

第 47 屆國際技能競賽第 2 階段國手選拔賽 競賽試題(說明)

職類名稱：飛機修護職類

第____頁，共____頁

第一站 飛操鋼繩調校

競賽試題及說明

一、題目：飛操鋼繩調校

二、說明：(公開試題在競賽時得約有百分之三十之調整)

(一)本試題以鬆緊套保險及鋼繩張力測量、螺帽開口銷安裝，及副翼角度量測為主要考

試範圍，保險之裝置、拆卸與現場清理全程均列入評分標準。

(二)針對現場之飛操鋼繩模擬訓練器，依據工作單步驟實施操作，選用適當之材料與工具進行鬆緊套保險，並於保險完成後交給監評人員。經監評人員同意後，依適當程序將保險之裝置拆下，恢復工作前之情況。

(三)工作完畢，清點現場工具並清理工作現場。

三、評審要點：

(一)完縱鋼繩系統，及實施操縱面調整及操作。完成時限：60分鐘。

(二)技能標準：

1. 正確依據公告之操作流程實施操作。了解飛行操縱面鋼繩操縱作動原理，依據公告流程正確安裝飛行操
2. 保險材料與線徑規格選擇正確，長度取用時不致過長或過短，選用正確之工具、以正確之方法進行鬆緊套保險之安裝與拆卸。
3. 正確使用角度量測儀量測副翼角度。
4. 保險之完成品應符合航空規範之規定：
 - A. 鋼繩型別測量：需使用游標卡尺確認其選擇之鋼繩型別正確。
 - B. 鋼繩張力調整及測量：需準確判斷飛機操縱系統鋼繩張力之調整適當。

(三)工作安全態度：

1. 工具之使用是否熟練。
2. 工作安全是否注意。
3. 工具使用前後之檢查與清點。
4. 工作現場之環境清潔保持與整理。

第 47 屆國際技能競賽第二階段國手選拔賽

飛機修護職類

第一站 飛操鋼繩調校

試題工作單

題目：飛操鋼繩調校

選手編號：_____ 選手姓名：_____

測驗時間：60分鐘 開始時間：_____時_____分，結束時間：_____時_____分

工作程序

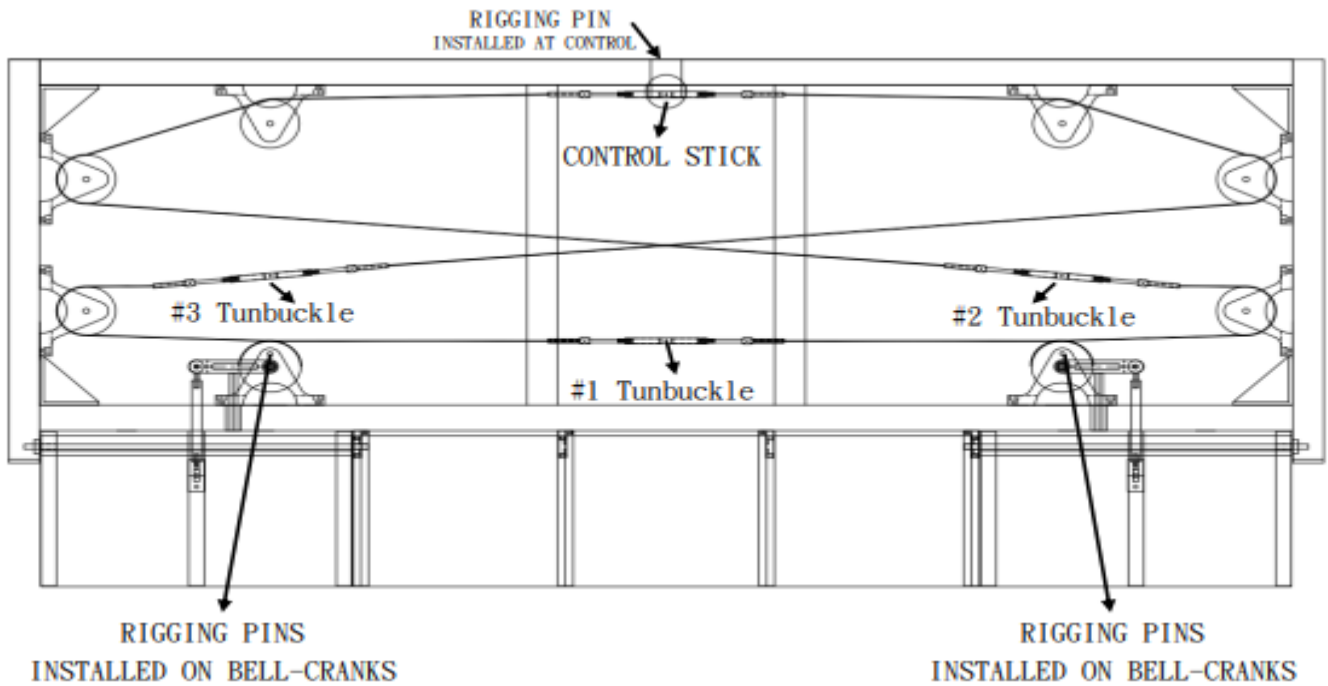
- 一、安裝定位銷至控制桿置中位置(如附圖 1 及 1-1)。
- 二、安裝調校銷至鐘型曲桿(Bell-cranks)固定位置(如附圖 1 及 1-2)。
- 三、調整左側/右側副翼翼面行程控制調整桿行程至水平置中位置後，並將兩側固定螺帽先行用手帶緊即可。
- 四、依序執行確認鋼繩鬆緊套位置(如附圖 1)並執行安裝及調整#2、#3 鋼繩鬆緊套。
- 五、使用游標卡尺執行鋼繩外徑量測尺寸為：_____。
- 六、使用張力表執行鋼繩鬆緊套組之張力量測，依據附表一，以室溫 90°F 之張力值調整鋼繩張力。*量測三次(含)以上取其平均值。
- 七、#1Tunbuckle 鋼繩保險，必須為 Clip-type(如附圖 2-E)，
#2、#3Tunbuckle 鋼繩保險，必須為 DOUBLE WRAP(SPIRAL) (如附圖 2-A)。
- 八、再次檢查鋼繩張力，並向裁判人員報告量測結果及填寫張力表實際量測讀值：
#2 鋼繩鬆緊套鋼繩張力量測數值：_____。
#3 鋼繩鬆緊套鋼繩張力量測數值：_____。
- 九、確認安裝控制桿定位銷及調校銷並檢查副翼翼面於水平置中位置；
- 十、拆除控制桿定位銷及調校銷並安裝電子數位角度規檢查左及右副翼翼面並執行調整至行程規範內（向上 $14^{\circ} \pm 1^{\circ}$ 、向下 $12^{\circ} \pm 1^{\circ}$ ），確認行程於規範內後將止檔保險螺帽固定上緊及執行保險；執行副翼翼面行程控制調整桿檢查孔目視檢查，將固定保險螺帽上緊並執行保險(如附圖 1-3)。
- 十一、執行檢查各控制翼面行程角度及相關固定保險，及所有飛行控制部件鋼繩鬆緊套保險是否正確及確認相關控制翼面於水平置中位置並安裝定位銷及調校銷。
- 十二、待裁判人員檢查完後，拆除所有保險及鋼繩鬆緊套，並實施完工後整理。

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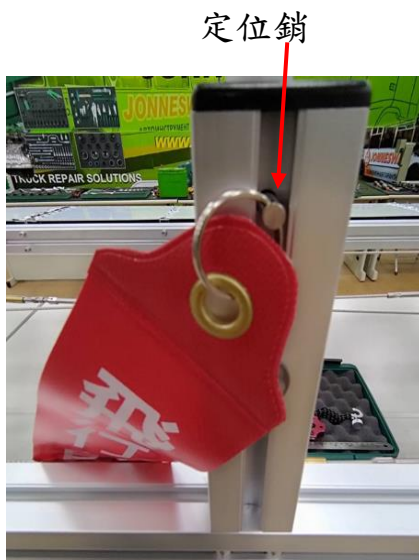
飛機修護職類

第一站 飛操鋼繩調校

試題工作單



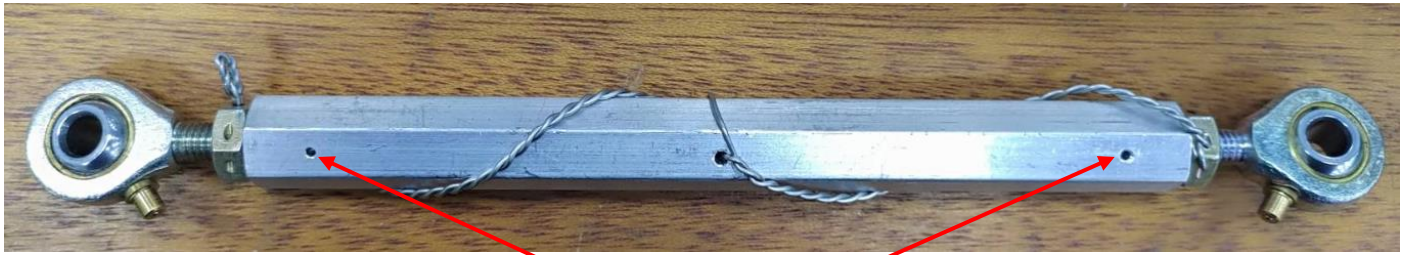
附圖 1：飛操鋼繩系統



附圖 1-1

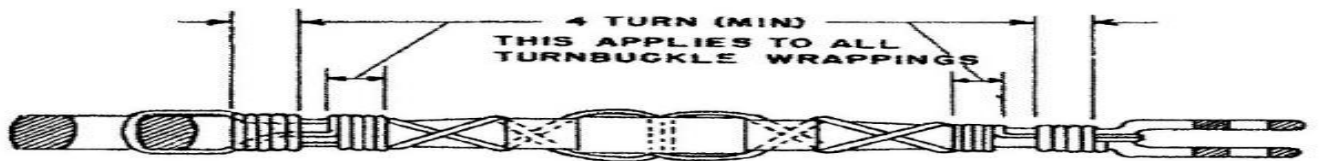


附圖 1-2



行程檢查孔

附圖 1-3：行程調整桿保險方式(依據 AC43.13)



(A) DOUBLE WRAP (SPIRAL)



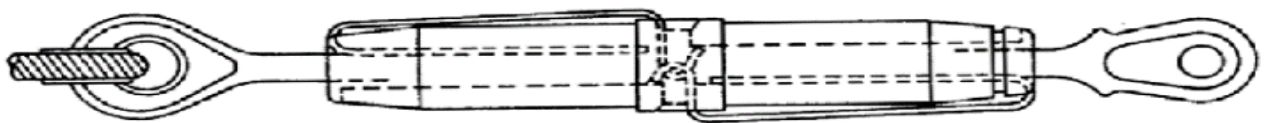
(B) DOUBLE WRAP



(C) SINGLE WRAP (SPIRAL)



(D) SINGLE WRAP



TURNBUCKLE BODY
MS21251

LOCKING-CLIP
MS21256

(E)Clip-type locking device

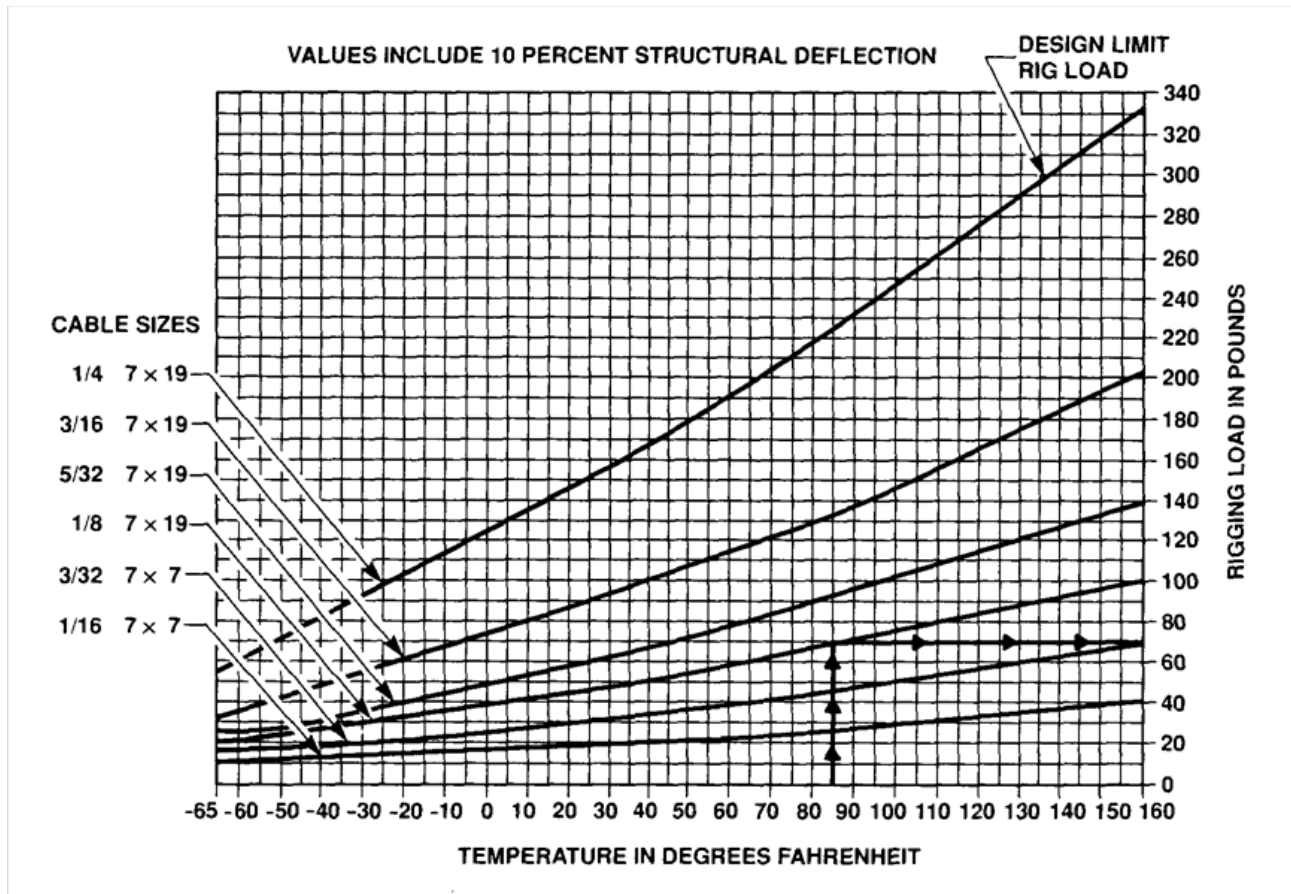
附圖 2：鋼繩鬆緊套保險方式

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飛機修護職類

第一站 飛操鋼繩調校

附表 1: Typical cable rigging chart



【本表為參考範本，以當日競賽場地提供為主，僅限此次競賽用】

附表 2 鋼繩尺寸對照表

Table 16-1. Safetywire, Type and Size for Various Turnbuckle Cable Diameters

Cable Diameter	1/16	3/32 or 1/8	5/32, 3/16, 7/32, 1/4, 9/32, 5/16
Turnbuckle, AN155 Dash No.	-5S, 8-S, or-8L	-16S, -16L, -32S or -32L	-32S, -32L, -46L, -80L, -125L or-175L
Carbon Steel	0.032	0.040 ↵	0.047
Monel			0.040
Inconel	0.020	0.032	
Corrosion-Resistant Steel			0.041
Aluminum Alloy	0.023	0.040 ↵	0.047

第 47 屆國際技能競賽第二階段國手選拔賽

職類名稱：飛機修護職類

第二站 飛機機件拆裝

競賽試題及說明

一、題目：飛機機件拆裝

二、說明：(公開試題在競賽時得約有百分之三十之調整)

(一)本試題以能夠依照工作程序拆除及復裝 PFCU、連桿、液壓管及外鐘型柄為主要考試範圍，機件之保養、保險之裝置與現場清理全程均列入評分標準。

(二)針對模擬器依據工作程序，選用適當之工具進行機件拆除、保養、復裝及保險，並於完工後向監評人員報告。經裁判人員同意後，方可執行清點現場工具及清理工作現場。

三、評審要點：

(一)完成時限：100 分鐘

(二)技能標準：

1. 正確依據公告之操作流程實施操作。
2. 拆除及安裝各項機件應小心謹慎，避免損傷機件。
3. 使用有毒物質保養機件，應配戴防護用具。
4. 保險材料與線徑規格選擇正確，長度取用時不致過長或過短，選用正確之工具、以正確之方法保險之安裝。
5. 保險之完成品應符合航空規範之規定。

(三)工作安全態度：

1. 工具之使用是否熟練。
2. 工作安全是否注意。
3. 工具使用前後之檢查與清點。
4. 工作現場之環境清潔保持與整理。

第 47 屆國際技能競賽第二階段國手選拔賽

職類名稱：飛機修護職類

第二站 飛機機件拆裝

題目：飛機機件拆裝

選手編號：_____ 選手姓名：_____

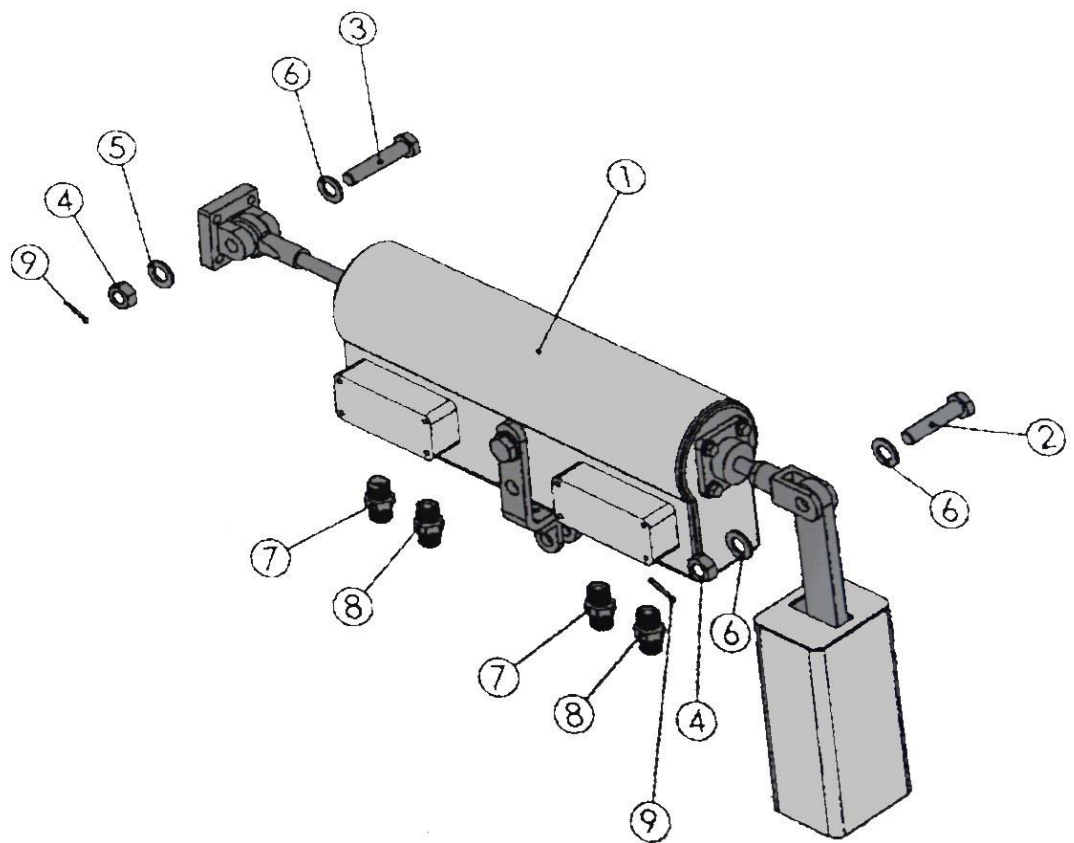
測驗時間：100 分鐘 開始時間：_____時 _____分，結束時間：_____時 _____分

Process:

1. <u>Preparation</u> 1.1 Access Panels 1.2 Rigging pin	Remove as required, Store safely on racking. Into the PFCU.
2. <u>Removal</u> Powered Flying Control Unit (PFCU) Ensure Hydraulic pressure has been dissipated 2.1 PFCU flexible hydraulic hoses NB Ensure that each attachment bolt and nut are kept as a set to avoid misalignment of split pin holes on refit. 2.2 PFCU input control rod 2.3 PFCU Fixed end and Ram end attachment bolts x2 2.4 PFCU 2.5 PFCU 2.6 PFCU 2.7 PFCU Eye End spherical bearing	Confirm with expert Display warning sign Remove wire locking from the PFCU unions and disconnect from the PFCU Remove split pin and disconnect from the PFCU input lever. Remove split pins, nuts and washers. Support body. Remove attachment bolts x2 Remove from HST Examine Clean and Lubricate with L112
3 <u>Fit</u>	

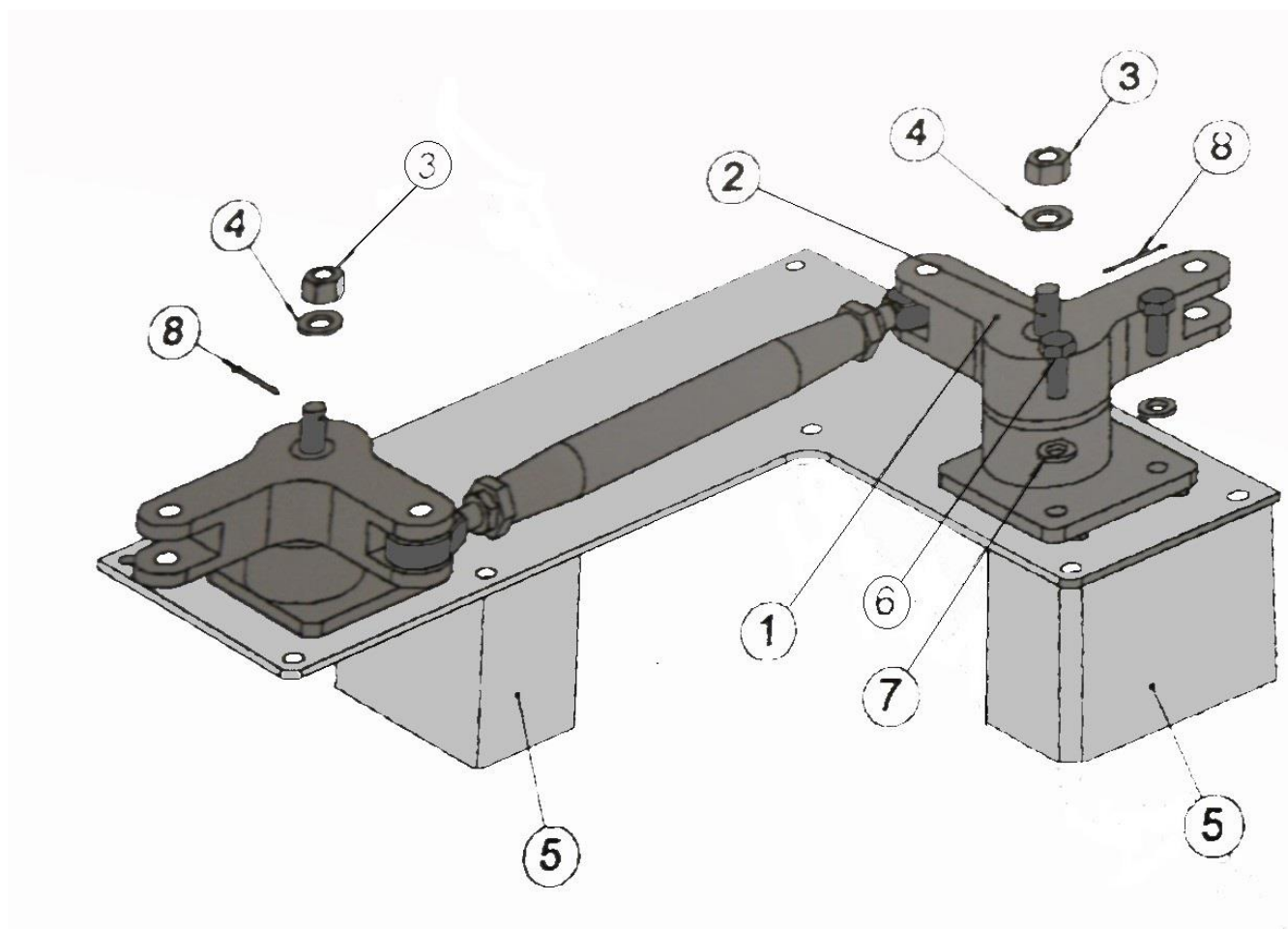
3.1 PFCU	Position in the HST and align the eye ends.
3.2 PFCU attachment bolts	Fit ensuring Correct bolt orientation and washer position (refer figure 1). Do not fit split pins at this stage.
3.3 PFCU Input control rod	Connect. Do not fit split pins at this stage.
3.4 PFCU Hydraulic hoses	Connect and tighten. Ensure hoses are correctly routed and are not twisted during the tightening procedure. (Refer table 1)
4. Inner Bell Crank Removal Ensure that each attachment bolt and nut is kept as a set to avoid misalignment of split pin holes.	
4.1 Inner Bell Crank assembly Input and output control rod Attachment bolts.	Remove split pins and disconnect the input and output Control rods from the inner bell crank input and output lever arms.
4.2 Inner Bell Crank pivot block	(b) Remove mounting bolts x2, remove the Inner bell crank assembly from the HST.
4.3 Inner Bell Crank assembly	(c) Remove the split pin, nut and washer from the Pivot block stud and remove the Bell crank lever arm from the pivot block.
5. Inner Bell Crank Examination	
5.1 Inner Bell Crank Assembly	Clean and examine, ensure No radial movement exists between the bell crank and the nylon bush.
5.2 Bell Crank Lever	Examine for thread damage.
5.3 Bell Crank Lever pivot Block Stud	Reassemble; refit the nut and washer, torque load to the value in the HST torque table.
5.4 Bell Crank Lever and pivot block	(Chap 07-00). Fit the split pin.
5.5 Bell crank assembly	Lubricate with XG287 - ensure free to rotate.
6. Inner Bell Crank Fit	
6.1 Inner Bell Crank Assembly	Mounting bolts x 2
6.2 Pivot Block (c) Pivot mounting bolts	Fit mounting bolts (x2) Hand tighten bolts then torque load to value given in HST torque tables. (Chap 07-00)
6.3 Inner bell crank Output/PFCU input Control rod	Wire-lock bolts. Re connect to the Inner Bell Crank assembly output Lever. Fit the attachment bolts and nuts, torque load

	to value given in HST torque tables. (Chap 07-00). Fit the split pin.
7. <u>PFCU Final Fit</u> 7.1 PFCU Hydraulic Hoses 7.2 PFCU attachment bolts x2 7.3 PFCU input control rod attachment bolt 7.4 All control rods	Wire lock unions x2 Tighten attachment bolts (refer table 2) and fit split pin. Tighten attachment bolts (refer table 2) and fit split pin. All disturbed control rods fit split pin. (Refer table 2)
8. <u>Recovery</u> 8.1 Rigging pin 8.2 Access panels	Remove if Fitted Carry out F.O. checks and refit all removed panels (Refer figure 3)



項次	名稱
1	PFCU
2	BOLT
3	BOLT
4	NUT
5	WASHER
6	WASHER
7	HYD UNION
8	HYD UNION
9	SPLIT PIN

附圖 1 Powered Flying Control Unit (PFCU)



項次	名稱
1	BELL CRANK ASSEMBLY
2	STUD
3	NUT
4	WASHER
5	MOUNTING BLOCK
6	BOLT
7	WASHER
8	SPLIT PIN

附圖 2 . Inner Bell Crank



調校銷



PFCU



PFCU 輸入控制桿臂



PFCU 輸入/內鐘形曲柄輸出控制桿

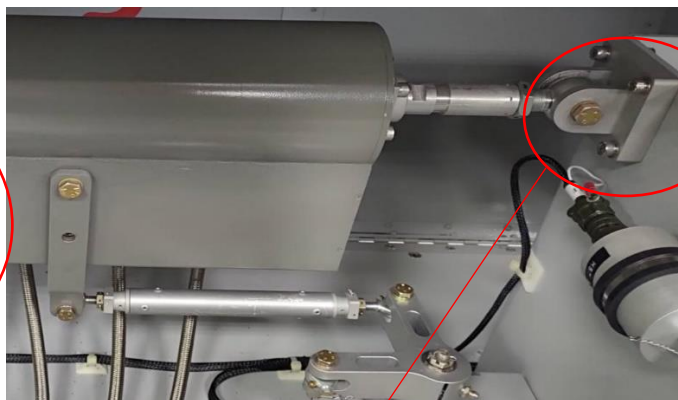


PFCU 活動端

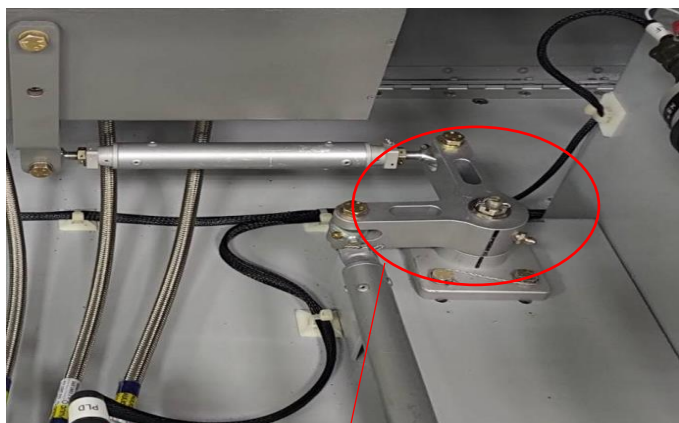
PFCU 固定端



飛機機件拆裝模擬訓練器又稱 HST



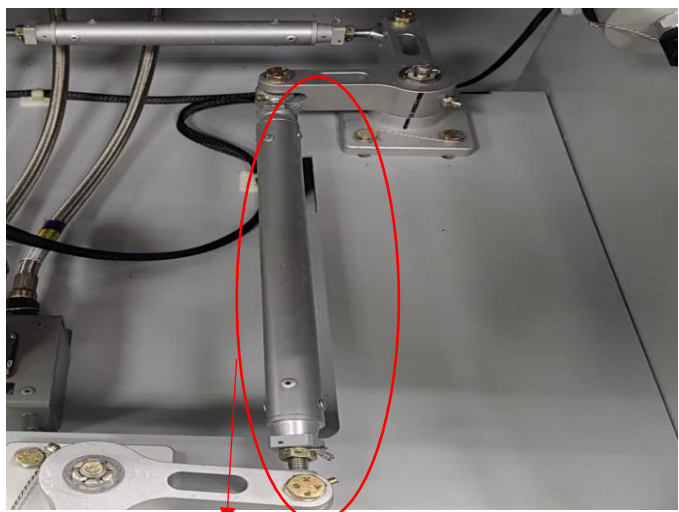
眼端球型軸承



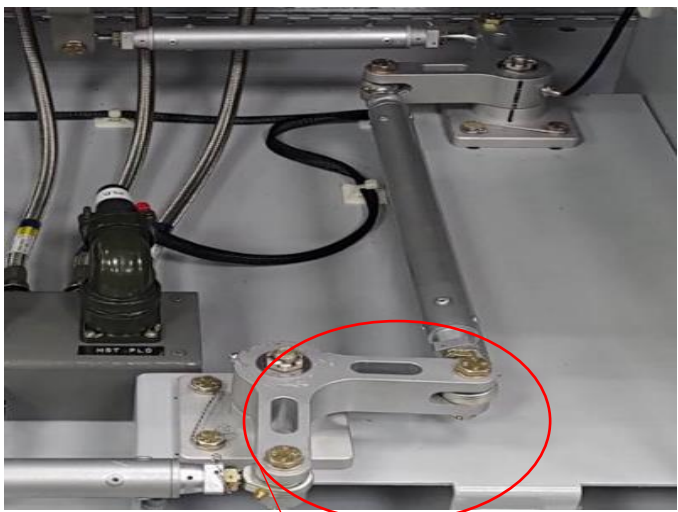
內鐘形曲柄



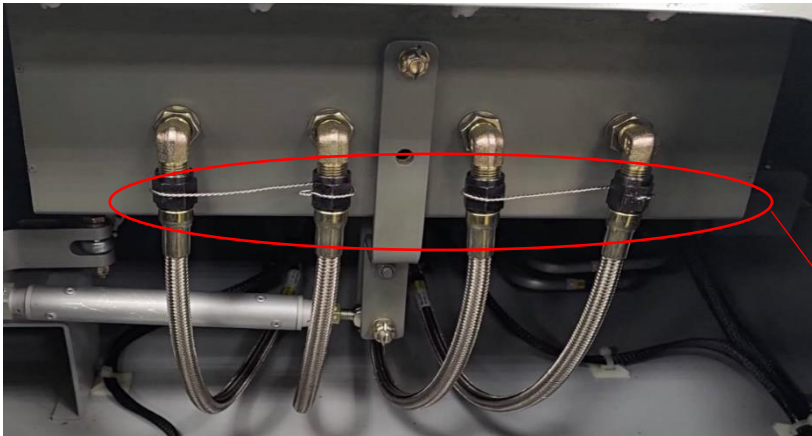
內鐘形曲柄樞軸座



外鐘形曲柄輸出/內鐘形曲柄輸入控制桿



外鐘形曲柄



PFCU 液壓軟管接頭

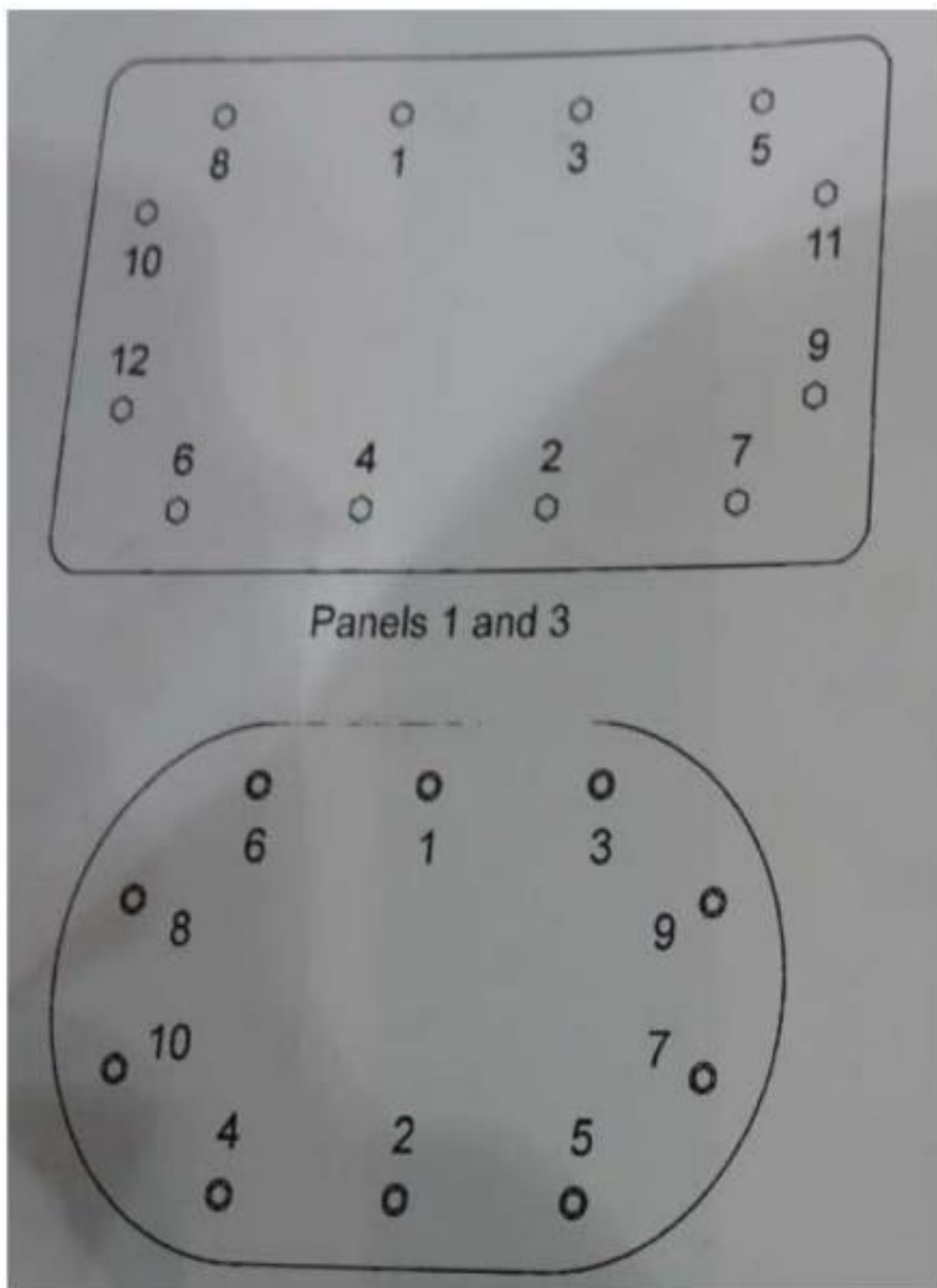
Table 1

Hydraulic pipe union flare nuts.

Tightening procedure: Tighten union by hand first, and then use 2 spanners for 30 degrees further. This will ensure tightness without overloading the union.

Table 2

PFCU-mounting bolts/nuts	Tighten bolts/nuts by hand first ,and then further use 2 spanners to tighten to align locking hole (do not slacken nut).
Bell crank lever	Tighten bolts/nuts by hand first ,and then further use 2 spanners to tighten until they align locking hole (do not slacken nut).
Bell crank pivot block	40~50 lbf-in and further tighten to align locking hole (do not slacken nut).
Bell crank mounting bolts	40~50 lbf-in and further tighten to align locking hole (do not slacken nut).



附圖 3 Access panels

第 47 屆國際技能競賽第二階段國手選拔賽

競賽試題及說明(含競賽時程)

職類名稱：飛機修護

第三站 飛機電器線路組裝

一、題目：飛機電器線路組裝檢測與修護

二、說明：

- (一) 本試題以電器線路機台及一般手工具執行線路焊接、熱縮、線號製作；電路正確依照電路說明運作，主要考試範圍為測試人員對於電路電子元件功能理解、操作，及依相關線路圖及所提供之一般修護維修手冊執行相關作業的能力。
- (二) 參賽者應依據所提供之技術文件及線路圖(該文件係依據比賽需求修改)，並按照內容安裝及操作。
- (三) 飛機電路基本元件認識、基本原理、量測檢視
 1. 本試題以使用競賽場之電路系統模型為主要考試範圍。
 2. 依據現場裁判人員指定之系統線路圖如圖 1 接線圖及圖 2 電路板圖，接線、鉗接及安裝，並依參考資料安裝電路線束(含接頭、開關、端子、線號等)。
 3. 安裝完成後，檢查測試電路的運作。
- (四) 安裝完成，通知裁判人員，並按照電路圖動作內容說明逐一檢試電路操作情形。
- (五) 工作完成後，將工具恢復原狀並清點及清理工作現場。

三、評審要點：

(一)完成時限：120 分鐘

(二)技能標準

1. 正確依據線路圖執行線束焊接製作。
2. 可解讀基本之電路原理並製作電路。
3. 正確依線路圖對每條線束賦予編號(於熱縮套管以奇異筆寫上線束編號)。
4. 須了解飛機各項儀表功能原理及作用。
5. 按技術文件程序正確拆裝儀表。
6. 須按技術文件說明執行線束整理。
7. 正確依線路圖執行線路安裝。
8. 線路故障檢測及修護。

(三)工作安全與態度

1. 量具、工具、三用電錶正確使用。
2. 安裝線路是否有短路情況。
3. 工作時需注意自身及他人安全。
4. 工具是否清潔、清點及維持場地清潔。

第三站飛機電器線路組裝工作單

選手編號： 選手姓名： _____

測驗時間：120 分鐘 開始時間： _____時____分； 完成時間： _____時____分

說明：

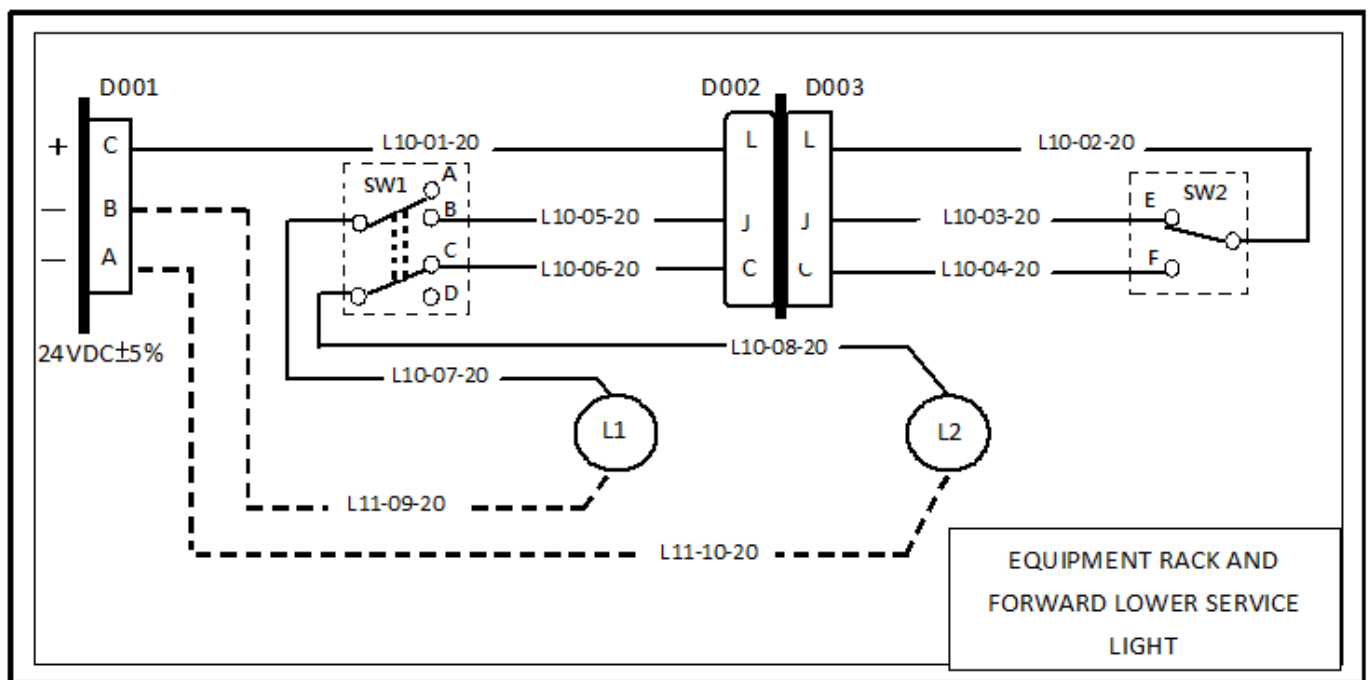
1. 請依下列圖一電路圖執行及線路製作、佈線、並標註線號。
2. 請依圖二導線電路板圖，依圖安裝硬體、燈元件和面板安裝硬體、燈元件和面板安裝線路連接座。
3. 線路圖二連接器型號為：YH3012A10SL-3P; YH3476W14-18P; YH3472W14-18S
4. 導線為 Tefzel- insulated Wire AWG20

一、請填寫量測電路結果：

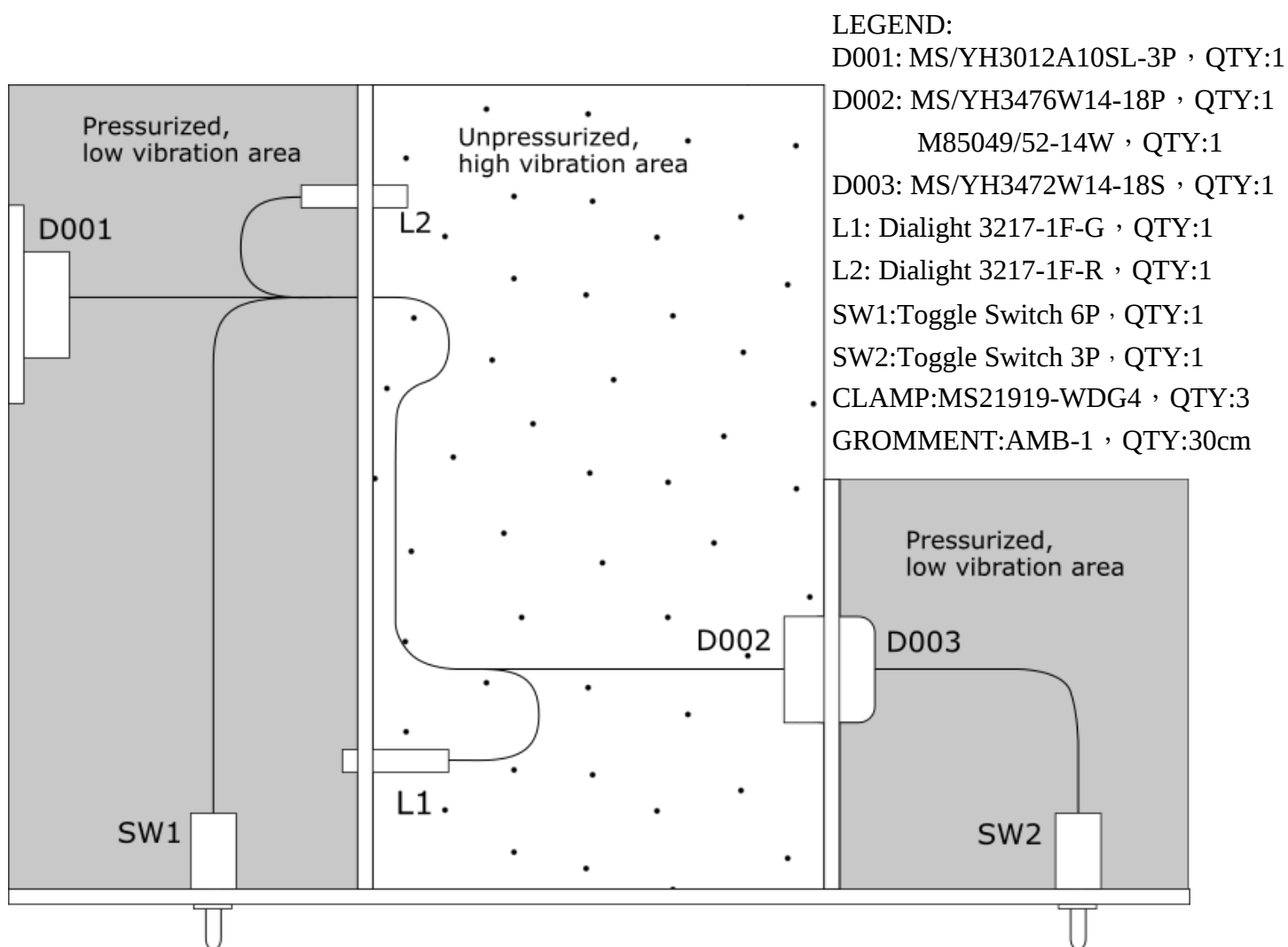
自行檢測電路，檢測出故障原因後進行故障排除。

二、SW1 於 B 位置，SW2 於 E 位置時量測：

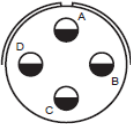
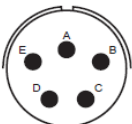
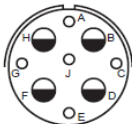
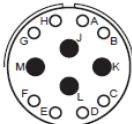
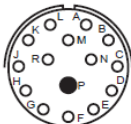
總電壓值 _____，總電流值 _____

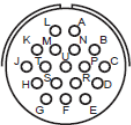
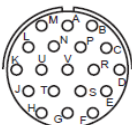
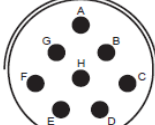


圖一 接線圖示



圖二、電路板圖示

					
Insert Arrangement	14-04	14-05	14-09	14-12	14-15
Service Rating	I	II	I	I	I
Number of Contacts	4	5	5 4	8 4	14 1
Contact Size	12	16	20 12	20 16	20 16

					
Insert Arrangement	14-18	14-19	16-08	16-23	16-26
Service Rating	I	I	II	I	I
Number of Contacts	18	19	8	22 1	26
Contact Size	20	20	16	20 16	20

圖三、電器接頭圖

參考資料 1:

Other than keeping the unit clean and properly stored when not in service, no operator maintenance is required. DMC offers complete factory service by knowledgeable technicians within a reasonable turnaround time. Complete instructions concerning the use, care and warranty are supplied with each tool. Additional copies are available on request.

Pneumatic versions of this tool are found on page 12.

The battery powered versions of this tool are found on page 10.



The DMC1186 tool kit contains the AF8 tool frame, tool gage, and all mil-spec positioners and turret heads. Also included in the DMC1186 are tool instruction sheets and a tool selection chart.

Periodic gaging is recommended to insure accurate calibration. This can be done easily by setting the tool selector knob to position #4, and checking indenter closure with the M22520/3-1 "GO/NO-GO" gage (DMC part no. G125).



MILITARY P/N	DMC P/N	DESCRIPTION	NSN
M22520/1-01	AF8	TOOL FRAME	5120-01-335-8571
M22520/1-02	TH1A	TURRET	5120-01-335-8834
M22520/1-03	TH4	TURRET	5120-01-335-8835
M22520/1-04	TH163	TURRET	5120-01-335-8836
M22520/1-05	UH2-5	ADJUSTABLE POSITIONER	5120-01-335-8583
M22520/1-06	TP45	POSITIONER	5120-01-335-8584
M22520/1-07	TP85	POSITIONER	5120-01-335-8585
M22520/1-08	TH199S	TURRET	5120-00-016-7654
M22520/1-09	TP360	POSITIONER	5120-01-335-8586
M22520/1-10	TP365	POSITIONER	5120-01-335-8587
M22520/1-11	TP465	POSITIONER	5120-01-335-8588
M22520/1-12	TH270	TURRET	5120-01-335-8838
M22520/1-13	TH285	TURRET	5120-01-036-9221
M22520/1-14	TH286	TURRET	5120-01-036-9222
M22520/1-15	TP485	POSITIONER	5120-01-335-8589
M22520/1-16	TP513	POSITIONER	5120-01-335-8590
M22520/1-17	TP651	POSITIONER	5120-01-335-8591
M22520/3-1	G125	GAGE	5220-01-016-6002
	DMC1186	M22520/1 Tool Kit	



STEP 1

INSERT CONTACT



STEP 2

INSERT PRE-STRIPPED WIRE



STEP 3

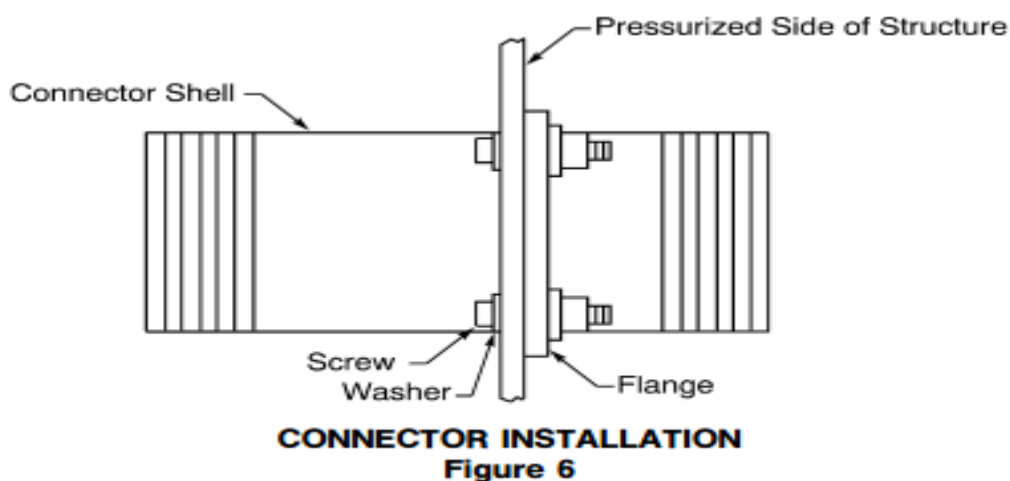
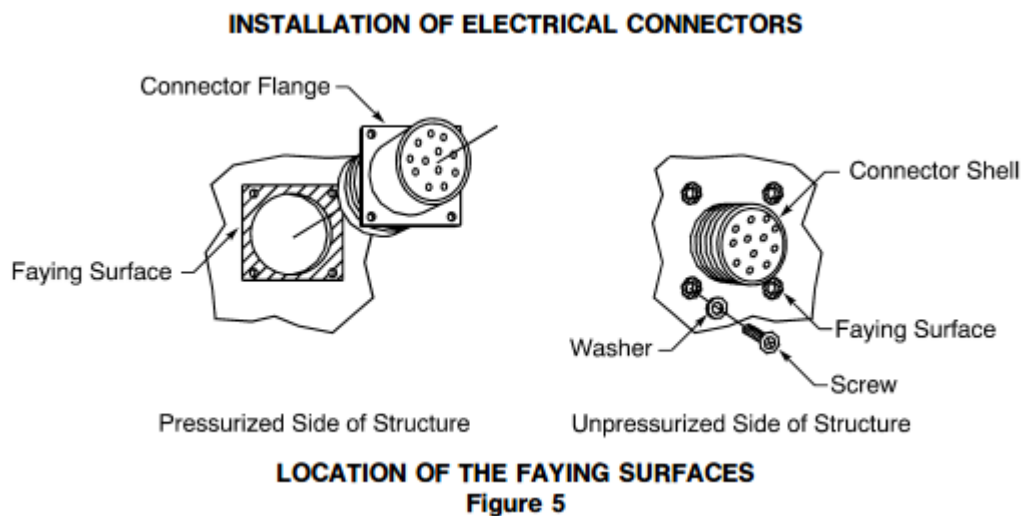
CLOSE / OPEN HANDLE



STEP 4

REMOVE TERMINATED WIRE ASSEMBLY

參考資料 2:



Installation of MS3057A Cable Clamp

72. The MS3057A cable clamp is installed as follows (see Figure 10-53):

- a. Slide MS3057A cable clamp, without saddles, on to the wire bundle before wires are connected.
- b. Slide MS3420 telescoping bushing on wire bundle before wires are connected.

- c. Assemble wires to connector and tighten back shell.
- d. Push MS3057A cable clamp together with inserted MS3420 bushing toward back shell and hand tighten. Use plug pliers or a strap wrench to tighten fully.
- e. Attach both saddles with supplied screws and lockwashers.

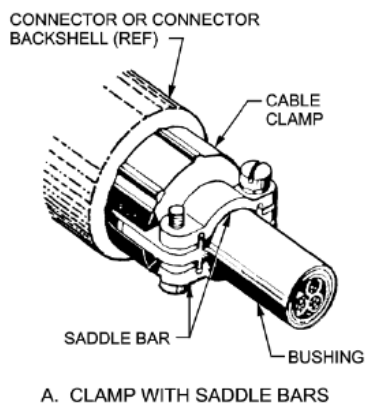
NOTE

Ensure that the saddle clamp screw heads are placed so that pushing on screw heads will tighten cable clamp to backshell. (Some saddle bars have both screw heads on same side).

CAUTION

Ensure bushings are not pinched between saddles and centre bar. Ensure that there is no flexing of the cable within the tightened saddle bars, Flexing will cause damage to the connector wiring.

- f. Tighten saddles until firm against cable, making sure that the cable is not pinched within the clamping assembly. If saddles do not prevent cable from flexing inside the connector, use extra MS 3420 telescoping bushings in the connector assembly. See Table 10–13 for telescoping bushing dimensions. The saddle clamps may be tight against the centring bar as long as the cable is not pinched within the assembly.



TYPICAL INSTALLATION

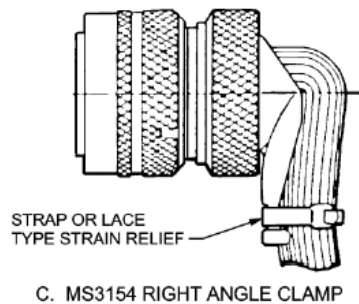
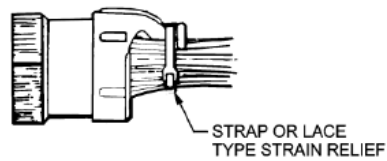
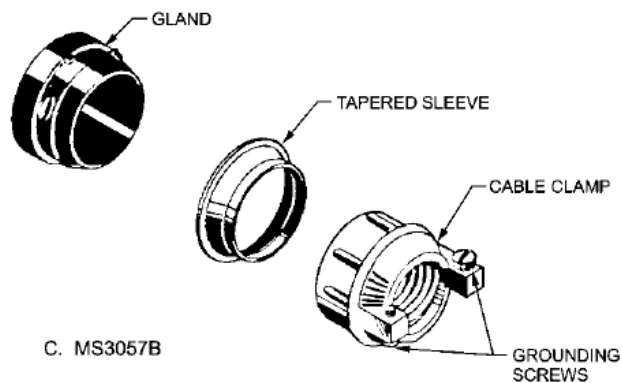
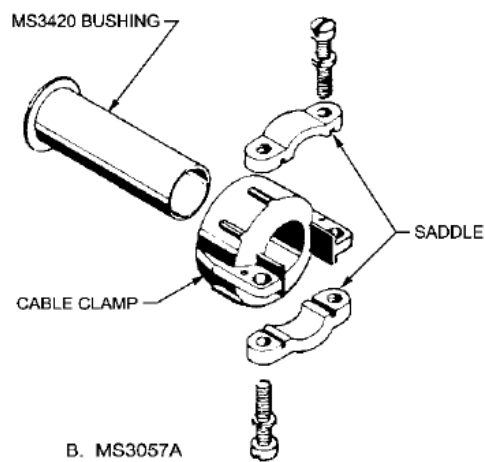
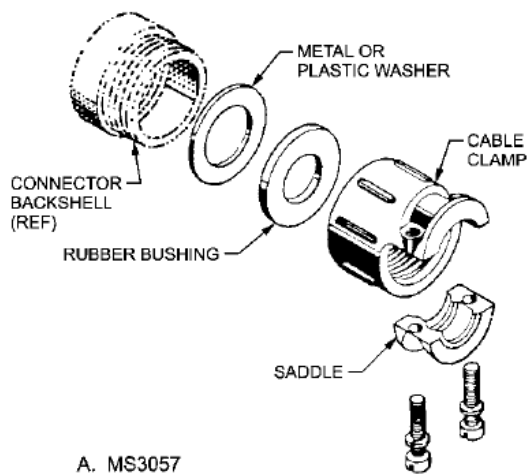


Figure 10-48 Cable Clamps



704500206

Figure 10-49 MS3057 Connector Cable Clamp Types – Exploded View

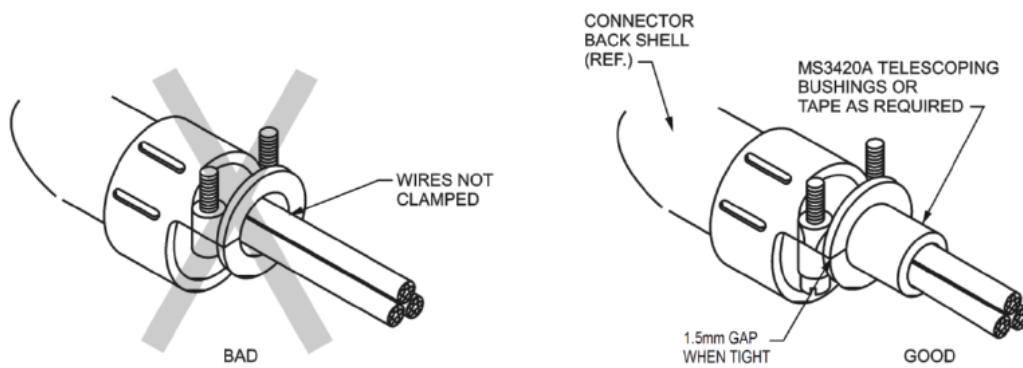


Figure 10-50 Installation of MS3057 Cable Clamp

參考資料 3:

AC 43.13-1B

9/8/98

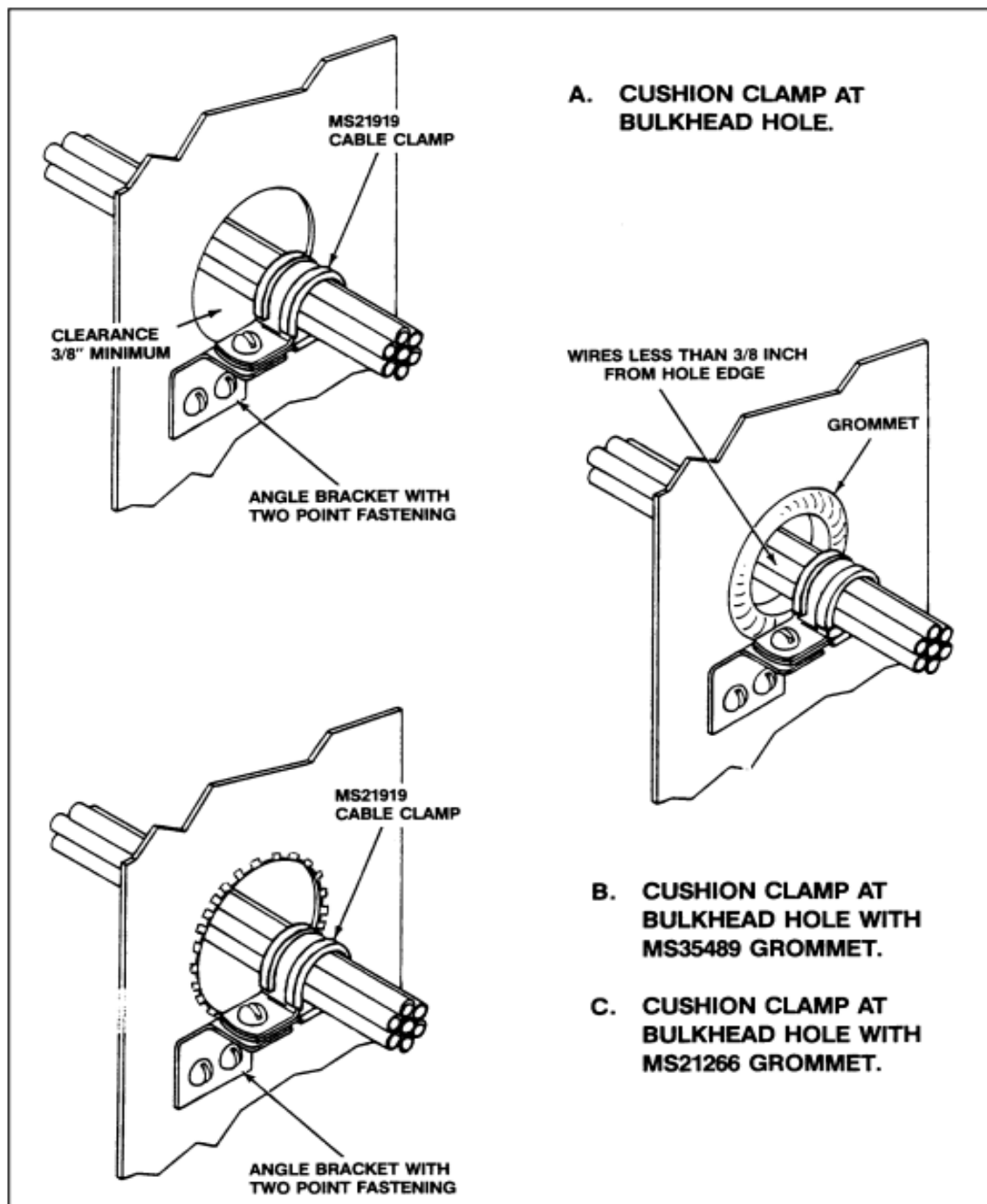


FIGURE 11-14. Clamping at a bulkhead hole.

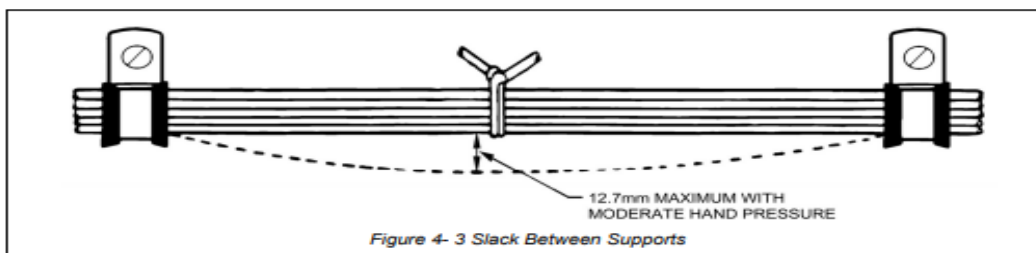
11-148.—11-154. [RESERVED.]

參考資料 4:

AC 21-99 Aircraft Wiring and Bonding Sect 2 Chap 4

12. Do not install single wires or wire bundles with excessive slack. Slack between support points such as cable clamps should normally not exceed 12.7mm. (See Figure 4-3.) This is the maximum that it should be possible to deflect the wire with moderate hand force. This may be exceeded if the wire bundle is thin and the clamps are far apart but the slack must never be so great that the wire bundle can touch any surface against which it may abrade. Allow a sufficient amount of slack near each end for any or all of the following:

- a. To permit ease of maintenance.
- b. To allow replacement of terminals at least twice.
- c. To prevent mechanical strain on the wires, cables, junctions, and supports.
- d. To permit free movement of shock-and-vibration mounted equipment.
- e. To permit shifting of equipment, for purposes of maintenance, while installed in the aircraft.



參考資料 5:

AC 43.13-1B CHG 1

9/27/01

(4) Select the applicable installation tool and move the tension setting to the correct position. (See figure 11-30.)

(5) Slide tip of strap into opening in the installation tool nose piece. (See figure 11-30.)

(6) Keeping tool against head of tie-down strap, ensure gripper engages tie-down strap, and squeeze trigger of installation tool until strap installation is completed as shown in figure 11-31.

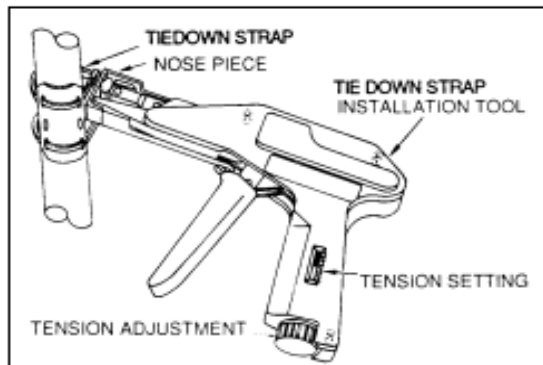


FIGURE 11-30. Tie-down strap installation tool.



FIGURE 11-31. Completed installation.

11-221. TEMPORARY WIRE AND CABLE MARKING PROCEDURE. A temporary wire marking procedure follows but should be used only with caution and with plans for future permanence. (See figure 11-32.)

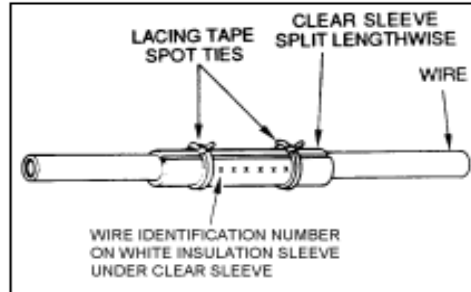


FIGURE 11-32. Temporary wire identification marker.

a. With a pen or a typewriter, write wire number on good quality white split insulation sleeve.

b. Trim excess white insulation sleeve, leaving just enough for one wrap around wire to be marked, with number fully visible.

c. Position marked white insulation sleeve on wire so that shielding, ties, clamps, or supporting devices need not be removed to read the number.

d. Obtain clear plastic sleeve that is long enough to extend 1/4 inch past white insulation sleeve marker edges and wide enough to overlap itself when wrapped around white insulation and wire.

e. Slit clear sleeve lengthwise and place around marker and wire.

f. Secure each end of clear sleeve with lacing tape spot tie to prevent loosening of sleeve.

11-222. MARKER SLEEVE INSTALLATION AFTER PRINTING. The following general procedures apply:

a. Hold marker, printed side up, and press end of wire on lip of sleeve to open sleeve. (See figure 11-33.)



FIGURE 11-33. Inserting wire into marker.

b. If wire has been stripped, use a scrap piece of unstripped wire to open the end of the marker.

c. Push sleeve onto wire with a gentle twisting motion.

d. Shrink marker sleeve, using heat gun with shrink tubing attachment. (See figure 11-34.)

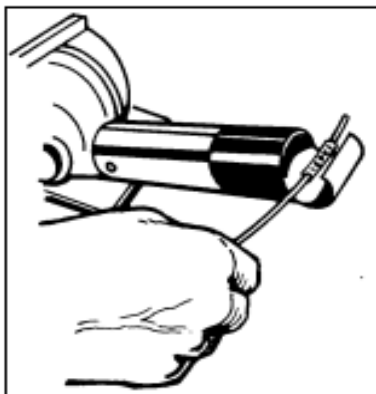


FIGURE 11-34. Shrinking marker on wire.

11-223.—11-229. [RESERVED.]

Tying Sleeves to Wire Groups or Wire Bundles

20. Secure sleeves to wire groups or bundles by tying as described in paragraph 17.

SELF-CLINCHING CABLE STRAPS AND SPIRAL WRAP

Self-Clinching Cable Straps

21. These are adjustable, lightweight, flat plastic straps used for tying and supporting cable assemblies and wire bundles. The strap configuration is shown in Fig 8-5. The straps are of two types:

- a. MS3367 cable securing strap shown by the bold lines in Fig 8-5 and;
- b. MS3368 identification and securing strap illustrated by the broken lines in Fig 8-5. These straps are available either in black or natural colour.

22. Strap, Tiedown, Black is weather resistant and is to be used where straps are subjected to direct sunlight.

23. Tool tension settings specified in Table 8-2 are for typical wire bundle applications. Settings higher or lower than those specified may be necessary for specific applications.

24. Tiedown straps may be used on wire bundles containing solid dielectric coaxial cables provided that the tension setting on the installation tool is not greater than required to prevent axial slippage.

25. Tiedown straps should NOT be used in the following situations:

- a. Where total temperature (ambient plus rise) exceeds 85° C.
- b. Where failure of the strap would permit movement of the wiring against parts which could damage the insulation or foul mechanical linkages.
- c. Where failure would permit the strap to fall into moving mechanical parts.
- d. In high vibration areas.
- e. Outside the fuselage.
- f. In wheel wells.
- g. Where exposure to ultraviolet light might exist, unless the straps are resistant to such exposure ie. black coloured straps.
- h. To tie wire groups or harnesses within bundles.
- i. On coaxial cables or wire bundles containing coaxial cables which do not have solid dielectrics.

26. Paragraph 25 step f disallows the use of tiedown straps in wheel well applications. Concession is given to use black tiedown straps PN MS3367-3-0 and MS3367-6-0 enclosed in plastic tubing PN G167 or equivalent, to secure wiring in wheel well applications where all other avenues to secure the wiring in accordance with this publication have been exhausted.

27. Tiedown straps conforming to SAE AS23190 can be supplied with either a metal or plastic locking device. Both types are suitable for aircraft use.

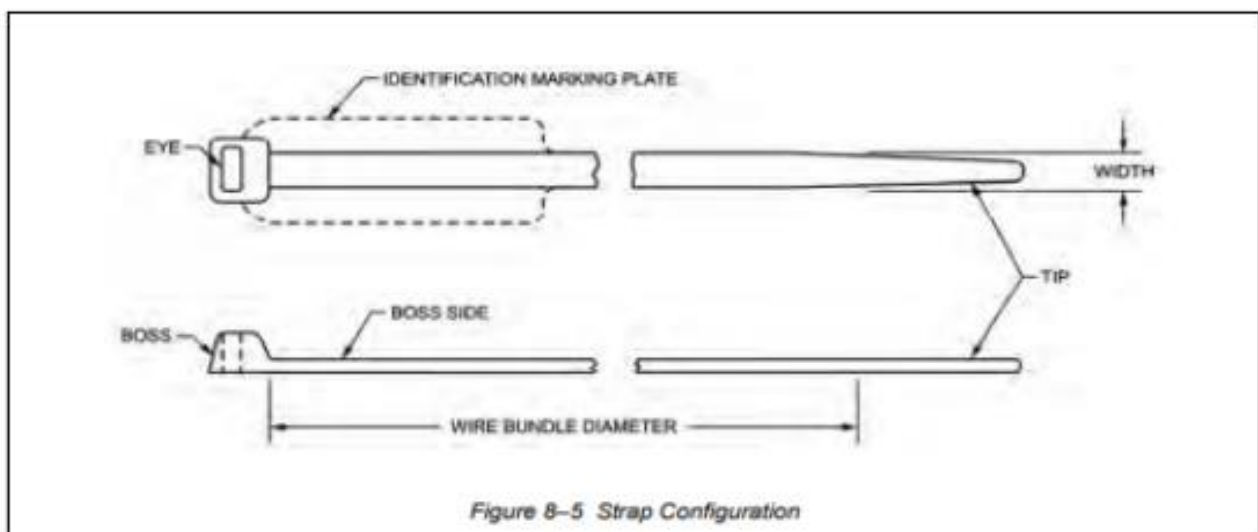


Figure 8-5 Strap Configuration

Table 8-2 Self Clinching Cable Straps and Installation Tools

Part Number	Description (Width/Length) [Inches]	Bundle Diameter (Min-Max) mm [Inches]	Tool Part Number	Tool Tension Setting
MS3367-1-0	Strap, Tiedown, Electrical Components, Standard, Black (0.190/6.30)	1.587-44.45 (0.0625 – 1.750)	MS90387-1	6 to 8
MS3367-1-9	Strap, Tiedown, Electrical Components, Standard, Natural (0.190/6.30)	1.587-44.45 (0.0625 – 1.750)	MS90387-1	6 to 8
MS3367-2-0	Strap, Tiedown, Electrical Components, Standard, Black (0.192/13.35)	1.587-101.60 (0.0625 – 4.0)	MS90387-1	6 to 8
MS3367-2-9	Strap, Tiedown, Electrical Components, Standard, Natural (0.192/13.35)	1.587-101.60 (0.0625 – 4.0)	MS90387-1	6 to 8
MS3367-3-0	Strap, Tiedown, Electrical Components, Heavy, Black (0.310/12.0)	4.763-88.90 (0.1875 – 3.5)	MS90387-2	5 to 8
MS3367-3-9	Strap, Tiedown, Electrical Components, Heavy, Natural (0.310/12.0)	4.763-88.90 (0.1875 – 3.5)	MS90387-2	5 to 8
MS3367-4-0	Strap, Tiedown, Electrical Components, Miniature, Black (0.100/2.72)	4.763-15.87 (0.1875 – 0.625)	MS90387-1	1 to 3
MS3367-4-9	Strap, Tiedown, Electrical Components, Miniature, Natural (0.100/2.72)	4.763-15.87 (0.1875 – 0.625)	MS90387-1	1 to 3
MS3367-5-0	Strap, Tiedown, Electrical Components, Intermediate, Black (0.146/4.68)	4.763-31.75 (0.1875 – 1.25)	MS90387-1	3 to 5
MS3367-5-9	Strap, Tiedown, Electrical Components, Intermediate, Natural (0.146/4.68)	4.763-31.75 (0.1875 – 1.25)	MS90387-1	3 to 5
MS3367-6-0	Strap, Tiedown, Electrical Components, Heavy, Black (0.310/26.25)	4.763-203.20 (0.1875 – 8.0)	MS90387-2	5 to 8
MS3367-6-9	Strap, Tiedown, Electrical Components, Heavy, Natural (0.310/26.25)	4.763-203.20 (0.1875 – 8.0)	MS90387-2	5 to 8
MS3367-7-0	Strap, Tiedown, Electrical Components, Standard, Black (0.192/10.2)	1.587-76.2 (0.0625 – 3.0)	MS90387-1	6 to 8
MS3367-7-9	Strap, Tiedown, Electrical Components, Standard, Natural (0.192/10.2)	1.587-76.2 (0.0625 – 3.0)	MS90387-1	6 to 8

Cable Strap Installation

28. Using the Military hand tool listed in Table 8-2 and illustrated in Figure 8-6, perform the following:

- From Table 8-2 select a strap size and appropriate tool for the wire bundle diameter being secured. (Refer to paragraph 25 for restrictions on strap usage).
- Slip strap tip around the bundle with boss side up.
- Thread tip through eye then hand pull strap tight against the bundle.
- Adjust the tool index line to the tension locator value specified in Table 8-2. If standard changes in the tension adjustment knob does not align the index line with the required tension locator value, the knob may be pulled out and rotated until alignment occurs.

- Pass the free end of the cable tie through the slot in the end of the tool, then push tool snugly against the boss.
- While holding strap firmly against side of tool and tool face squarely against boss, pump handle several times without fully activating the tool's cutting knife. Once the strap has been stretched to its maximum, squeeze handle slowly and firmly until strap is cut.

WARNING

The strap must be cut flush with the boss surface in order to eliminate painful cuts and scratches from protruding strap ends.

- Inspect strap end to ensure strap end is flush with boss surface and trim or replace strap as required to ensure strap end is flush with boss surface.
- Carry out appropriate disposal of all broken straps and strap ends that were cut off.

Spiral Wrap

29. The use of Tube, Plastic, Spiral Wrap (Spirap) as an alternative method to prevent chafing of wiring is discouraged. However, where chafing cannot be avoided using procedures listed in Section 2, Chapter 4, the use of Spirap is approved.

30. Listed in Table 8-3 are identification details for Spirap for use in various environments.

LACING AND TYING IN HIGH TEMPERATURE AREAS

31. Use A-A-59474 high temperature insulation tape to tie all wire groups and cable bundles in areas where the temperature may go above 85°C. Use MIL-I-19166 high temperature insulation tape in areas where the

temperature may exceed 85°C and dimensional stability of the tape is required. (jet turbine engine areas).

WARNING

MIL-I-15126 insulation tape (including the glass fibre type) is highly flammable and should not be used in a high temperature environment. A-A-59474 insulation tape is designed for high-temperature operation (suitable for continuous operation at 260°C) and should be used in high temperature environments at or below 260°C. MIL-I-19166 glass fibre insulation tape is designed for jet turbine engine areas where temperatures may exceed 370°C where dimensional stability and high strength are required.



Figure 8-6 MS90387 Adjustable Hand Tools for Installing Self-Clinching Plastic Tiedown Straps

第 47 屆國際技能競賽第二階段國手選拔賽

競賽試題及說明(含競賽時程)

第四站 機體結構補片成型與應用

選手編號：

選手姓名：_____

測驗時間：120 分鐘 開始時間： 時 分，結束時間： 時 分

一、題目：機體結構補片成型與應用

二、說明：

1. 依金屬補片計畫工作圖(附圖 1)執行以下作業。
2. 本題型測試競賽者以精準彎曲金屬片，依據提供之圖說來佈設扣件與安裝鉚釘的組裝能力為競賽範圍。
3. 將領到之一片 400mm 長×200mm 寬×1mm 厚鋁合金材料，依圖 1 尺寸大小剪裁成 4 片 130mm 寬×1mm 厚之依圖指定長度之鋁合金板。並參考圖 1 及圖 2 設計兩片雙折鋁框及兩片平面鋁板，組合成之鋁合金框架；依圖施工執行 A 板與 B、C 板單側鉚接施工，以及鋁合金板 D 板與 B、C 板施予鑽孔作業。
4. 計算展開加工圖尺寸(附圖 1)，彎曲折板之回置與彎曲裕度如圖 3 或 4(僅供參考)，計算正確板材尺寸並於附圖 2 中寫出施工圖尺寸，請計算至小數點第二位。
5. 請依據圖 1 及圖 2 工作圖執行裁剪及彎折作業，使用板金剪床及彎折機(折床)，依試題所給定之鋁合金板片剪裁大小尺寸並執行彎折成型。並依圖安排鉚接位置、畫線、鑽孔，修邊、去毛邊。
6. 依圖 1 執行 A 板與 B 板及 C 板單邊各 5 組之鉚接施工，施予 1/8 吋沉頭鑽孔，並以 MS20426AD4-X 鉚釘鉚接。
7. 依圖 1 執行 D 板蓋上鑽孔，鋁合金板 D 板與 B 板及 C 板施予 1/8 吋之鑽孔、去毛邊作業。
8. 完工後請在工件上簽名，並向裁判報告，同時將工作單繳交裁判人員。
9. 經裁判委員確認無誤並獲得同意後，將工具恢復原狀、清點工具並清理工作現場。

附註：本試題將各類型鉚釘置於盒內，選手須自行於鉚釘盒內選取正確型式之鉚釘。

三、評審要點：

(一)完成時限：120 分鐘。

(二)技能標準：

1. 計算展開加工圖尺寸是否正確。
2. 裁剪及彎折尺寸是否合乎題型尺寸。
3. 鉚接前，準確依圖安裝鉚釘位置及鉚釘數、確認鉚釘型式及尺寸。
4. 以正確程序進行鑽孔與裝置鉚釘，並注意裝置時與裝置後，鉚釘與板材之尺寸與情況是否合乎規範。

(三)工作安全態度：

1. 工具之使用是否熟練。
2. 工作安全是否注意。
3. 量具、工具使用前後之檢查與清點。
4. 工作現場之環境清潔保持與整理。

單位: mm

材料厚度: $T = 1\text{mm}$
彎折半徑: $R = 5\text{mm}$
彎曲角度: $\theta = 90^\circ$

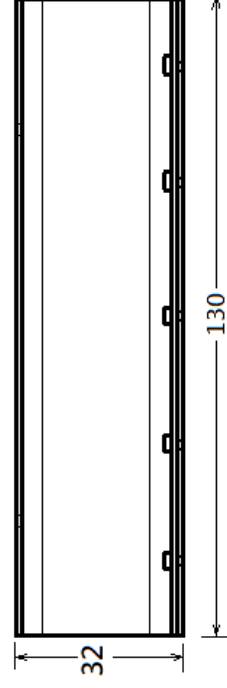
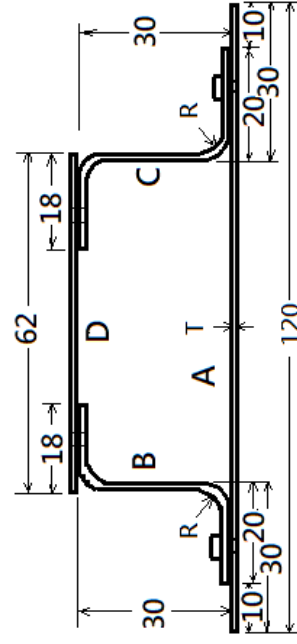
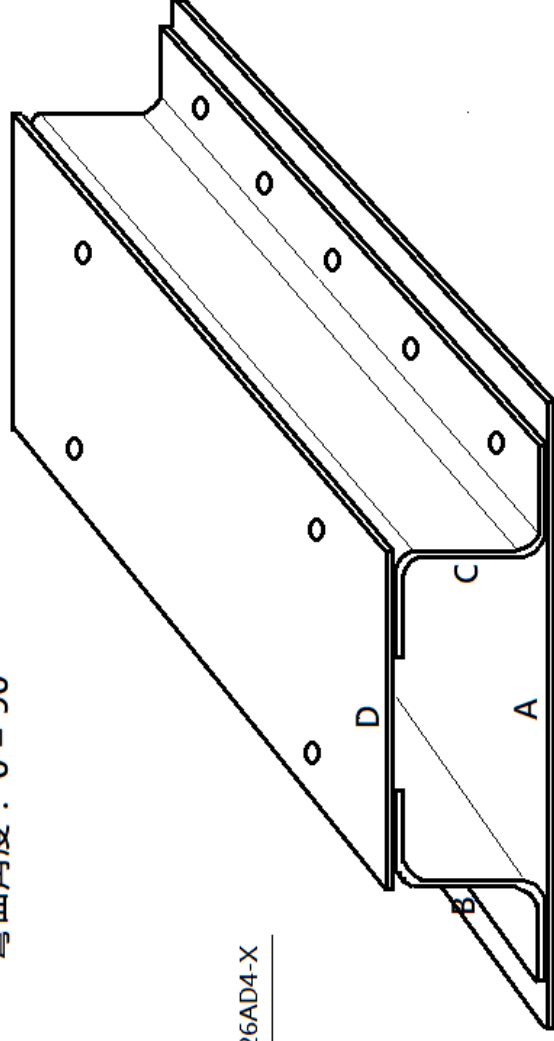
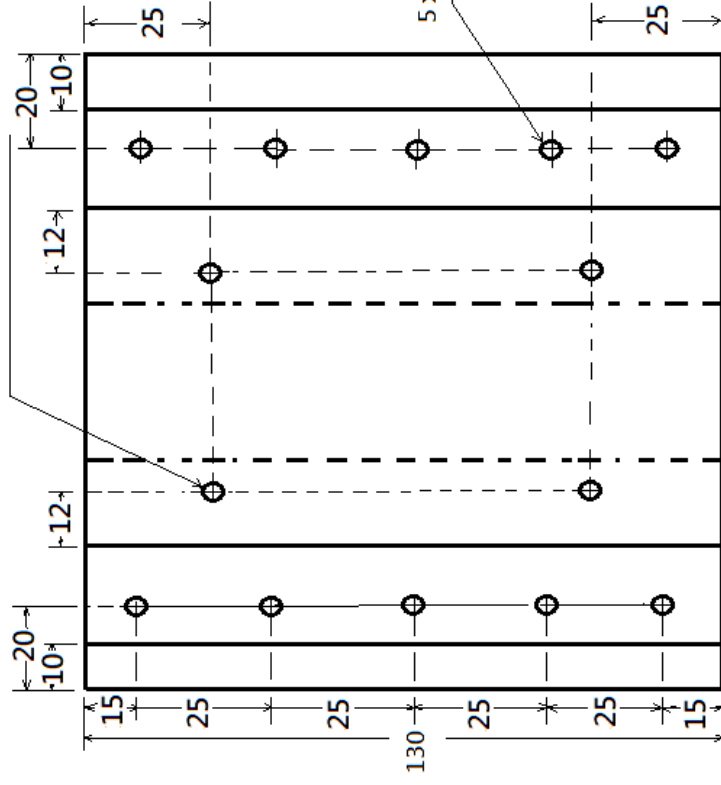
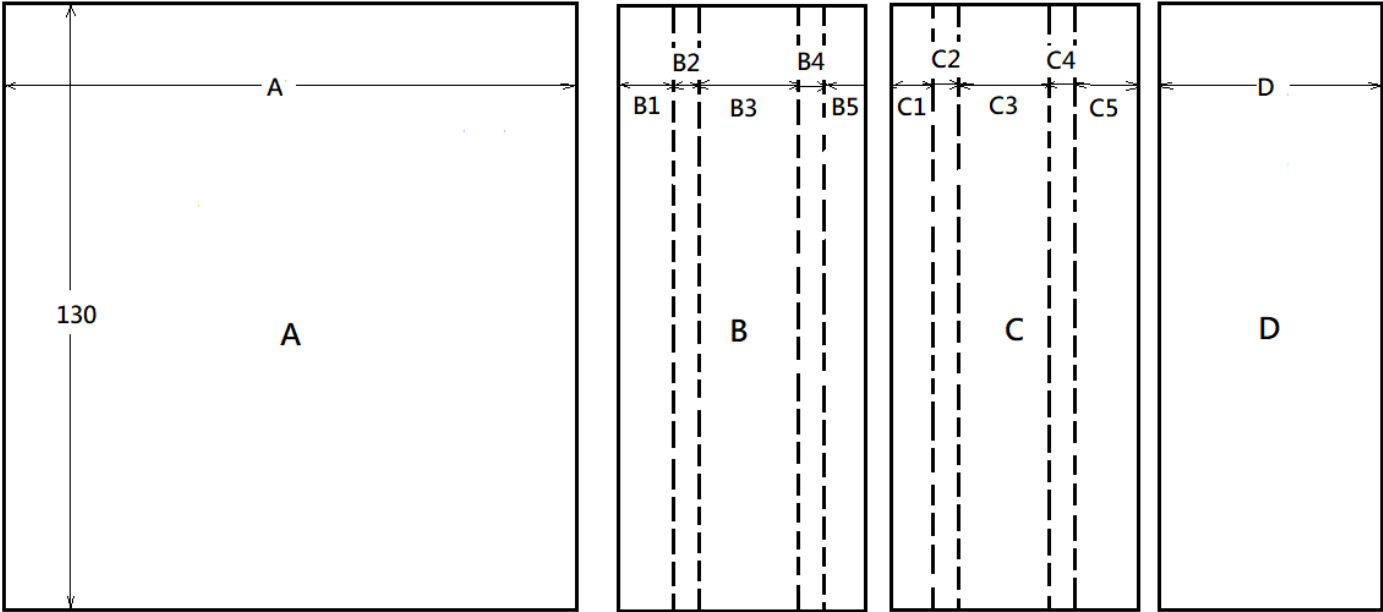


圖 1-金屬成形三視及立體圖

材料厚度：1mm
彎折半徑：5mm (R5)
彎曲角度：90°
鑽孔: 1/8”
鉚釘: MS20426AD4-X

平面佈置計算：



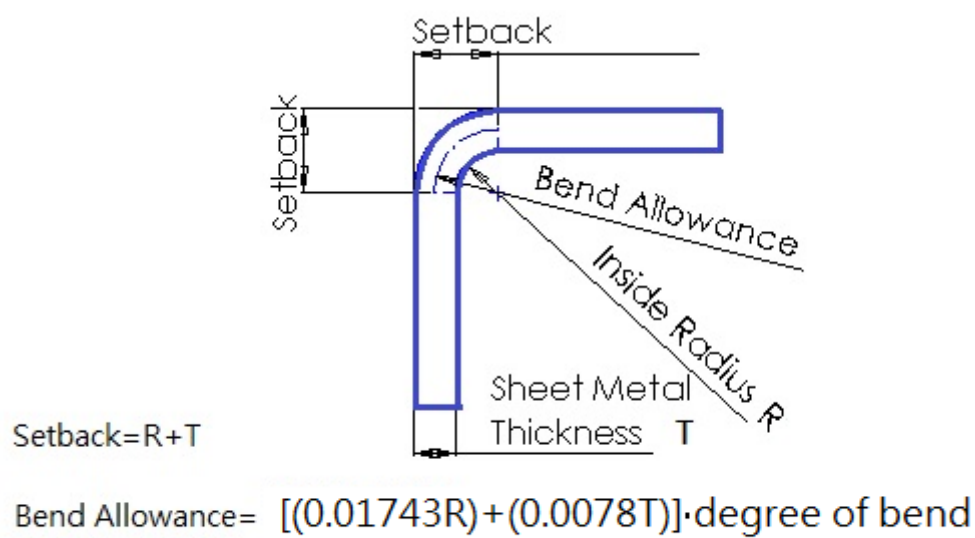
A_{total} =

B₁= B₂= B₃= B₄= B₅= B_{total} =

C₁= C₂= C₃= C₄= C₅= C_{total} =

D_{total} =

附圖 2 展開加工圖計算



附圖 3 回置與彎折裕留- a【僅供競賽參考】

彎折裕度表

折 彎 半 徑	材 料 厚 度							
	0.012	0.016	0.020	0.025	0.032	0.040	0.050	0.063
0.03125 (1/32)	0.00065	0.00068	0.00072	0.00076	0.00082	0.00089	0.00099	0.00110
0.0625 (1/16)	0.00120	0.00123	0.00126	0.00131	0.00137	0.00145	0.00153	0.00165
0.09375 (3/32)	0.00174	0.00178	0.00181	0.00185	0.00191	0.00198	0.00208	0.00219
0.125 (4/32)	0.00229	0.00232	0.00235	0.00240	0.00246	0.00253	0.00262	0.00274
0.15625 (5/32)	0.00283	0.00286	0.00290	0.00294	0.00300	0.00307	0.00317	0.00328
0.1875 (3/16)	0.00338	0.00341	0.00345	0.00349	0.00355	0.00362	0.00372	0.00383
0.21875 (7/32)	0.00392	0.00396	0.00400	0.00404	0.00410	0.00417	0.00426	0.00438
0.250 (1/4)	0.00447	0.00450	0.00454	0.00458	0.00464	0.00471	0.00481	0.00492
0.29125 (9/32)	0.00501	0.00505	0.00508	0.00513	0.00519	0.00526	0.00535	0.00547
0.3125 (5/16)	0.00556	0.00559	0.00563	0.00567	0.00573	0.00580	0.00590	0.00601
0.34375 (11/32)	0.00610	0.00614	0.00617	0.00622	0.00628	0.00635	0.00644	0.00656
0.375 (3/8)	0.00665	0.00669	0.00672	0.00677	0.00683	0.00690	0.00699	0.00711
0.40625 (13/32)	0.00719	0.00723	0.00726	0.00731	0.00737	0.00744	0.00753	0.00765
0.4375 (7/16)	0.00774	0.00778	0.00781	0.00786	0.00792	0.00799	0.00808	0.00820
0.46875 (15/32)	0.00828	0.00832	0.00835	0.00840	0.00846	0.00853	0.00862	0.00874
0.500 (1/2)	0.00883	0.00887	0.00890	0.00895	0.00901	0.00908	0.00917	0.00929
0.53125 (17/32)	0.00937	0.00941	0.00944	0.00949	0.00955	0.00962	0.00971	0.00983
0.5625 (9/16)	0.00992	0.00996	0.00999	0.01004	0.01010	0.01017	0.01026	0.01038
0.59375 (19/32)	0.01047	0.01051	0.01054	0.01059	0.01065	0.01072	0.01081	0.01093
0.625 (5/8)	0.01101	0.01105	0.01108	0.01113	0.01119	0.01126	0.01135	0.01147
0.65625 (21/32)	0.01156	0.01160	0.01163	0.01168	0.01174	0.01181	0.01190	0.01202
0.6875 (11/16)	0.01210	0.01214	0.01217	0.01222	0.01228	0.01235	0.01244	0.01256
0.71875 (23/32)	0.01264	0.01268	0.01271	0.01276	0.01282	0.01289	0.01298	0.01310
0.750 (3/4)	0.01320	0.01324	0.01327	0.01332	0.01338	0.01345	0.01354	0.01366
0.78125 (25/32)	0.01374	0.01378	0.01381	0.01386	0.01392	0.01399	0.01408	0.01420
0.8125 (13/16)	0.01428	0.01432	0.01435	0.01440	0.01446	0.01453	0.01462	0.01474
0.84375 (27/32)	0.01482	0.01486	0.01489	0.01494	0.01500	0.01507	0.01516	0.01528
0.875 (7/8)	0.01537	0.01541	0.01544	0.01549	0.01555	0.01562	0.01571	0.01583
0.90625 (29/32)	0.01592	0.01596	0.01599	0.01604	0.01610	0.01617	0.01626	0.01638
0.9375 (15/16)	0.01648	0.01652	0.01655	0.01660	0.01666	0.01673	0.01682	0.01694
0.96875 (31/32)	0.01701	0.01705	0.01708	0.01713	0.01719	0.01726	0.01735	0.01747
1.0	0.01757	0.01761	0.01764	0.01769	0.01775	0.01782	0.01791	0.01803

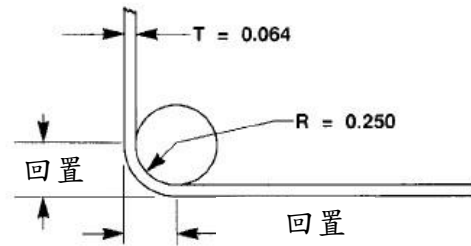
【僅供競賽參考】

K 係數表

角度[度]	K 值	角度[度]	K 值	角度[度]	K 值	角度[度]	K 值
1	0.00873	46	0.42447	91	1.0176	136	2.4751
2	0.01745	47	0.43481	92	1.0355	137	2.5386
3	0.02618	48	0.44523	93	1.0538	138	2.6051
4	0.03492	49	0.45573	94	1.0724	139	2.6746
5	0.04366	50	0.46631	95	1.0913	140	2.7475
6	0.05241	51	0.47697	96	1.1106	141	2.8239
7	0.06116	52	0.48773	97	1.1303	142	2.9042
8	0.06993	53	0.49858	98	1.1504	143	2.9887
9	0.07870	54	0.50952	99	1.1708	144	3.0777
10	0.08749	55	0.52057	100	1.1917	145	3.1716
11	0.09629	56	0.53171	101	1.2131	146	3.2708
12	0.10510	57	0.54295	102	1.2349	147	3.3759
13	0.11393	58	0.55431	103	1.2572	148	3.4874
14	0.12278	59	0.56577	104	1.2799	149	3.6059
15	0.13165	60	0.57735	105	1.3032	150	3.7320
16	0.14054	61	0.58904	106	1.3270	151	3.8667
17	0.14945	62	0.60086	107	1.3514	152	4.0108
18	0.15838	63	0.61280	108	1.3764	153	4.1653
19	0.16734	64	0.62487	109	1.4019	154	4.3315
20	0.17633	65	0.63707	110	1.4281	155	4.5107
21	0.18534	66	0.64941	111	1.4550	156	4.7046
22	0.19438	67	0.66188	112	1.4826	157	4.9151
23	0.20345	68	0.67451	113	1.5108	158	5.1455
24	0.21256	69	0.68728	114	1.5399	159	5.3995
25	0.22169	70	0.70021	115	1.5697	160	5.6713
26	0.23087	71	0.71329	116	1.6003	161	5.9758
27	0.24008	72	0.72654	117	1.6318	162	6.3137
28	0.24933	73	0.73996	118	1.6643	163	6.6911
29	0.25862	74	0.75355	119	1.6977	164	7.1154
30	0.26795	75	0.76733	120	1.7320	165	7.5957
31	0.27732	76	0.78128	121	1.7675	166	8.1443
32	0.28674	77	0.79543	122	1.8040	167	8.7769
33	0.29621	78	0.80978	123	1.8418	168	9.5144
34	0.30573	79	0.82434	124	1.8807	169	10.385
35	0.31530	80	0.83910	125	1.9210	170	11.430
36	0.32492	81	0.85408	126	1.9625	171	12.706
37	0.33459	82	0.86929	127	2.0057	172	14.301
38	0.34433	83	0.88472	128	2.0503	173	16.350
39	0.35412	84	0.90040	129	2.0965	174	19.081
40	0.36397	85	0.91633	130	2.1445	175	22.904
41	0.37388	86	0.93251	131	2.1943	176	26.636
42	0.38386	87	0.94890	132	2.2460	177	38.138
43	0.39391	88	0.96569	133	2.2998	178	57.290
44	0.40403	89	0.98270	134	2.3558	179	114.590
45	0.41421	90	1.0000	135	2.4142	180	無限

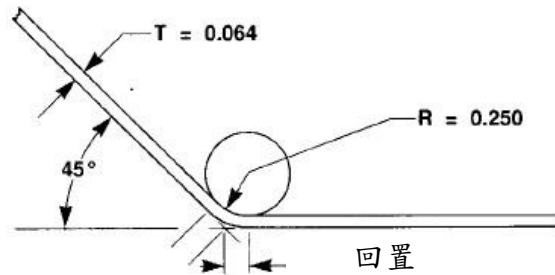
【僅供競賽參考】

彎曲半徑回置方法



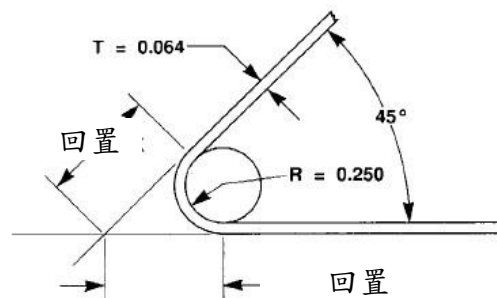
此為一 90 度角

$$\begin{aligned}\text{回置} &= (BR+MT) K \\ &= 0.250+0.064 \\ &= 0.314 \text{ 吋}\end{aligned}$$



此為一 135 度開口角，金屬僅彎曲 45 度

$$\begin{aligned}\text{回置} &= (BR+MT) K \\ &= (0.250+0.064) 0.41421 \\ &= 0.130 \text{ 吋}\end{aligned}$$



此為一 45 度閉合角

$$\begin{aligned}\text{回置} &= (BR+MT) K \\ &= (0.250+0.064) 2.4142 \\ &= 0.758 \text{ 吋}\end{aligned}$$

附圖 4. 回置與彎折裕留-b【僅供競賽參考】

第 47 屆國際技能競賽第二階段國手選拔賽

競賽試題及說明(含競賽時程)

第五站飛機維護手冊查閱

職類名稱：飛機修護

一、題目：波音 747 飛機維護手冊查閱

二、說明：(本試題為模擬範例，競賽試題為不同問題)

(一) 本試題以所提供之波音 747-400 型飛機維護手冊(B747-400 Airframe Maintenance Manual AMM)，以第 12、20、28 章為主之相關飛機維護作業程序之手冊查閱能力。

(二) 參賽者以所提供之飛機維護方法、作業規範、執行程序等問題，查閱相關技術文件之章節目頁次所在位置，寫出文件敘述內容，並翻譯成中文。

(三) 查閱完成，將正確結果寫於題目中。

(四) 工作完成後，將工具恢復原狀並清點及清理工作現場。

三、評審要點：

(一) 完成時限：60 分鐘

(二) 技能標準

1. 了解手冊功能及編排原理。
2. 正確查閱及使用手冊之方法與步驟。
3. 了解飛機各系統功能原理及作用。
4. 按技術文件程序正拆裝更換飛機零組件。
5. 按技術文件說明執行故障原因分析及故障排除。
6. 正確依據維護手冊制定維護方法及程序。
7. 了解飛機故障檢測及修護能力。
8. 英文基礎能力及航空英文閱讀能力。

(三) 工作安全與態度

1. 正確手冊版本使用。
4. 維持場地清潔。

第 47 屆國際技能競賽第二階段國手選拔賽

競賽試題及說明(含競賽時程)

職類名稱：飛機修護

第五站飛機維護手冊查閱工作單

選手編號：_____ 選手姓名：_____

測驗時間：60 分鐘 開始時間：_____時_____分； 完成時間：_____時_____分

一、請寫出下列之中文名稱？

1. AMM 維修手冊 12-21-01 章中, 有哪幾頁為修訂後頁次, 修訂日期為：

Page:_____ 日期:_____ (8 分)

2. AMM 第 20-30-01 page-201 章(章-節-目/開始頁次)中英文名為：

_____ (8 分)

二、請寫出下列之手冊相關技術問題？

1. B747-400 要去除多餘的液壓油需參考 AMM 維修手冊 _____ - _____ - _____
page-_____ (章-節-目/開始頁次), 要用哪種除油液清潔熱組件液壓油？

_____ (12 分)

2. 備用或主油箱檢修門(Reserve or Main Tank Access Door)安裝扭力螺桿安裝順序, 參考 AMM 維修手冊 _____ - _____ - _____ page-_____ Figure _____ (章-節-目/頁次/圖表);
螺桿安裝順序目的是: _____ (12 分)

三、查閱手冊問答及翻譯

1. 747-400 檢查出飛機油箱有重度微生物污染時, 有哪些相關微生物生長常發生區域位置, 請寫出英文原文程序並翻譯成中文(16 分), 可從維修手冊 _____ - _____ - _____
page-_____ (章-節-目/頁次)中得知(4 分)。

2. 進行測量飛機引擎滑油消耗量時，要遵守那注意些事項及步驟：(寫出英文原文並翻譯成中文)，(16 分) 可從維修手冊 _____ - _____ - _____page- _____ (章-節-目/頁次) (4 分) 中得知。

3. 如何清除飛機電線附近燒焦物質如何清除，請寫出英文原文程序並翻譯成中文(16 分)，可從維修手冊 _____ - _____ - _____page- _____ (章-節-目/頁次) (4 分) 中得知。