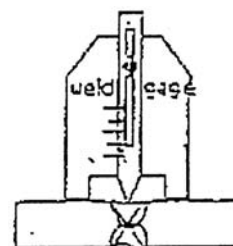
24. (D) In reference to the below drawing , a magnetic field as shown will detect which of the following defects ? (參照下圖，磁場將用於探測下列那種缺陷：)

- A 、 Longitudinal crack (縱向裂紋)
- B 、 Transverse crack (橫向裂紋)
- C 、 Crack at 45° (45 度裂紋)
- D 、 B and C above (以上 B 和 C)
- E 、 None of the above (以上均不對)



25. (E) The weld gage on the right is measuring the : (右側焊規正在測量)

- A 、 Excessive convexity (焊縫過高)
- B 、 Insufficient throat (焊喉偏低)
- C 、 Excessive undercut (過度咬邊)
- D 、 Overlap (焊瘤)
- E 、 None of the above (以上均不對)



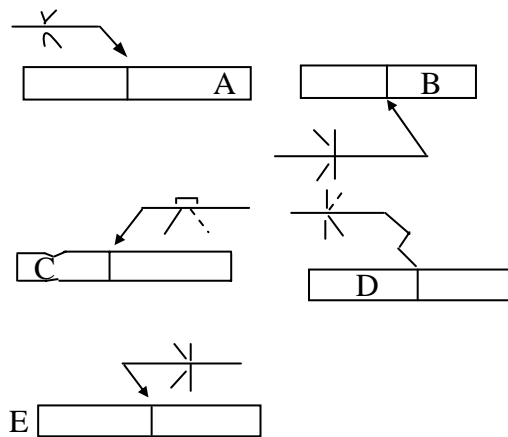
26. (D) Consistent weld quality& repeatability depend heavily upon ? (穩定的焊接質量和再現性主要依賴於)

- A 、 Qualified procedures and qualified welders (評定合格的焊接工藝和焊工)

- B、Skill in selection the electrode oven (熟練選擇焊條烘箱)
- C、Pride of workmanship (優秀的技藝)
- D、All of the above (以上都對)

27. (C) In reference to the above drawing , letter “A” refers to which of the following weld preparations ? (按下圖，字母“A”表示下述那種焊接坡口)

- A、Welded from one side only (單面焊焊縫)
- B、Is a partial penetration weld (部分焊透焊縫)
- C、Beveled on both sides (雙面坡口)
- D、Broken arrow for ease of draftsman (繪圖員的簡易折線箭頭)
- E、Fillet weld on both sides , without bevel (雙面無坡口角焊縫)



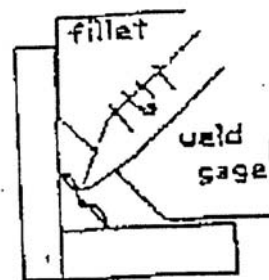
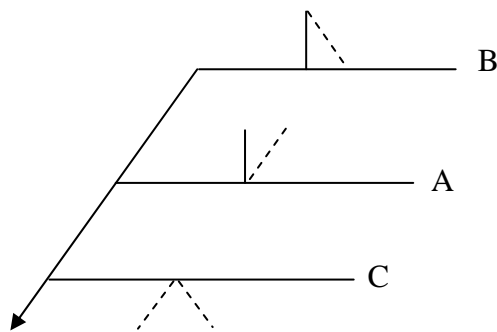
28. (E) In reference to the above drawing , letter “D” refers to which of the following weld preparations ? (按上圖，字母“D”表示下述那種焊接坡口)

- A、Has a full penetration J bevel without additional fillet weld. (“J”坡口全焊透焊縫，無附加角焊縫)
- B、Has melt thru on arrow side (箭頭測全焊透)
- C、Bevel vertical member (直立件開坡口)
- D、Is a partial penetration J bevel (“J”坡口部分焊透)
- E、Double bevel groove weld on both sides (雙面坡口雙面焊)

29. (D) In reference to the above drawings , letter “C” refers to which of the following weld preparations ? (按上圖，字母“C”表示下述那種焊接坡口)

- A、Is back gouged with bead on other dike and with additional fillet weld (另一側背面清根並加角焊縫)
- B、Has fillet weld on one side only (僅在另一側加角焊縫)
- C、Is a single bevel groove weld with no additional fillet weld (單面坡口焊無附加角焊縫)
- D、Single vee groove weld with backing strip (單面“V”坡口焊帶襯墊)
- E、A and B above (以上 A 和 B)

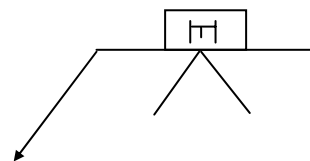
30. (E) In reference to the above drawings, letter “E” refers to which of the following weld preparations ? (按上圖，字母“E”表示下述那種焊接坡口)
- A 、 Weld ha melt thru symbols (全焊透焊縫)
 - B 、 Broken arrows points to member that is to be beveled (折線箭頭指向開坡口的焊件)
 - C 、 Has a single bevel groove and a double fillet weld (單面坡口雙面角焊縫)
 - D 、 Symbol shows backing strap and strip (表示襯墊)
 - E 、 None of the above (以上均不對)
31. (A) The fillet gage on the right is measuring the : (右側焊規正在測量)
- A 、 Insufficient throat (焊喉尺寸不夠)
 - B 、 Weld size (焊縫尺寸)
 - C 、 Overlap (焊瘤)
 - D 、 Inadequate penetration (未焊透)
 - E 、 A and B above (以上 A 和 B)



32. (C) With reference to the above symbol drawing , the letter “A” represents which welding operation ? (上圖焊接符號中字母“A”表示何種焊接操作？)
- 甲 、 First (先施焊)
 - 乙 、 Third (第三步施焊)
 - 丙 、 Second (第二步施焊)
 - 丁 、 None of the above (以上都不對)
33. (D) With reference to the above symbol drawing, the letter “C” represents which welding operation ? (上圖焊接符號中字母“C”表示何種焊接操作？)
- 甲 、 Third (第三步施焊)
 - 乙 、 Second weld symbol (第二步施焊)
 - 丙 、 First (第一步施焊)
 - 丁 、 Answers a & b (以上 a 和 b.)

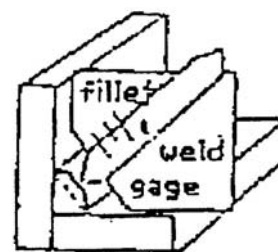
34. (B) What does this welding symbol designate ? (該焊接符號指出什麼)

- 甲、Plug weld (塞焊縫)
- 乙、Weld with backing material (帶襯墊的焊接縫)
- 丙、Slot weld (縫焊焊縫)
- 丁、Depth of fill (填充深度)
- 戊、Spacer (嵌條)



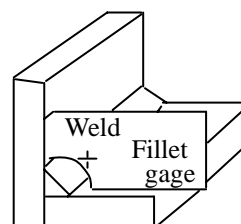
35. (D) The fillet gage on the right is measuring the : (右側焊規正在測量 :)

- 甲、Throat (焊喉)
- 乙、Toe (焊趾)
- 丙、weld size (焊縫尺寸)
- 丁、excessive convexity (過度凸出)
- 戊、overlap (焊瘤)



36. (B) The fillet gage on the right is measuring the : (右側焊規正在測量 :)

- 甲、Inadequate penetration (未焊透)
- 乙、Insufficient leg (焊腳尺寸不夠)
- 丙、Throat (焊喉)
- 丁、Undercut (咬邊)
- 戊、Insufficient throat (焊喉尺寸不夠)



37. (C) Extension bars are used to extend the weld past the parts joined in which type of weld ?
(延長杆用於延長何種焊縫越過焊件?)

- 甲、Fillet joint (填角焊縫)
- 乙、Slot (縫焊焊縫)
- 丙、Groove (坡口焊縫)
- 丁、Plug (塞焊焊縫)

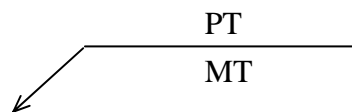
38. (B) All of the following are important ethical requirements for the welding inspector except :
(以下哪項不是對檢驗員的主要道德要求)

- 甲、Integrity (誠實)
- 乙、Volunteering public statements for personal exposure (對個人出場做自願公開聲明)
- 丙、Responsibility to the public (對公眾負責)
- 丁、Making accurate and truthful public statements when asked (當有要求時，做準確和真實的公開聲明)
- 戊、None of the above (以上都不對)

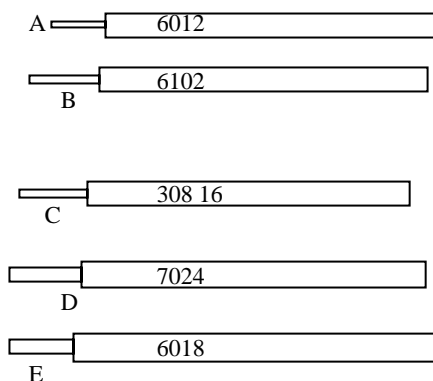
39. (B) The width of the cut made by the oxygen stream of an oxyacetylene cutting torch is called the : (氧-乙炔割炬切割時由氧流造成的切割寬度稱為)

- 甲、 Drag (拖弋)
- 乙、 Kerf (切口)
- 丙、 Cutting face (切割面)
- 丁、 Bevel (坡口)
- 戊、 None of the above (以上都不對)

40. (A) What nondestructive test method is to be applied to the arrow side ? (何種無損檢測方法適用於箭頭側?)



- 甲、 magnetic particle testing (磁粉檢驗)
- 乙、 eddy current testing (渦流檢驗)
- 丙、 radiographic testing (射線檢驗)
- 丁、 penetrant testing (滲透檢驗)
- 戊、 none of the above (以上都不對)



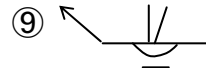
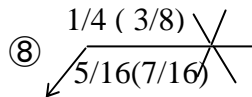
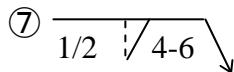
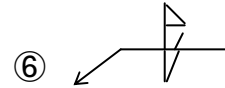
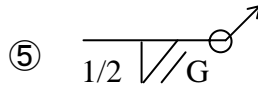
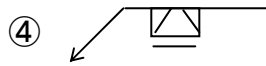
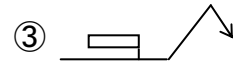
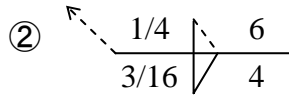
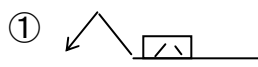
41. (C) For austenitic stainless steel welding which of the above electrodes would be preferred ? (上面不銹鋼焊接應選何種焊條?)

- 甲、
- 乙、
- 丙、
- 丁、
- 戊、

42. (D) Which of the above electrodes is low penetration with an iron powder coating (上面哪種焊條是鐵粉淺熔深焊條)

- 1.
- 2.

- 3.
- 4.
- 5.



43. (E) A groove weld with melt through is shown at number (上面哪種是全焊透坡口焊縫)

- 甲、2
- 乙、3
- 丙、6
- 丁、7
- 戊、none of the above (都不對)

44. (A) A plug weld not completely filled is shown at number (幾號表示不填滿的塞焊縫?)

- A、1
- B、3
- C、5
- D、7
- E、9

45. (E) A weld with back or backing is shown at number (幾號表示帶墊的焊縫?)

- A、1
- B、3
- C、5
- D、7
- E、9

46. (D) an intermittent fillet weld is shown at number (幾號表示間斷角焊縫?)

- A、1
- B、3
- C、5
- D、7
- E、9

53. (A) Equal thicknesses of steel, cast iron, aluminum, lead and copper are radiographed using the same exposure conditions. Which material will result in the lightest radiograph ? (相同厚度的鋼，鑄鐵，鋁，鉛和銅再相同的曝光條件下，何種材料的射線片最淡？)
- A、lead (鉛) D、copper (銅)
B、steel (鋼) E、cast iron (鑄鐵)
C、aluminum (鋁)
54. (A) Which type of defect is detectable by the liquid penetrant method ? ()
- A、Surface crack (表面裂紋) D、All the above (上述全對)
B、Internal inclusion (內部夾雜) E、None of the above (上述都不對)
C、Sub-surface crack (近表面裂紋)
55. (D) Capillary action plays a role in which NDT method ? (毛細作用在何種無損檢測中起作用？)
- A、ET D、PT
B、UT E、MT
C、RT
56. (B) The “Flux Coated” electrode is used in which of the following processes : (藥芯焊絲被用於何種焊接方法？)
- A、Heliarc (氬弧焊)
B、Innershield (內保護焊)
C、Metal inert gas (熔化極惰性氣體保護焊)
D、Shielded metal arc (手弧焊)
57. (B) The size of convex fillet welds are measured : (凸出的角焊縫的尺寸測量應：)
- A、Across the face (橫跨焊縫面)
B、Along the shortest leg (沿最短的焊腳)
C、Along the longest leg (沿最長的焊腳)
D、None of these methods (以上都不對)
58. (E) Which one of the following is not true of visual inspection? (對於目視檢驗，以下哪項不對？)
- A、They may take place during the actual welding operation (可在焊接操作過程中進行)
B、Mechanical properties cannot be confirmed (機械性能不能確定)
C、They are almost always less expensive than other tests (幾乎總是比其他檢驗更經濟)
D、They show most large discontinuities (能顯示大部分缺陷)
E、Almost anyone, even the least experienced can perform them (幾乎每個人，甚至經驗最少的人都可以進行目視檢驗)
F、The eye can see only surface discontinuities (眼鏡只能看到表面缺陷)

59. (D) Which one of the following weld discontinuities is not typically inspected through the use of visual inspection ? (何種焊縫不連續不是典型的目視檢驗檢出缺陷)

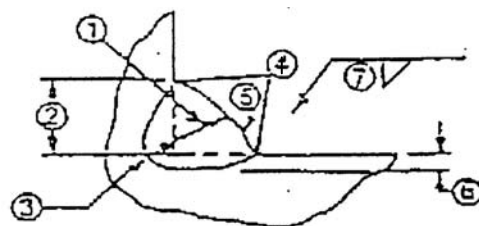
- A 、 Surface porosity (表面氣孔)
- B 、 undercut (咬邊)
- C 、 overlap (焊瘤)
- D 、 Laminations (分層)
- E 、 Cracks (裂紋)
- F 、 Inclusions (夾雜)

60. (E) radiography can be performed using : (射線檢驗可用：)

- A 、 X-ray machine (X-射線機)
- B 、 Cesium 137 (銫 137)
- C 、 Iridium 192 (銱 192)
- D 、 Cobalt 60 (鈷 60)
- E 、 All of the above (以上全對)

61. (C) For the fillet weld at right 5 indicates the : (右圖 5 表示)

- A 、 Leg (焊腳)
- B 、 Throat (焊喉)
- C 、 Face (表面)
- D 、 Toe (焊趾)
- E 、 Root (根部)



62. (A) Using the above data, 60,000psi is equivalent to which of the following ?

(用上述數據，60,000psi 相當於：)

- a. 413635kpa
- b. 8700kpa
- c. 41,360kpa
- d. 87,000kpa
- e. none of the above (以上均不對)

63. (A) The degree of sensitivity of the magnetic particle method of inspection decreases :

(磁粉檢測靈敏度減少：)

- a. With a decrease in size of the discontinuity and also with an increase in depth below the surface (不連續尺寸減小和距表面深度增加)
- b. In defects which are in lengthy cracklike forms (缺陷有長的裂紋型態)
- c. When defects are perpendicular to the lines of force (當缺陷垂直於磁力線時)
- d. All of the above (以上都對)

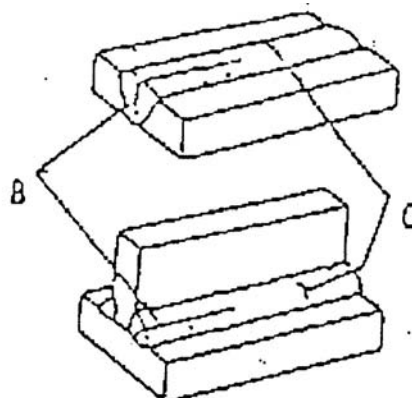
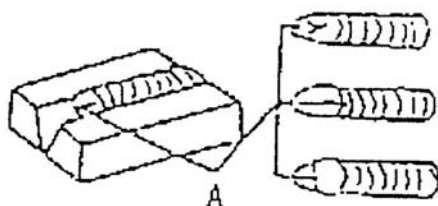
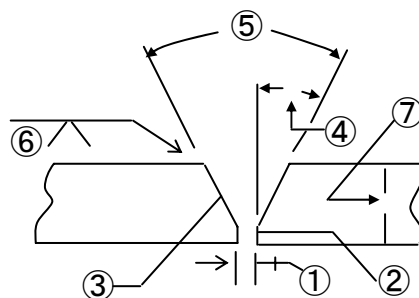
64. (D) Which magnetic particle inspection method applies the medium to the surface of the work while the magnetic current is flowing ? (何種磁粉檢驗方法當磁力線流動時要加媒質在工作表面上？)

- a. Dry method (乾法)
- b. Residual method (剩磁法)
- c. Wet method (濕法)
- d. Continuous method (連續磁化法)

65. (C) Subsurface discontinuity indication produce powder patterns with : (近表面不連續使磁粉呈現)
- A sharply defined appearance (清晰顯示)
 - MT cannot locate sub-surface discontinuities (磁粉檢測不能檢出近表面缺陷)
 - A fuzzy appearance (模糊顯示)
 - A straight, sharp, fine and often intermittent appearance (正氣的，清晰的，纖細的，經常是間斷的顯示)
66. (D) The magnetic particle method of inspection is applicable to : (磁粉檢驗用於：)
- Non ferrous materials (非鐵基材料)
 - Austenitic steels (奧氏體鋼)
 - Braze-welded joints (黃銅焊接接頭)
 - Ferromagnetic materials in which the deposited weld metal is also ferromagnetic (鐵磁材料其上的焊縫也是鐵磁材料)
67. (A) Decibel is a term associated with which NDT method ? (術語分貝與何種無損檢測方法相關聯)
- UT
 - RT
 - MT
 - PT
 - ET
68. (B) Which of the following is truly a volumetric test method ? (以下何種是體積檢驗方法？)
- RT
 - UT
 - ET
 - MT
 - None of the above

69. (D) For the butt joint at right, 1 indicates the : (右側對接接頭中，1 表示)

- Shoulder (肩)
- Included angle (坡口角度)
- Throat (焊喉)
- Root opening (根部間隙)
- None of the above (以上都不對)



70. (B) In reference to the above drawing, letter “A” represents which of the following defects ?

(上圖中字母“A”表示何種缺陷？)

- a. Toe crack (焊趾裂紋)
- b. Crater crack (弧坑裂紋)
- c. Underbead crack (焊道下裂紋)
- d. Throat crack (焊喉裂紋)
- e. Heat affected zone crack (熱影響區裂紋)

71. (E) In reference to the above drawing, letter “B” represents which of the following defects ?

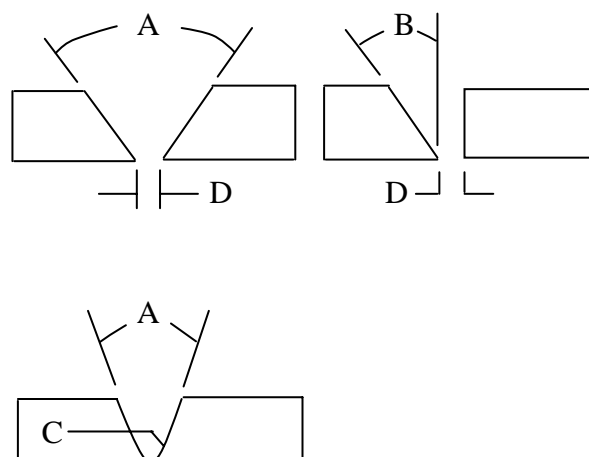
(上圖中字母“B”表示何種缺陷？)

- a. Crater crack (弧坑裂紋)
- b. Transverse crack (橫向裂紋)
- c. Toe crack (焊趾裂紋)
- d. Lamellar tear (層狀撕裂)
- e. Longitudinal crack (縱向裂紋)

72. (D) In reference to the above drawing, letter “C” represents which of the following defects ?

(上圖中字母“C”表示何種缺陷？)

- a. Underbead crack (焊道下裂紋)
- b. Delamination (分層)
- c. Toe crack (焊趾裂紋)
- d. None of the above (以上都不對)



73. (E) In reference to the above drawings, the letter “D” refers to which of the following weld preparations : (參照上圖，字母“D”表示：)

- a. Groove face (坡口面)
- b. Root face (鈍邊)

- c. Groove angle (坡口角度)
- d. Plate thickness (板厚)
- e. Root opening (根部間隙)

74. (D) In reference to the above drawings, the letter “C” refers to which of the following weld preparations : (參照上圖，字母“C”表示：)

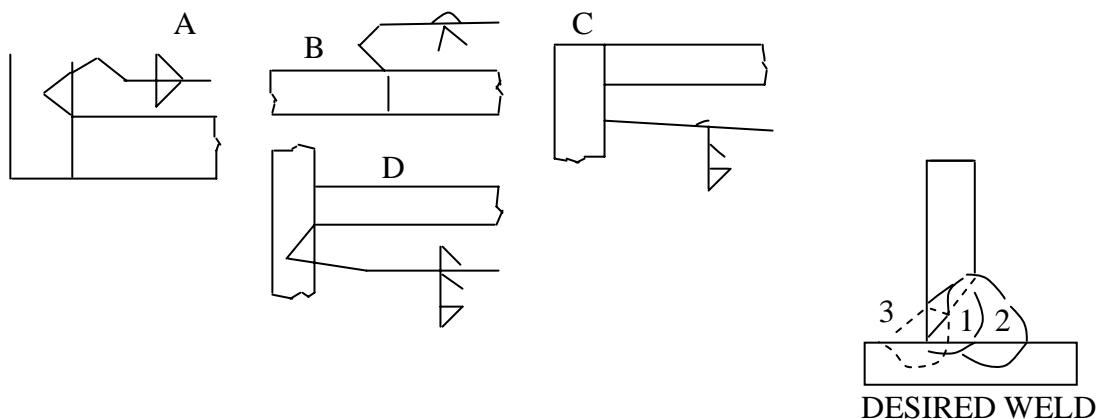
- a. Bevel angle (坡口角度)
- b. Root face (坡口面)
- c. Root opening (根部間隙)
- d. Groove radius (坡口半徑)
- e. Throat (焊喉)

75. (C) In reference to the above drawings, the letter “A” refers to which of the following weld preparations : (參照上圖，字母“A”表示：)

- a. Root opening (根部間隙)
- b. Bevel angle (斜面角度)
- c. Groove angle (坡口角度)
- d. Root face (鈍邊)
- e. Weld size (焊縫尺寸)

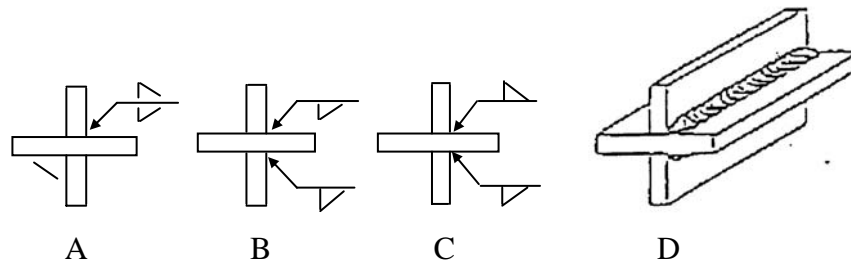
76. (A) In reference to the above drawings, the letter “B” refers to which of the following weld preparations : (參照上圖，字母“B”表示：)

- a. Bevel angle (斜面角度)
- b. Root opening (根部間隙)
- c. Groove angle (坡口角度)
- d. Plate thickness (板厚)
- e. Groove radius (坡口半徑)



77. (D) In reference to the above desired weld, what is the correct weld symbol for this joint ? (哪個焊縫符號能正確表示上圖的焊縫)

- a.
- b.
- c.
- d.

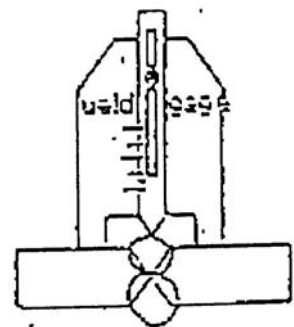


78. (B) With reference to the above desired weld, which correct weld symbol represents this joint ? (哪個焊縫符號能正確表示上圖的焊縫)

- a.
- b.
- c.

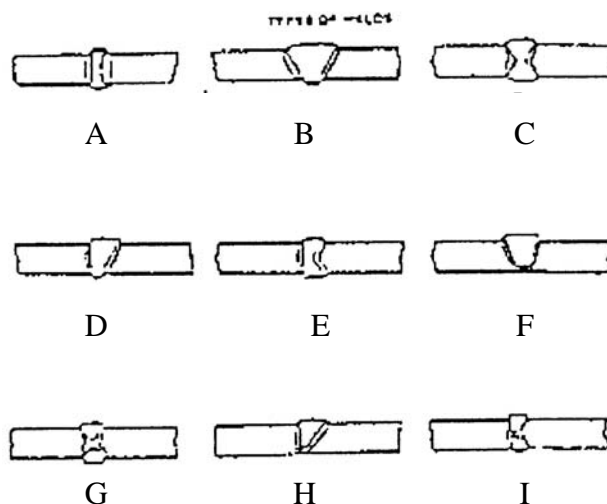
79. (C) The weld gage on the right is measuring the : (右圖焊規正在測量：)

- a. excessive undercut (超標咬邊)
- b. underfill (未焊滿)
- c. excessive convexity (超高)
- d. overlap (焊瘤)
- e. acceptable buildup (合格的堆焊焊縫)



80. (D) When welds need repair, to whom should you make the report ? (焊縫需要修理時，向誰報告？)

- a. To the welder whose mark is on the weld (焊縫上所打焊工識別號的焊工)
- b. To another welder, better trained (另一名培訓更好的焊工)
- c. To the secretary (秘書)
- d. To the project engineer (項目工程師)



81. (E) Match the letter “D” with the correct weld groove detail.

(與上圖中字母“D”相對應的焊縫是：)

- a. Single U groove weld (單面 U 坡口焊縫)
- b. Double bevel groove weld (雙面坡口焊縫)
- c. Single J groove weld (單面 J 坡口焊縫)
- d. Single V groove weld (單面 V 坡口焊縫)
- e. None of the above (以上都不對)

82. (B) Match the letter “G” with the correct weld groove detail.

(以上圖中字母“G”相對應的焊縫是：)

- a. double V groove weld (雙面 V 型坡口焊縫)
- b. double U groove weld (雙面 U 型坡口焊縫)
- c. single U groove weld (單面 U 型坡口焊縫)
- d. double J groove weld (雙面 J 型坡口焊縫)
- e. single V groove weld (單面 V 型坡口焊縫)

83. (D) Using the above drawings, match the letter : C : with the correct weld groove detail.

(與上圖中字母“C”相對應的焊縫是)

- a. Double J groove weld (雙面 J 型坡口焊縫)
- b. Double U groove Weld (雙面 U 型坡口焊縫)
- c. Double bevel groove weld (雙面坡口焊縫)
- d. Double V groove weld (雙面 V 型坡口焊縫)
- e. None of the above (以上都不對)

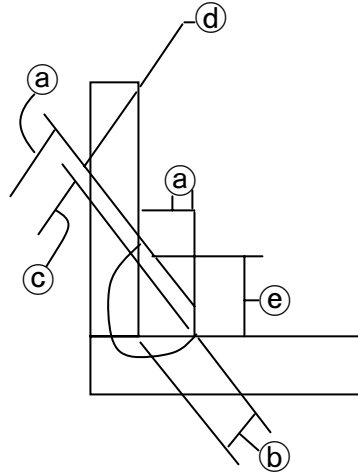
84. (B) Match the letter “F” with the correct weld groove detail.

(與上圖中字母“F”相對應的焊縫是)

- a. double U groove weld (雙面 U 型坡口焊縫)
- b. single U groove weld (單面 U 型坡口焊縫)
- c. single J groove weld (單面 J 型坡口焊縫)
- d. double J groove weld (雙面 J 型坡口焊縫)
- e. none of the above (以上都不對)

85. (B) What NDT method is most likely to reveal internal laminations in a rolled plate ? (何種無損檢測方法用於檢測軋制鋼板的內部分層？)

- a. RT
- b. UT
- c. ET
- d. MT
- e. None of the above (以上都不對)



86. (B) In reference to the above drawing, the letter “C” refers to which of the following : (參照上圖，字母“C”表示)

- a. Leg (焊腳)
- b. Effective throat (有效焊喉)
- c. Convexity (凸起)
- d. Theoretical throat (理論焊喉)
- e. Actual throat (實際焊喉)

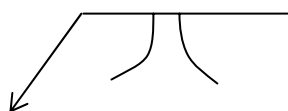
87. (D) In reference to the above drawing, the letter “B” refers to which of the following : (參照上圖，字母“B”表示：)

- a. Leg (焊腳)
- b. Effective throat (有效焊喉)
- c. Convexity (凸起)
- d. Theoretical throat (理論焊喉)
- e. Actual throat (實際焊喉)

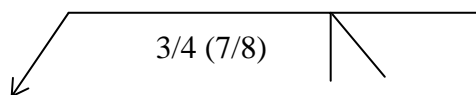
88. (E) In reference to the above drawing, the letter “A” refers to which of the following : (參照上圖，字母“A”表示：)

- a. Leg (焊腳)
- b. Effective throat (有效焊喉)
- c. Convexity (凸起)
- d. Theoretical throat (理論焊喉)
- e. Actual throat (實際焊喉)

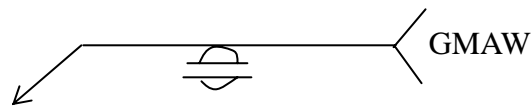
89. (C) The graphic description of the type of weld is called the : (圖示焊類型稱為)
- tall (高)
 - welding symbol (焊接符號)
 - weld symbol (焊縫符號)
 - arrow (箭頭)
 - none of the above (以上都不對)
90. (D) Of the following, which may be considered either mandatory or nonmandatory ? (以下哪項是非強制性的？)
- codes (法規)
 - specifications (規程)
 - standards (標準)
 - b and c above (b 和 c)
 - all of the above (以上都是)
91. (A) The type of document that has legal status is : (那種文件有法律聲明？)
- code (法規)
 - standard (標準)
 - specification (規程)
 - both a and b above (a 和 b)
 - all of the above (以上都對)
92. (A) The symbol below depicts what type of weld ? (下圖表述何種焊縫？)



- flare V-groove (翻邊 V 型坡口)
 - flare bevel groove (翻邊斜坡口)
 - edge flange (端部翻邊)
 - corner flange (角翻邊)
 - none of the above (以上都不對)
93. (C) In the symbol below, the 3/4 dimension refer to what ? (下圖中尺寸 3/4 表示)
- weld size (焊縫尺寸)
 - effective throat (有效喉高)
 - depth of preparation (熔深)
 - root opening (根部間隙)
 - none of the above (以上都不對)



94. (C) The symbol below shows what type of weld ? (下面焊接符號表示何種焊縫？)



- a. gas metal arc spot weld (熔化極電弧點焊)
- b. resistance spot weld (電阻點焊)
- c. gas metal arc seam weld (熔化極電弧縫焊)
- d. resistance seam weld (電阻縫焊)
- e. none of the above (以上都不對)

95. (C) The specification covering the requirements for welding electrodes is designated: (下列哪個標準是對焊條的要求？)

- a. AWS D1.X
- b. AWS D14.X
- c. AWS A5.X
- d. ASTM A53
- e. ASTM A36

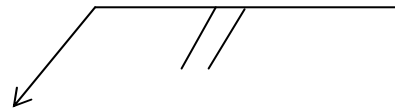
96. (B) The code that covers the design and fabrication of unfired pressure vessels is : (哪個法規是對壓力容器的設計和製造要求？)

- a. ASME Section IX
- b. ASME Section VIII
- c. ASME Section III
- d. API 1'104
- e. AWS D1.1

97. (D) The code that covers the welding of steel structures is : (關於鋼結構的規範是：)

- a. ASME Section IX
- b. ANSI B31.1
- c. API 1'104
- d. AWS D1.1
- e. None of the above (以上都不對)

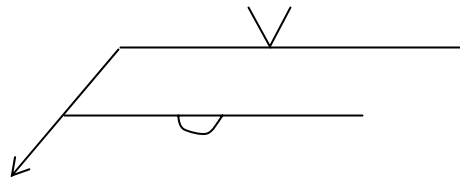
98. (D) The symbol below shows what type of joint configuration ? (下面焊接符號表示何種接頭形式?)



- a. square groove (直邊坡口)
- b. skewed groove (斜坡口)
- c. sloped groove (斜面坡口)
- d. scarf (嵌接)
- e. none of the above (以上都不對)

99. (E) The symbol below shows the use of what type of weld ? (下面焊接符號表示何種焊縫?)

- a. single bevel-groove weld (單斜面坡口焊縫)
- b. backing weld (打封底焊縫)
- c. single V-groove weld (單面 V 型坡口焊縫)
- d. back weld (封底焊縫)
- e. b and c above (b 和 c)



100. (A) Changes in electrical conductivity can be measured using which NDT Method ? (電導的改變可用何種無損檢測方法測量?)

- a. ET
- b. RT
- c. MT
- d. PT
- e. All of the above (以上都對)

Select the correct answer for the following questions. Refer to the “Examination Book of Specifications” for the appropriate information.

(爲下列問題選擇正確答案，請參考“檢驗技術要求”)

1. The designer has detailed the joint B-U2-GF for the welding of two structural members. What is the acceptable range of root opening dimensions for that joint configuration ?
(設計者要求兩個構件的接頭形式爲 B-U2-GF，請問根部間範圍是？)
 - a. 0 to 1/8”
 - b. 1/16 to 3/16
 - c. 0 to 1/4”
 - d. 0 to 3/16”
 - e. none of the above (以上答案都不對)
2. Where would the designation A5.18,A5.29,etc.appear on the form in Appendix I ?
(A5.18,A5.29 應該在附錄 I 中出現在哪裡？)
 - a. Space #5 (#5 空格)
 - b. Space #6 (#6 空格)
 - c. Space #7 (#7 空格)
 - d. Space #1 (#1 空格)
 - e. None of the above (以上答案都不對)
3. Which of the following would be an acceptable electrode for GMAW of 3” thick A514 steel ?
(對於氣體保護焊焊接 3” 厚的 A514 鋼板，應使用下列哪種焊條？)
 - a. E10XT
 - b. ER100S
 - c. ER110S
 - d. All of the above (所有以上焊條)
 - e. None of the above (以上答案都不對)
4. For the condition listed in Question #3, what is the required preheat and interpass temperature ?
(對於#3 問題中的情況，預熱溫度和層間溫度的要求是什麼)
 - a. 225°F minimum (最低 225°F)
 - b. 225°F maximum (最高 225°F)
 - c. 225°F min.- 450°F max. (最低 225°F，最高 450°F)
 - d. 225°F min.- 400°F max. (最低 225°F，最高 400°F)
 - e. none of the above (以上答案都不對)

Butt Weld Sample (對接焊縫試樣)

5. What is the depth of the undercut on this weld sample ? (本焊縫試樣中咬邊深度爲多少)
 - a. 1/16”

Visual inspection worksheet (spring 1991)
(目視檢驗工作表)

- b. .003mm
- c. 1/32"
- d. 5.01mm

6. The weld reinforcement on this sample is (本焊縫加強餘高為多少)

- a. 1/32" – 1/8"
- b. 0.8mm – 3.2mm
- c. 1/2" – 5/8"
- d. both a and b (a 和 b 都對)

7. Which of the following processes would be acceptable for the pre-qualified joining B-U2-GF ?
(下列哪種方法用於 B-U2a-GF 接頭可免除工藝評定?)

- a. FCAW (藥芯焊絲氣體保護焊)
- b. SMAW (手工電弧焊)
- c. GTAW (鎢極氬弧焊)
- d. SAW (埋弧自動焊)
- e. All of the above (所有以上答案)

The following information applies for questions 8 through 14 below : (下列資訊用於問題 8-14)

A welding procedure is being qualified for the welding of A514 plate for a bridge application. The welding process to be used is FCAW, and the weld configuration is single-V-groove weld with a steel backing. The thickness of the test coupon is 1-1/2" . This procedure coupon is being welded in the 2G position. (一種焊接工藝用於橋樑焊接 A514 板材，焊接方法為藥芯焊絲氣體保護焊，接頭形式為單 V 形坡口，帶鋼襯板。工藝評定用鋼板厚度為 1-1/2"，焊接位置為 2G)

8. What is a matching filler metal classification for this procedure ? (該評定應使用哪種填充金屬)

- a. E11XT with a minimum impact strength of 20 ft-lbs at 0°F (最低沖擊性能為 0°F 時 20ft-lbs 的 E11XT)
- b. E10XT
- c. E8XT
- d. E8XT with a minimum impact strength of 20 ft-lbs at -18°C (最低沖擊性能為 -18°F 時 20ft-lbs 的 E8XT)
- e. None of the above (以上答案都不對)

9. What is the required preheat and interpass temperature for this procedure ? (該評定要求預熱溫度和層間溫度為多少)

- a. 150°min.-205°C max.
- b. 125°min.-400°F max.
- c. 50°min.-230°C max.

Visual inspection worksheet (spring 1991)
(目視檢驗工作表)

- d. a and b above (a 和 b)
 - e. b and c above (b 和 c)
10. For what thickness will this procedure be qualified if the required tests are passed successfully ?
(若該評定順利通過，那麼這個評定可以覆蓋多大的板材厚度)
- a. 3/4" to 3"
 - b. 3" maximum (最大 3")
 - c. unlimited (任意板厚)
 - d. 3/4" to 1-1/2"
 - e. none of the above (以上答案都不對)
11. Refer to Appendix VII, paragraph (9). "Acceptance criteria for ASTM A514 and A517 steels shall be based on visual inspection performed not less than 48 hours after completion of the weld." The most probable reason for requiring a 48 hour delay in inspection is : (參考附錄七，第九段“對於 ASTM A514 和 A517 鋼應在焊接完成 48 小時後進行目視檢驗，以確定是否可以接受”。為什麼要求焊接 48 小時後才能檢驗？)
- a. Provide adequate time for welding personnel to leave the area (為焊接人員提供充足的時間離開現場)
 - b. Permit repairs to be made before acceptance (允許在驗收前進行修補)
 - c. Susceptibility of A514 and A517 materials to delayed hydrogen cracking (A514 和 A517 鋼易產生延遲裂紋)
 - d. Permit any weld porosity present at time of welding to clear up (允許焊接時產生的氣孔消失)
 - e. Weld surface slag is easier to remove after it has cooled (冷卻後容易去除焊接表面夾渣)
12. If the welder who performs this procedure qualification test is also qualified, in what positions is he qualified for production welding ? (如果焊工做該工藝評定的同時經過認可，他可以焊接哪些位置？)
- a. Horizontal groove and fillet welds in plate (板材的橫焊位置，接頭為坡口焊縫或角焊縫)
 - b. Flat and horizontal groove and fillet welds in plate (板材的平焊或橫焊位置，接頭為坡口焊縫或角焊縫)
 - c. Overhead groove and fillet welds in plate (板材的仰焊位置，接頭為坡口焊縫或角焊縫)
 - d. Flat groove welds only (只可以焊接平焊位置的坡口焊縫)
13. What is the F-number of the filler metal being used ? (所用的填充金屬組別號是？)
- a. 1
 - b. 3
 - c. 6

- d. 5
- e. none of the above (以上答案都不對)

14. What test specimens are required for this qualification test ? (該工藝評定需要作哪幾個試樣?)
- a. 2 tensiles, 2 root bends, 2 face bends (2 個拉伸, 2 個背彎, 2 個面彎)
 - b. 2 tensiles, 4 side bends (2 個拉伸, 4 個側彎)
 - c. 2 tensiles, 2 macroetch specimens, 4 side bends (2 個拉伸, 2 個宏觀侵蝕, 4 個側彎)
 - d. 2 tensiles, 2 macroetch specimens, 2 root bends 2 face bends (2 個拉伸, 2 個宏觀侵蝕, 2 個背彎, 2 個面彎)
 - e. none of the above (以上答案都不對)
15. During the evaluation of guided bend test specimen, a 5/16" corner crack is observed. There is no evidence of slag inclusion or other fusion type discontinuities. The specimen is (在鑒定一個導向彎曲試樣的時候, 在試樣邊上發現一條 5/16" 長的裂紋。未發現夾渣和其他未熔合不連續。那麼該試樣:)
- a. Acceptable (可以接收)
 - b. Rejectable because the crack is greater than 1/4" (拒收, 因為裂紋大於 1/4")
 - c. Rejectable because the crack is greater than 1/8" (拒收, 因為裂紋大於 1/8")
 - d. Disregarded and a replacement specimen taken from the original weldment (重新在原焊件上取樣)
 - e. Disregarded and a replacement specimen taken from a different weldment (在另外的焊件上取樣)
16. Where would the information for Question #3 appear on the form in Appendix I ? (問題#3 的內容出現在附錄 I 中的?)
- a. Space #5 (空格#5)
 - b. Space #6 (空格#6)
 - c. Space #7 (空格#7)
 - d. No prescribed space for this information (沒有指定的空格)
 - e. This information is not applicable for procedure qualification (該內容對工藝評定不適用)

Sample T-Joint Side "A"(Big T)

17. What is the weld size of fillet weld, Side A ? (角焊縫的 A 側焊角尺寸是多少?)
- a. 5/16"
 - b. 3/8"
 - c. 17/32"
 - d. 3/16"

18. The discontinuity illustrated from 0 to A1 is (從 0 到 A1 指的哪種不連續?)
- a. Arc strike (電弧灼傷)
 - b. Linear porosity (線性非連續)
 - c. Cluster porosity (密集氣孔)
 - d. Spatter on weld face (焊縫表面的飛濺)

Porosity Sample T-Joint Side "A"(Little T) (T 型接頭的氣孔試樣，A 面)

19. The porosity in A3 measures (A3 中的氣孔尺寸為)
- a. 86.97mm
 - b. 0.313 in
 - c. 0.549 in
 - d. none of these (以上答案都不對)
20. The porosity in A3 is (A3 中的氣孔是)
- a. Acceptable (可以接收)
 - b. Unacceptable (不可以接收)

The following information applies for Questions #21 through #26

(請閱讀以下的資訊，回答問題 21-26)

A welder is being qualified on a groove weld in the horizontal position on 8" schedule 80 using the SMAW process. The material being joined is API 5L grade X42 to API 5L grade X52.

(某焊工有資格焊接 8"，sch80 的管子，接頭為坡口焊接，位置為橫焊，焊接方法是手工電弧焊。母材是 API 5L 中的 X42 和 X52)

21. For what thickness is this qualification valid ? (該焊工有資格焊接的厚度範圍是)
- a. 5/16" -3/4"
 - b. 3/4" min-unlimited (3/4" 以上)
 - c. 0.187" min.-unlimited (0.187" 以上)
 - d. all of the above (以上答案都對)
 - e. none of the above (以上答案都不對)
22. What is a recommended filler metal for this weld ? (該焊接應採用什麼填充金屬)
- a. E6010
 - b. E7010
 - c. E7018
 - d. a or b above (a 和 b)
 - e. b or c above (b 和 c)
23. For what range of diameters is this qualification valid ? (外徑多大的管子適用於該評定?)
- a. 3/4" through 4" (3/4" 到 4")

- b. 4" or smaller (小於或等於 4")
- c. 4" or larger (大於或等於 4")
- d. all diameters (所有直徑的管子)
- e. test diameter and above (等於或大於評定用的管子直徑)

24. What test specimens are required ? (該評定需做哪些試樣 ?)

- a. 2 face bends, 2 root bends (兩個面彎試樣，兩個背彎試樣)
- b. 1 face bend, 1 root bend (一個面彎試樣，一個背彎試樣)
- c. 2 face bends, 2 root bends, 2 reduced section tensiles (兩個面彎試樣，兩個背彎試樣，兩個縮截面拉伸試樣)
- d. 4 side bends (四個側彎試樣)
- e. none of the above (以上答案都不對)

25. What is the required preheat and interpass temperature for welding this joint ? (焊接本接頭要求預熱和層間溫度是多少 ?)

- a. None (沒有要求)
- b. None, as long as the base metal is above 32°F (只要母材高於華氏 32 度，沒有要求)
- c. 50°F minimum (至少華氏 50 度)
- d. 150°F minimum (至少華氏 150 度)
- e. none of the above (以上答案都不對)

26. What F-number(s) apply to the proper filler metal for this weld ? (哪個組別的填充金屬可用於這個焊接 ?)

- a. 1&6
- b. 2&6
- c. 6&21
- d. 4 only
- e. none of the above (以上答案都不對)

Tensile Specimens (拉伸試樣)

Measure each of the tensile specimens and supply the following information.

(測量每個拉伸試樣將答案寫到下面)

Load=12,500pounds applied to each specimen. (每個拉伸試樣承受載荷 12,500 磅)

Formula Tensile Strength = Load divided by the Area (拉伸強度=載荷/載面積)

27. White Sample (白色試樣)-reduced section (縮截斷面)

Width (寬度) _____ in (英寸) _____ mm (毫米)

Thickness (厚度) _____ in (英寸) _____ mm (毫米)

Area (面積) _____ in.sq. (平方英寸)

28. Amber Samper (琥珀色試樣)

Width (寬度) _____ in (英寸) _____ mm (毫米)

Thickness (厚度) _____ in (英寸) _____ mm (毫米)

Area (面積) _____ in.sq. (平方英寸)

Amber sample tensile strength _____ psi. (琥珀色試樣拉伸強度為多少磅/平方英寸)

29. Gray Sample (灰色試樣)

Width (寬度) _____ in (英寸) _____ mm (毫米)

Thickness (厚度) _____ in (英寸) _____ mm (毫米)

Area (面積) _____ in.sq. (平方英寸)

Gray sample tensile strength _____ psi. (灰色試樣拉伸強度為多少磅/平方英寸)

30. If the welder starts at the bottom of the pipe and welds upward, where would that information appear on the form in Appendix II ? (如果焊工從管部開始向上焊接，應在附錄 II 中何處出現該資訊？)

- a. Space #3 (#3 空格)
- b. Space #7 (#7 空格)
- c. Space #12 (#12 空格)
- d. Space #16 (#16 空格)
- e. None of the above (以上答案都不對)

Porosity Sample T-Joint Side B (Little T) (氣孔試樣 T 型接頭 B 側)

31. In region B2, is the porosity acceptable ? (在 B2 區，氣孔可以接收嗎？)

- a. Yes (可以)
- b. NO (不可以)
- c. no acceptance criteria provided (沒有提供接收的標準)
- d. not enough information provided (沒有提供足夠的資訊)

32. The total porosity in the region B3 measures (B3 區所有的氣孔測量結果為：)

- a. 0.438 in (0.438 英寸)
- b. 0.157 in (0.157 英寸)
- c. 9.87 mm (9.87 毫米)
- d. both b & c (b 和 c 都對)

33. What is the heat input in J/in for a weld made with the GMAW process using 26 volts, 260 amps and 6 in/min travel speed ? (使用氣體保護焊，電壓 26 伏，電流 260 安培，行走速度為 6 英寸/分鐘時的輸入線能量是多少焦耳/英寸)

Joules per inch=Volts × Amps × 60/Travel speed (焦耳/英寸=電壓 X 電流 X60/行走速度)

Fillet Weld Sample A (角焊縫試樣 A)

34. What is the most severe discontinuity present at the lower weld toe on sample A (Side 1) ? (在試樣 A 的 1 側下焊趾上出現的最嚴重的不連續為？)

Visual inspection worksheet (spring 1991)
(目視檢驗工作表)

- a. Toe crack (焊趾裂紋)
- b. Undercut (咬邊)
- c. Underfill (未焊滿)
- d. Excessive convexity (焊縫凸起)
- e. Overlap (焊瘤)

35. What is the weld size of side #3 ? (#3 側的焊角尺寸是多少)

- a. 3/16"
- b. 1/4"
- c. 5/16"
- d. 3/8"
- e. none of the above (以上答案都不對)

36. Is the undercut on side #4 acceptable if the weld axis is perpendicular to the applied stress ? (如果應力與焊縫軸線垂直，#4 側咬邊可以接嗎？)

- a. Yes (可以)
- b. No (不可以)
- c. No acceptance criteria provided (沒有接受標準)
- d. No enough information provided (沒有提供足夠的資訊)

To determine a metals ductility, calculations can be made based on the determination of percent elongation and percent reduction of area. (爲了確定金屬的延展率，可以根據延長率和斷面收縮率的結果來計算)

Questions 37 and 38 can be answered using the following information :

(37 和 38 題可以參考以下數據)

Original length 1.75 in (原長度 1.75 英寸) original area 0.3in² (原面積 0.3 平方英寸)

Final length 2.5 in (最終長度 2.5 英寸) final area 0.1 in² (最終面積 0.1 平方英寸)

37. Calculate the percent elongation (計算延伸率)

- Final length minus original length. Total divided by original length, times 100 = _____ %
(最終長度減去原長度，再除以原長度，乘以 100% 等於 _____ %)

38. Calculate the percent reduction of area (計算縮截面積的百分比)

- Original area minus final area. Total divided by original area, times 100 _____ % (原面積減去最終面積，再除以原面積，乘以 100% 等於 _____ %)

Guided Bend Samples (導向彎曲試樣)

39. Sample A&B are _____ bends. (A 和 B 是什麼形式的彎曲試樣？)

- a. Side (側彎)
- b. Tensile (拉伸)
- c. Root (背彎)

d. Face (面彎)

40. Based on “Examination Book of Specification”, does the guided bends pass or fail as a group ?
(根據“檢驗技術要求”，該組導向彎曲通過還是失敗？)

a. Pass (通過)

b. Fail (失敗)

41. What is the minimum yield strength of 1 inch thick ASTM A514 weld metal, using E-11018 as the filler metal ? (當使用 E-11018 做填充金屬時，1 英寸的母材 ASTM A514 的最小屈服強度是多少？)

a. 110 Ksi

b. 180 Ksi

c. 97 Ksi

d. 100 Ksi

Fillet Weld Sample B (角焊縫試樣 B)

42. Is the weld on side #2 acceptable is the drawing requires a 1/2" fillet weld ? (圖紙要求角焊縫尺寸為 1/2"，#2 側的焊縫是否可以接受？)

a. Yes (可以)

b. No (不可以)

c. No acceptance criteria provided (缺乏接受標準)

d. Not enough information provided (缺乏充分的資訊)

43. What is the most rejectable discontinuity found on side #3 ? (在#3 側最大的不可以接受的不連續是什麼？)

a. Overlap (焊瘤)

b. Undercut (咬邊)

c. Arc strike (電弧灼傷)

d. Transverse crack (橫裂紋)

44. Based on information in Appendix VII, is the weld on side #1 acceptable ? (根據附錄七，#1 側的焊縫可不可以接受？)

a. Yes (可以)

b. No (不可以)

c. None of the above (非上述答案)

45. A welder performed a qualification test on a groove weld on 3/8 inch thick material. What thick ness material, on groove welds, is the welder not qualified to weld ? (某焊工持有的焊工証為坡口焊縫，厚度為 3/8 英寸，那麼焊工不能焊接的厚度是？)

Visual inspection worksheet (spring 1991)
(目視檢驗工作表)

- a. 0.25 (0.25 英寸)
- b. 0.50 (0.50 英寸)
- c. 1.25 (1.25 英寸)
- d. all of the above (所有以上厚度)

46. 36,379 kPa equals how many psi ? (36,379 kPa 等於多少 psi ?)
_____ psi

AWS D1.1 Code Clinic Exercise Questions

1. Select the correct answer for the following questions. Refer to the “Examination Book of Where are the definitions associated with welding as per AWS D1.1 to be found ? (在 AWS D1.1 什麼章節中可以找到與焊接有關的定義？)

- a. ANSI/AWS A2.4
- b. ANSI/AWS A3.0
- c. Annex B (附錄 B)
- d. b and c above (上述的 b 和 c)
- e. All of the above (上述所有的)

Safety precautions to be observed during welding to AWS D1.1 are found in (有關在焊接過程中的安全警示在 AWS D1.1 的哪一章節中？)

- a. Annex J (附錄 J)
- b. ANSI Z49.1
- c. Annex K (附錄 K)
- d. a and b above (上述的 a 和 b)
- e. All of the above (上述所有的)

What does the nonstandard term “downhand” mean ? (非標準術語“平焊”表示什麼意思？)

- a. Welding vertically downward (垂直的從上往下焊)
- b. Welding in the flat position (在平面位置焊)
- c. The pause during electrode changes (在換焊條時的停頓)
- d. The pause of welding during deslagging (在清除焊渣時的焊接停頓)
- e. None of the above (無上述任何一個)

In what year was the first bridge welding specification published by the AWS ? (AWS 在哪一年出版了第一本橋樑焊接技術規範？)

- a. 1928
- b. 1934
- c. 1936
- d. 1972
- e. 1988

Which of the following steels are intended to be used in work covered by D1.1 ? (下列哪種鋼可以在 D1.1 控制的工作中使用？)

- a. All alloy steels with a yield strength of 97,000 psi or less (屈服強度等於或小於 97,000psi 的所有合金)
- b. Low carbon steels, 5/32in. thick (5/32in 厚的低碳鋼)
- c. Low alloy steel with a yield strength of 970 Mpa (屈服強度為 970Mpa 的低合金鋼)
- d. Low carbon stainless steels (低碳不銹鋼)
- e. None of the above (無上述任何一個)

- 2.1 In contract documents, welding symbols without dimensions to indicate groove weld details, are (在合同文件中，指明坡口焊縫細節的沒有尺寸的焊接符號是：)
- a. Mandatory (強制的)
 - b. Recommended (推薦的)
 - c. Not recommended (不推薦)
 - d. Only to be used when reinforcement is required (只有當有加強要求是使用)
 - e. Only required when joint will be cyclically loaded (只有當接頭周期載荷時要求)
- 2.2 Fillet welds on the opposite side of a common plane of contact are required to be (在一接觸的共同平板相反一側的角焊縫要求要：)
- a. Continuous all around (連續全焊)
 - b. Interrupted at the ends of members (在焊件的端部中斷)
 - c. Interrupted at common corners (在共同角處中斷)
 - d. Boxed (returned) at common corners (在共同角處分隔)
 - e. None of the above (無上述任何一個)
- 2.3 What is the maximum size of the fillet welds of a lap joint of member 3/8in. thick ? (焊件厚度為 3/8in 的搭接接頭的角焊縫的最大尺寸是多少？)
- a. 3/16 in
 - b. 1/4 in
 - c. 5/16 in
 - d. 3/8 in
 - e. Any size at designer's option except if cyclically loaded (除了如果是循環載荷，設計者可以選任何尺寸)
- 2.4 How are transitions in thickness of a groove joint to be made ? (坡口接頭的過渡厚度是：)
- a. Chamfering the thicker member after welding (在焊接後對較厚件進行倒角)
 - b. By chamfering the thicker member before welding on one side only (在焊接前僅對較厚件的一邊進行倒角)
 - c. By chamfering the thicker member before welding on both sides only (在焊接前僅對較厚件的二邊進行倒角)
 - d. By sloping the weld surface(s) (把焊縫表面加工成斜面過渡)
 - e. All of the above (上述所有的)
- 2.5 What is the maximum allowable stress for CJP groove weld metal splicing two ASTM A-36 steel non-redundant members of equal thickness and width, subject to loading of 2×10^6 life time stress reversals, assuming the weld reinforcement remains and all such joints are to be radiographed ? (對於連續兩個同樣厚度和寬度的 ASTM A-36 鋼的非超靜定焊接件，假定保持焊縫加強高並所有如此接頭都要進行射線探傷，在承受 2×10^6 連續應力交變載荷下完全熔透坡口焊縫金屬的最大允許應力是多少？)
- a. 7500 psi

- b. 10,000 psi
- c. 13,500 psi
- d. 16,000 psi
- e. 18,000 psi

3.1 What is the minimum tensile strength of steel conforming to ASTM A572, grade 65 ? (符合 ASTM A572,65 級鋼的最小拉伸強度 ?)

- a. 60,000 psi
- b. 65,000 psi
- c. 70,000 psi
- d. 75,000 psi
- e. 80,000 psi

3.2 What is the required minimum preheat and interpass temperature for 1 in. thick API 5L grade B steel welded with flux cored arc welding ? (對於用藥芯電弧焊接厚度為 1in 的 API 5L, B 級鋼的最小預熱及層間溫度是多少 ?)

- a. 150°F
- b. 100°F
- c. 50°F
- d. None (無)
- e. None except if ambient temperature is $\leq 50^{\circ}\text{F}$ (無，除非如果大氣溫度小於等於 50°F)

3.3 May a groove preparation detailed for SMAW be used unchanged for FCAW prequalified WPSs (是否用於 SMAW 坡口詳細準備可以用於 FCAW 免除評定的 WPS 而不作任何改變 ?)

- a. Yes (可以)
- b. No (不可以)
- c. Only if FCAW is used in DCEP mode (只有當藥芯焊絲氣體保護焊為直流反接時)
- d. Only when welding group I or group II steels are being welded (只有第 I 和 II 組別的鋼材焊接時)
- e. Only at designers option except if joints are statically loaded (設計人員選擇，除非接頭是靜載)

3.4 What is the range of groove angles for joint designation BC-P8, as fit up ? (BC-P8 焊接接頭組裝時的坡口角度範圍是 ?)

- a. 45° to 55°
- b. 40° to 55°
- c. 35° to 50°
- d. 30° to 45°
- e. 25° to 40°

3.5 What is the maximum depth of bevel S₂ for joint designation B-U3c-S when welding 3-12 in. plate ? (3-1/2 英寸厚的板材 B-U3c-S 形式的接頭坡口深度 S₂ 最大是多少 ?)

- a. 1-1/4 in.
- b. 1-1/8 in.

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- c. 1 in.
- d. 7/8 in.
- e. 3/4 in.

4.1 Plug and slot tests welded in the horizontal position qualify a WPS in what position(s) ? (橫焊位置的塞焊和槽焊評定能覆蓋什麼位置?)

- a. All (所有的位置)
- b. Flat and horizontal (平焊和橫焊位置)
- c. All except overhead (除了仰焊以外的其他位置)
- d. Horizontal (橫焊)
- e. None of the above (以上都不對)

4.2 A groove weld qualification on 1/2 in. plate qualifies a procedure for what range of thicknesses ? (在 1/2 英寸板材上進行的坡口焊接工藝評定覆蓋的板材厚度範圍?)

- a. 0 to 1 in.
- b. 0 to 3/4 in.
- c. 1/8 in. to 1 in.
- d. 1/8 in. to 3/4 in.
- e. None of the above (以上都不對)

4.3 What diameters of electrodes are qualified by a procedure test using a 5/64 in. FCAW electrode ? (用 5/64 英寸藥芯焊絲進行的工藝評定可以覆蓋的焊絲直徑是多少?)

- a. All diameters (所有直徑的焊絲)
- b. 5/64 in. only (只有 5/64 英寸直徑的焊絲)
- c. 5/64 in. and smaller (5/64 英寸直徑及以下的焊絲)
- d. 5/64 in. and larger (5/64 英寸直徑及以上的焊絲)
- e. none of the above (以上答案都不對)

4.4 May a qualified WPS for a CJP groove weld be used to weld PJP grooves ? (某坡口焊縫完全熔透的工藝評定可以用於部分熔透的坡口焊接嗎?)

- a. Yes (可以)
- b. No (不可以)
- c. Only when used for T-groove joints with a superimposed fillet weld (只有用於 T 型接頭坡口焊縫的多層角焊縫)
- d. Only if designated weld size is demonstrated by three Macro sections (只有達到指定尺寸的焊縫經過三個宏觀浸蝕試驗驗證)
- e. Only if designated weld size is checked by on-job macro sections (只有達到指定尺寸的焊縫經過現場宏觀浸蝕試驗驗證)

4.5 The minimum length of a T-joint weld test coupon for welder performance qualification is (用於評定焊工的 T 型接頭角焊縫試樣的最小尺寸是多少?)

- a. 6in.

- b. 7in.
- c. ≥ 6 in.
- d. ≥ 15 in.
- e. 8 in. minimum (最小 8 英寸)

5.1 How many times may low hydrogen electrodes be rebaked ? (低氫焊條最多可以重新烘乾幾次?)

- a. Once (一次)
- b. Twice (兩次)
- c. Not limited (沒有限制)
- d. Not limited , except if coating is damaged (除非藥皮被破壞了)
- e. Not specified (沒有要求)

5.2 What grade or grades of steel should be used for spacers ? (什麼級別的鋼材可以用做嵌條?)

- a. Any approved (Table 3.1 or Annex M) base metal (所有在表 3.1 或附錄 M 被認可的母材)
- b. Only steels of the 60 ksi class (只有 60ksi 級別的鋼材)
- c. Any approved steel matching the weld metal (任何被認可的與母材匹配的鋼材)
- d. The same as the base metal (與母材相同的鋼材)
- e. Any grade of steel, as the spacer will be gouged out during welding (任何級別的鋼材。因為嵌條在清根時會被刨掉)

5.3 What is the allowable deviation from straightness for a 40 foot long primary truss member ? (對 40 英寸長的主桁架構件允許的直線度偏差是多少?)

- a. 1/2 in.
- b. 7/16 in.
- c. 3/8 in.
- d. 5/16 in.
- e. 1/4 in.

5.4 What is the allowable variation between the center lines of the web and flange of a 30 feet long built-up I-beam ? (30 英寸長的組裝工字梁的腹板中心線和翼板中心線間的允許變化值是多少?)

- a. 1/2 in.
- b. 7/16 in.
- c. 3/8 in.
- d. 5/16 in.
- e. 1/4 in.

5.5 What is allowable misalignment between members of a butt joint, under any circumstances ? (在任何情況下，對接焊縫的錯邊允許多少?)

- a. No misalignment permitted (不允許錯邊)
- b. 1/8 in.
- c. 10% of the thickness of the thinner member (較薄件厚度的 10%)

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- d. 10% of the thickness of the thicker member (較薄件厚度的 10%)
- e. 3/16 in.

6.1 Who is responsible to ensure that welding equipment conforms to the provisions of 5.11 ? (誰負責保證焊接設備符合 5.11 條的規定)

- a. The contractor (承包商)
- b. The engineer (工程師)
- c. The welder (焊工)
- d. The welding inspector (焊接檢驗員)
- e. Not specified (沒有規定)

6.2 What maximum depth of undercut is permitted in transverse splices of primary members ? (在主要構件中，橫向接縫的咬邊最大允許多深？)

- a. 0.01 in.
- b. 1/32 in.
- c. 1/16 in.
- d. None permitted (不允許)
- e. Not specified (沒有要求)

6.3 Except for stiffener-to web joints, the maximum diameter of piping porosity in fillet welds is (除了腹板加強筋的接頭，角焊縫的管狀氣孔直徑最大允許多少？)

- a. 1/32 in.
- b. 1/16 in.
- c. 3/32 in.
- d. 1/8 in.
- e. None of the above (以上答案都不對)

6.4 For a groove welded tension member in 3/4 in. plate, what is the maximum size of fusion discontinuity permitted in a statically loaded member ? (對於 3/4 英寸板材的受拉構件坡口焊縫，在承受靜載荷時，熔合性缺陷允許的最大尺寸是多少？)

- a. 1/2 in.
- b. 7/16 in.
- c. 3/8 in.
- d. 5/16 in.
- e. 1/4 in.

6.5 For the joint in Question 6.4, what designation hole type IQI should be used ? (對於問題 6.4 中的接頭，應使用什麼標號的孔型像質計？)

- a. 10
- b. 12
- c. 15
- d. 17

e. 20

6.6 In what circumstances, if any, can a CWI whose certification has-expired, accept D1.1 work ? (在什麼情況下一個證書已經過期的 CWI 可以接受按照 D1.1 做的工作 ?)

- a. Not permitted due to expiry of certification (不允許，因為證書已過期)
- b. Requires engineer approval (需要工程師批准)
- c. Permitted with a current visual acuity test (需要視覺靈敏度測試)
- d. Permitted with current visual acuity test and engineer approval (需要視覺靈敏度測試和工程師批准)
- e. **May only work as a CAWI (只能作為助理焊接檢驗員工作)**

6.7 What is the essential wire diameter (of wire type IQI) for the joint in Question 6.4 ? (在問題 6.4 中的接頭應用的線型像質計在底片上應顯示的鋼絲直徑是多少 ?)

- a. 0.010 in.
- b. 0.013 in.
- c. 0.016 in.
- d. **0.020 in.**
- e. 0.025 in.

7.1 What action is required if a crack 1/4 in. long is observed in a standard 5/8 in. stud head ? (如果 5/8 英寸的螺柱頭部發現一條 1/4 英寸長的裂紋，則採取什麼行動：)

- a. No action, use as is (照常使用)
- b. Repair crack and use (修復裂紋後使用)
- c. **Do not use , replace stud (不能使用，替換螺柱)**
- d. Suitable only for concrete encased studs (只能用做水泥包住的螺柱)
- e. Notify stud manufacturer (通知螺柱製造商)

7.2 Through what angle are the daily start up test studs to be bent, assuming 360° flash ? (若飛邊為 360°，在每天或每班開始生產時進行的螺柱彎曲試驗彎曲角度是多少 ?)

- a. Bend test not requested with 360° flash (飛邊為 360°時不要求彎曲試驗)
- b. 30°
- c. **15°**
- d. 10°
- e. $\pm 10^\circ$

8.1 Which of the following is not a recommended method of cyclic loading improvement ? (下列哪個方法在周期載荷結構的補強和修理時不推薦使用 ?)

- a. Toe grinding with a carbide burr or pencil grinder (用筆狀磨頭或砂輪打磨焊趾)
- b. Toe grinding plus hammer peening (打磨焊趾外加錘擊)
- c. **Toe grinding plus shot peening of the weld toes (打磨焊趾外加焊趾表面噴丸)**
- d. Reshaping of weld toes by TIG welding (TIG 修整)
- e. Hammer peening of weld toes (錘擊焊趾)

