AERONAUTICAL STRUCTURE & EQUIPMENT FITTER

NSQF LEVEL - 4

2nd Year

TRADE PRACTICAL

SECTOR: CAPITAL GOODS AND MANUFACTURING

(As per revised syllabus July 2022 - 1200 Hrs)

Directorate General of Training

DIRECTORATE GENERAL OF TRAINING
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
GOVERNMENT OF INDIA

NATIONAL INSTRUCTIONAL MEDIA INSTITUTE, CHENNAI

Post Box No. 3142, CTI Campus, Guindy, Chennai - 600 032

Sector : Capital Goods and Manufacturing

Duration : 2 - Years

Trades : Aeronautical Structure & Equipment Fitter - 2nd Year Trade Practical - NSQF Level - 4 (Revised 2022)

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FOREWORD

The Government of India has set an ambitious target of imparting skills to 30 crores people, one out of every four Indians, by 2020 to help them secure jobs as part of the National Skills Development Policy. Industrial Training Institutes (ITIs) play a vital role in this process especially in terms of providing skilled manpower. Keeping this in mind, and for providing the current industry relevant skill training to Trainees, ITI syllabus has been recently updated with the help of Media Development Committee members of various stakeholders viz. Industries, Entrepreneurs, Academicians and representatives from ITIs.

The National Instructional Media Institute (NIMI), Chennai, has now come up with instructional material to suit the revised curriculum for **Aeronautical Structure & Equipment Fitter - Trade Practical - 2nd Year - NSQF Level - 4 (Revised 2022)** in **Capital Goods and Manufacturing Sector** under Yearly Pattern. The NSQF Level - 4 (Revised 2022) Trade Practical will help the trainees to get an international equivalency standard where their skill proficiency and competency will be duly recognized across the globe and this will also increase the scope of recognition of prior learning. NSQF Level - 4 (Revised 2022) trainees will also get the opportunities to promote life long learning and skill development. I have no doubt that with NSQF Level - 4 (Revised 2022) the trainers and trainees of ITIs, and all stakeholders will derive maximum benefits from these Instructional Media Packages IMPs and that NIMI's effort will go a long way in improving the quality of Vocational training in the country.

The Executive Director & Staff of NIMI and members of Media Development Committee deserve appreciation for their contribution in bringing out this publication.

Jai Hind

Directorate General of Training
Ministry of Skill Development & Entrepreneurship
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New Delhi - 110 001

PREFACE

The National Instructional Media Institute (NIMI) was established in 1986 at Chennai by then Directorate General of Employment and Training (D.G.E & T), Ministry of Labour and Employment, (now under Directorate General of Training, Ministry of Skill Development and Entrepreneurship) Government of India, with technical assistance from the Govt. of Federal Republic of Germany. The prime objective of this Institute is to develop and provide instructional materials for various trades as per the prescribed syllabi under the Craftsman and Apprenticeship Training Schemes.

The instructional materials are created keeping in mind, the main objective of Vocational Training under NCVT/NAC in India, which is to help an individual to master skills to do a job. The instructional materials are generated in the form of Instructional Media Packages (IMPs). An IMP consists of Theory book, Practical book, Test and Assignment book, Instructor Guide, Audio Visual Aid (Wall charts and Transparencies) and other support materials.

The trade practical book consists of series of exercises to be completed by the trainees in the workshop. These exercises are designed to ensure that all the skills in the prescribed syllabus are covered. The trade theory book provides related theoretical knowledge required to enable the trainee to do a job. The test and assignments will enable the instructor to give assignments for the evaluation of the performance of a trainee. The wall charts and transparencies are unique, as they not only help the instructor to effectively present a topic but also help him to assess the trainee's understanding. The instructor guide enables the instructor to plan his schedule of instruction, plan the raw material requirements, day to day lessons and demonstrations.

In order to perform the skills in a productive manner instructional videos are embedded in QR code of the exercise in this instructional material so as to integrate the skill learning with the procedural practical steps given in the exercise.The instructional videos will improve the quality of standard on practical training and will motivate the trainees to focus and perform the skill seamlessly.

IMPs also deals with the complex skills required to be developed for effective team work. Necessary care has also been taken to include important skill areas of allied trades as prescribed in the syllabus.

The availability of a complete Instructional Media Package in an institute helps both the trainer and management to impart effective training.

The IMPs are the outcome of collective efforts of the staff members of NIMI and the members of the Media Development Committees specially drawn from Public and Private sector industries, various training institutes under the Directorate General of Training (DGT), Government and Private ITIs.

NIMI would like to take this opportunity to convey sincere thanks to the Directors of Employment & Training of various State Governments, Training Departments of Industries both in the Public and Private sectors, Officers of DGT and DGT field institutes, proof readers, individual media developers and coordinators, but for whose active support NIMI would not have been able to bring out this materials.

Chennai - 600 032 **EXECUTIVE DIRECTOR**

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NIMI records its appreciation of the Data Entry, CAD, DTP Operators for their excellent and devoted services in the process of development of this Instructional Material.

NIMI also acknowledges with thanks, the invaluable efforts rendered by all other staff who have contributed for the development of this Instructional Material.

NIMI is grateful to all others who have directly or indirectly helped in developing this IMP.

INTRODUCTION

TTRADE PRACTICAL

The trade practical manual is intented to be used in workshop . It consists of a series of practical exercises to be completed by the trainees during the two years course of the **Aeronautical Structure & Equipment Fitter** in **Capital Goods & Manufacturing** trade supplemented and supported by instructions/ informations to assist in performing the exercises. These exercises are designed to ensure that all the skills in compliance with NSQF Level - 4 (Revised 2022)

This manual is divided into Six modules. The Six modules are given below

Module 1 - Manufacturing of Panel and Boxs

Module 2 - Equipment Fitting Mechanic

Module 3 - Wiring

Module 4 - Manufacturing

Module 5 - Mechanic

Module 6 - Electrical

The skill training in the shop floor is planned through a series of practical exercises centred around some practical project. However, there are few instances where the individual exercise does not form a part of project.

While developing the practical manual a sincere effort was made to prepare each exercise which will be easy to understand and carry out even by below average trainee. However the development team accept that there is a scope for further improvement. NIMI looks forward to the suggestions from the experienced training faculty for improving the manual.

TRADE THEORY

The manual of trade theory consists of theoretical information for the two years course of the **Aeronautical Structure & Equipment Fitter** in **Capital Goods & Manufacturing** Trade. The contents are sequenced according to the practical exercise contained in the manual on Trade Theory. Attempt has been made to relate the theoretical aspects with the skill covered in each exercise to the extent possible. This co-relation is maintained to help the trainees to develop the perceptional capabilities for performing the skills.

The trade theory has to be taught and learnt along with the corresponding exercise contained in the manual on trade practical. The indications about the corresponding practical exercises are given in every sheet of this manual.

It will be preferable to teach/learn the trade theory connected to each exercise at least one class before performing the related skills in the shop floor. The trade theory is to be treated as an integrated part of each exercise.

The material is not for the purpose of self learning and should be considered as supplementary to class room instruction.

CONTENTS

LEARNING / ASSESSABLE OUTCOME

On completion of this book you shall be able to

S.No.	Learning Outcome	Ref.Ex.No
1	Perform coating and validation of coating PR sealant application on a manufactured closed box. AAS/N9410	2.1.43 - 45
2	Perform monolithic panel in plain weave composite material,Glass Fibre, unidirectional carbon fibre by wet lay-up. AAS N9411	2.1.46 - 48
3	Perform operations of drilling on composite material, Carbon (Unidirectional) and Glass Fibre (plain weave). AAS/N1602	2.1.49 - 50
4	Produce composite riveted components using different thicknesses of Carbon Fibre and different types of rivets. AAS/N1602	2.1.51 - 53
5	Manufacture composite open and closed riveted box using different types of metal and composite materials AAS/N9412	2.1.54 - 56
6	Prepare the task, the corresponding material and tools for Equipment fitting (Aircraft Systems) by using and processing technical documentation related and standard practices. AAS/N1602	2.2.57 - 58
7	Identify the aircraft systems assembly phases and mechanical assembly knowing the operation of the different aircraft systems: Hydraulic, Pneumatic, Fuel, Oxygen and Flight control. AAS N9413	2.2.59 - 62
8	Perform pipe fitting assembly by different operations using standard tools and check for specified accuracy [Metallic pipes, composite ducts and flexible hoses].AAS/N9414	2.2.63- 2.3.66
9	Prepare the task, the corresponding material and tools for Equipment fitting by using and processing technical documentation and standard practices AAS/N1602	2.4.67- 70
10	Perform surface treatment, Heat treatment and touch-ups on manufactured metal parts. AAS/N9415	2.4.71 - 74
11	Perform corrosion treatment and NDT by observing standard procedure. AAS/N1803	2.4.75-76
12	Plan, dismantle, and assemble different mechanical components used for full mechanical flight control chain AAS/N1607	2.5.77
13	Plan, dismantle, and assemble different Hydraulic \ components used for full Hydraulic system and Performpipe routing inspections and leak tests.	2.5.78 - 80
14	Plan, dismantle, and assemble different Pneumatic components used for full Pneumatic system and Perform pipe routing inspections and leak tests.	2.5.81 - 82
15	Plan, dismantle, and assemble different Oxygen components used for full Oxygen system and Perform pipe routing inspections and leak tests. AAS/N1605	2.5.83 - 86
16	Plan, dismantle, and assemble different Fuel components used for full Fuel system and Perform pipe routing inspections and leak tests. AAS/N1608	2.5.87 - 1.5.89
17	Join cables to build a harness and Insertion and extraction on different types of connector terminations by using the appropriate tools AAS/N1609	2.6.90-93
18	Fit and install harness on different types of panels and structure elements and Perform basic electrical tests relative to connections and check compliance of harness building AAS/N1609	2.6.94-98

SYLLABUS

Duration	Reference Learning Outcome	Professional Skills (Trade Practical) With Indicative Hours	Professional Knowledge (Trade Theory)
Professional Skill 42 Hrs; Professional Knowledge 12Hrs	Perform coating and validation of coating PR sealant application on a manufactured closed box. AAS/N9410	43. Coating PR sealant application: Perform PR sealant application by coating on a closed box with bended sheets: pickling, cleaning, PR mixing, rivets and rivets and fasteners covering. (21hrs)	English technical vocabulary related to the task. Heat treatment and advantages. PR sealant types, uses, curing, pot life, storage, care & maintenance. (06 hrs)
		44 Coating PR sealant application validation by performing a leak test of the closed wing profile by using a Schrader plug and compressed air: Appropriate Measuring Instrument. [Schrader plug and compressed air] 45 Removal PR sealant by performing: - Rivets and fasteners removal - Mastic removal by scraping - Surface cleaning. (21hrs)	English technical vocabulary related to the task. Manufacturing processes for metallic materials: molding, welding, forging, forging die, sheet metal work (bending, cutting, stamping, rolling), additive manufacturing PR sealant types, uses, curing, pot life, storage, care &maintenance. Manufacturing processes for metallic materials: molding, welding, forging, forging die, sheet metal work (bending, cutting, stamping, rolling), additive manufacturing. PR sealant removal operations and cleaning. (06 hrs)
Professional Skill 63 Hrs; Professional Knowledge 18 Hrs	Perform monolithic panel in plain weave composite material, Glass Fibre, unidirectional carbon fibre by wet lay-up. AAS N9411	46 Composite panel manufacturing N°1: Using GFRP (Glass Fibre Reinforced Polymer), sheet size 500 mm x 500 mm perform operations of: - Marking plies - Making Fibre orientation choice - Calculating resin ratio - Composite wet lay-up - Vacuum bag installation - Resin curing. (21hrs)	English technical vocabulary related to the task. Manufacturing processes for metallic materials: molding, welding, forging, forging die, sheet metal work (bending, cutting, stamping, rolling), additive manufacturing. Composite Fibre: types, conductivity, specific gravity, mechanical properties and uses. Resins types, conductivity, specific gravity, mechanical properties and uses. Composite Fibre orientation, different waves types, resin ratio calculation Composite manufacturing processes. (06 hrs)
		47`Composite panel manufacturing N°2: Using unidirectional CFRP (Carbon Fibre Reinforced Polymer), sheet size 500 mm x 500 mm perform operations of:-Making a thin panel by wet lay up - Making Fibre orientation choice - Calculating resin ratio - Composite lay-up - Vacuum film installation - Resin curing, (21hrs)	English technical vocabulary related to the task.Composite Material Science : properties -Physical & Mechanical, Fiber Types -Resin types, difference between CFRP, GFRP, AFRP, QFRP, different weaving types, manufacturing methods, resin ratio, curing, sandwich materials, different core materials, composite technical textile. Composite Fibre: types, conductivity, specific gravity, mechanical properties and uses.Resins types, conductivity, specific gravity, mechanical properties and uses.

			Composite Fibre orientation, different waves types, resin ratio calculation. Composite manufacturing processes.(06hrs)
		48 Composite panel manufacturing N°3 : Using CFRP Carbon Fibre Reinforced Polymer), sheet size 500 mm x 500 mm, perform operations of: - Making a curved panel by wet lay-up - Making Fibre orientation choice - Calculating resin ratio - Composite lay-up - Vacuum film installation - Resin curing. (21hrs)	English technical vocabulary related to the task. Composite Material Science: properties - Physical & Mechanical, Fiber Types -Resin types, difference between CFRP, GFRP, AFRP, QFRP, different weaving types, manufacturing methods, resin ratio, curing, sandwich materials, different core materials, composite technical textile. Composite Fibre: types, conductivity, specific gravity, mechanical properties and uses.Resins types, conductivity, specific gravity, mechanical properties and uses. Composite Fibre orientation, different waves types, resin ratio calculation. Composite manufacturing processes.(06hrs)
Professional Skill 21 Hrs; Professional Knowledge 06 Hrs	Perform operations of drilling on composite material, Carbon (Unidirectional) and Glass Fibre (plain weave). AAS/N1602	49 Composite drilling: Using previous GFRP & CFRP, sheets size 500 mm x 500 mm, perform operations of: - Drilling, counter drilling Using hand drill machine - Countersinking - Temporary fitting 50 Composite sandwich manufacturing: Using previous CFRP, sheets size 500 mm x 500 mm, make a sandwich panel by performing operations of: - Tracing - Fibre orientation, resin ration calculation, composite lay-up, honeycomb cutting, vacuum bag, polymerization. Appropriate Measuring Instrument. [Tap test] (21hrs)	English technical vocabulary related to the task. Composite Material Science: properties - Physical & Mechanical, Fiber Types -Resin types, difference between CFRP, GFRP, AFRP, QFRP, different weaving types, manufacturing methods, resin ratio, curing, sandwich materials, different core materials, composite technical textile. Drill- material, types, parts and sizes for composite materials. Drill angle-cutting angle for different materials, cutting speed feed. R.P.M. for composite materials. Drilling composite materials handling and maintenance. Composite Material Science: properties - Physical & Mechanical, Fiber Types -Resin types, difference between CFRP, GFRP, AFRP, QFRP, different weaving types, manufacturing methods, resin ratio, curing, sandwich materials, different core materials, composite technical textile. Composite core, types, mechanical properties and uses. Sandwiches composites manufacturing processes, curing.(06hrs)
Professional Skill 42 Hrs; Professional Knowledge 12 Hrs	Produce composite riveted components using different thicknesses of Carbon Fibre and different types of rivets. AAS/N1602	51 Composite riveted installation: Using different thicknesses of CFRP and different types of rivets (LGP, Hi-lite, Cherry-max, Compos lock, etc.) perform operations of: - Drilling, Counter drilling, Countersinking Using hand drill machine - Deburring	English technical vocabulary related to the task. Sheet holders pins: material, construction, types, accuracy and uses. Perform riveting operations on composite structure, Rivet pull machine, care, maintenance, specification, description, types and their uses, method of using. Blind rivet specifications for composite installation, definition, types, sizes, materials, length calculation (06 hrs)

		- Reaming - Temporary fitting - Rivets and fasteners fitting (LGP, Hi-lite, Cherry-max, etc.). Appropriate Measuring Instrument. [Rivet gauge, " GO no GO" gauge](21hrs)	
		52 Composite riveted installation: Using different thicknesses of multi materials (Aluminum, Titanium, CFRP, GRFP...) and different types of rivets and fasteners (LGP, Hi-lite, Cherryˆmax, Composi-lock, etc.) perform operations of: - Drilling, counter drilling, countersinking Using hand drill machine - Deburring - Reaming - Temporary fitting - Rivets and rivets and fasteners fitting (LGP, Hiˆlite, Cherry-max, etc.) Appropriate Measuring Instrument. [Rivet gauge, " GO no GO" gauge] 53 Rivets and fasteners removal: Using Metallic and composite assembly perform rivets and fasteners removals on the composite component by manual drilling and use of punch tool and pin drift.(21hrs)	English technical vocabulary related to the task. Sheet holders pins: material, construction, types, accuracy and uses. Composite metallic assembly specification. Blind rivet and specific fasteners specifications for composite and metallic installation, definition, types, sizes, materials, length calculation. Blind Rivet and other fasteners definition, types, sizes, removal operations. Aviation Legislation: International Aviation legislation: Chicago Convention and the role of the International Civil Aviation Organization. Directorate General of Civil Aviation: India safety policy, Structure of the aviation regulatory framework, relationship between CAR-21, CAR-M, CAR-145, CAR-147. General description of CAR 21 and the importance of applying Airworthiness requirements. (06 hrs)
Professional Skill 63 Hrs; Professional Knowledge 18 Hrs	Manufacture composite open and closed riveted box using different types of metal and composite materials AAS/N9412	54 Composite riveted box manufacturing :Using CFRP, Aluminum 2024, Titanium TA6V and AISI 316L Stainless steel, sheets size 400 mm x 200 mm, perform operations of: - Riveting - Drilling - Countersinking - Temporary fitting - Rivets and fasteners installation Perform Quality Inspection on an existing installation: defects and non conformities detection by visual inspection. Appropriate Measuring Instrument. [Rivet gauge](21hrs)	English technical vocabulary related to the task. Aircraft description: ATA standard and ATA list, General description of the main Aircraft systems and related parts. Perform riveting operations on composite structure, Rivet pull machine, care, maintenance, specification, description, types and their uses, method of using. Composite metallic assembly specification, Blind rivet specifications for composite and metallic installation, definition, types, sizes, materials, length calculation. (06 hrs)
		55 Composite riveted closed box manufacturing: Using CFRP, size 500 mm x 500 mm, make a metal-composite assembly performing operations of: - Bending - Riveting	English technical vocabulary related to the task. Aircraft description: General description of the main Aircraft systems and related parts. Perform riveting operations on composite structure, Rivet pull machine, care,

		- Drilling - Countersinking - Pinning - Rivets and fasteners installation - PR sealant application. Appropriate Measuring Instrument. [Rivet gauge](21hrs)	maintenance, specification, description, types and their uses, method of using. Blind rivet specifications for composite and metallic installation, definition, types, sizes, materials, length calculation. PR sealant types, uses, curing, pot life, storage, care & maintenance on composite materials. (06 hrs)
		56 Composite riveted closed box manufacturing –Examination Using CFRP, size 500 mm x 500 mm, make a metal-composite assembly by performing operations of: - Bending - Riveting - Drilling - Countersinking - Pinning - Rivets and fasteners installation - PR sealant application. Appropriate Measuring Instrument. [Rivet gauge](21hrs)	English technical vocabulary related to the task. Aircraft description: General description of the main Aircraft systems and related parts. Perform riveting operations on composit structure, Rivet pull machine, care, maintenance, specification, description, types and their uses, method of using. Blind rivet specifications for composite and metallic installation, definition, types, sizes, materials, length calculation. PR sealant types, uses, curing, pot life.(06hrs)
Professional Skill 21 Hrs; Professional Knowledge 06 Hrs	Prepare the task, the corresponding material and tools for Equipment fitting (Aircraft Systems) by using and processing technical documentation related and standard practices. AAS/N1602	57 Reception of a pipe. Perform operations of: - Checking the lack of impact on the pipes, - Checking the protections - Handling of all types of pipes and different lengths (trolleys, protective foam, bubble wrap, transport case) 58 **Operations before mounting piping (ATA 26,28,29,30,35,36,38...) : Perform operations of :** - Identification of the pipe's plugs shutter - Installation of the corresponding plugs - Checking that the elements to be mounted have not been damaged - Checking that their part or equipment number corresponds to the requisition sheet - Checking the expiry date. (21hrs)	English technical vocabulary related to the task. Aircraft description: General description of the main Aircraft systems and related parts. Unpacking and storage conditions. Different common damage. English technical vocabulary related to the task. Standard practices procedures on the technical documentation.Different types of plugs. (06 hrs)
Professional Skill 42 Hrs; Professional Knowledge 12 Hrs	Identify the aircraft systems assembly phases and mechanical assembly knowing the operation of the different aircraft systems: Hydraulic, Pneumatic, Fuel,	59 Identify the aircraft systems assembly phases by team of 2 students: On structure panels and mock-up, Perform for each system (Hydraulic, Pneumatic, Fuel, Oxygen and Flight controls): - Identification of the different elements and explanations of their role	English technical vocabulary related to the task. Brief description of Hydraulic, Pneumatic, Fuel, Oxygen and Flight controls systems. (06 hrs)

	Oxygen and Flight control. AAS N9413	- Brief presentation of the system operating - Identification of the hazards - Association of each element of the panel its symbol on the corresponding diagram - Identifying in the work card the order of assembly of each element - Assembly on the mockˆup all the different elements - Crosschecking by another team according to the technical documentation.(21hrs)	
		60 Pipe routing on a diagram: On mock-up with technical documentation, perform operations of: - Identification of each pipe mentioned in the work card and its belonging system - Identification of the fluid flow direction - Identification of tools and equipments to achieve the pipe routing - Checking the condition of the connection ends - Preparation of the structure panel and mark - Marking the path of the different elements 61 Screwing and torquing operations On structure panels Perform operations of: - Screwing different types of screws using the appropriate tools - Tightening different types of screws using ratchet socket with the appropriate torque wrench regarding the torque Aluminum required and mentioned in the work card 62 Locking techniques on different subassemblies and structure panel, Perform operations of: - Locking with nut lockwasher, pin and castle nut, self-locking nut - Wire locking of nut retainer, screw, nut and piping and safety wire - Locking fault identification.(21 hrs) tle nut, self-locking nut	English technical vocabulary related to the task. Routing diagram. Definition of the appropriate marking according to the type of pipe. Technical vocabulary related to the systems. Select a torque wrench and read the Aluminum of torquing on an abacus. Locking techniques.(06hrs)

		- Wire locking of nut retainer, screw, nut and piping and safety wire - Locking fault identification. (21 hrs)	
Professional Skill 42 Hrs; Professional Knowledge 12 Hrs	Perform pipe fitting assembly by different operations using standard tools and check for specified accuracy [Metallic pipes, composite ducts and flexible hoses]. AAS/ N9414	63 Metallic pipe installation by performing operations of: - Combs, pipe support collars and clamps installation and torque tightening. - Connection of the pipe in accordance with work card. - Dismantling, assembly valves and fitting with pipes. - Fittings torque tightening with torque wrench. - Ensuring the electrical continuity and grounding with bonding leads. ^^F - Assembly of metal pipes on different structural panels with respect of the gaps between pipes and the surrounding environment. - Checking the mounting constraints.(21 hrs)	English technical vocabulary related to the task. Different pipe joining techniques / grounding / bounding. Identify pipes constraints and gaps between pipes and the surrounding environment. (06 hrs)
		64 Composite duct installation by performing operations of: - Composite duct support collars, brackets installation and torque tightening. - Connection of the duct in accordance with work card. - Dismantling, assembly of sleeves and bellows. - Fittings torque tightening with torque wrench. - Assembly of composite ducts on different structural panels with respect of the gaps between ducts and the surrounding environment. - Checking the mounting constraints. 65 Flexible hose installation by performing operations of: - Connection of the flexible hose in accordance with work card. - Dismantling, assembly of fittings. - Fittings torque tightening with torque wrench. - Assembly of flexible hoses on different structural panels with respect of the gaps between ducts and the surrounding environment.	English technical vocabulary related to the task. Different duct joining techniques/ grounding/ bounding. Identify ducts constraints and gaps between ducts and the surrounding environment. English technical vocabulary related to the task. Different flexible hose joining techniques. Identify flexible hose constraints, bending radius, kinking and gaps between flexible hoses and the surrounding environment. Common damage. Different thermal insulation sleeving assembly techniques. Common damage.(06hrs)

		- Checking the mounting constraints, bending radius and lack of kinking. 66 On different subassemblies perform operations of: - Checking that the insulation sleeves comply with installation plans, standards and technical specifications. - Put the sleeve in place and fix it to the pipe work. (21hrs).	
Professional Skill 63Hrs; Professional Knowledge 18 Hrs	Prepare the task, the corresponding material and tools for Equipment fitting by using and processing technical documentation and standard practices AAS/N1602	67 Perform assembly/ disassembly of Over Heat Detection System by performing operations of: - Muff installation on duct coupling - Connection of the Graviner and wire locking in accordance with work card - Assembly of OHDS on different ducts with respect of the functional installation rules - Checking the tolerances for waviness, bends in wire and two detection loops - Checking the duct coupling - Checking the correct adjustment between the muff position and the Graviner. (21hrs)	English technical vocabulary related to the task. Different types of GRAVINER systems.Common damage / mistakes. (06 hrs)
		68 Perform assembly / disassembly of different mechanical sub-assemblies by operations of: - Applying the task according to technical documentation - Disassembly the mechanical subˆassembly: classification, verification, identification and storage of the parts - Assembly of mechanical sub assembly: clearance gaps, torque tightening, lockage - Checking the correct assembly(Cross-check by another trainee) - Checking the proper functioning of all the assembled parts: bonding, leaks.(21hrs)	English technical vocabulary related to the task. Different types of locking techniques.Common damage / mistakes. (06 hrs)
		69 Wiring technical documentation identification and use - Define necessary documents for the job to perform. - Verify effectively and applicability of the extracted documents. - Find and understand the main information in the different types of	English technical vocabulary related to the task. Safety rules and use technical documentation related to wiring practices Aeronautic electrical wires and cables: characteristics, references, types and gauges, shielded and coaxial cables, special cables, manufacturer marking, identification

		technical documents (texts, electrical schemes, wiring diagrams, manufacturers norms) 70 Harness kit preparation Analyze the work card, identifying tasks,necessary tools and materials for: - Cutting different wires/cables types according to length definitions - Classify and store the cables for next practical exercises.(21hrs)	marking. Wiring tools: cutting pliers, scissors, cable cutter, ruler and tape measure. (06hrs)
Professional Skill 63 Hrs; Professional Knowledge 18 Hrs	Perform surface treatment, Heat treatment and touch-ups on manufactured metal parts. AAS/N9415	71 Surface treatment Perform surface treatments on the manufactured parts by: - Sanding - Pickling - Reworking - Alodine process application - Zinc chromate touch-ups - Painting touch-ups Appropriate Measuring Instrument.(21hrs)	English technical vocabulary related to the task. Corrosion definition: different types of corrosion (galvanic, pitting, filiform, crevice, stress, fatigue, intergranular) Methods of corrosion protection. Corrosion treatment. Physical properties of materials. Surfaces treatment knowledge, grinding, scouring. Surface protection, definition: types, uses, properties, paint. (06hrs)
		72 Tensile Test n°4 Heat treatment by: - Performing Heat treatment on the manufactured parts with Aluminum 2024, Aluminum 5086 and Aluminum 7075 - Tensile tests on the treated parts in order to verify the physical and mechanical properties. (21hrs)	English technical vocabulary related to the task. Corrosion definition: different types of corrosion (galvanic, pitting, filiform, crevice, stress, fatigue, intergranular) Methods of corrosion protection. Corrosion treatment. Safety practices. Physical properties of Aluminum metal: phase diagram of Al-Cu, AL-Zn and Al-Mg, Heat treatment associated. (06hrs)
		73 Sheet metal boxes assembly Using CFRP, GFRP, AF73. Sheet metal boxes assembly Using CFRP, GFRP, AFRP (AramideFibre Reinforced Polymer), Aluminum 2024, Titanium TA6V and AISI 316L Stainless steel, sheets size 500 mm x 300 mm, perform operations of: - Tracing - Manual drilling, Counter drilling using hand drill machine - Deburring - Temporary fitting - Reaming - Countersinking - Rivets and fasteners installation /PR sealant application - Bending - Fitting process (using files) - Performing an access panel with hinge - Self-check by using rivet gauge	English technical vocabulary related to the task.PR sealant types, uses, curing, pot life, storage, care &maintenance on composite materials.Torquing specifications. Wire lock installation.(06hrs)

		74 Perform Quality Inspection on an existing installation: defects and non^conformities detection by visual inspection.(21hrs)	
Professional Skill 42 Hrs; Professional Knowledge 12 Hrs	Perform corrosion treatment and NDT by observing standard procedure.AAS/ N1803	75 Corrosion treatment elimination by : - Manual rework - Tool rework - Sanding blending - Pickling - Alodine treatment - Zinc chromate touch-ups - Painting touch-ups. (21hrs)	English technical vocabulary related to the task. 90°angle sander handling, care and maintenance Corrosion reworking and corrosion removal processes.(06hrs)
		76 Non Destructive Test performing inspections: - Tapping - Ultrasonic - Dye penetrant - Visual camera. (21hrs)	English technical vocabulary related to the task.NDT definition, types, uses, care, maintenance for metallic and composite materials.(06hrs)
Professional Skill 21 Hrs; Professional Knowledge 06 Hrs	Plan, dismantle, and assemble different mechanical components used for full mechanical flight control chain AAS/N1607	77 Perform assembly of flight controls and settings by operations of: - Assembly the components a flight control chain: control rod, cable, pulley, shaft... - Tightening according to the standard torque Aluminum mentioned in work card - Bonding/grounding:screw the ground termination, apply varnish on different pipes - Checking flight controls functionality. - Constraint checking / tension of a cable. (21hrs)	English technical vocabulary related to the task. Technical documentation, tolerance criteria Flight controls chain and setting process Common damage / mistakes. Specific hazards regarding the test procedure. (06 hrs)
Professional Skill 42Hrs; Professional Knowledge 12 Hrs	Plan, dismantle, and assemble different Hydraulic components used for full Hydraulic system and Performpipe routing inspections and leak tests. AAS/ N9416	78 Perform assembly on the Hydraulic system by operations of: - Assembly of the Hydraulic system components: valve, pump, actuators. - Position parts relative to each other - Tightening according to the standard torqueAluminum mentioned in work card - Bonding/grounding: screw the ground termination, apply varnish on different pipes - Functionality check according to the technical documentation. (21hrs)	English technical vocabulary related to the task.Technical documentation and operation of hydraulic system.Common damage / mistakes.(06 hrs)
		79 Perform crosscheck visual inspection (by team of 2 students) on a mock up with defaults on the hydraulic system:	English technical vocabulary related to the task. Technical documentation, standards inspection procedure

		- Routing according to the diagram - Cleanliness - Grounding, bounding standards - Marking and lockage - Marking of systems - Check tightening torques - Check the assembly compliance of the system according to the requirements defined in the documentation. 80 Using compressed air, perform Hydraulic system leak tests.(21hrs)	according to the system. Common faults / mistakes English technical vocabulary related to the task. Technical documentation, tolerance criteria. Specific hazards regarding test procedure.(06hrs)
Professional Skill 42 Hrs; Professional Knowledge 12 Hrs	Plan, dismantle, and assemble different Pneumatic components used for full Pneumatic system and Perform pipe routing inspections and leak tests AAS/N1605	81 Perform assembly on the Pneumatic system by operations of: - Assembly the hydraulic system components: compressor, pressure gauge, filter, regulator... - Position parts relative to each other - Tightening according to the standard torque Aluminum mentioned in work card - Bonding/grounding: screw the ground termination, apply varnish on different pipes - Checking functionality according to the technical documentation - Checking leakages. (21hrs)	English technical vocabulary related to the task.Technical documentation and operation of pneumatic system. Common faults / mistakes. (06 hrs)
		82. Perform crosscheck visual inspection (by team of 2 students) on a mock up with defaults on the Pneumatic system: - Routing according to the diagram - Cleanliness - Grounding, bounding standards - Marking and lockage - Marking of systems - Check tightening torques - Check the assembly compliance of the system according to the requirements defined in the documentation.(21hrs)	English technical vocabulary related to the task. Technical documentation, standards inspection procedure according to the system. Common faults / mistakes. (06 hrs)
Professional Skill 42 Hrs; Professional Knowledge 12 Hrs	Plan, dismantle, and assemble different Oxygen components used for full Oxygen system and Perform pipe routing inspections and leak tests. AAS/N1605	83 Using compressed air, perform Pneumatic system leak tests. 84 Perform assembly and fitting of Oxygen components by operations of: - Position parts relative to each other - Tightening according to the standard torque Aluminum mentioned in work card - Bonding/grounding: screw the ground termination, apply varnish on different pipes	English technical vocabulary related to the task. Technical documentation, tolerance criteria. Specific hazards regarding test procedure.(06hrs)

		- Checking functionality according to the technical documentation.(21hrs)	
		85 Perform crosscheck visual inspection (by team of 2 students) on a mock up with defaults on the Oxygen system: - Routing according to the diagram - Cleanliness - Grounding, bounding according to CDCCL standards - Marking of systems - Check tightening torques - Check the assembly complianceof the system according to the requirements defined in the documentation. 86 Using compressed air, perform Oxygen system leak tests.(21hrs)	English technical vocabulary related to the task. Technical documentation, standards inspection procedure according to the system. Common faults /mistakes. Technical documentation, tolerance criteria. Specific hazards regarding test procedure.(06hrs)
Professional Skill 42 Hrs; Professional Knowledge 12 Hrs	Plan, dismantle, and assemble different Fuel components used for full Fuel system and Perform pipe routing inspections and leak tests. AAS/ N1608	87 Perform assembly and fitting of fuel components by operations of: - Assembly of Fuel system components: pump, pipes, vent valve, fixed and semi-floating elements, floating fittings, pipe fastening elements, different fitting joints, pipe marking... - Positioning parts relative to each other - Tightening according to the standard torque Aluminum mentioned in work card - Bonding/grounding: screw the ground termination, apply varnish on different pipes (Fuel Tank Safety standard) - Checking leakages. (21hrs)	English technical vocabulary related to the task. Technical documentation and operation of Fuel system. Common faults / mistakes. (06 hrs)
		88 Perform crosscheck visual inspection (by team of 2 students) on a mock up with defaults on the Fuel system: - Routing according to the diagram - Cleanliness - Grounding, bounding according to CDCCL standards - Marking of systems - Check tightening torques - Check the assembly compliance of the system according to the requirements defined in the documentation 89 Using compressed air, perform Fuel system leak tests.(21hrs)	English technical vocabulary related to the task. Technical documentation, standards inspection procedure according to the system. Common faults / mistakes. English technical vocabulary related to the task. Technical documentation, tolerance criteria. Specific hazards regarding test procedure. (06 hrs)

Professional Skill 63 Hrs; Professional Knowledge 18 Hrs	Join cables to build a harness and Insertion and extraction on different types of connector terminations by using the appropriate tools AAS/N1609	90 Shape and tie wires/cables to build a harness: - Check wires/cables :references lengths (notion of tolerances) - Carry out the wires/cables identification in correlation with the technical instructions - Set wires/cables according to their destination (layout - wiring diagram) - Tie wires/cables with plastic ties or lacing tape - Perform installation of textile/ plastic protective sheaths or sleeves - Install position markers (coloured scotch tape or lacing tape) - Identify harness and its different branches using labels. (21hrs)	English technical vocabulary related to the task. Cutting wires/cables to length within tolerances defined by the work card, wiring diagram and layout drawing understanding, tying techniques using plastic ties or textile lacing tape, mechanical protection for harness (plastic and textile sleeves, shrinkable sleeves), tightening gun settings according to the technical documentation, identification by labels and sleeves. (06 hrs)
		91 Shape and tie wires/cables to build a harness - Examination - Check wires/cables: references - lengths (notion of tolerances) - Carry out the wires/cables identification in correlation with the technical instructions - Set wires/cables according to their destination (layout - wiring diagram) - Tie wires/cables with plastic ties or lacing tape - Perform installation of textile/ plastic protective sheaths or sleeves - Install position markers (coloured scotch tape or lacing tape) - Identify harness and its different branches using labels 92 Strip different types of wires/cables (insulation removal) by: - Stripping small gauge wires using the stripping pliers - Removal insulation on shielded cables using the scalpel - Stripping and disassembly large section cables using the specific tooling - Checking for non conformities, (21hrs)	English technical vocabulary related to the task. Cutting wires/cables to length within tolerances defined by the work card, wiring diagram and layout drawing understanding, tying techniques using plastic ties or textile lacing tape, mechanical protection for harness (plastic and textile sleeves, shrinkable sleeves), tightening gun settings according to the technical documentation, identification by labels and sleeves. English technical vocabulary related to the task. Stripping techniques using appropriate tools according towires/cables types and gauges, and in compliance with technical documentation. Stripping defects/ nonconformities. Safety rules with cutting tools. Wiring tools: Scalpel or cutter, stripping pliers, ruler. (06 hrs)
		93 Using infra-red gun or hot air gun perform operations of: - Shielding by end implementation (special measurements, insulation stripping, shield cutting, wire lead and solder sleeve	English technical vocabulary related to the task. Aeronautic shielded cables. Stripping techniques and associated inspections. Solder sleeves and shrinkable sleeves.

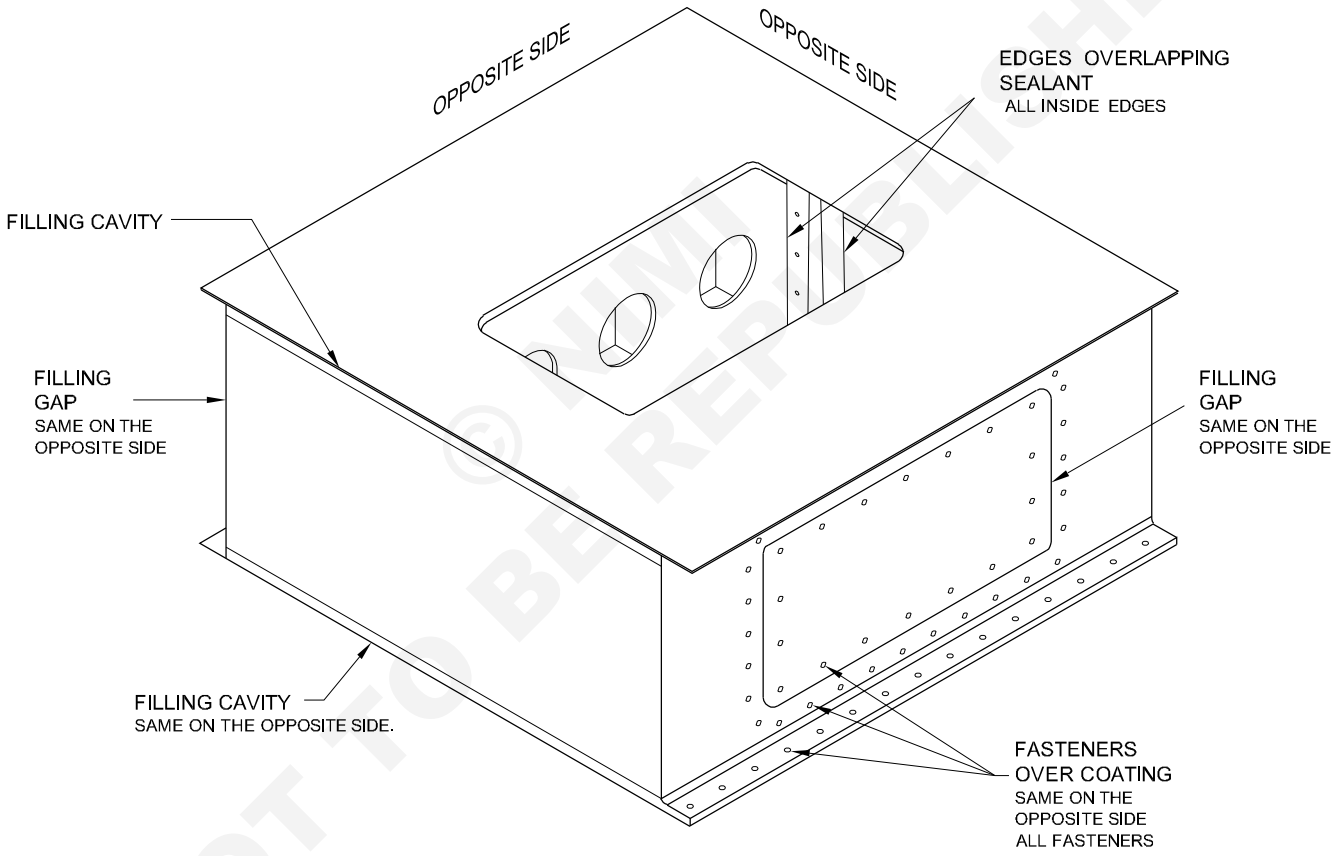
		installation, infra-red gun heating, checking) - Shielding by window implementation (special measurements, insulation stripping, shield cutting, wire lead and solder sleeve installation, infra-red gun heating, checking) - Shield stop implementation (special measurements, insulation stripping, shield cutting, shrinkable sleeve heating with hot airgun). (21hrs)	Wiring tools: Scalpel or cutter, cutting pliers, scissors, ruler, infra-red gun, hot air gun. Quality requirements.(06hrs)
Professional Skill 84 Hrs; Professional Knowledge 22 Hrs	Fit and install harness on different types of panels and structure elements and Perform basic electrical tests relative to connections and check compliance of harness building AAS/N1609	94 Perform crimping operations of different terminal components by: - Crimping contacts on small gauge wires - Crimping lugs on small gauge wires - Crimping splices small gauge wires - Crimping plugs on big gauge cables - Checking for non^conformities - Ensuring the traceability of crimping operations on the associated technical sheet 95 Insertion and extraction of various contacts on different types of connector / Connect lugs on terminal blocks by performing operations of: - Insertion/extraction on different connectors type (rectangular, circular, modules) using the appropriate tools - Associated checks - Coding change (fool proofing devices) on rectangular connectors - Connecting lugs on terminal blocks and secure terminal block covers. (21hrs)	English technical vocabulary related to the task. Terminal types: contents, splices, lugs, spare wire end caps. Stripping techniques. Crimping procedures for small gauge wires with hand crimping pliers (for contacts, lugs and splices) and associated controls (Quality requirements). Crimping procedures for big gauge cables with pneumatic crimping tool and associated controls (Quality requirements).Wiring tools: Crimping pliers, locators, positioner, stripping pliers, cutting pliers. Tools validity. English technical vocabulary related to the task. Insertion and extraction tools and the associated standard practices. Terminal types for connectors: pins, sockets, short-male contacts, sealing pins Connector types: plugs/sockets, mobile fixed, circular, rectangular, junction modules, grounding modules, ARINC connectors, terminal blocks, relay bases. Connector accessories: back shells, cable clamps, fool proofing devices, protective covers, sealing plugs Terminal types: contacts, splices, lugs, spare wire end caps. Wiring tools: contacts insertion/extraction tools, fool proofing ejector. (06 hrs)
		96 Using a torque wrench, strap wrench, thread lock, lock wire and connector assembly tools, finalize assembly of harness components by performing operations of: - Installation all connector accessories according to the work card - Tightening and torque the back	English technical vocabulary related to the task. Connector types plugs/sockets, mobile fixed, circular, rectangular, junction modules, grounding modules, ARINC connectors, terminal blocks, relay bases. Connector accessories: back shells, cable clamps, fool proofing devices, protective covers, sealing plugs.

		shells on circular connectors and apply the appropriate locking procedures, marking procedures - Coding on rectangular connectors and install cable clamps 97 Perform electrical tests using a multimeter: - Carry out a wire continuity check on the harness - Perform troubleshooting in case of mistakes during insertion task. - Correct the wrong position contacts by extracting/re-inserting - Ensure the harness compliance according to quality and functional requirements after repair - Cross-check on the harness of another student - Perform Quality Inspection on an existing installation: defects and non-conformities detection by visual inspection.(21hrs)	Wiring tools: Strap wrench, torque wrench, locking wirepliers, connector assembly plate. Consumable supplies: thread lock, lock wire. English technical vocabulary related to the task Wiring diagram understanding and troubleshooting method.Quality Inspection. Electrical tests: continuity check using a multimeter. (06hrs)
		98 Fit and install harness on different types of attaching part (+20 scenarios) by performing operations of: - Inspecting the integrity of harness before beginning the installation tasks - Choosing the attaching parts / routing supports (plastic vee supports, metallic or plastic clamps, spacers, screws and washers) to be fastened to the structure panels according to the work card - Installation of the attaching parts on the panels using ratchet, sockets, screwdrivers and torque wrench - Installation harness on the different attaching points in accordance with 2D routing drawing - Bonding/grounding connections: torque the bonding/grounding terminals, apply protection varnish on the bonding/grounding terminals - Ensuring the protection of the connection elements with plastic caps or bags - Ensuring the traceability of the tasks on the associated traceability sheet - Self-check. (42hrs)	English technical vocabulary related to the task. Attaching parts (plastic vee supports, metallic or plastic clamps, spacers, screws and washers). Structure and fuselage parts (frames, stringers, brackets, panels). Harness fitting rules: special care for harness integrity, bending radii, position markers, routing, segregation, tightening. (10hrs)

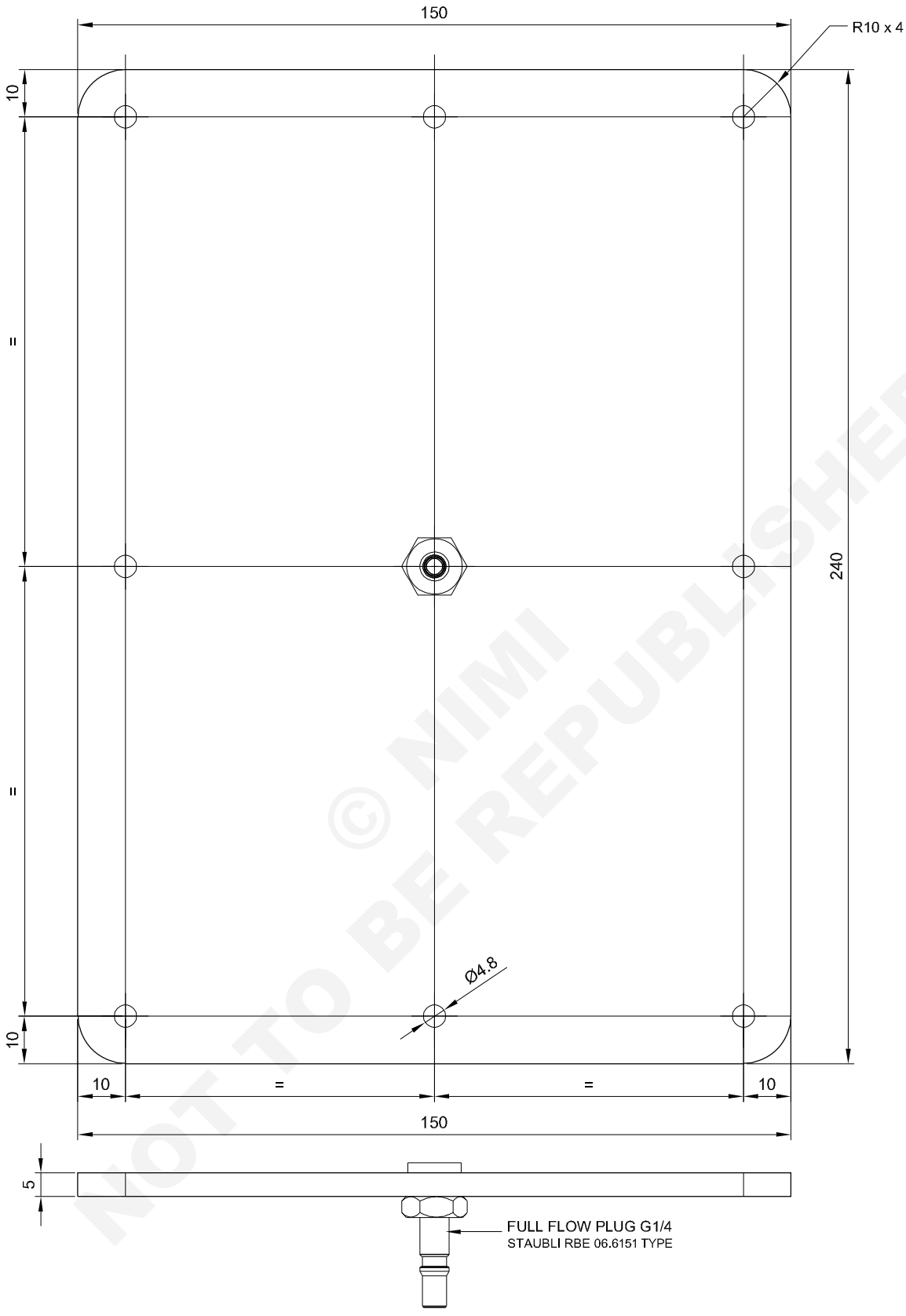
Coating PR sealant application - closed box - sealing

Objectives: At the end of this exercise you shall be able to·

- **prepare surfaces for sealing**
- **fill gap and cavities**
- **overcoat fasteners.**

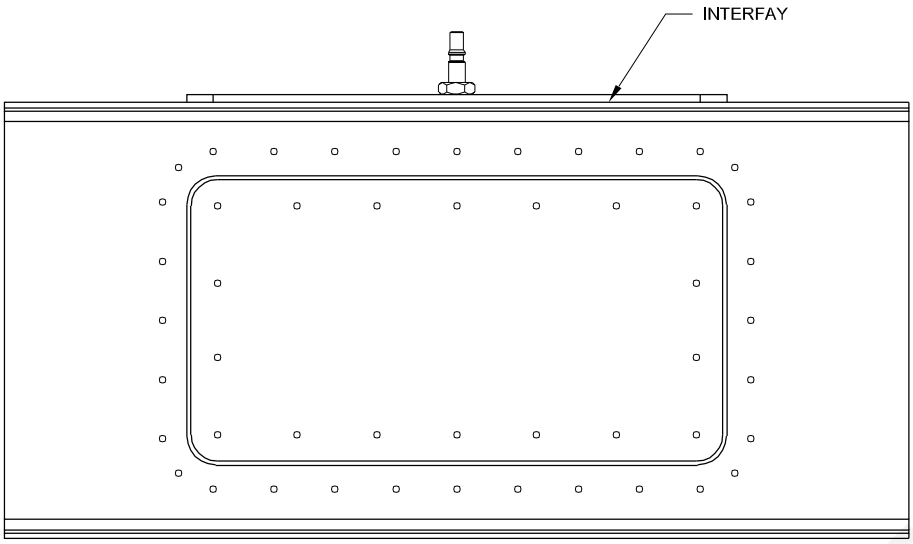


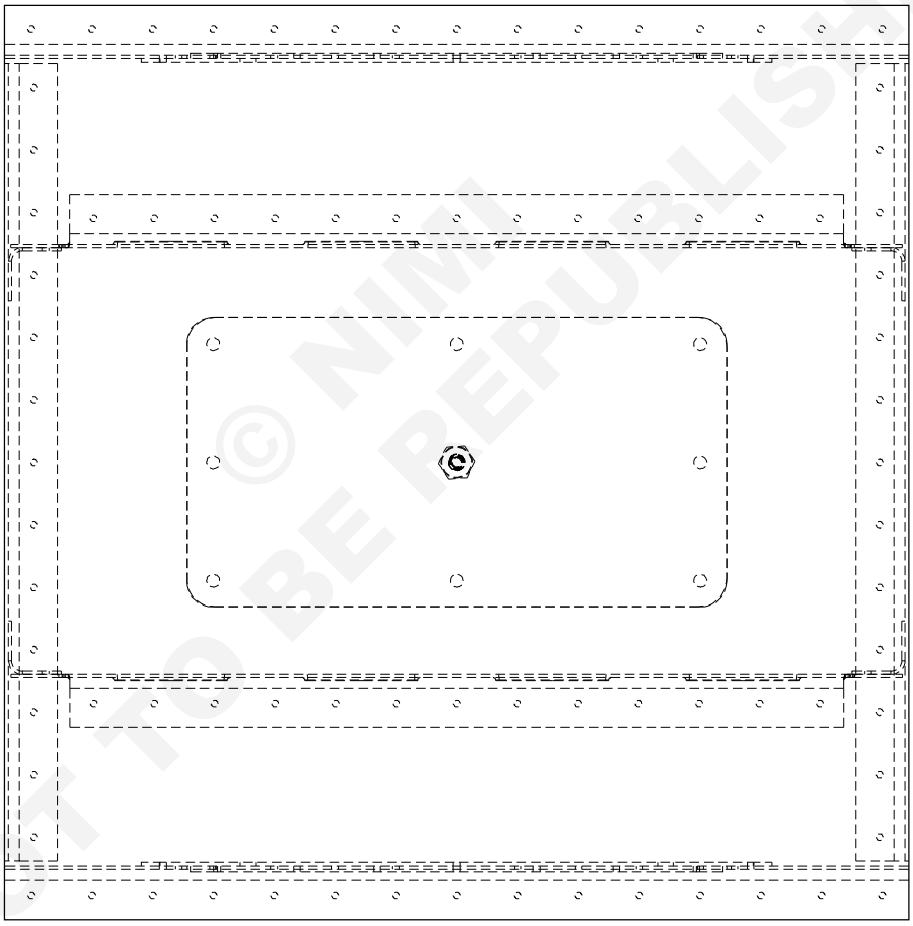
-	-	< 2.1.42	-	-	-	3.1.43
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**CLOSED BOX - SEALING**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3143E1	



1	-	RBE 06.6151	-	-	-	3.1.43
1	150 x 240 - THICK. 5	-	AW - 2017	-	-	3.1.43
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE : NTS	**CLOSED BOX - PLUG MANUFACTURING**	DEVIATIONS	TIME : 20 Hrs
		CODE NO : AFN3143E2	





BOLT-NAS1801-3D-5
WASHER-NAS1149F033ZP
ANCHER NUT-NAS1479-A3
NUT PLATE RIVET-CCR264-3-3
DO NOT OVERCOAT BOLT HEAD

-	-	< 2.1.42	-	-	-	3.1.43
1	150 x 240 - THICK. 5	BUSH	AW - 2017	-	-	3.1.43
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE : NTS	**CLOSED BOX - FINAL ASSEMBLY**	DEVIATIONS	TIME : 20 Hrs
		CODE NO : AFN3143E3	

Job Sequence

TASK 1: **Plug manufacturing**

- Check dimensions and thickness.
- Mark external dimensions.
- File the external dimensions.
- Drawn filing all edges.
- Deburr edges.
- Check dimensions.
- Mark the holes position and drill.
- Deburr holes.
- Thread the central hole.
- Install the full flow plug (Staubli RBE 06.6151 type).
- Check and complete the report sheet.

— — — — — — — —

TASK 2: **Close the box**

- Mark the plug position and clamp.
- Drill the holes.
- Counter-drill to final diameter.
- Deburr holes.
- Locate the self-sealing anchor nuts NAS1473-A3.
- Install the anchor nuts with two CCR264-3-3 blind rivets.
- Check the correct installation of anchor nuts and blind rivets.

— — — — — — — —

TASK 3: **Sealing - Surfaces preparation**

- Prepare all surfaces following the instructions given in 2nd year (Vol I of II) theory

Sealing - Interfay application

- Apply a thin layer of sealant with a roller to the surface in contact with the plug.
- Assemble with bolts (NAS1801-3D-5) and washers(NAS1149F0332P) and torque.
- Leave for 15 minutes.
- Apply a second torque.

Do not overcoat the bolt head

Sealing – Fill gap and cavity

- Apply sealant with sealant gun.

Sealing – Overlap edges

- Apply sealant with brush.

Sealing – Overcoat fasteners

- Apply sealant with sealant gun and brush.
- Check all sealant applications and rework if defects or damages are found.

— — — — — — — —

Report sheet – plug

Dimensions	Theorical		Measured
External dimensions	150	±0.5	
	240	±0.5	
	R10	±0.5	
Radius	R10	±0.5	
	R10	±0.5	
	R10	±0.5	

Drilling	Theorical		Measured
Edge distance	10	+1 / -0	
Number of holes	8		
Hole diameter	Ø 4.8		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Thread	Theorical	Measured
Position	-	☐ OK ☐ NOK
Thread size	According with full flow plug	☐ OK ☐ NOK
Thread quality	-	☐ OK ☐ NOK
Deburring quality	-	☐ OK ☐ NOK

Deburring quality	CONFORM	NOT CONFORM
Absence of marks, impacts or scratches	CONFORM	NOT CONFORM

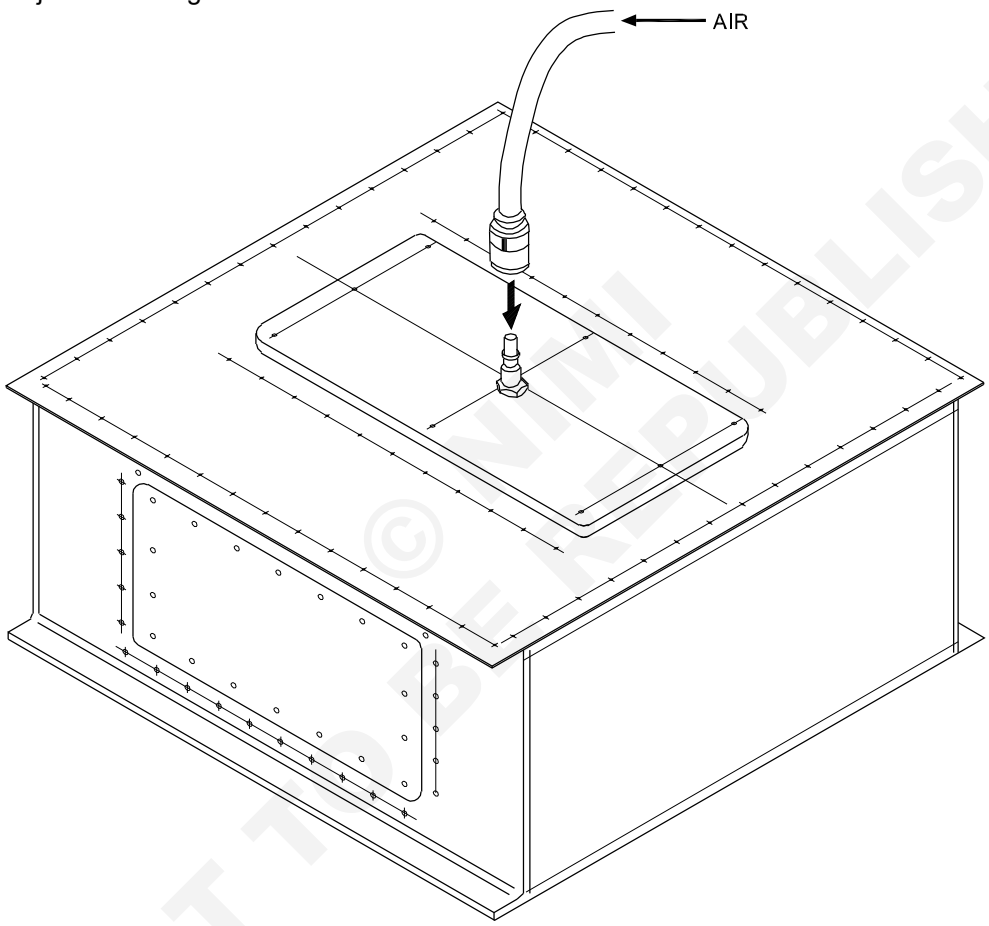
Observations:

Coating PR sealant application validation

Objectives: At the end of this exercise you shall be able to·
- **check the correct application of sealant.**

Job Sequence

- Connect the part to a compressed air hose.
- Immerse the item completely in a large container full of water.
- Observe all joints and edges of the item for leaks.



-	-	< 2.1.42	-	-	-	3.1.44
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS		**CLOSED BOX - SEALING**			DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3144E1	

Leaks are indicated by the presence of bubbles.

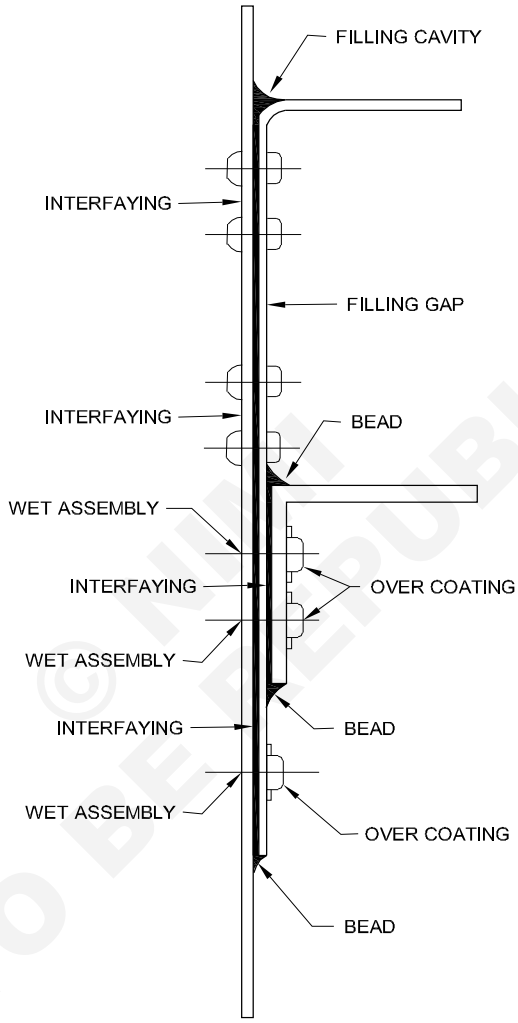
Check:

The assembly is completely sealed ☐ YES ☐ NO

Removal PR sealant

Objectives: At the end of this exercise you shall be able to·

- **remove cured sealant**
- **clean components without damaging surfaces..**



1	-	> 2.1.36	-	-	-	3.1.45
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS					DEVIATIONS	TIME : 20 Hrs
	SEALANT REMOVAL				CODE NO : AFN3145E1	

Job Sequence

Using a non-metallic spatula, remove:

- Overcoating.
- Overlapping.
- Beads.
- Sealant on gaps.
- Sealant on cavities.

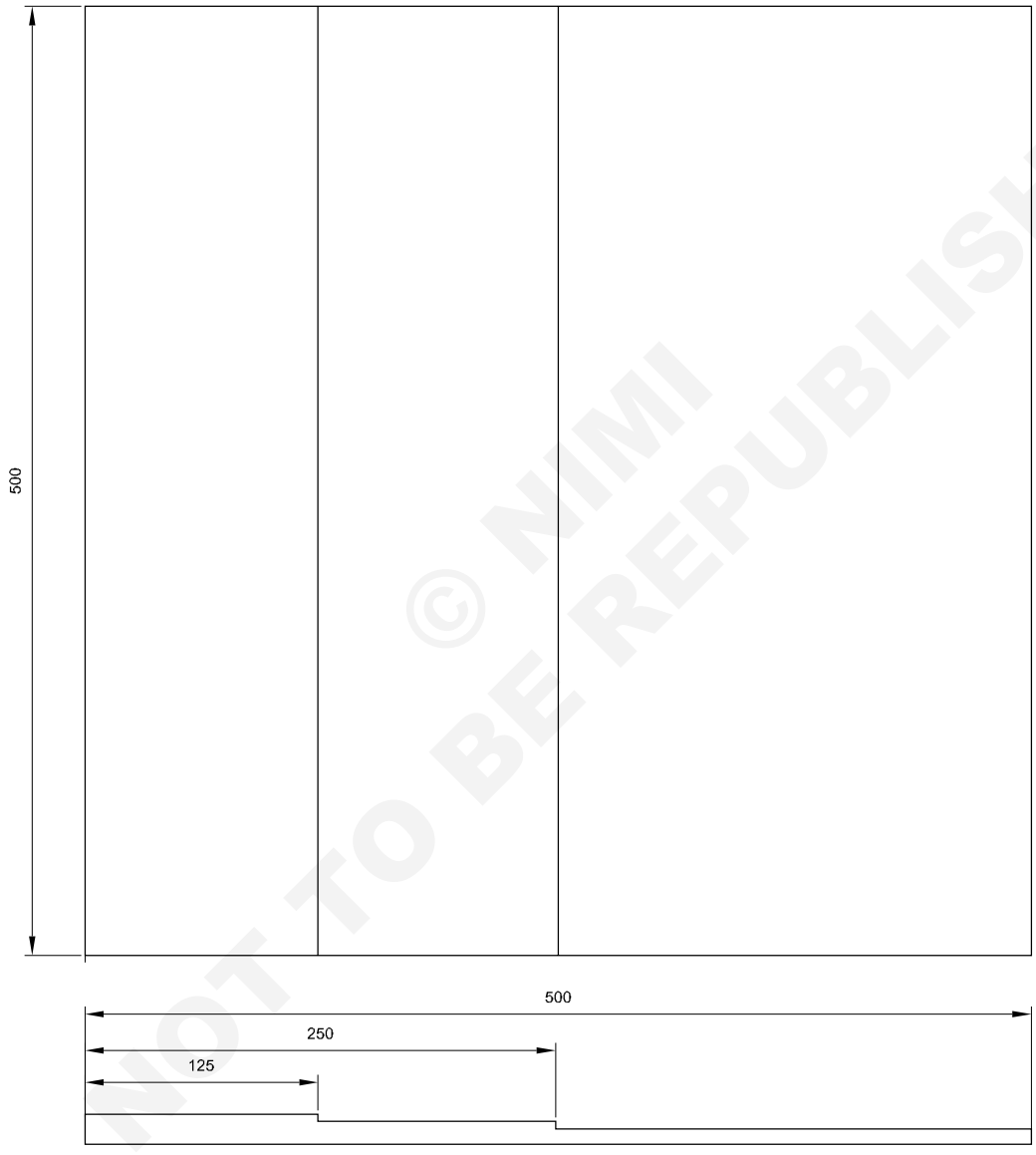
Remove the remains with a Scotch-Brite™ (General Purpose Hand Pad 7447 type)lightly impregnated with solvent.

Check the surfaces and rivet heads.

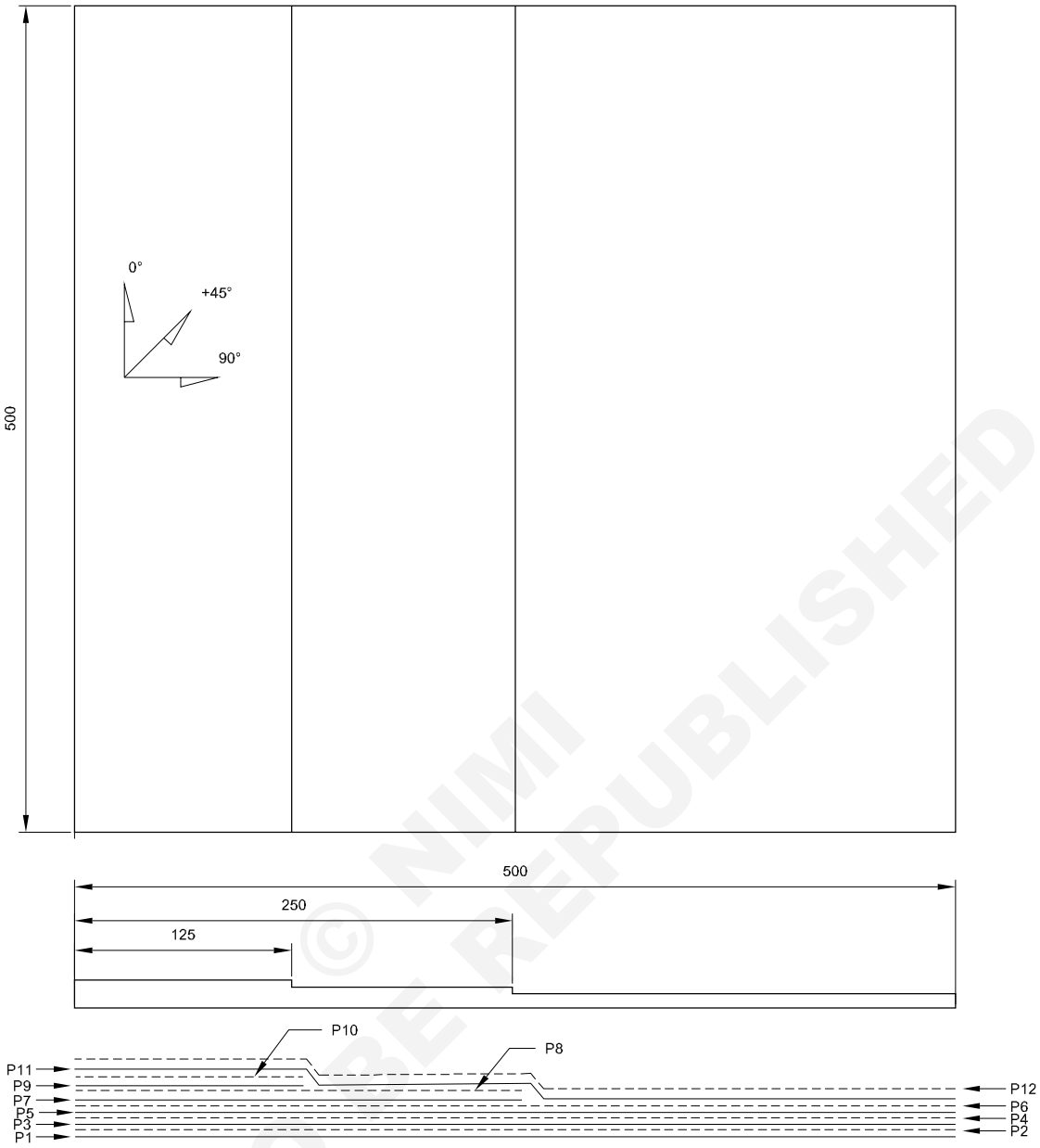
Composite panel manufacturing N°1- GFRP flat panel

Objectives: At the end of this exercise you shall be able to·

- **cut glass fabrics**
- **prepare epoxy resin**
- **manufacture flat panel by stratification**
- **cure the component in vacuum bag.**



-	-	-	GFRP	-	-	3.1.46
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**GFRP FLAT PANEL FINAL SIZE**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3146E1	



-	-	-	GFRP	-	-	3.1.46
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**GFRP FLAT PANEL LAMINATION DRAWING**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3146E2	

Job Sequence

Cutting of fabrics

According to Table 1 below, cut the glass fabric.

Note: Add 1 to 2 cm to the required size.

Table 1

Ply number	Final size	Orientation
P1	500x500	0°
P2	500x500	90°
P3	500x500	+45°
P4	500x500	-45°
P5	500x500	90°
P6	500x500	0°
P7	250x500	90°
P8	250x500	90°
P9	125x500	90°
P10	125x500	90°
P11	500x500	45°
P12	500x500	0°

Preparation of the mould

- Clean the mould and remove any residue from the previous use.
- Carefully degreasse the mould.
- With 50mm wide adhesive masking tape, cover the sides of the mould.
- With a brush, apply the release agent. Allow to dry.
- With a brush, apply a second coat of release agent and allow to dry.

Wear a protective mask and nitrile gloves.

- Check that the entire surface of the tooling is properly coated with release agent.

Preparation of vacuum bagging products

To carry out vacuum bagging, prepare the components as follows:

- Peel ply.
- Perforated or non-perforated release film.
- Breather fabric.
- Vacuum bag sealant.
- Vacuum bag film.
- Vacuum pick-up valve.
- Vacuum hose.

Lamination

- On the mould, position the plies according to Table 1 and the drawing.
- Prepare the resin according to the manufacturer's instructions.

Calculate the quantity of resin required with a 50% fibre/resin ratio.

- Apply the resin to the plies by spreading the resin correctly with a spatula and a roller.

Wear a protective mask and nitrile gloves.

- Check to ensure there is no lack of resin.

Vacuum bagging

- Make the vacuum bag.
- Apply the vacuum avoiding the formation of wrinkles.
- Check that there are no leaks.
- Allow to cure at room temperature.

Demoulding

- Remove the vacuum bag.
- Using a non-metallic wedge (or a spatula), carefully unstick the part from the mould.

  Insert wedges along one side ofthe part then insert additional wedges to extend the separationaround the part until it pops loose.
- Check the part for defects.
- Clean the mould properly and protect it with kraft paper.

Adjustment to external dimensions

- Check dimensions and thickness.
- Mark external dimensions.
- File the external dimensions.
- Deburr edges.
- Check dimensions.

Record sheet

Dimensions	Theorical	Measured
External dimensions	500 ±0.5	
	500 ±0.5	
Step 1	125 ±0.5	
Step 2	250 ±0.5	

Absence of delamination	☐ CONFORM	☐ NOT CONFORM
Absence of burn marks	☐ CONFORM	☐ NOT CONFORM
Absence of debonding	☐ CONFORM	☐ NOT CONFORM
Deburring quality	☐ CONFORM	☐ NOT CONFORM
Absence of marks, impacts or scratches	☐ CONFORM	☐ NOT CONFORM

The products have been discarded for recycling in the appropriate bins.

YES NO

The wearing of PPE during work has been respected.

YES NO

Observations:

Skill Sequence

Vacuum bagging moulds and mould preparation

Objectives: This shall help you to·

- **prepare mould with mould release.**

Vacuum bagging moulds vary widely in shape, size, and method of construction.

The mould surface must be airtight and smooth enough to prevent bonding to the laminate.

Moulds should be at least 100mm larger than the laminate on all sides to allow excess laminate for trimming and to provide a clean area around the perimeter to seal the bag to the mould.

Type of moulds

Flat moulds

One of the simplest and most useful moulds is a flat, rigid table faced.

This mould is useful for producing flat laminates or panels for bulkheads, doors, beams, and a wide range of custom structural components. Any portion of the table may be used, and multiple lay-ups of different sizes can be vacuum bagged at one time.

Curved moulds

Curved parts can be laminated over male or female moulds.

A female mould's surface is generally concave, producing a laminated part with the smooth finish on the convex or outside.

A male mould generally has a convex mould surface, producing a part with a smooth surface on the concave side.

Mould preparation

Apply the appropriate mould release to the mould and shelf surfaces. Follow the manufacturer directions for application.

Mould release is essential for preventing the epoxy from sticking to the mould when laminating a part.

Safety rules, hazards and precautions

Objectives: This shall help you to
- **practice on hazards of epoxy resin.**

Hazards

The primary hazard associated with epoxy involves skin contact. Resin may cause moderate skin irritation. Hardeners are corrosive and may cause severe skin irritation. Resins and hardeners are also sensitizers and may cause an allergic reaction similar to poison ivy.

Epoxy resin

Fig 1

Hazard Statements

- Auses skin irritation.
- May cause an allergic skin reaction.
- Causes serious eye irritation.
- Toxic to aquatic life with long lasting effects.

Hardener

Fig 2

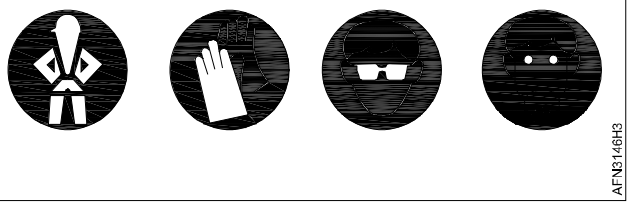
Hazard Statements

- Harmful if swallowed
- Harmful in contact with skin
- May be harmful if inhaled
- Causes severe skin burns and eye damage
- May cause an allergic skin reaction
- Suspected of causing genetic defects
- May cause damage to organs through prolonged or repeated exposure
- Toxic to aquatic life
- Toxic to aquatic life with long lasting effects

Precautions

- Avoid contact with resin, hardeners, mixed epoxy and sanding dust from epoxy that is not fully cured.
- Wear protective gloves and clothing whenever you handle epoxies.

Fig 3



- If you do get resin, hardener or mixed epoxy on your skin, remove it as soon as possible.
- Resin is not water soluble. Use a waterless skin cleanser to remove resin or mixed epoxy from your skin.
- Hardener is water soluble. Wash with soap and warm water to remove hardener or sanding dust from your skin.
- Always wash thoroughly with soap and warm water after using epoxy.
- Never use solvents to remove epoxy resin from your skin.

Protect your eyes

- Protect your eyes from contact with resin, hardeners, mixed epoxy, and sanding dust by wearing appropriate eye protection.
- If contact occurs, immediately flush the eyes with water under low pressure for 15 minutes.
- If discomfort persists, seek medical attention.
- Avoid breathing concentrated vapours and sanding dust
- Provide ample ventilation when working with epoxy in confined spaces. When adequate ventilation is not possible, wear a respirator with an organic vapor cartridge.
- Provide ventilation and wear a dust mask when sanding epoxy, especially uncured epoxy. Breathing uncured epoxy dust increases your risk of sensitization.
- Although epoxy cures quickly to a sandable solid, it may take over two weeks at room temperature, or post-curing, to cure completely.

Avoid ingestion

- Wash thoroughly after handling epoxy, especially before eating or smoking.
- If epoxy is swallowed, drink large quantities of water.
- DO NOT induce vomiting. Because hardeners are corrosive, they can cause additional harm if vomited.
- Refer to First Aid procedures on the Material Safety Data Sheet.

WARNING!

- **Curing epoxy generates heat. Do not fill or cast layers of epoxy thicker if enclosed by foam or other insulated material.**
- **Several volumes of mixed epoxyin a plastic mixing cup will generate enough heat to melt the cup if left to stand for its full pot life. For this reason, do not use foam or glass mixing containers.**
- **If a pot of mixed epoxy begins to exotherm (heat up), quickly move it outdoors. Avoid breathing the fumes.**
- **Do not dispose of the mixture until the reaction is complete and has cooled.**

Epoxy resin clean-up

Objectives: This shall help you to·
- **clean cured and uncured epoxy resin.**

Cleaning

- Clean resin or mixed epoxy residue with lacquer thinner, acetone or alcohol.
- Follow all safety warnings on solvent containers.
- Clean hardener residue with warm soapy water.
- Clean Hardener residue with lacquer thinner, acetone or alcohol.

Removing uncured or non-curing epoxy.

- Uncured epoxy is removed as you would spilled resin.
- Scrape as much material as you can from the surface using a stiff metal or plastic scraper - warm the epoxy to lower its viscosity.
- Clean the residue with lacquer thinner, acetone, or alcohol.
- Follow safety warnings on solvents and provide adequate ventilation.
- Allow solvents to dry before re-coating.

Removing cured epoxy coating.

- Use a heat gun to soften the epoxy (about 120°C).
- Heat a small area and use a spatula or scraper to remove the bulk of the coating.
- Sand the surface to remove the remaining material. Provide ventilation or wear a respirator when heating epoxy.

Mixing resin

Objectives: This shall help you to
- **measure quantity of resin and hardener.**
- **mix correctly resin and hardener.**

Dispense the proper proportions of resin and hardener into a clean plastic, metal or wax-free paper container.

Don't use glass or foam containers because of the potential danger from exothermic heat buildup.

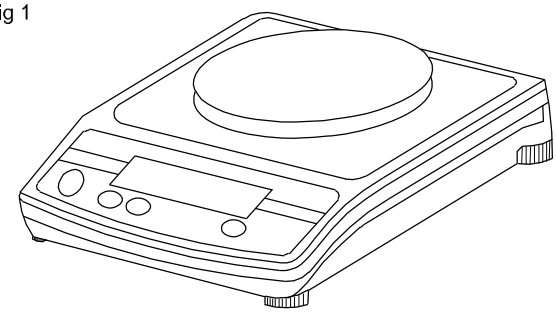
DO NOT attempt to alter the cure time by altering the ratio. An accurate ratio is essential for a proper cure and full development of physical properties.

Only use the manufacturer's recommended mix ratios.

Measuring epoxy by weight using a digital weighingscale (Fig. 1)

- Place a mixing cup on the scale and reset the scale to zero by pressing the Tare or Zero Scale button.
- Pour your epoxy first and note the amount poured.
- Calculate the amount of hardener needed based on that amount of epoxy resin that you poured.
- Pour in your hardener, directly from the bottle to the mixtures.

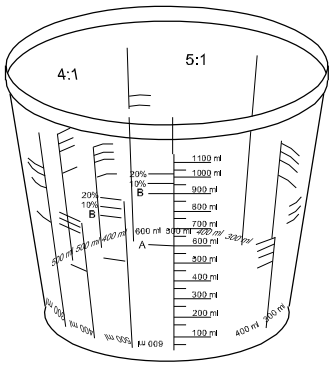
Fig 1



- Epoxy and hardener have different densities which means that epoxy weighs more than the hardener, we recommend keeping a chart for quick reference to ensure that you make accurate mixtures.

Measuring epoxy by volume (Fig 2)

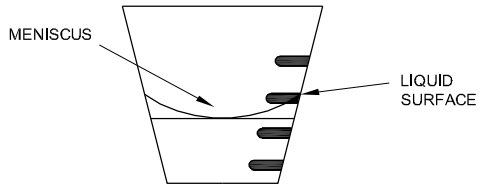
Fig 2



You can measure your epoxy resin by volume, just make sure you have mixing cups with well-marked graduations.

- Determine as close as possible the amount of mixed material that the application requires. If you require more epoxy resin, you can always mix a second batch to finish off the job. Resin is an expensive input for any application so try and keep wastage to a minimum.
- Begin by pouring the epoxy amount your mixture requires into the graduated measuring cup.When pouring, be sure that the bottom of the curved liquid surface, called the meniscus, meets the line that you're pouring to (Fig 3).

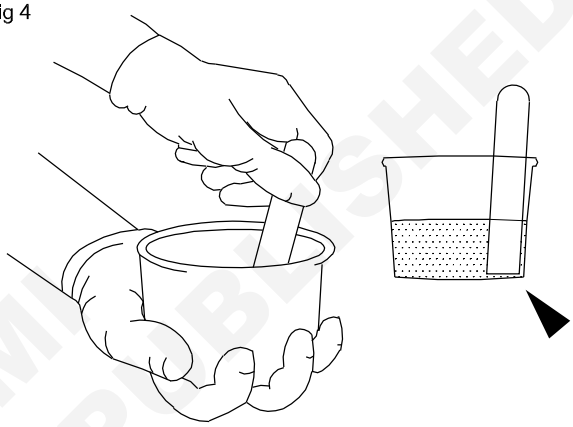
Fig 3



Stir the two ingredients together thoroughly, at least 1 minute, longer in coolertemperatures.

To assure thorough mixing, scrape the sides and bottom of thepot as you mix (Fig 4). Use the flat end of the mixing stick to reach the inside corner of the pot.

Fig 4



Vacuum bag making

Objectives: This shall help you to
- **make a vacuum bagging.**

Vacuum bagging (Fig 1)

The vacuum bagging system consists of the airtight clamping envelope and a method for removing air from the envelope until the epoxy adhesive cures.

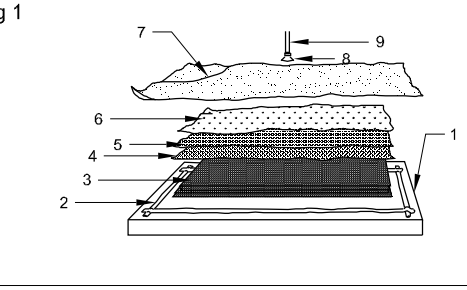
Vacuum bagging uses atmospheric pressure as a clamp to hold laminate plies together. The laminate is sealed within an airtight envelope. The envelope may be an airtight mould on one side and an airtight bag on the other. When the bag is sealed to the mould, pressure on the outside and inside of this envelope is equal to atmospheric pressure.

As a vacuum pump evacuates air from the inside of the envelope, air pressure inside of the envelope is reduced while air pressure outside.

Atmospheric pressure forces the sides of the envelope and everything within the envelope together, putting equal and even pressure over the surface of the envelope.

The pressure differential between the inside and outside of the envelope determines the amount of clamping force on the laminate.

Fig 1



1 Mould

2 Vacuum bag sealant

3 Fabric

4 Peel ply

5 Perforated (or non-perforated) film

6 Breather fabric

7 Vacuum bag film

8 Vacuum valve

9 Vacuum hose

Vacuum Bagging Equipment

Peel ply release fabric (4)

Release Fabric is a tough, finely woven nylon fabric treated with a release agent. It is used to separate the breather fabric and vacuum bag from the laminate in vacuum bagging operations. Excess epoxy bleeds through and is peeled from the cured laminate along with the Release Fabric. It's also used in hand lay-up applications to allow more squeegee pressure and protect the lay-up from contamination and blush. Peels easily and leaves a smooth textured surface, ready for bonding, sanding or finishing.

Perforated film (5)

A perforated plastic film may be used in conjunction with the release fabric. This film helps hold the resin in the laminate when high vacuum pressure is used with slow curing resin systems or thin laminates. Perforated films are available in a variety of hole sizes and patterns depending on the clamping pressure, and the resin's open time and viscosity.

Breather Fabric (6)

Breather Fabric is a lightweight, polyester blanket that provides excellent air passage within the vacuum envelope while it absorbs excess epoxy.

A breather (or bleeder) cloth allows air from all parts of the envelope to be drawn to a portor manifold by providing a slight air space between the bag and the laminate.

Vacuum Bag Film (7)

Clear, heat-stabilized, modified nylon resin film. A tough, stretchable film for high vacuum pressures.

Vacuum Bag Sealant (2)

Mastic tape sealant for airtight seals between vacuum bags and moulds. Easy to work around difficult angles, patching small leaks in the vacuum system.

Make a vacuum bag

1 Apply mastic sealant to the mould perimeter.

Use firmpressure and overlap the ends so there are no gaps. Leavespace around the laminate area and keep the paper backingin place on the mastic so it will not become contaminatedwith wet epoxy. It is nearly impossible to seal thebag to wet mastic.

2 Place a layer of peel ply release fabric over the laminate.

The release fabric will peel off the cured laminate leaving afine-textured surface. Excess epoxy which has bledthrough will be removed along with the release fabric.

3 Place Perforated (or non-perforated) film.

4 Place breather material over the release fabric.

Breather Fabric is a polyester blanket thatallows air to pass through its fibers to the port and absorbsexcess epoxy that passes through the release fabric.

Press all of the layers of material into contact with themould to avoid bridging when vacuum pressure isapplied.

5 Place the vacuum bag over the mould and seal it to themould's perimeter.

Starting at a corner of the mould, peelthe protective paper from the mastic. Press the edge ofthe bag firmly onto the mastic while pulling the bag tautenough to avoid wrinkles.

When cutting the bag to size, allow enough excess bag material within the sealant perimeter to avoid stretching the bag or bridging areas when the vacuum is applied.

6 Connect the vacuum line to the bag with a vacuum valve (or port).

Puncture a small hole in the bag and attach the portto the bag over the hole. Breather fabric provides a pathto the port inside the bag over a wide area.

Place an extralayer or two of breather under the port.

Place the port outside of the laminate.

Multiple ports may be necessary onlarger parts.

7 Turn the vacuum pump on, to begin evacuating airfrom the bag.

If necessary, temporarily shut off the vacuum to adjust the bag.

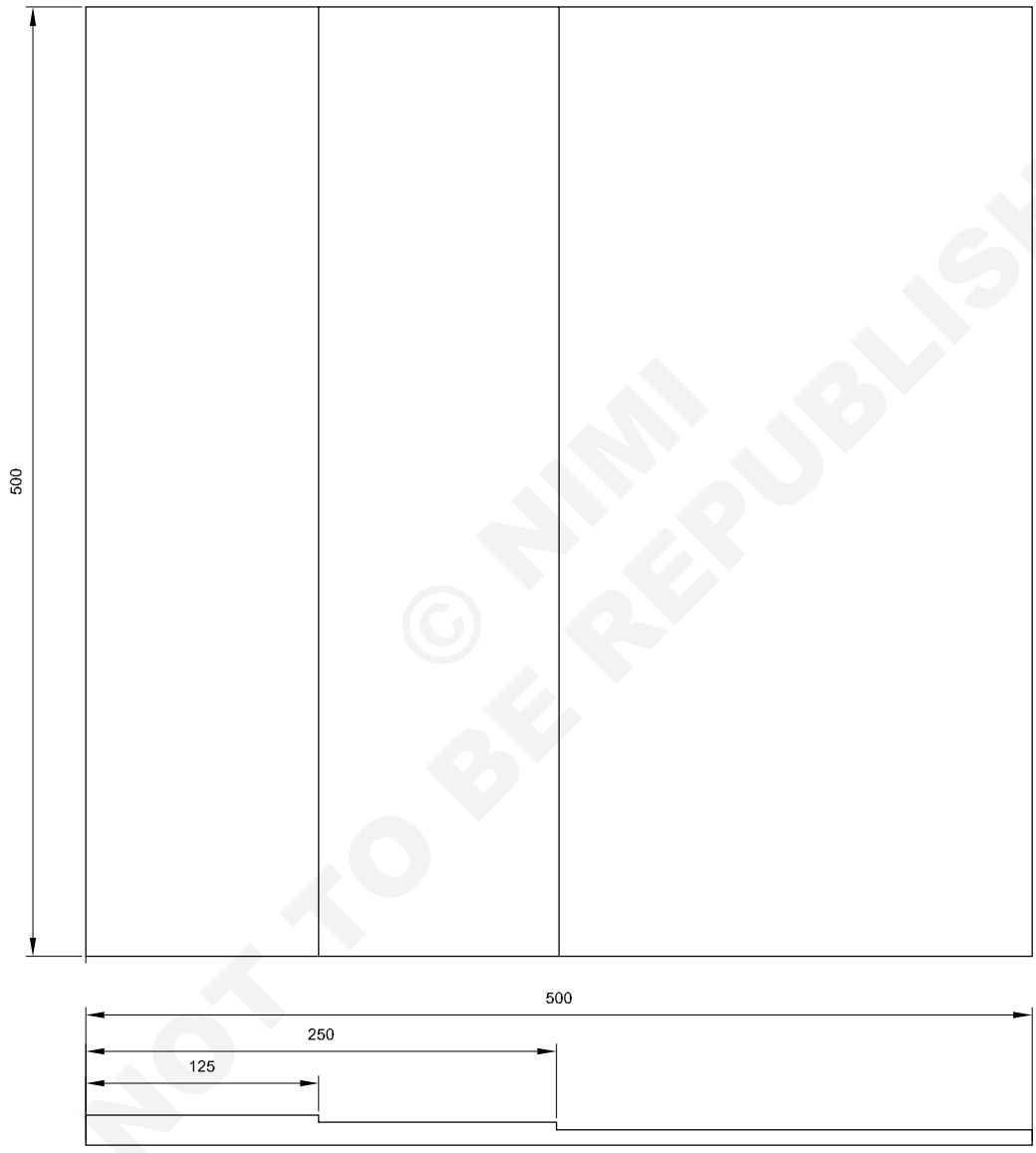
8 As the air is removed from the bag, listen for leaks around the bag perimeter, especially at folds in the bag, laps in the mastic and at the vacuum line or port connection.

Where leaks are found, push the bag into the sealant or, if necessary,plug the leaks with pieces of mastic or tape.

Composite panel manufacturing N°2

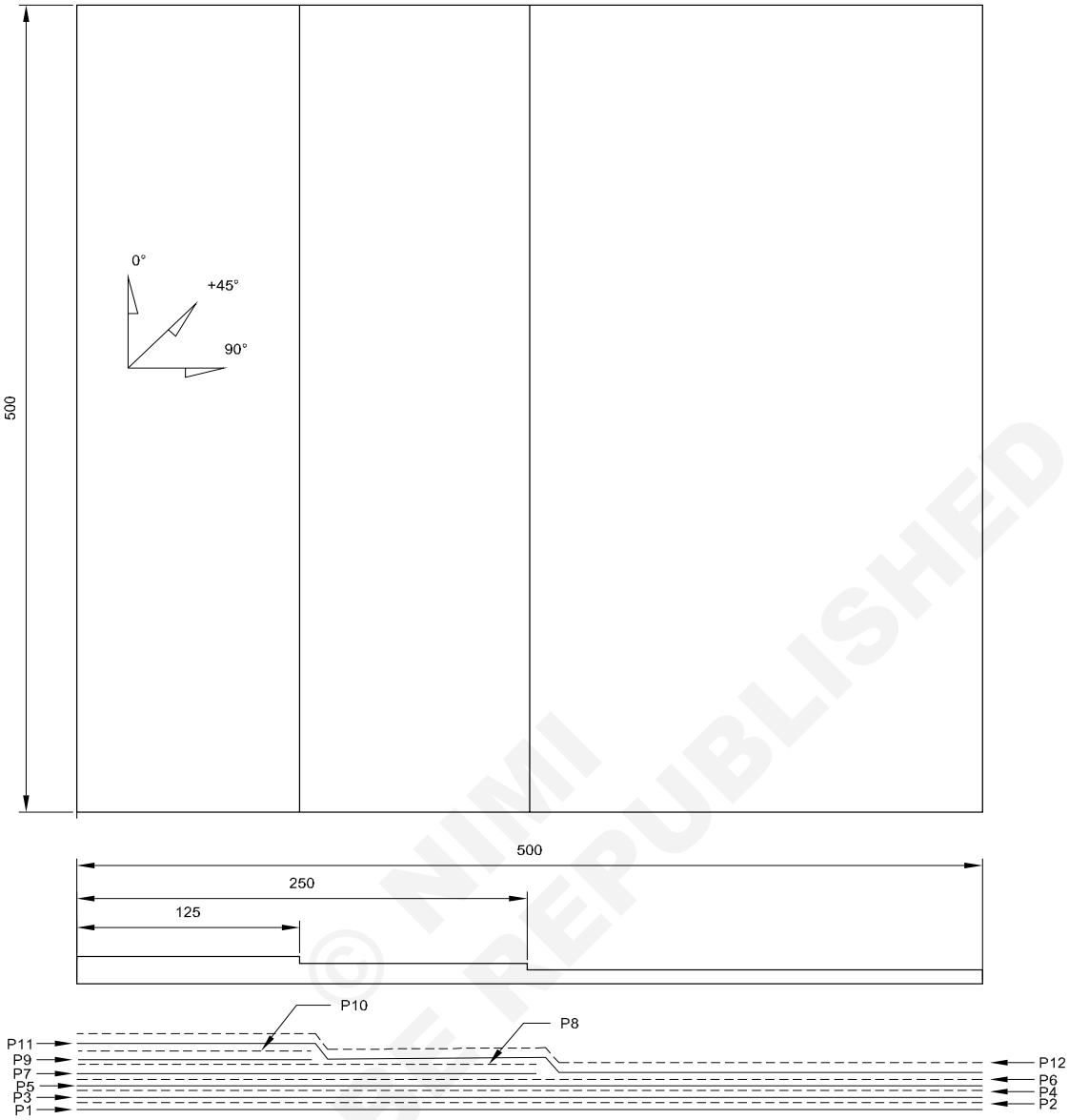
Objectives: At the end of this exercise you shall be able to·

- **cut unidirectional carbon fibre**
- **manufacture thin flat panel with unidirectional tape**
- **cure the component in vacuum bag.**



-	-	-	UD CFRP	-	-	3.1.47
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE : NTS	UD CFRP FLAT PANEL FINAL SIZE	DEVIATIONS	TIME : 20 Hrs
		CODE NO : AFN3147E1	



-	-	-	UD CFRP	-	-	3.1.47
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS					DEVIATIONS	TIME : 20 Hrs
	UD CFRP FLAT PANEL STRATIFICATION DRAWING				CODE NO : AFN3147E2	

Job Sequence

Cutting of tapes

According to Table 1 below, cut the glass fabric.

Note: Add 1 to 2 cm to the required size.

Table 1

Ply Number	Final Size	Orientation
P1	500x500	0°
P2	500x500	90°
P3	500x500	+45°
P4	500x500	-45°
P5	500x500	90°
P6	500x500	0°
P7	250x500	0°
P8	250x500	90°
P9	125x500	0°
P10	125x500	90°
P11	500x500	90°
P12	500x500	90°

Preparation of the mould

- Clean the mould and remove any residue from the previous use.
- Carefully degrease the mould.
- With 50mm wide adhesive masking tape, cover the sides of the mould.
- With a brush, apply the release agent. Allow to dry.
- With a brush, apply a second coat of release agent and allow to dry.

Wear a protective mask and nitrile gloves.

- Check that the entire surface of the tooling is properly coated with release agent.

Preparation of vacuum bagging products

To carry out vacuum bagging, prepare the components as follows:

- Peel ply.
- Perforated or non-perforated release film.
- Breather fabric.
- Vacuum bag sealant.
- Vacuum bag film.
- Vacuum pick-up valve.
- Vacuum hose.

Lamination

- On the mould, position the plies according to Table 1 and the drawing.
- Prepare the resin according to the manufacturer's instructions.

Calculate the quantity of resin required with a 50% fibre/resin ratio.

- Apply the resin to the plies by spreading the resin correctly with a spatula and a roller.

Wear a protective mask and nitrile gloves.

- Check to ensure there is no lack of resin.

Vacuum bagging

- Make the vacuum bag.
- Apply the vacuum avoiding the formation of wrinkles.
- Check that there are no leaks.
- Allow to cure at room temperature.

Demoulding

- Remove the vacuum bag.
- Using a non-metallic spatula, carefully unstick the part from the mould.
- Check the part for defects.
- Clean the mould properly and protect it with Kraft paper.

Adjustment to external dimensions

- Check dimensions and thickness.
- Mark external dimensions.
- File the external dimensions.
- Deburr edges.
- Check dimensions.

Record Sheet

Dimensions	Theorical		Measured
External dimensions	500	±0.5	
	500	±0.5	
Step 1	125	±0.5	
Step 2	250	±0.5	

Absence of delamination	☐ CONFORM	☐ NOT CONFORM
Absence of burn marks	☐ CONFORM	☐ NOT CONFORM
Absence of debonding	☐ CONFORM	☐ NOT CONFORM
Deburring quality	☐ CONFORM	☐ NOT CONFORM
Absence of marks, impacts or scratches	☐ CONFORM	☐ NOT CONFORM

The products have been discarded for recycling in the appropriate bins.

☐ YES ☐ NO

The wearing of PPE during work has been respected.

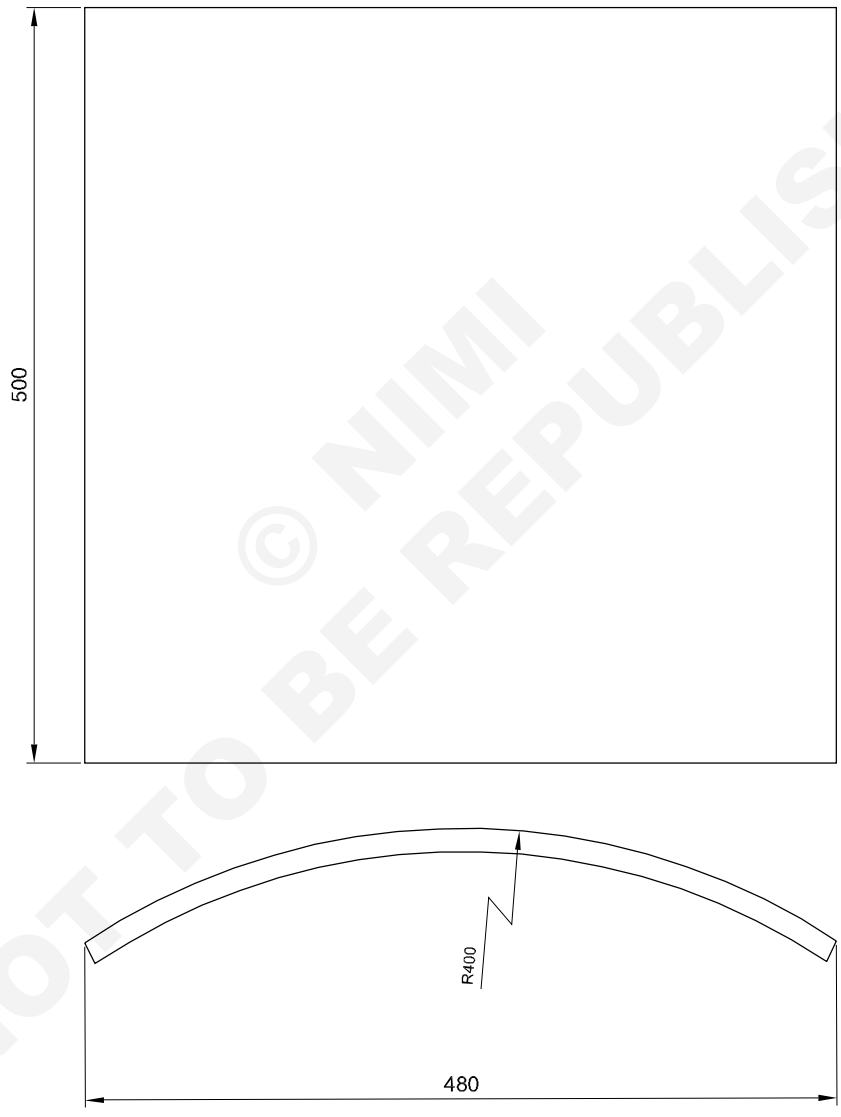
☐ YES ☐ NO

Observations:

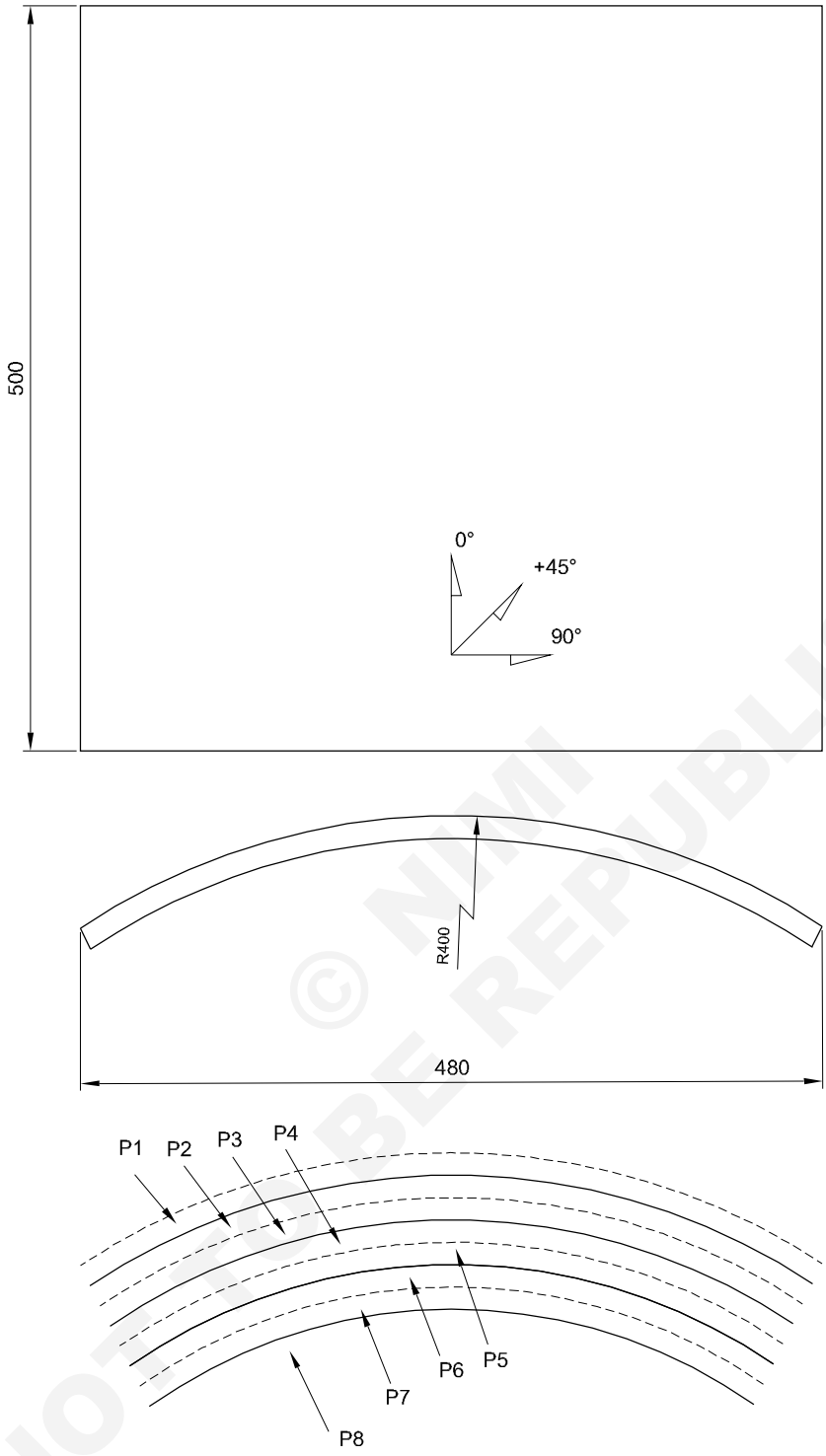
Composite panel manufacturing N°3

Objectives: At the end of this exercise you shall be able to·

- **cut carbonfabrics**
- **prepare epoxy resin**
- **manufacture curve panel by stratification**
- **cure the component in vacuum bag**



-	-	-	CFRP	-	-	3.1.48
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**CFRP CURVED PANEL FINAL SIZE**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3148E1	



-	-	-	CFRP	-	-	3.1.48
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**GFRP FLAT PANEL** **LAMINATION DRAWING**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3148E2	

Job Sequence

Cutting of fabrics

According to Table 1 below, cut the glass fabric.

Note: Add 1 to 2 cm to the required size.

Table 1

Ply Number	Final Size	Orientation
P1	500x500	0°
P2	500x500	90°
P3	500x500	+45°
P4	500x500	+45°
P5	500x500	-45°
P6	500x500	-45°
P7	500x500	90°
P8	500x500	0°

Preparation of the mould

- Clean the mould and remove any residue from the previous use.
- Carefully degrease the mould.
- With 50mm wide adhesive masking tape, cover the sides of the mould.
- With a brush, apply the release agent. Allow to dry.
- With a brush, apply a second coat of release agent and allow to dry.

Wear a protective mask and nitrile gloves.

- Check that the entire surface of the tooling is properly coated with release agent.

Preparation of vacuum bagging products

- To carry out vacuum bagging, prepare the components as follows:
- Peel ply.
- Perforated or non-perforated release film.
- Breather fabric.
- Vacuum bag sealant.
- Vacuum bag film.
- Vacuum pick-up valve.
- Vacuum hose.

Lamination

- On the mould, position the plies according to Table 1 and the drawing.
- Prepare the resin according to the manufacturer's instructions.

Calculate the quantity of resin required with a 50% fibre/resin ratio.

- Apply the resin to the plies by spreading the resin correctly with a spatula and a roller.

Wear a protective mask and nitrile gloves.

- Check to ensure there is no lack of resin.

Vacuum bagging

- Make the vacuum bag.
- Apply the vacuum avoiding the formation of wrinkles.
- Check that there are no leaks.
- Allow to cure at room temperature.

Demoulding

- Remove the vacuum bag.
- Using a non-metallic spatula, carefully unstick the part from the mould.
- Check the part for defects.
- Clean the mould properly and protect it with kraft paper.

Adjustment to external dimensions

- Check dimensions and thickness.
- Mark external dimensions.
- File the external dimensions.
- Deburr edges.
- Check dimensions.

Record Sheet

Dimensions	Theorical		Measured
External dimensions	500	±0.5	
	480	±0.5	
External radius	400	±1	

Absence of delamination ☐ CONFORM ☐ NOT CONFORM

Absence of burn marks ☐ CONFORM ☐ NOT CONFORM

Absence of debonding ☐ CONFORM ☐ NOT CONFORM

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches ☐ CONFORM ☐ NOT CONFORM

The products have been discarded for recycling in the appropriate bins.

☐ YES ☐ NO

The wearing of PPE during work has been respected.

☐ YES ☐ NO

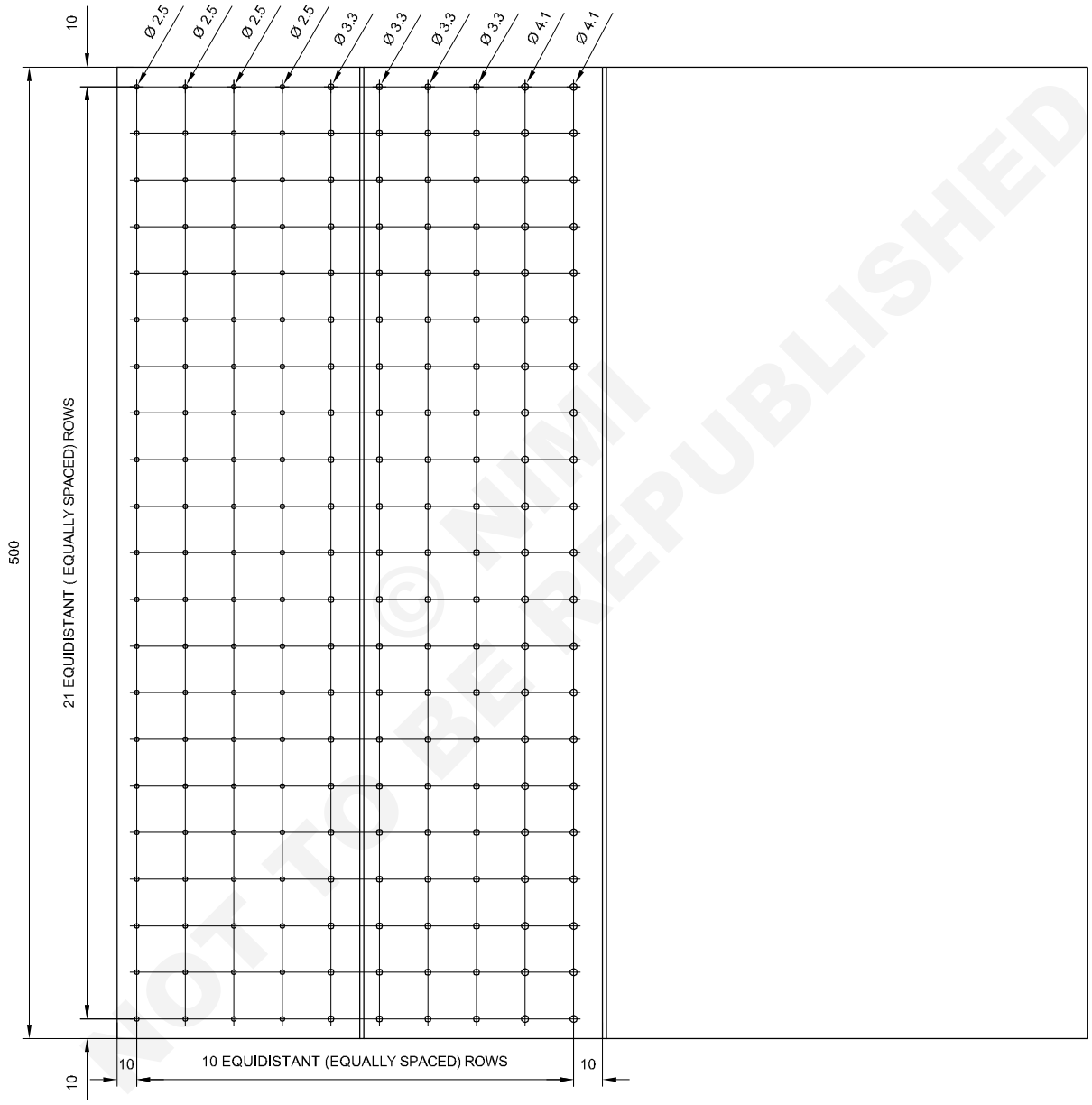
Observations:

Composite drilling

Objectives: At the end of this exercise you shall be able to·

- **drill GFRP flat panel without defect**
- **drill UDGFRP flat panel without defect**
- **check defect on FRP drilled panel.**

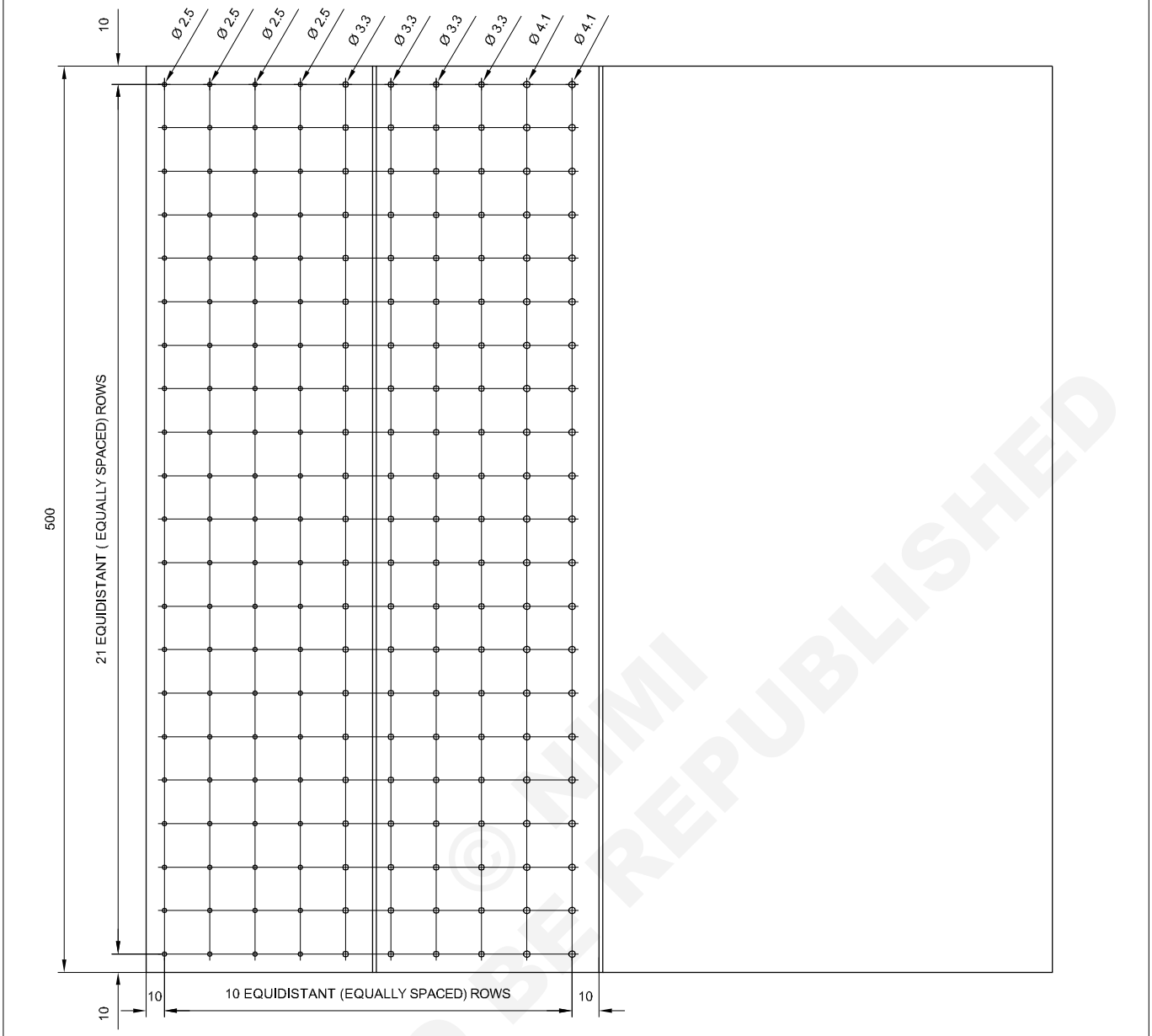
TASK 1



1	-	>3.1.46	GFRP	-	-	3.1.49
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE : NTS	COMPOSITE DRILLING GFRP	DEVIATIONS	TIME : 20 Hrs
		CODE NO : AFN3149E1	

TASK 2



1	-	>3.1.47	UD CFRP	-	-	3.1.49
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**COMPOSITE DRILLING UD CFRP**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3149E2	

Job Sequence

TASK 1:

Drilling GFRP flat panel

- Mark the holes positions.

Drilling diameter 2.5 (all holes)

- Hold the workpiece and drill holes with hand drill.
- Deburr both sides.
- Check diameter and perpendicularity of each hole.

Drilling diameter 3.3 (see drawing)

- Make a circle around each centre to be drilled.
- Hold the workpiece and drill holes with hand drill using drill bushing holder.
- Deburr both sides.
- Check diameter and perpendicularity of each hole.

Drilling diameter 4.1 (see drawing)

- Make a circle around each centre to be drilled.
- Hold the workpiece and drill holes with hand drill using drill bushing holder.
- Deburr both sides.
- Check diameter and perpendicularity of each hole.
- Report defects on the report sheet above.

TASK 2:

Drilling UD CFRP flat panel

- Mark the holes positions.

Drilling diameter 2.5 (all holes)

- Hold the workpiece and drill holes with hand drill.
- Deburr both sides.
- Check diameter and perpendicularity of each hole.

Drilling diameter 3.3 (see drawing)

- Make a circle around each centre to be drilled.
- Hold the workpiece and drill holes with hand drill using drill bushing holder.
- Deburr both sides.
- Check diameter and perpendicularity of each hole.

Drilling diameter 4.1 (see drawing)

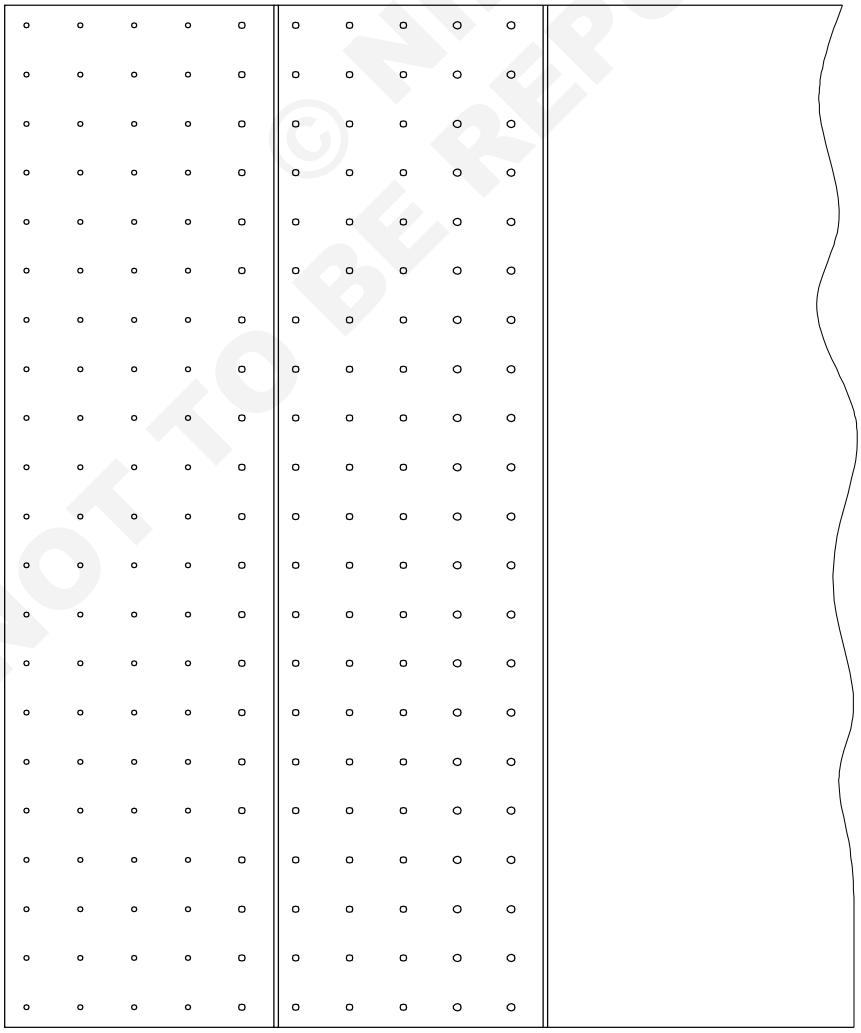
- Make a circle around each centre to be drilled.
- Hold the workpiece and drill holes with hand drill using drill bushing holder.
- Deburr both sides.
- Check diameter and perpendicularity of each hole.

Report defects on the report sheet above.

Record Sheet – GFRP flat panel

For each hole, mark the defect found.

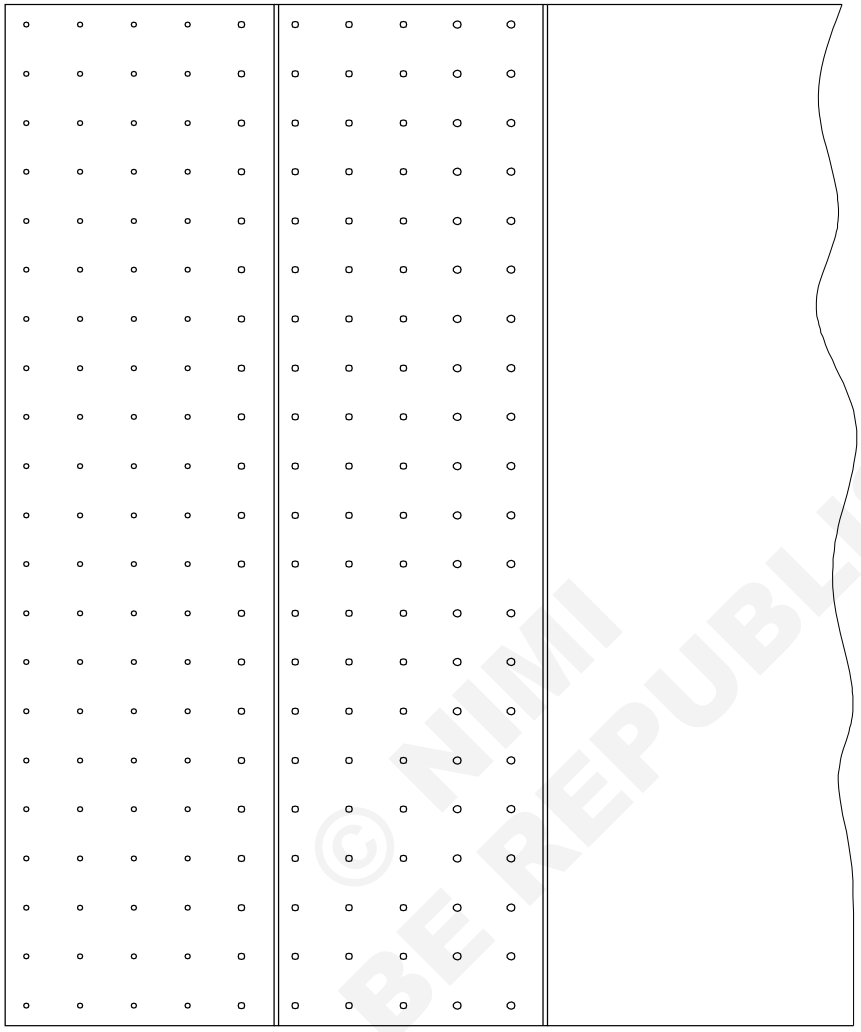
Ø> Diameter	P> Perpendicularity	C> Circularity	D> Deburring	NC> Not centred
X > Delamination	B > Burned			



Record Sheet – UD CFRP flat panel

For each hole, mark the defect found.

Ø> Diameter	P> Perpendicularity	C> Circularity	D> Deburring	NC> Not centred
X > Delamination	B > Burned			



Skill Sequence

Drilling defects

Objectives: This shall help you to·

- **check common drilling defects on composite materials..**

Delamination / Flaking

Delamination is a damage that is likely to occur in the inter-laminar region, along the contact plan between the adjacent layers in laminate parts.

It therefore depends not only on fibre nature but also on resin type and respective properties such as the interlaminar fracture toughness, the elastic modulus.

The delamination mechanisms are divided into push-down and peel-up, according to on which laminate side it occurs:

Push-down >drill exit or entrance, respectively.

Push-down is a consequence of the compressive thrust force that the chisel edge of the drill always exerts on the workpiece.

Peel-up or flaking > drill entrance

Peel-up is caused by the cutting force pushing the abraded and cut materials to the flute surface.

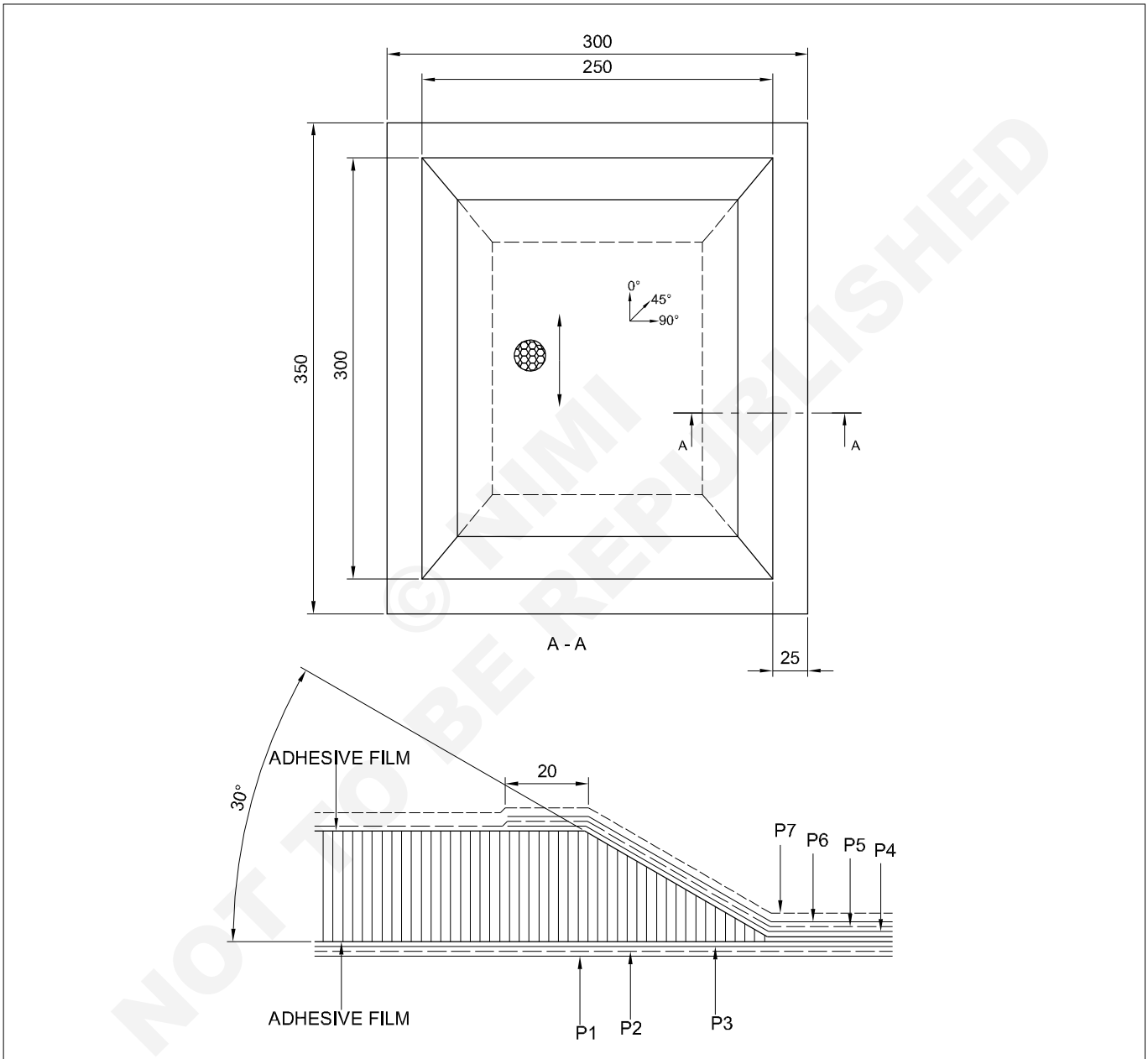
Overheating

Overheating shall be identified by a visual inspection of the hole entrance and exit and of the stack interface. There shall be no discoloration or damage of the fibre / matrix due to overheating.

Prepare composite sandwich

Objectives: At the end of this exercise you shall be able to·

- **prepare a composite sandwich panel**
- **cut and chamfer Nomex honeycomb**
- **make a vacuum bag with folds**



-	-	-	GFRP	-	-	3.1.50
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**COMPOSITE SANDWICH MANUFACTURING**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3150E1	

Job Sequence

Cutting of fabrics

According to Table 1 below, cut the glass fabric.

Note: Add 1 to 2 cm to the required size.

Table 1

Ply Number	Size	QTY	Orientation
P1	350X300	1	0°
P2	350X300	1	90°
P3	350X300	1	0°
P4	360X95	4	45°
P5	370X320	1	90°
P6	360X85	4	45°
P7	370X320	1	90°

Cutting of adhesive film

According to Table 2 below, cut the glass fabric.

Note: Add 1 to 2 cm to the required size.

Table 2

Adhesive film	Size	QTY
F1	350X300	1
F2	370X320	1

Cutting of NOMEX honeycomb

According to the drawing, cut the honeycomb.

Chamfer at 30°.

Deburr and clean.

Preparation of the mould

Clean the mould and remove any residue from the previous use.

Carefully degrease the mould.

With 50mm wide adhesive masking tape, cover the sides of the mould.

With a brush, apply the release agent. Allow to dry.

With a brush, apply a second coat of release agent and allow to dry.

Wear a protective mask and nitrile gloves.

- Check that the entire surface of the tooling is properly coated with release agent.

Preparation of vacuum bagging products

To carry out vacuum bagging, prepare the components as follows:

- Peel ply.
- Perforated or non-perforated release film.
- Breather fabric.
- Vacuum bag sealant.
- Vacuum bag film (add about 20cm to the required size).
- Vacuum pick-up valve.
- Vacuum hose.

Lamination

- On the mould, position the plies P1, P2 and P3 according to Table 1 and the drawing.
- Prepare the resin according to the manufacturer's instructions.

Calculate the quantity of resin required with a 50% fibre/resin ratio.

Wear a protective mask and nitrile gloves.

- Apply the resin to the plies P1, P2 and P3 by spreading the resin correctly with a spatula and a roller.
- Check to ensure there is no lack of resin.
- Place the adhesive film F1.
- Position the nomex honeycomb on position.
- Place the adhesive film F2.

Prepare a clean flat plate for resin application on fabrics (P4 to P7).

Calculate the quantity of resin required with a 50% fibre/resin ratio.

- Apply the resin on the plies P4 by spreading the resin correctly with a spatula and a roller.
- Place de 4 plies P4 in accordance with the drawing.
- Apply the resin on the P5 by spreading the resin correctly with a spatula and a roller.
- Place de fabric ply.
- Apply the resin on the plies P6 by spreading the resin correctly with a spatula and a roller.
- Place de 4 plies P6 in accordance with the drawing.
- Apply the resin on the P7 by spreading the resin correctly with a spatula and a roller.
- Place de fabric ply.

Vacuum bagging

- Make the vacuum bag with folds around honeycomb limits to avoid bridges.
- Apply the vacuum avoiding the formation of wrinkles and bridges.
- Check that there are no leaks.
- Allow to cure at room temperature.

Demoulding

- Remove the vacuum bag.
- Using a non-metallic spatula, carefully unstick the part from the mould.
- Check the part for defects.
- Clean the mould properly and protect it with kraft paper.

Adjustment to external dimensions

- Mark external dimensions.
- File the external dimensions.
- Deburr edges.
- Check dimensions.

Record Sheet

Dimensions	Theorical		Measured
External dimensions	300	±0.5	
	350	±0.5	
Distance between honeycomb and edges	25	±0.5	
	25	±0.5	
	25	±0.5	
	25	±0.5	
Overlap reinforcement	20	±0.5	
	20	±0.5	
	20	±0.5	
	20	±0.5	

Absence of delamination	☐ CONFORM	☐ NOT CONFORM
Absence of burn marks	☐ CONFORM	☐ NOT CONFORM
Absence of debonding	☐ CONFORM	☐ NOT CONFORM
Deburring quality	☐ CONFORM	☐ NOT CONFORM
Absence of marks, impacts or scratches	☐ CONFORM	☐ NOT CONFORM

The products have been discarded for recycling in the appropriate bins.

☐ YES ☐ NO

The wearing of PPE during work has been respected.

☐ YES ☐ NO

Observations:

Skill Sequence

Folds on vacuum bag film

Objectives: This shall help you to·
- **make a fold on vacuum bag.**

Because the bag perimeter is greater than the sealant perimeter, you should create several folds or pleats of excess material as the bag is sealed around the mould.

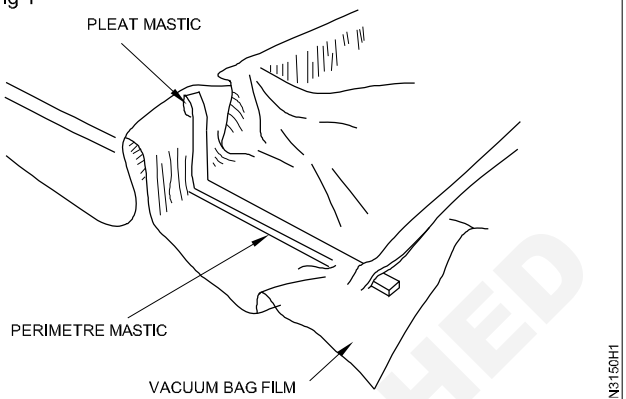
Seal the pleats of excess bag with a strip of masticfrom perimeter mastic to the inside top of the pleat.

Then press the bag to both sides of the strip forming a continuous air tight seal.

Repeat this procedure wherever there is a pleat around the mould.

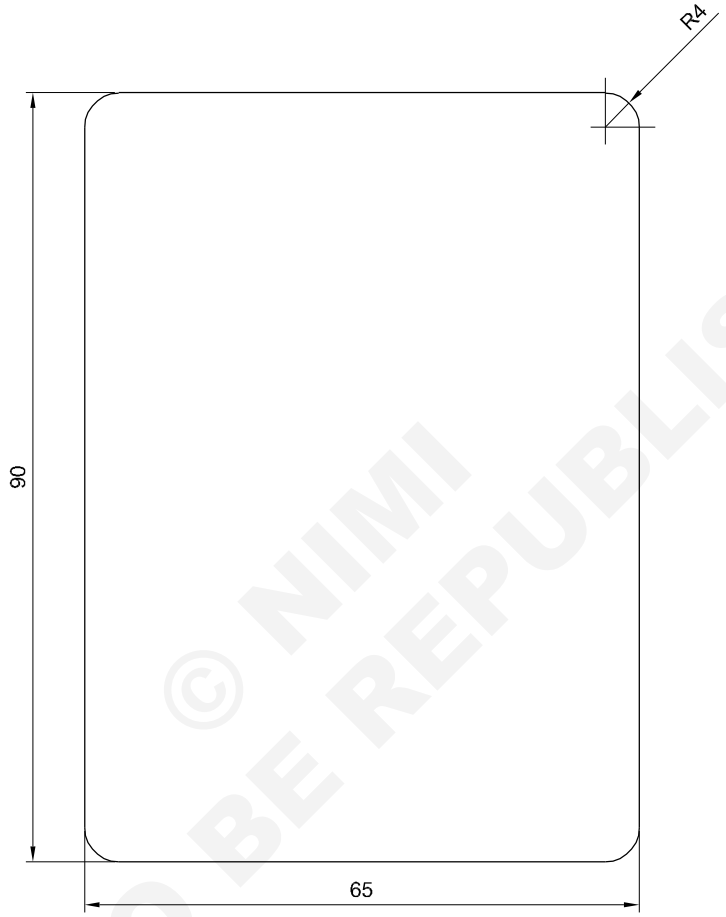
To avoid bridges on the angles, you can make a fold right on the angle.

Fig 1



Composite riveted installation

Objectives: At the end of this exercise you shall be able to·
- **install permanent fasteners in composite assembly**
- **choose the right length of a fastener**
- **find the correct diameter to fasteners installation.**



CFRP
Thickness 2mm

Job Sequence

Parts fabrication

ITEM 01

4 parts

- Check dimensions and thickness.
- Mark external dimensions and radii.
- File the external dimensions and radii.
- Drawn filing all edges.
- Deburr edges.
- Check dimensions.

4	65X90 - Thick.2	-	CFRP	-	01	3.1.51
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**COMPOSITE RIVETED INSTALLATION COMPONENTS MANUFACTURING - ITEM 01**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3151E1	

Record Sheet - Item 01 - Batch Number 1

Dimensions	Theorical		Measured
External dimensions	90	±0.5	
	65	±0.5	
Radius	R4	±0.5	
	R4	±0.5	
	R4	±0.5	
	R4	±0.5	

Absence of delamination	☐ CONFORM	☐ NOT CONFORM
Absence of burn marks	☐ CONFORM	☐ NOT CONFORM
Absence of debonding	☐ CONFORM	☐ NOT CONFORM
Deburring quality	☐ CONFORM	☐ NOT CONFORM
Absence of marks, impacts or scratches	☐ CONFORM	☐ NOT CONFORM

The products have been discarded for recycling in the appropriate bins.

☐ YES ☐ NO

The wearing of PPE during work has been respected.

☐ YES ☐ NO

Observations:

Record Sheet - Item 01 - Batch Number 2

Dimensions	Theorical		Measured
External dimensions	90	±0.5	
	65	±0.5	
Radius	R4	±0.5	
	R4	±0.5	
	R4	±0.5	
	R4	±0.5	

Absence of delamination	☐ CONFORM	☐ NOT CONFORM
Absence of burn marks	☐ CONFORM	☐ NOT CONFORM
Absence of debonding	☐ CONFORM	☐ NOT CONFORM
Deburring quality	☐ CONFORM	☐ NOT CONFORM
Absence of marks, impacts or scratches	☐ CONFORM	☐ NOT CONFORM

The products have been discarded for recycling in the appropriate bins.

☐ YES ☐ NO

The wearing of PPE during work has been respected.

☐ YES ☐ NO

Observations:

Record Sheet - Item 01 - Batch Number 3

Dimensions	Theorical		Measured
External dimensions	90	±0.5	
	65	±0.5	
Radius	R4	±0.5	
	R4	±0.5	
	R4	±0.5	
	R4	±0.5	

Absence of delamination ☐ CONFORM ☐ NOT CONFORM

Absence of burn marks ☐ CONFORM ☐ NOT CONFORM

Absence of debonding ☐ CONFORM ☐ NOT CONFORM

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches ☐ CONFORM ☐ NOT CONFORM

The products have been discarded for recycling in the appropriate bins.

☐ YES ☐ NO

The wearing of PPE during work has been respected.

☐ YES ☐ NO

Observations:

Record Sheet - Item 01 - Batch Number 4

Dimensions	Theorical		Measured
External dimensions	90	±0.5	
	65	±0.5	
Radius	R4	±0.5	
	R4	±0.5	
	R4	±0.5	
	R4	±0.5	

Absence of delamination ☐ CONFORM ☐ NOT CONFORM

Absence of burn marks ☐ CONFORM ☐ NOT CONFORM

Absence of debonding ☐ CONFORM ☐ NOT CONFORM

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches ☐ CONFORM ☐ NOT CONFORM

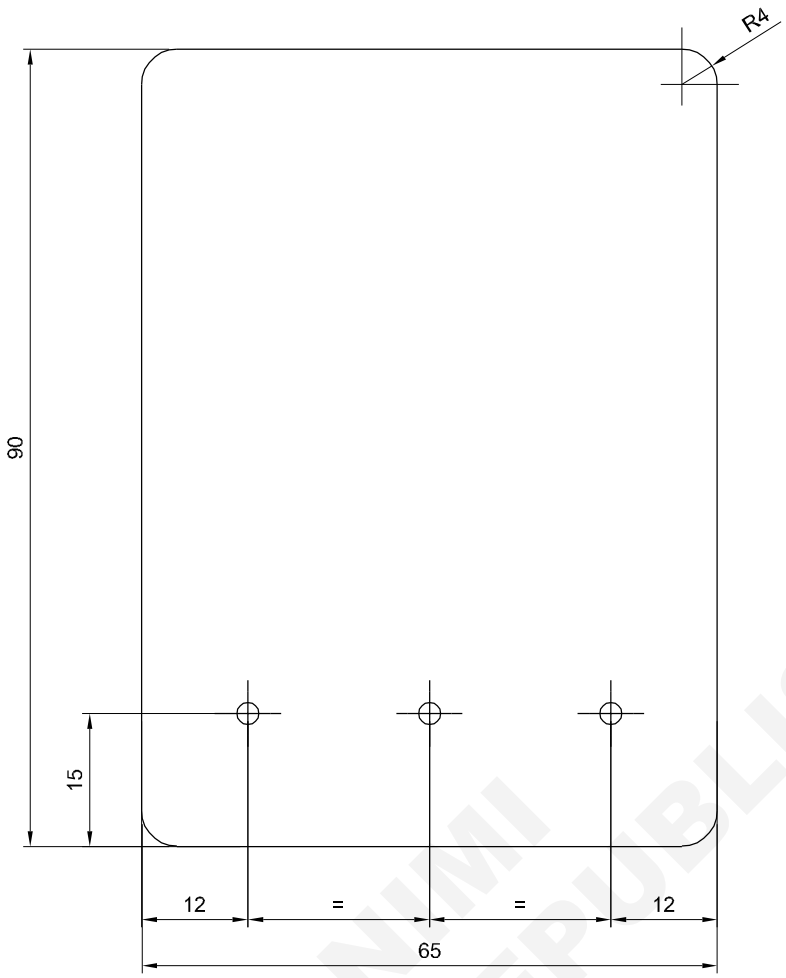
The products have been discarded for recycling in the appropriate bins.

☐ YES ☐ NO

The wearing of PPE during work has been respected.

☐ YES ☐ NO

Observations:



CFRP
Thickness 2mm

Job Sequence

ITEM 02

4 parts

- Check dimensions and thickness.
- Mark external dimensions and radii.
- File the external dimensions and radii.
- Drawn filing all edges.
- Deburr edges.
- Check dimensions.
- Mark holes positions.
- Drill holes and deburr.
- Clean parts.

4	65X90 - Thick.2	-	CFRP	-	02	3.1.51
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**COMPOSITE RIVETED INSTALLATION COMPONENTS MANUFACTURING - ITEM O2**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3151E2	

Record Sheet - Item 02 - Batch Number 1

Dimensions	Theorical		Measured
External dimensions	90	±0.5	
	65	±0.5	
Radius	R4	±0.5	
	R4	±0.5	
	R4	±0.5	
	R4	±0.5	

Drilling	Theorical		Measured
Edge distance 1	15	+1 / -0	
Edge distance 2	12	+1 / -0	
Number of holes	3		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Absence of delamination	☐ CONFORM	☐ NOT CONFORM
Absence of burn marks	☐ CONFORM	☐ NOT CONFORM
Absence of debonding	☐ CONFORM	☐ NOT CONFORM
Deburring quality	☐ CONFORM	☐ NOT CONFORM
Absence of marks, impacts or scratches	☐ CONFORM	☐ NOT CONFORM

The products have been discarded for recycling in the appropriate bins.

☐ YES ☐ NO

The wearing of PPE during work has been respected.

☐ YES ☐ NO

Observations:

Record Sheet - Item 02 - Batch Number 2

Dimensions	Theorical		Measured
External dimensions	90	±0.5	
	65	±0.5	
Radius	R4	±0.5	
	R4	±0.5	
	R4	±0.5	
	R4	±0.5	

Drilling	Theorical		Measured
Edge distance 1	15	+1 / -0	
Edge distance 2	12	+1 / -0	
Number of holes	3		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Absence of delamination	☐ CONFORM	☐ NOT CONFORM
Absence of burn marks	☐ CONFORM	☐ NOT CONFORM
Absence of debonding	☐ CONFORM	☐ NOT CONFORM
Deburring quality	☐ CONFORM	☐ NOT CONFORM
Absence of marks, impacts or scratches	☐ CONFORM	☐ NOT CONFORM

The products have been discarded for recycling in the appropriate bins.

☐ YES ☐ NO

The wearing of PPE during work has been respected.

☐ YES ☐ NO

Observations:

Record Sheet - Item 02 - Batch Number 3

Dimensions	Theorical		Measured
External dimensions	90	±0.5	
	65	±0.5	
Radius	R4	±0.5	
	R4	±0.5	
	R4	±0.5	
	R4	±0.5	

Drilling	Theorical		Measured
Edge distance 1	15	+1 / -0	
Edge distance 2	12	+1 / -0	
Number of holes	3		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Absence of delamination	☐ CONFORM	☐ NOT CONFORM
Absence of burn marks	☐ CONFORM	☐ NOT CONFORM
Absence of debonding	☐ CONFORM	☐ NOT CONFORM
Deburring quality	☐ CONFORM	☐ NOT CONFORM
Absence of marks, impacts or scratches	☐ CONFORM	☐ NOT CONFORM

The products have been discarded for recycling in the appropriate bins.

☐ YES ☐ NO

The wearing of PPE during work has been respected.

☐ YES ☐ NO

Observations:

Record Sheet - Item 02 - batch number 4

Dimensions	Theorical		Measured
External dimensions	90	±0.5	
	65	±0.5	
Radius	R4	±0.5	
	R4	±0.5	
	R4	±0.5	
	R4	±0.5	

Drilling	Theorical		Measured
Edge distance 1	15	+1 / -0	
Edge distance 2	12	+1 / -0	
Number of holes	3		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Absence of delamination	☐ CONFORM	☐ NOT CONFORM
Absence of burn marks	☐ CONFORM	☐ NOT CONFORM
Absence of debonding	☐ CONFORM	☐ NOT CONFORM
Deburring quality	☐ CONFORM	☐ NOT CONFORM
Absence of marks, impacts or scratches	☐ CONFORM	☐ NOT CONFORM

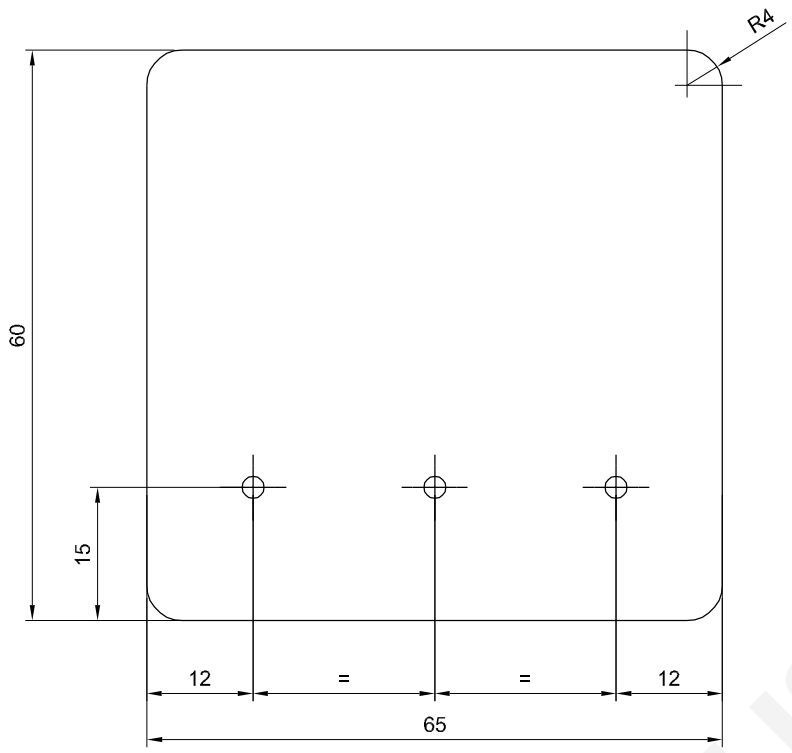
The products have been discarded for recycling in the appropriate bins.

☐ YES ☐ NO

The wearing of PPE during work has been respected.

☐ YES ☐ NO

Observations:



CFRP
Thickness 2mm

Job Sequence

ITEM 03

4 parts

- Check dimensions and thickness.
- Mark external dimensions and radii.
- File the external dimensions and radii.
- Drawn filing all edges.
- Deburr edges.
- Check dimensions.
- Mark holes positions.
- Drill holes and deburr.
- Clean parts.

4	65X60 - Thick.2	-	CFRP	-	03	3.1.51
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**COMPOSITE RIVETED INSTALLAION** **COMPONENTS MANUFACTURING - ITEM 03**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3151E3	

Record Sheet - Item 03 - Batch Number 1

Dimensions	Theorical		Measured
External dimensions	60	±0.5	
	65	±0.5	
Radius	R4	±0.5	
	R4	±0.5	
	R4	±0.5	
	R4	±0.5	

Drilling	Theorical		Measured
Edge distance 1	15	+1 / -0	
Edge distance 2	12	+1 / -0	
Number of holes	3		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Absence of delamination	☐ CONFORM	☐ NOT CONFORM
Absence of burn marks	☐ CONFORM	☐ NOT CONFORM
Absence of debonding	☐ CONFORM	☐ NOT CONFORM
Deburring quality	☐ CONFORM	☐ NOT CONFORM
Absence of marks, impacts or scratches	☐ CONFORM	☐ NOT CONFORM

The products have been discarded for recycling in the appropriate bins.

☐ YES ☐ NO

The wearing of PPE during work has been respected.

☐ YES ☐ NO

Observations:

Record Sheet - Item 03 - Batch Number 2

Dimensions	Theorical		Measured
External dimensions	60	±0.5	
	65	±0.5	
Radius	R4	±0.5	
	R4	±0.5	
	R4	±0.5	
	R4	±0.5	

Drilling	Theorical		Measured
Edge distance 1	15	+1 / -0	
Edge distance 2	12	+1 / -0	
Number of holes	3		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Absence of delamination ☐ CONFORM ☐ NOT CONFORM

Absence of burn marks ☐ CONFORM ☐ NOT CONFORM

Absence of debonding ☐ CONFORM ☐ NOT CONFORM

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches ☐ CONFORM ☐ NOT CONFORM

The products have been discarded for recycling in the appropriate bins.

☐ YES ☐ NO

The wearing of PPE during work has been respected.

☐ YES ☐ NO

Observations:

Record Sheet - Item 03 - batch number 3

Dimensions	Theorical		Measured
External dimensions	60	±0.5	
	65	±0.5	
Radius	R4	±0.5	
	R4	±0.5	
	R4	±0.5	
	R4	±0.5	

Drilling	Theorical		Measured
Edge distance 1	15	+1 / -0	
Edge distance 2	12	+1 / -0	
Number of holes	3		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Absence of delamination ☐ CONFORM ☐ NOT CONFORM

Absence of burn marks ☐ CONFORM ☐ NOT CONFORM

Absence of debonding ☐ CONFORM ☐ NOT CONFORM

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches ☐ CONFORM ☐ NOT CONFORM

The products have been discarded for recycling in the appropriate bins.

☐ YES ☐ NO

The wearing of PPE during work has been respected.

☐ YES ☐ NO

Observations:

Record Sheet - Item 03 - Batch Number 4

Dimensions	Theorical		Measured
External dimensions	60	±0.5	
	65	±0.5	
Radius	R4	±0.5	
	R4	±0.5	
	R4	±0.5	
	R4	±0.5	

Drilling	Theorical		Measured
Edge distance 1	15	+1 / -0	
Edge distance 2	12	+1 / -0	
Number of holes	3		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Absence of delamination	☐ CONFORM	☐ NOT CONFORM
Absence of burn marks	☐ CONFORM	☐ NOT CONFORM
Absence of debonding	☐ CONFORM	☐ NOT CONFORM
Deburring quality	☐ CONFORM	☐ NOT CONFORM
Absence of marks, impacts or scratches	☐ CONFORM	☐ NOT CONFORM

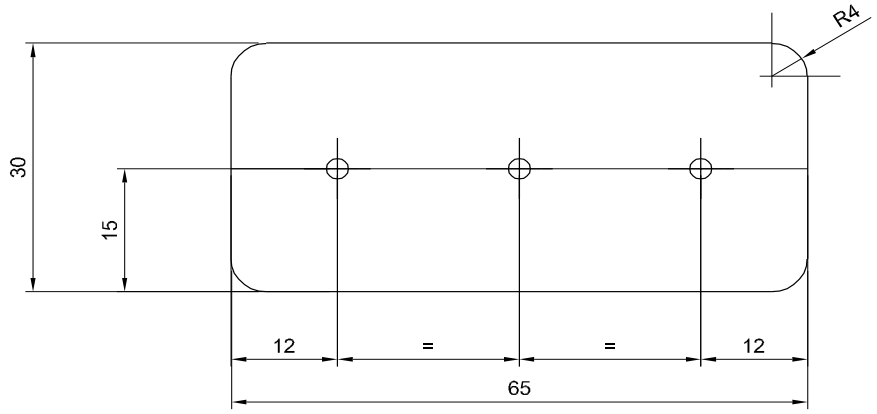
The products have been discarded for recycling in the appropriate bins.

☐ YES ☐ NO

The wearing of PPE during work has been respected.

☐ YES ☐ NO

Observations:



CFRP
Thickness 2mm

Job Sequence

ITEM 04

4 parts

- Check dimensions and thickness.
- Mark external dimensions and radii.
- File the external dimensions and radii.
- Drawn filing all edges.
- Deburr edges.
- Check dimensions.
- Mark holes positions.
- Drill holes and deburr.
- Clean parts.

4	65X30 - Thick.2	-	CFRP	-	04	3.1.51
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**COMPOSITE RIVETED INSTALLTION COMPONENTS MANUFACTURING - ITEM 04**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3151E4	

Record Sheet - Item 04 - Batch Number 1

Dimensions	Theorical		Measured
External dimensions	30	±0.5	
	65	±0.5	
Radius	R4	±0.5	
	R4	±0.5	
	R4	±0.5	
	R4	±0.5	

Drilling	Theorical		Measured
Edge distance 1	15	+1 / -0	
Edge distance 2	12	+1 / -0	
Number of holes	3		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Absence of delamination	☐ CONFORM	☐ NOT CONFORM
Absence of burn marks	☐ CONFORM	☐ NOT CONFORM
Absence of debonding	☐ CONFORM	☐ NOT CONFORM
Deburring quality	☐ CONFORM	☐ NOT CONFORM
Absence of marks, impacts or scratches	☐ CONFORM	☐ NOT CONFORM

The products have been discarded for recycling in the appropriate bins.

☐ YES ☐ NO

The wearing of PPE during work has been respected.

☐ YES ☐ NO

Observations:

Record Sheet - Item 04 - Batch Number 2

Dimensions	Theorical		Measured
External dimensions	30	±0.5	
	65	±0.5	
Radius	R4	±0.5	
	R4	±0.5	
	R4	±0.5	
	R4	±0.5	

Drilling	Theorical		Measured
Edge distance 1	15	+1 / -0	
Edge distance 2	12	+1 / -0	
Number of holes	3		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Absence of delamination	☐ CONFORM	☐ NOT CONFORM
Absence of burn marks	☐ CONFORM	☐ NOT CONFORM
Absence of debonding	☐ CONFORM	☐ NOT CONFORM
Deburring quality	☐ CONFORM	☐ NOT CONFORM
Absence of marks, impacts or scratches	☐ CONFORM	☐ NOT CONFORM

The products have been discarded for recycling in the appropriate bins.

☐ YES ☐ NO

The wearing of PPE during work has been respected.

☐ YES ☐ NO

Observations:

Record Sheet - Item 04 - batch number 3

Dimensions	Theorical		Measured
External dimensions	30	±0.5	
	65	±0.5	
Radius	R4	±0.5	
	R4	±0.5	
	R4	±0.5	
	R4	±0.5	

Drilling	Theorical		Measured
Edge distance 1	15	+1 / -0	
Edge distance 2	12	+1 / -0	
Number of holes	3		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Absence of delamination	☐ CONFORM	☐ NOT CONFORM
Absence of burn marks	☐ CONFORM	☐ NOT CONFORM
Absence of debonding	☐ CONFORM	☐ NOT CONFORM
Deburring quality	☐ CONFORM	☐ NOT CONFORM
Absence of marks, impacts or scratches	☐ CONFORM	☐ NOT CONFORM

The products have been discarded for recycling in the appropriate bins.

☐ YES ☐ NO

The wearing of PPE during work has been respected.

☐ YES ☐ NO

Observations:

Record Sheet - Item 04 - batch number 4

Dimensions	Theorical		Measured
External dimensions	30	±0.5	
	65	±0.5	
Radius	R4	±0.5	
	R4	±0.5	
	R4	±0.5	
	R4	±0.5	

Drilling	Theorical		Measured
Edge distance 1	15	+1 / -0	
Edge distance 2	12	+1 / -0	
Number of holes	3		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Absence of delamination	☐ CONFORM	☐ NOT CONFORM
Absence of burn marks	☐ CONFORM	☐ NOT CONFORM
Absence of debonding	☐ CONFORM	☐ NOT CONFORM
Deburring quality	☐ CONFORM	☐ NOT CONFORM
Absence of marks, impacts or scratches	☐ CONFORM	☐ NOT CONFORM

The products have been discarded for recycling in the appropriate bins.

☐ YES ☐ NO

The wearing of PPE during work has been respected.

☐ YES ☐ NO

Observations:

— — — — — — — —

PROCEDURE

TASK 1: **Cylindrical swaged bolts installation**

- Position item 1 on item 2.
- Hold in position.
- Counter drill and clamp.
- Position item 3 on top of unit 1-2.
- Counter drill and clamp.
- Position item 4 on unit 1-2-3.
- Counter drill and clamp.
- Check assembly.
- Find the required size of the hole in the table.

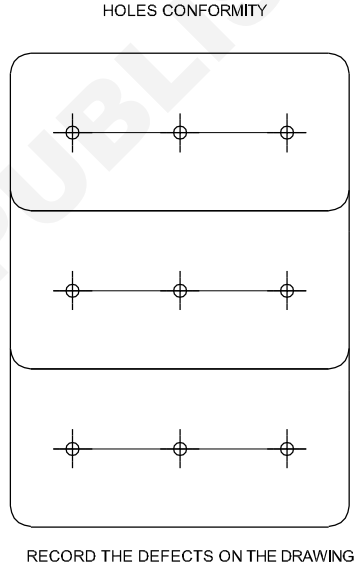
Record the hole diameter and ask your trainer to check it.

Hole diametre

- Counter-drill to the final diameter (reaming).
- Deburr and chamfer if necessary.
- Check the conformity of the drillings.
- Record the defects on the drawing.
- Using a dash measuring ruler, determine the thicknesses to be fastened.

Note the complete part numbers and ask your trainer for the fasteners.

Fig 1



Fasteners parts numbers

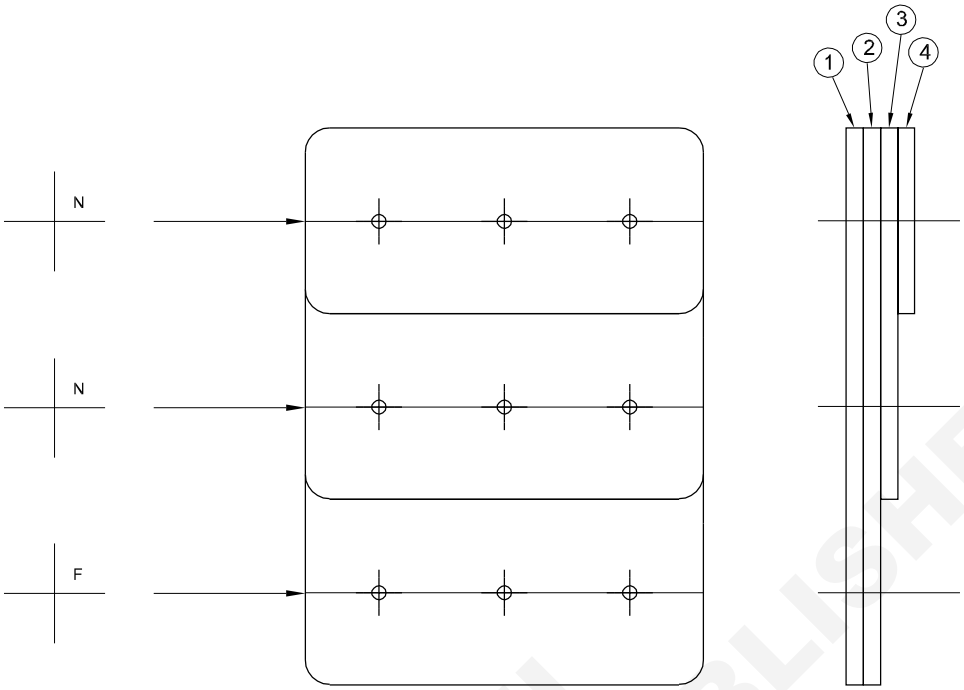
ROW 1 >

ROW 2 >

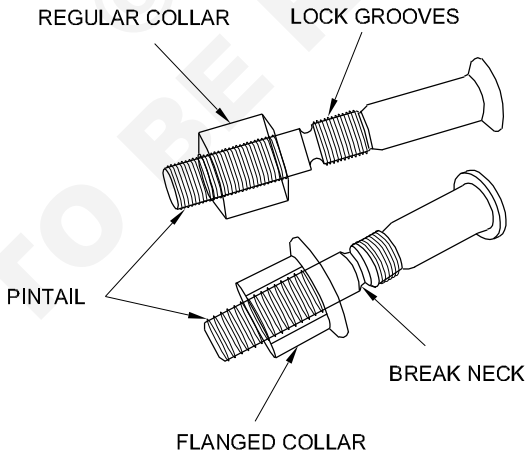
ROW 3 >

- Install the fasteners.
- Check the conformity of the installation.

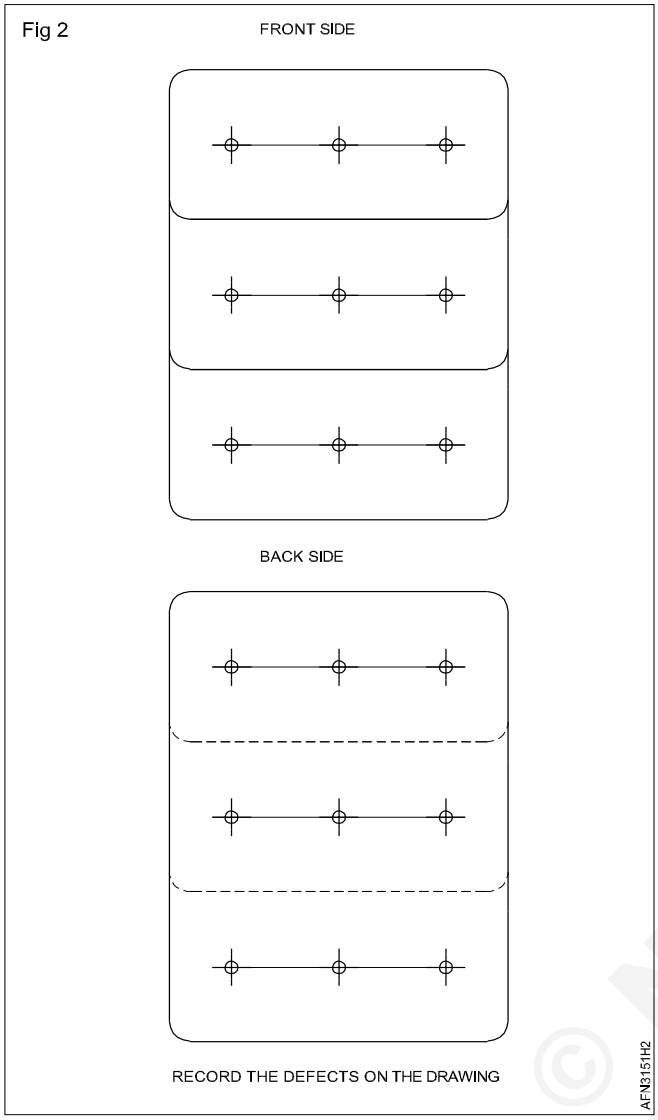
CYLINDRICAL SWAGED BOLT INSTALLATION



FASTENERS:
PROTUDING HEAD >GPL8TP-V06-.../ LGPL4SP-V06-... OR EQUIVALENT, WITH ASSOCIATED FLANGED COLLAR



-	-	-	-	-	-	3.1.51
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**COMPOSITE RIVETED INSTALLATION** **CYLINDRICAL SWAGED BOLT INSTALLATION**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3151E5	



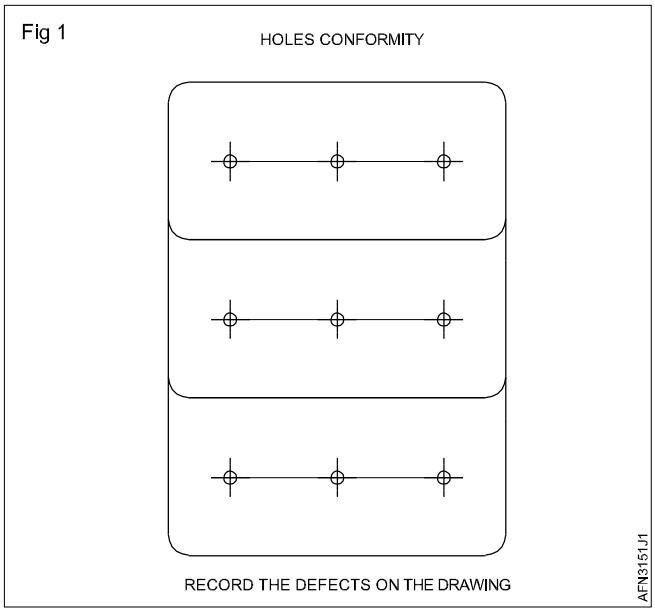
TASK 2: **Cylindrical swaged bolts installation**

- Position item 1 on item 2.
- Hold in position.
- Counter drill and clamp.
- Position item 3 on top of unit 1-2.
- Counter drill and clamp.
- Position item 4 on unit 1-2-3.
- Counter drill and clamp.
- Check assembly.
- Find the required size of the hole in the table.

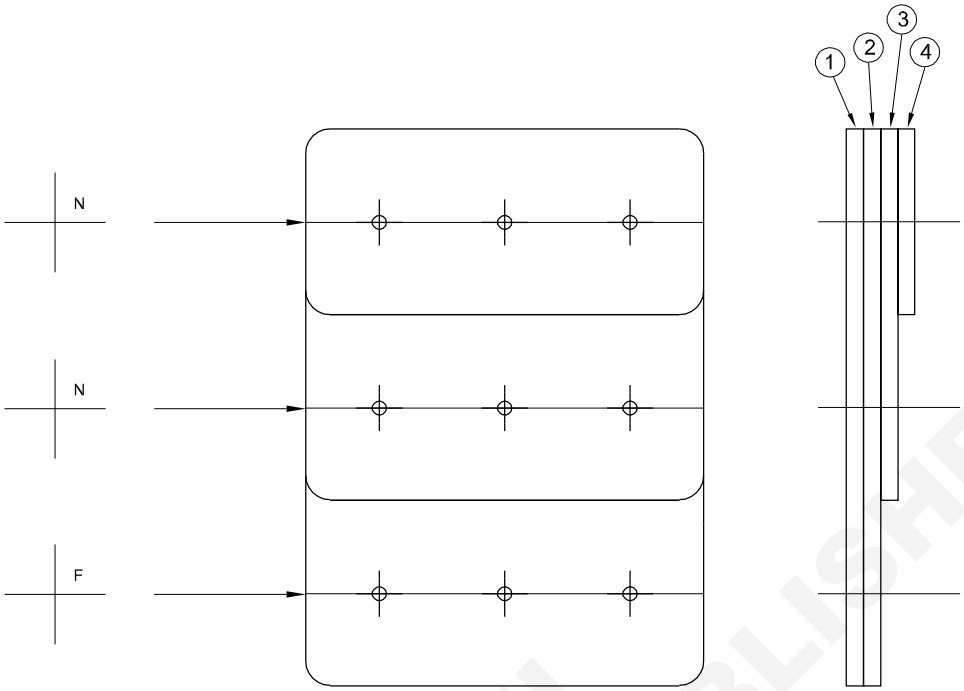
Record the hole diameter and ask your trainer to check it.

Hole diameter

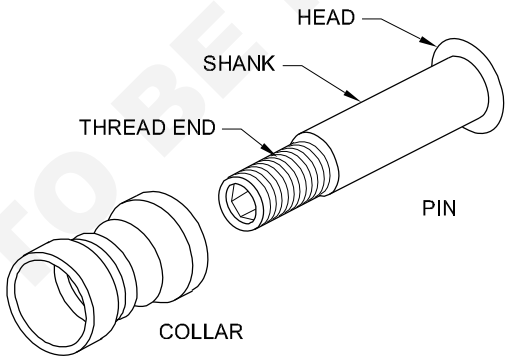
- Counter-drill to the final diameter (reaming).
- Deburr and chamfer if necessary.
- Check the conformity of the drillings.



CYLINDRICAL THREADED BOLT INSTALLATION



FASTENERS:
PROTUDING HEAD >EN6115T3-... OR EQUIVALENT, WITH ASSOCIATED FLANGED COLLAR



-	-	-	-	-	-	3.1.51
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**COMPOSITE RIVETED INSTALLATION** **CYLINDRICAL THREADED BOLT INSTALLATION**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3151E6	

- Using a dash measuring ruler, determine the thicknesses to be fastened.

Note the complete part numbers and ask your trainer for the fasteners.

Fasteners parts numbers

ROW 1 >

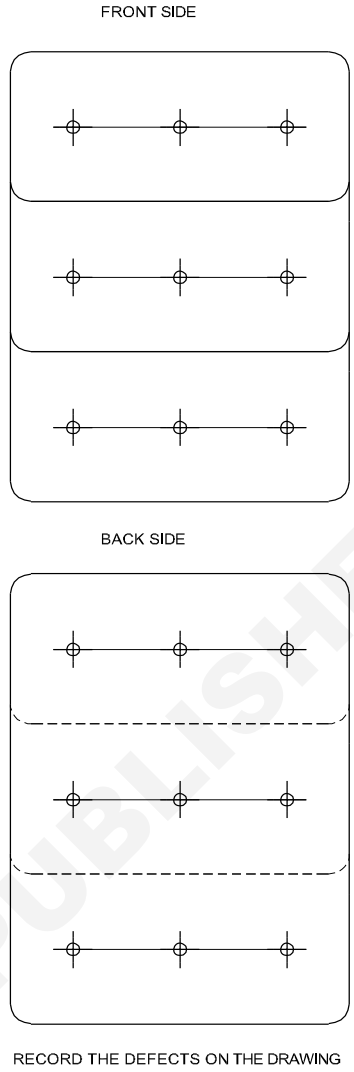
ROW 2 >

ROW 3 >

Install the fasteners.

Check the conformity of the installation.

Fig 2



TASK 3: **Blind threaded type bolts installation**

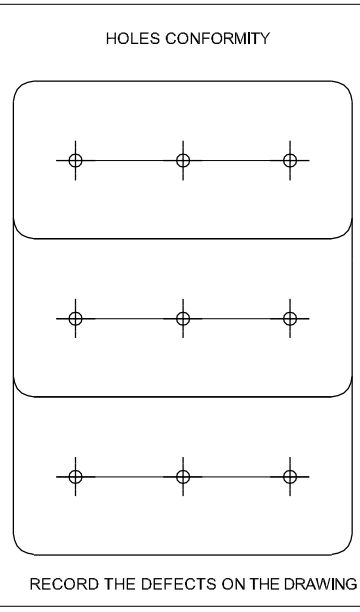
- Position item 1 on item 2.
- Hold in position.
- Counter drill and clamp.
- Position item 3 on top of unit 1-2.
- Counter drill and clamp.
- Position item 4 on unit 1-2-3.
- Counter drill and clamp.
- Check assembly.
- Find the required size of the hole in the table.

Record the hole diameter and ask your trainer to check it.

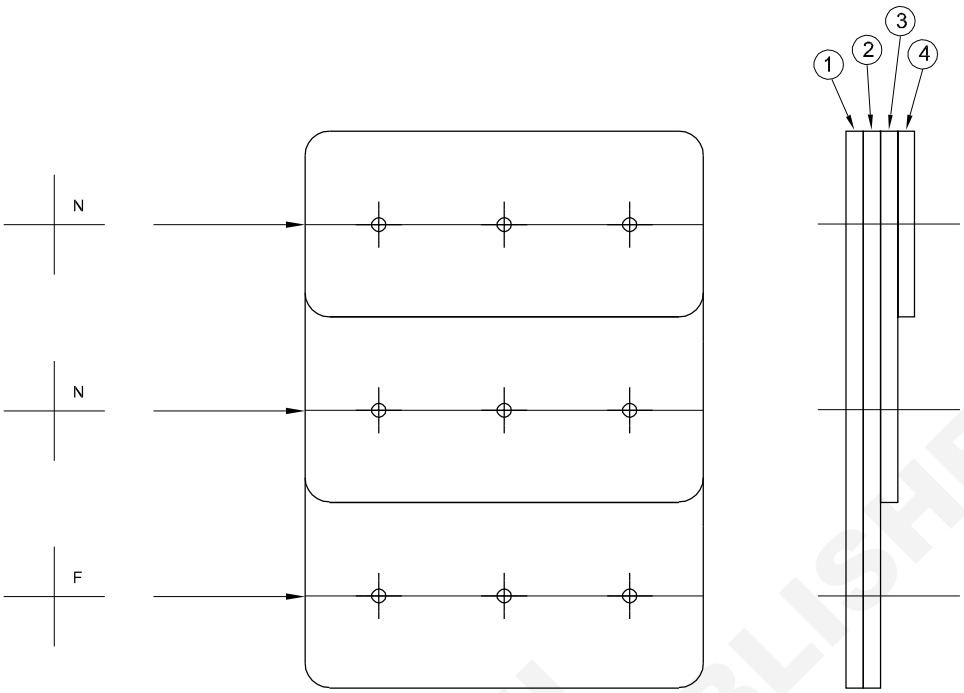
Hole diameter

- Counter-drill to the final diameter (reaming).
- Deburr and chamfer if necessary.

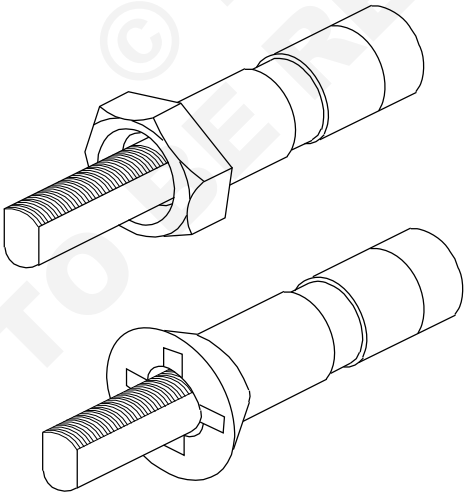
Fig 1



BLIND BOLT THREADED TYPE INSTALLATION



FASTENERS:
PROTUDING HEAD >NAS1669-06(L/DL)-.../PLT(5)210-06-... OR EQUIVALENT,



-	-	-	-	-	-	3.1.51
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**COMPOSITE RIVETED INSTALLATION BLIND BOLT THREADED INSTALLATION**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3151E7	

- Check the conformity of the drillings.
- Record the defects on the drawing.
- Using a dash measuring ruler, determine the thicknesses to be fastened.

Note the complete part numbers and ask your trainer for the fasteners.

Fasteners parts numbers

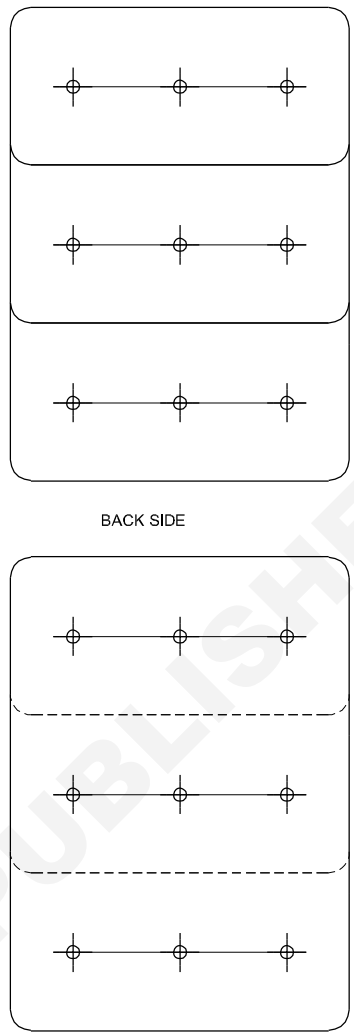
ROW 1 >

ROW 2 >

ROW 3 >

- Install the fasteners.
- Check the conformity of the installation.

Fig 2



TASK 4: **Blind rivet installation**

- Position item 1 on item 2.
- Hold in position.
- Counter drill and clamp.
- Position item 3 on top of unit 1-2.
- Counter drill and clamp.
- Position item 4 on unit 1-2-3.
- Counter drill and clamp.
- Check assembly.
- Find the required size of the hole in the table.

Record the hole diameter and ask your trainer to check it.

Hole diameter

- Counter-drill to the final diameter (reaming).
- Deburr and chamfer if necessary.
- Check the conformity of the drillings.
- Record the defects on the drawing.
- Using a dash measuring ruler, determine the thicknesses to be fastened.

Note the complete part numbers and ask your trainer for the fasteners.

Fasteners parts numbers

ROW 1 >

ROW 2 >

ROW 3 >

Install the fasteners.

Check the conformity of the installation.

Fig 1

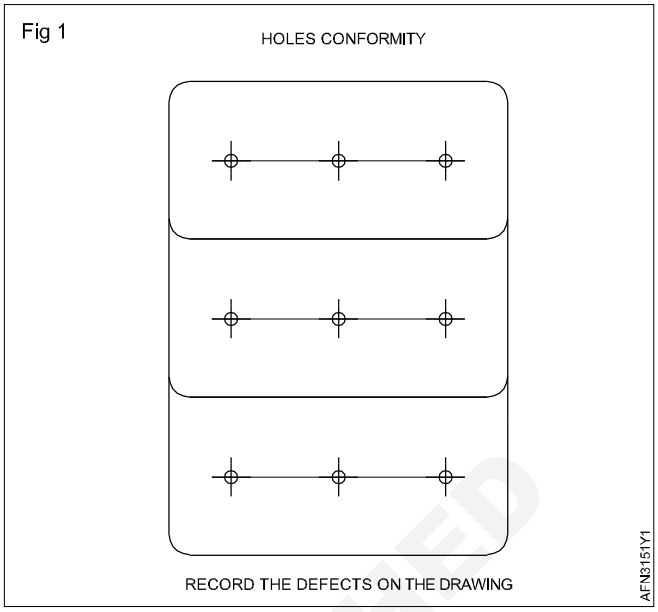
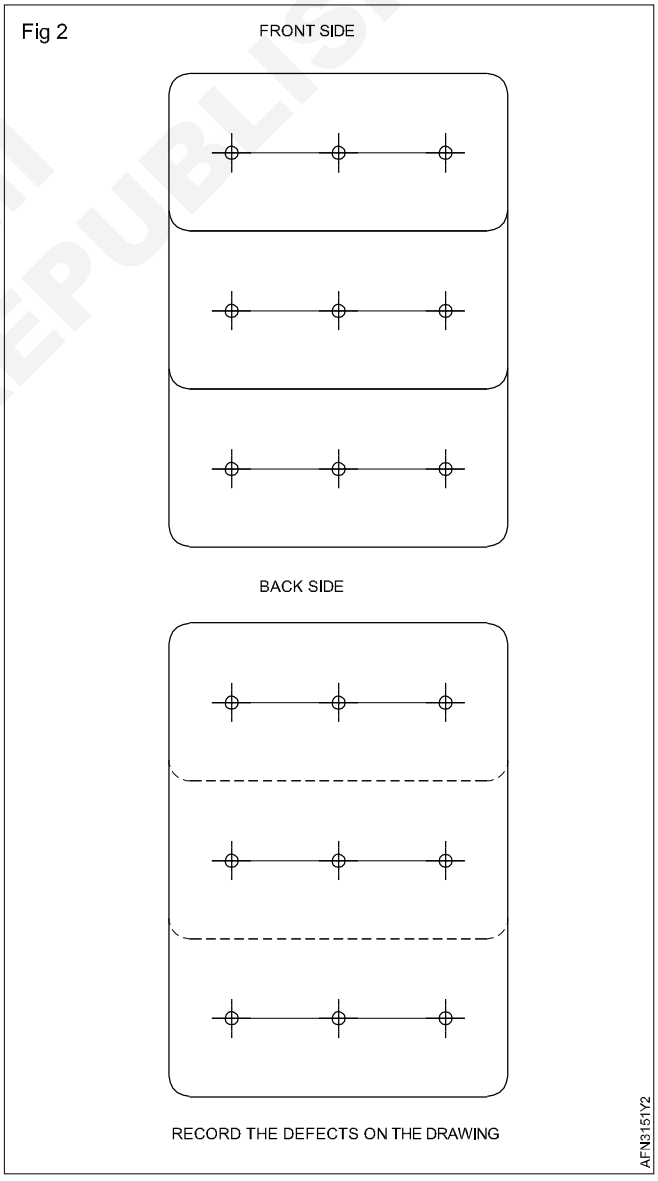
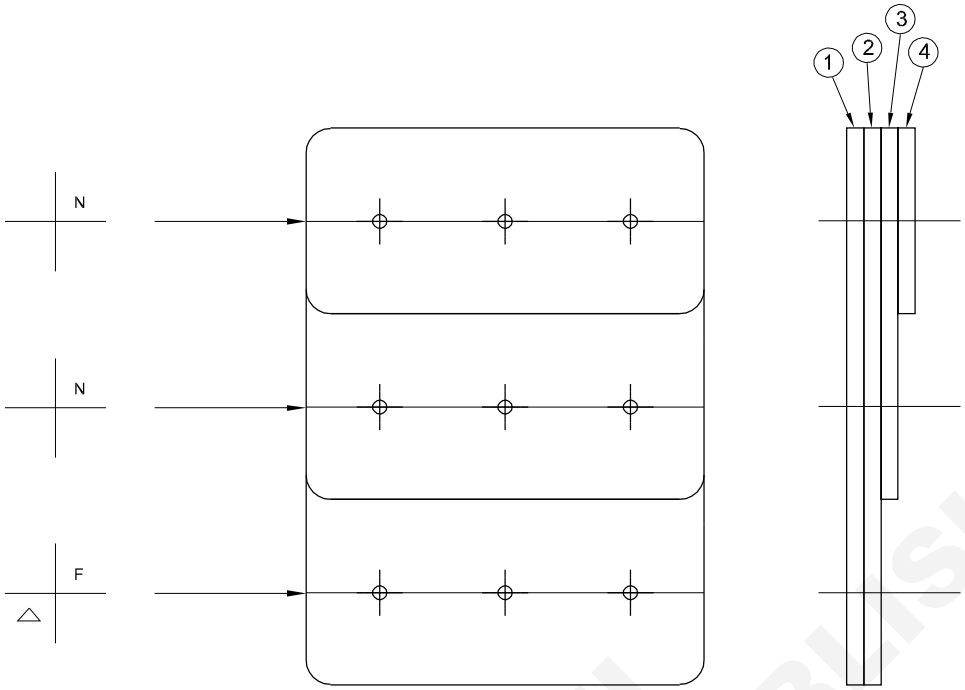


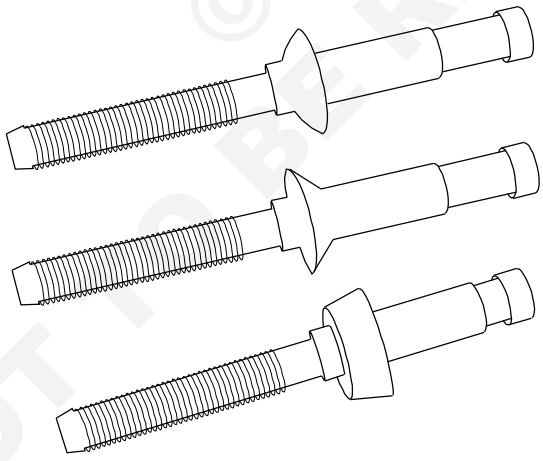
Fig 2



BLIND RIVET PULL- TYPE INSTALLATION



FASTENERS:
PROTUDING HEAD >NAS1738B 05-.../ CR2249-5-... OR EQUIVALENT,
COUNTERSUNK HEAD >NAS1739B 05- .../ CR2248-5-... OR EQUIVALENT



-	-	-	-	-	-	3.1.51
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**COMPOSITE RIVETED INSTALLATION** **BLIND RIVET PULL-TYPE INSTALLATION**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3151E8	

HOLES DATA

HI-LITE AND LOCKBOLT FASTNERS IN COMPOSITE / COMPOSITE ASSEMBLIES
HOLE DIAMETERS FOR LOW CLEARANCE FIT ASSEMBLY WITH COATED BOLTS
COMPOSITE/COMPOSITE

Dimensions in mm

Diameter code	Nominal Diameter	Clearance		Hole Diameter 'D'							
				Standard		1st oversize (Code x)		2nd oversize (Code Y)		3rd oversize (Code Z)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
5	3.97	.002	.057	4.155	4.185	-	-	-	-	-	-
6	4.76	.002	.057	4.815	4.845	5.148	5.178	-	-	-	-
8	6.35	.002	.065	6.339	6.377	6.736	6.773	7.132	7.169	-	-

ALL BLIND RIVET FOR ALL ASSEMBLIES

Dimensions in mm

Diameter code	Nominal Diameter	Clearance	
		Min	Max
04	3.2	3.25	3.37
05	4.0	4.05	4.17
06	4.8	4.85	4.97

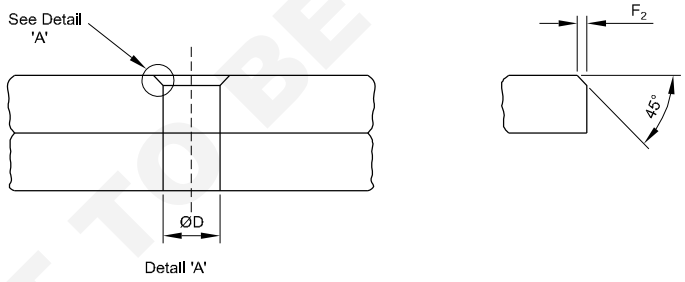
BLIND BOLT THREADED TYPE FOR ALL ASSEMBLIES

Dimensions in mm

Diameter code	Nominal Diameter	Hole Diameter			
		Type A		Type B	
		Min	Max	Min	Max
06	4.8	4.840	4.862	4.827	4.902
08	6.4	6.338	6.360	6.325	6.401

Diameter code in 1/32 "

HOLE CONFIGURATION FOR USE WITH PROTUDING HEAD
BOLTS NOT APPLICABLE FOR SOLID AND BLIND RIVET



Dimensions in mm

Diameter code	Nominal Diameter	Shear Bolts								Tension Bolts			
		Recommended				Reduced							
		Radius		Chamfer		Radius		Chamfer		Radius		Chamfer	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
2	3.97	0.6	0.9	0.6	0.9	0.6	0.7	-	-	-	-	-	-
3	4.76	0.6	0.9	0.6	0.9	0.6	0.7	-	-	1.0	1.3	1.05	1.15
8	6.35	0.6	0.9	0.6	0.9	0.6	0.7	-	-	1.0	1.3	1.05	1.15

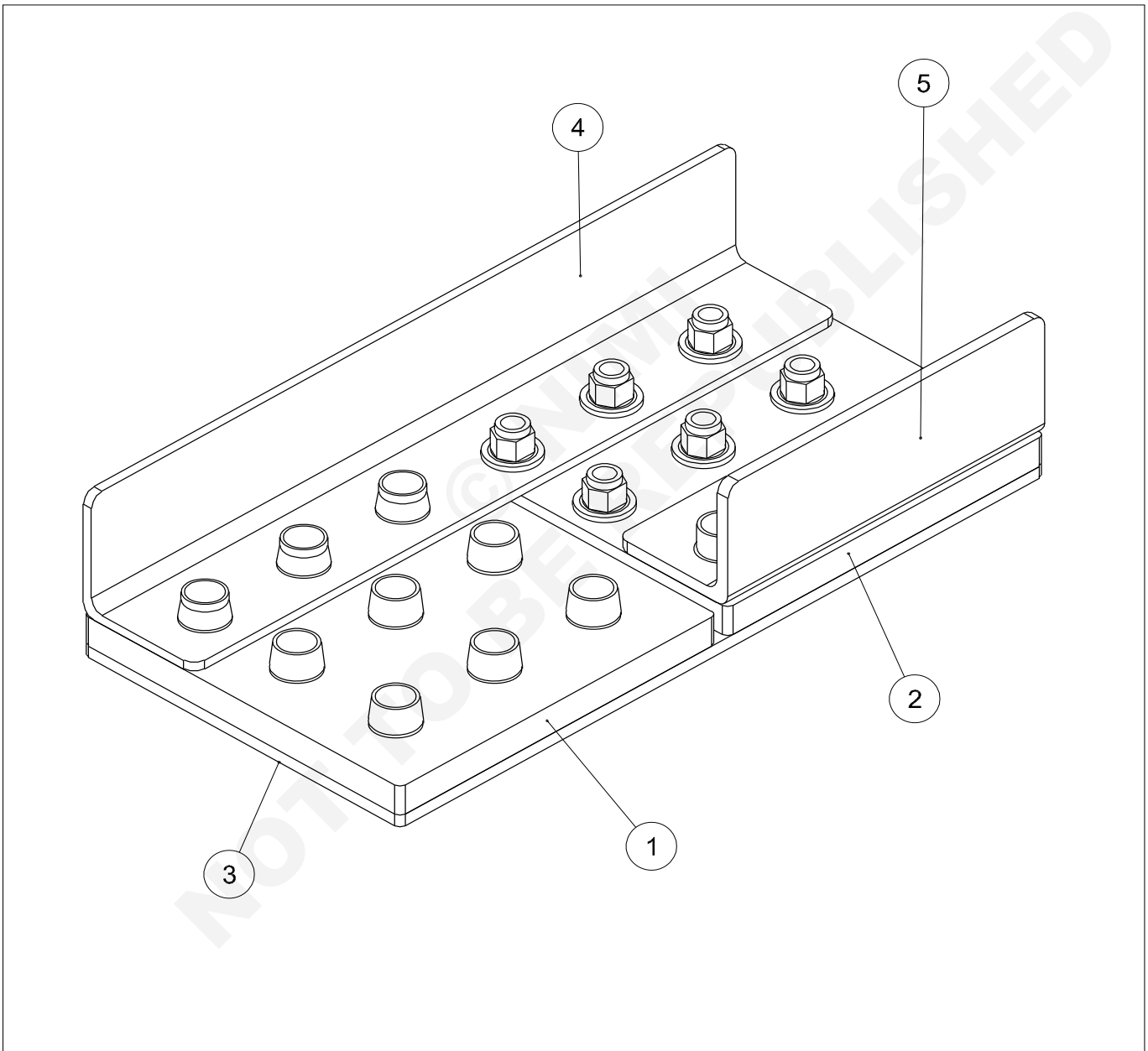
-	-	-	-	-	-	3.1.51
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**COMPOSITE RIVETED INSTALLATION HOLE AND DRILL DATA**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3151E9	

Composite riveted installation – Composite / Metallic

Objectives: At the end of this exercise you shall be able to·
- **install permanent fasteners in composite/metallic assembly**
- **choose the right length of a fastener**
- **overcoat fasteners.**

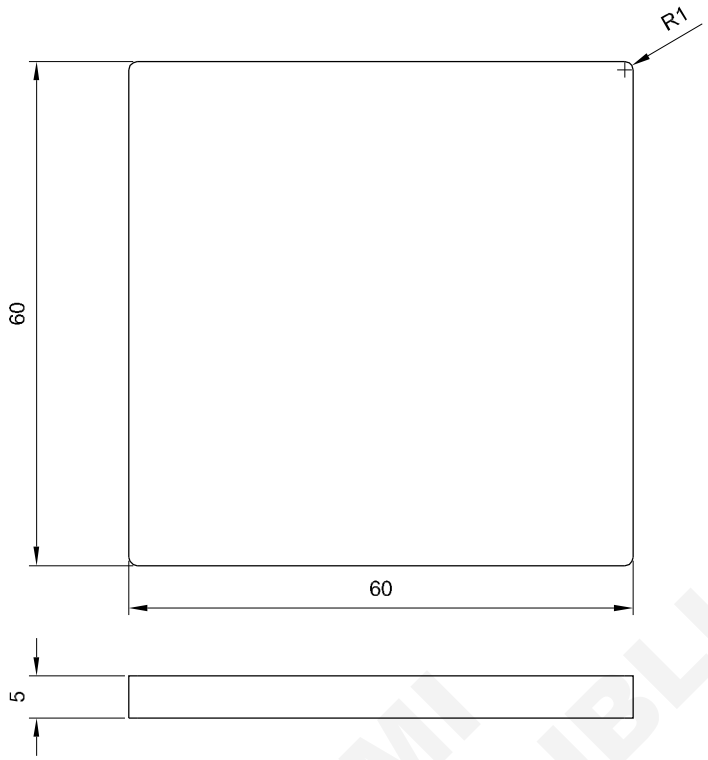
Job Sequence

TASK 1: **Parts fabrication**



-	-	-	-	-	-	3.1.52
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	COMPOSITE RIVETED INSTALLATION OVERVIWE				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3152E1	

PARTS MANUFACTURING



MATERIAL : ALUMINIUM AW - 2017

THICKNESS: 5 mm

QUANTITY: 1

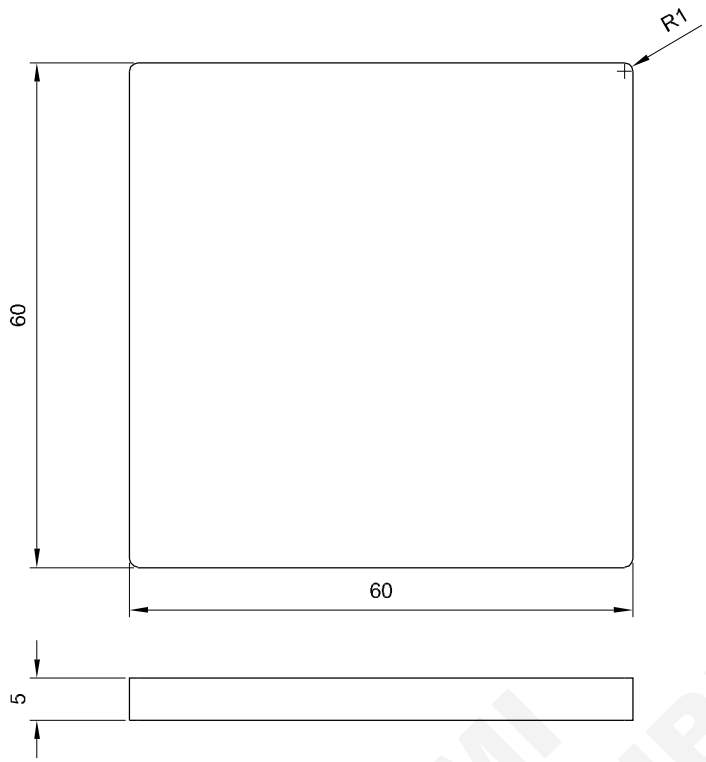
ITEM 01

Aluminium AW-2017

- Check dimensions and thickness.
- Mark external dimensions and radii.
- File the external dimensions and radii.
- Drawn filing all edges.
- Deburr edges.
- Check dimensions.

1	60 X 60 - Thick.5	-	EN-AW2017	-	-	3.1.52
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**COMPOSITE RIVETED INSTALLATION** **PARTS MANUFACTURING - ITEM 1**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3152E2	

PARTS MANUFACTURING



MATERIAL : CFRP

THICKNESS: 5 mm

QUANTITY: 1

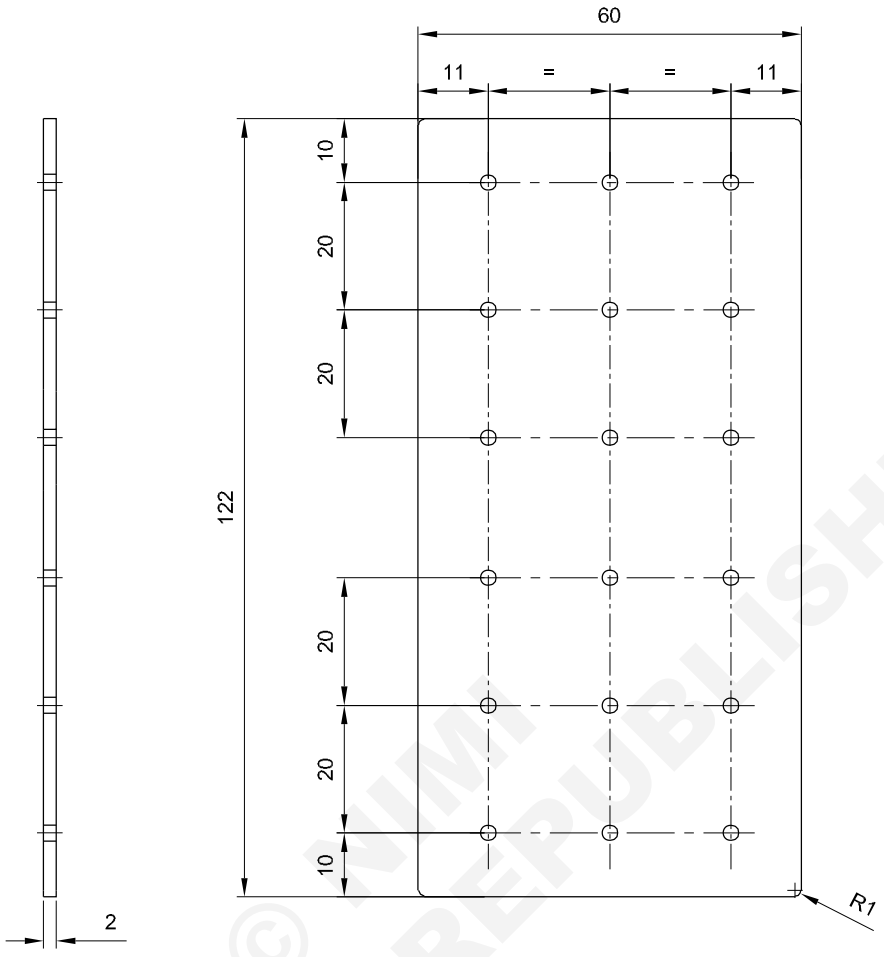
ITEM 02

CFRP

- Check dimensions and thickness.
- Mark external dimensions and radii.
- File the external dimensions and radii.
- Drawn filing all edges.
- Deburr edges.
- Check dimensions.

1	60 X 60 - Thick.5	-	CFRP	-	-	3.1.52
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**COMPOSITE RIVETED INSTALLATION** **PARTS MANUFACTURING - ITEM 2**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3152E3	

PARTS MANUFACTURING



MATERIAL: AISI 316L

THICKNESS: 2 mm

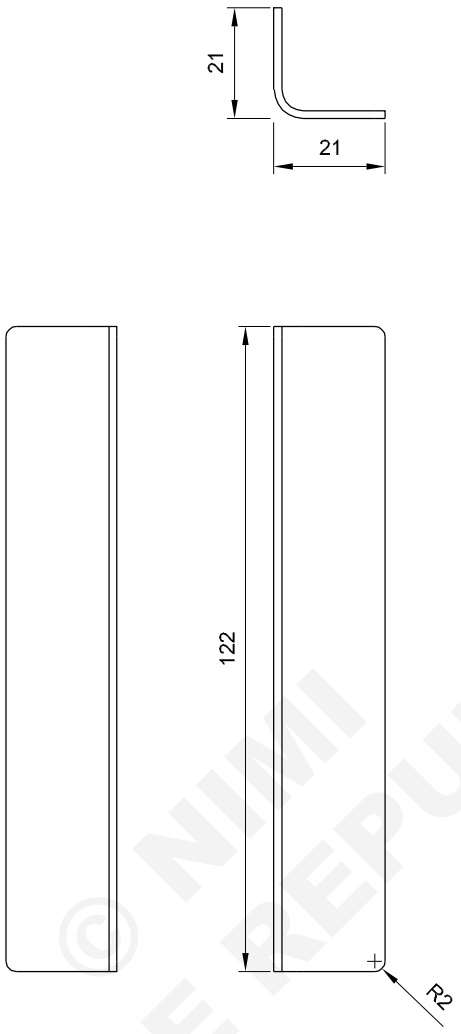
QUANTITY: 1

ITEM 03

AISI 316L

- Check dimensions and thickness.
- Mark external dimensions and radii.
- File the external dimensions and radii.
- Drawn filing all edges.
- Deburr edges.
- Check dimensions.
- Mark holes positions.
- Drill holes and deburr.
- Clean parts.

1	60 X 122 - Thick.2	-	AISI 316L	-	-	3.1.52
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**COMPOSITE RIVETED INSTALLATION** **PARTS MANUFACTURING - ITEM 3**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3152E4	



Material: Aluminium AW-2017
Thickness: 1.5 mm

QUANTITY: 1

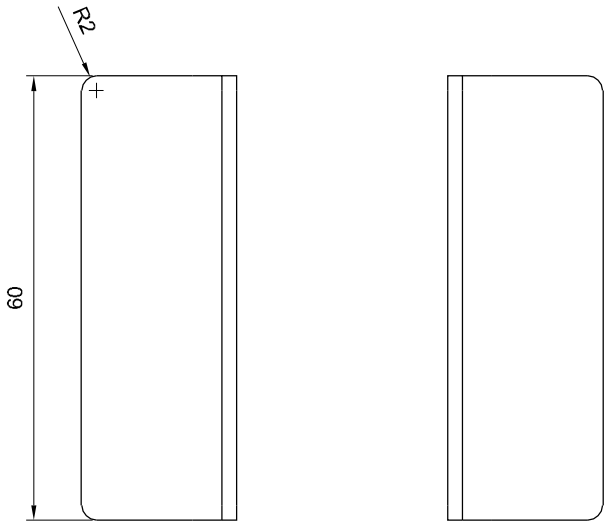
ITEM 04

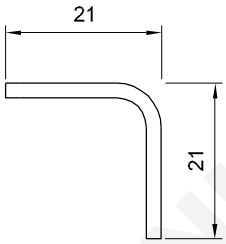
Aluminium AW-2017

- Check dimensions and thickness.
- Mark external dimensions and radii.
- File the external dimensions and radii.
- Drawn filing all edges.
- Deburr edges.
- Check dimensions.

1	21 X 21 - L 122	-	EN-AW2017	-	-	3.1.52
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**COMPOSITE RIVETED INSTALLATION** **PARTS MANUFACTURING - ITEM 4**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3152E5	

PARTS MANUFACTURING





Material: CFRP
Thickness: 2mm
Quantity: 1

ITEM 05

CFRP

- Check dimensions and thickness.
- Mark external dimensions and radii.
- File the external dimensions and radii.
- Drawn filing all edges.
- Deburr edges.
- Check dimensions.

1	21X21 - L 122	-	CFRP	-	-	3.1.52
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**COMPOSITE RIVETED INSTALLATION** **PARTS MANUFACTURING - ITEM 5**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3152E6	

Record Sheet - Item 01

Dimensions	Theorical		Measured
External dimensions	60	±0.5	
	60	±0.5	
Radius	R1	±0.5	
	R1	±0.5	
	R1	±0.5	
	R1	±0.5	

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches ☐ CONFORM ☐ NOT CONFORM

Observations:

Record Sheet - Item 02

Dimensions	Theorical		Measured
External dimensions	60	±0.5	
	60	±0.5	
Radius	R1	±0.5	
	R1	±0.5	
	R1	±0.5	
	R1	±0.5	

Absence of delamination ☐ CONFORM ☐ NOT CONFORM

Absence of burn marks ☐ CONFORM ☐ NOT CONFORM

Absence of debonding ☐ CONFORM ☐ NOT CONFORM

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches ☐ CONFORM ☐ NOT CONFORM

The products have been discarded for recycling in the appropriate bins.

☐ YES ☐ NO

The wearing of PPE during work has been respected.

☐ YES ☐ NO

Observations:

Record Sheet - Item 03

Dimensions	Theorical		Measured
External dimensions	60	±0.5	
	122	±0.5	
Radius	R1	±0.5	
	R1	±0.5	
	R1	±0.5	
	R1	±0.5	

Drilling	Theorical		Measured
Edge distance 1	10	+1 / -0	
Edge distance 2	11	+1 / -0	
Pitch	20	±0.5	
Number of holes	18		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Absence of burn marks ☐ CONFORM ☐ NOT CONFORM

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches ☐ CONFORM ☐ NOT CONFORM

Observations:

Record Sheet - Item 04

Dimensions	Theorical		Measured
Flange	21	±0.5	
Flange	21	±0.5	
Length	122	±0.5	

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches ☐ CONFORM ☐ NOT CONFORM

Observations:

Record Sheet - Item 05

Dimensions	Theorical		Measured
Flange	21	±0.5	
Flange	21	±0.5	
Length	60	±0.5	

Absence of delamination ☐ CONFORM ☐ NOT CONFORM

Absence of burn marks ☐ CONFORM ☐ NOT CONFORM

Absence of debonding ☐ CONFORM ☐ NOT CONFORM

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches ☐ CONFORM ☐ NOT CONFORM

The products have been discarded for recycling in the appropriate bins.

☐ YES ☐ NO

The wearing of PPE during work has been respected.

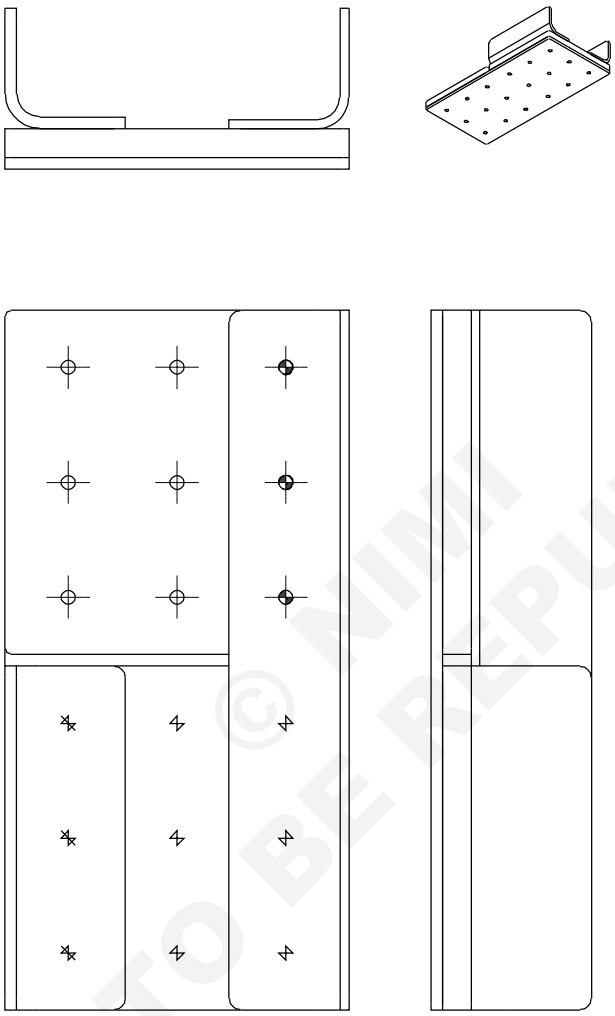
☐ YES ☐ NO

Observations:

— — — — — — — —

TASK 2 :**Assembly**

ASSEMBLY



-	-	-	-	-	-	3.1.52
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**COMPOSITE RIVETED INSTALLATION ASSEMBLY**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3152E7	

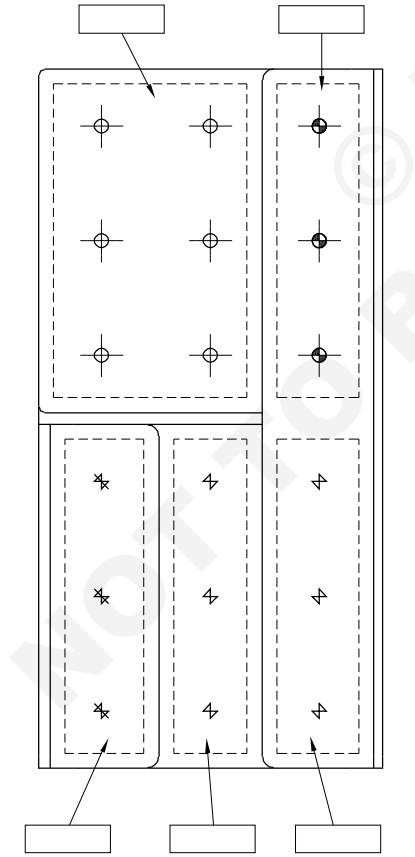
- Position item 1 on item 3.
- Hold in position.
- Counter drill and clamp.
- Position item 2 on top of unit 1-3 with 1.5 to 2mm gap.
- Counter drill and clamp.
- Position item 4 on unit 1-2-3.
- Counter drill and clamp.
- Position item 5 on unit 1-2-3.
- Counter drill and clamp.
- Check assembly.
- Find the required size of the hole in the table.

Record the hole diameter and ask your trainer to check it.

- Counter-drill to the final diameter (reaming).
- Deburr and chamfer if necessary.
- Check the conformity of the drillings.

Record the hole diameter and ask your trainer to check it.

Fig 1

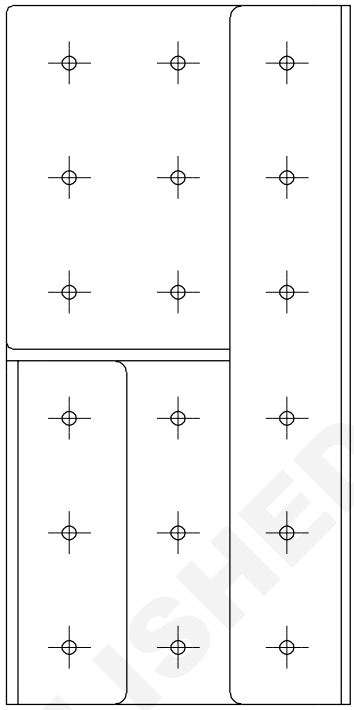


HOLES DIAMETER FOR EACH TYPE OF FASTENER

AFN3152H1

Fig 2

HOLES CONFORMITY

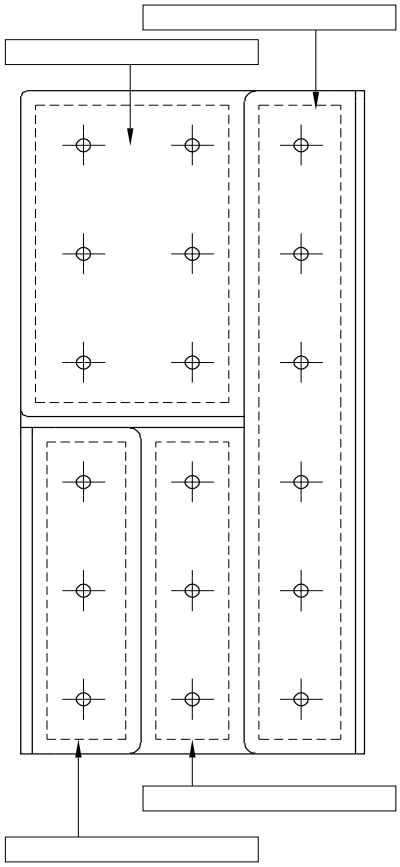


RECORD THE DEFECTS ON THE DRAWING

AFN3152H2

- Using a dash measuring ruler, determine the thicknesses to be fastened.

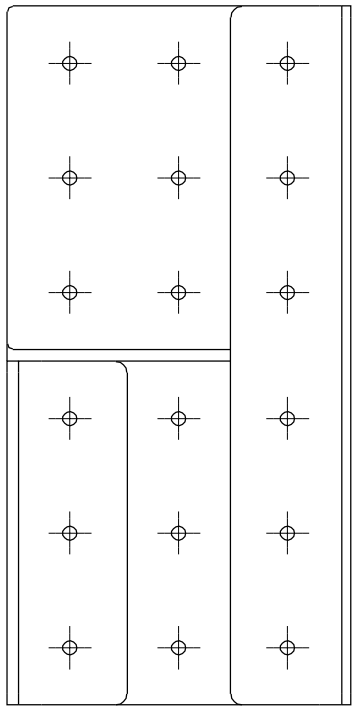
Fig 3



FASTENERS PARTS NUMBERS

AFN3152H3

Fig 4 INSTALLATION CONFORMITY



RECORD THE DEFECTS IN THE DRAWING

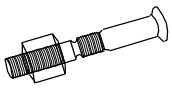
AFN3152H4

Note the complete part numbers and ask your trainer for the fasteners.

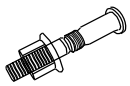
- Install the fasteners.
- Check the conformity of the installation.

FASTNERS HOLES DATA

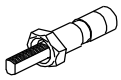
LOCKBOLT - REGULAR COLLAR
GPL8TP-V06-....or LGPL4SP-V06-....



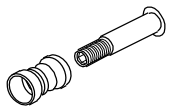
LOCKBOLT - FLANGED COLLAR
GPL8TP-V06-....or LGPL4SP-V06-....



BLIND BOLT
NAS1669-06-....(L/DL) or PLT(5)210-06-....



HI-LITE
EN6115TE-.... associated collar or nut



HI-LITE AND LOCKBOLT FASTNERS IN COMPOSITE / COMPOSITE ASSEMBLIES
HOLE DIAMETERS FOR LOW CLEARANCE FIT ASSEMBLY WITH COATED BOLTS

Dimensions in mm

Diameter code	Nominal Diameter	Clearance		Hole Diameter 'D'							
				Standard		1st oversize (Code x)		2nd oversize (Code Y)		3rd oversize (Code Z)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
5	3.97	.002	.057	4.155	4.185	-	-	-	-	-	-
6	4.76	.002	.057	4.815	4.845	5.148	5.178	-	-	-	-
8	6.35	.002	.065	6.339	6.377	6.736	6.773	7.132	7.169	-	-

HI-LITE AND LOCKBOLT IN COMPOSITE / METALLIC, METALLIC/ METALLIC ASSEMBLY
HOLE DIAMETERS FOR TRANSITION FIT ASSEMBLY WITH SHEAR BOLTS

Dimensions in mm

Diameter code	Nominal Diameter	Clearance		Hole Diameter 'D'							
				Standard		1st oversize (Code x)		2nd oversize (Code Y)		3rd oversize (Code Z)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
5	3.97	-.028	.032	4.125	4.160	-	-	-	-	-	-
6	4.76	-.033	.032	4.780	4.820	5.113	5.153	-	-	-	-
8	6.35	-.027	.038	6.310	6.350	6.707	6.747	7.103	7.142	-	-

HI-LITE AND LOCKBOLT IN HARD METAL ASSEMBLY
HOLE DIAMETERS FOR CLEARANCE FIT ASSEMBLY WITH SHEAR BOLTS

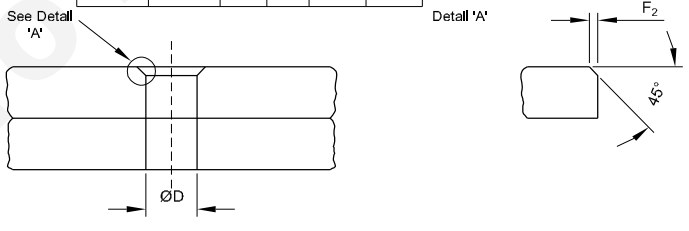
Dimensions in mm

Diameter code	Nominal Diameter	Clearance		Hole Diameter 'D'							
				Standard		1st oversize (Code x)		2nd oversize (Code Y)		3rd oversize (Code Z)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
5	3.97	.010	.080	4.163	4.208	-	-	-	-	-	-
6	4.76	.010	.080	4.823	4.868	5.148	5.193	-	-	-	-
8	6.35	.010	.080	6.347	6.392	6.736	6.781	7.132	7.176	-	-

ALL BLIND RIVET FOR ALL ASSEMBLIES

Dimensions in mm

Diameter code	Nominal Diameter	Hole diameter			
		Type A		Type B	
		Min	Max	Min	Max
06	4.8	4.840	4.862	4.827	4.902
08	6.4	6.338	6.360	6.325	6.401



Dimensions in mm

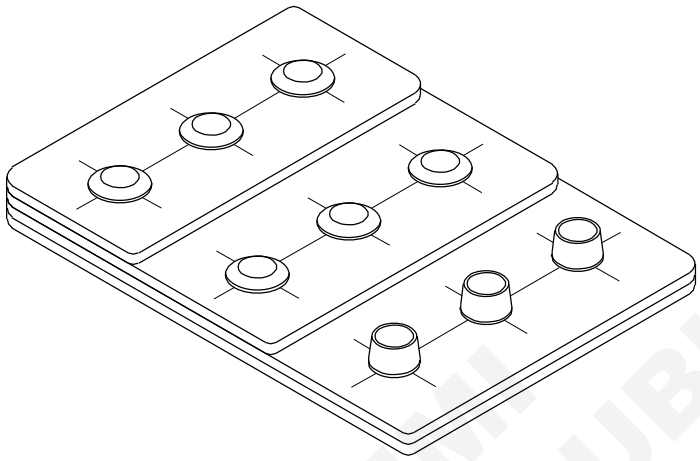
Diameter code	Nominal Diameter	Shear Bolts								Tension Bolts			
		Recommended				Reduced							
		Radius		Chamfer		Radius		Chamfer		Radius		Chamfer	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
2	3.97	0.6	0.9	0.6	0.9	0.6	0.7	-	-	-	-	-	-
3	4.76	0.6	0.9	0.6	0.9	0.6	0.7	-	-	1.0	1.3	1.05	1.15
8	6.35	0.6	0.9	0.6	0.9	0.6	0.7	-	-	1.0	1.3	1.05	1.15

-	-	-	-	-	-	3.1.52
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**COMPOSITE RIVETED INSTALLATION FASTENERS AND DRILL DATA**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3152E1	

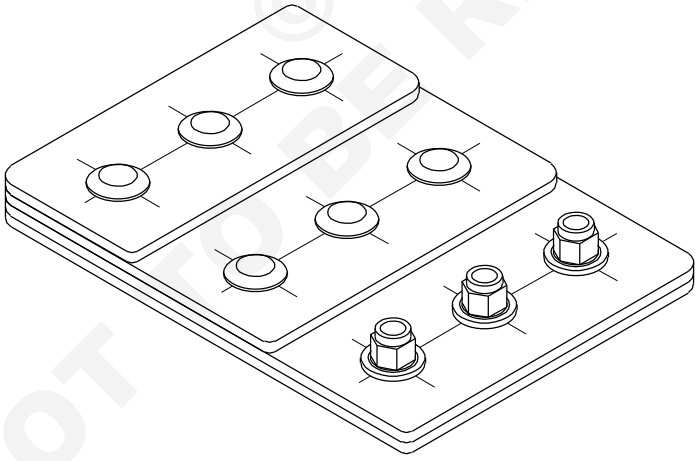
Rivet and fasteners removal

Objectives: At the end of this exercise you shall be able to·
• remove fasteners without damaging the structure
• remove fasteners without damaging the holes.

TASK 1



TASK 2



-	-	→ 3.1.51	-	-	-	3.1.53
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

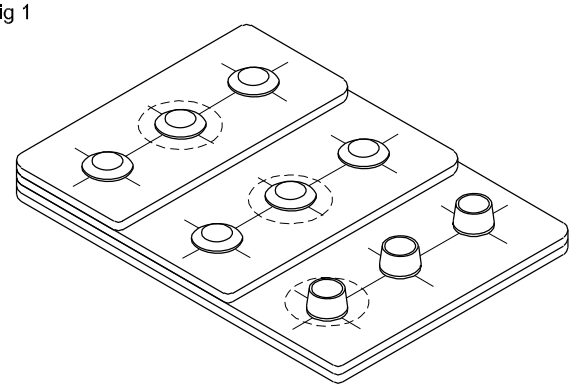
SCALE : NTS	FASTENERS REMOVAL ASSEMBLY N°1	DEVIATIONS	TIME : 20 Hrs
		CODE NO : AFN3153E1	

Job Sequence

TASK 1: **Lockbolt removal**

- Remove the 3 fasteners.
- Check holes and report defects in the drawing below.

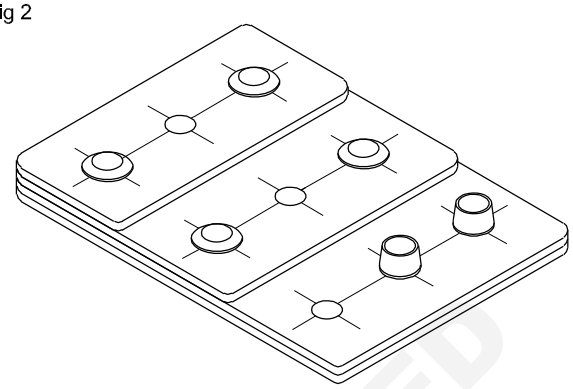
Fig 1



REMOVE THE MARKED FASTENERS

AFN3153H1

Fig 2



NOTE THE DEFECTS

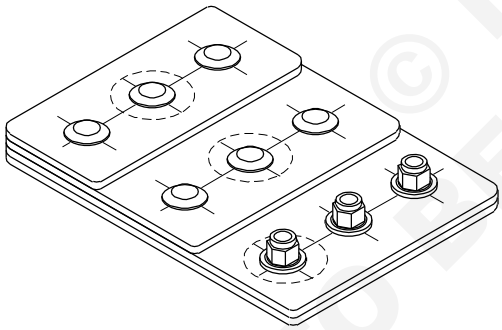
AFN3153H2

Refer Trade Theory for method.

TASK 2: **Hi-Lite removal**

- Remove the 3 fasteners.
- Check holes and report defects in the drawing below.

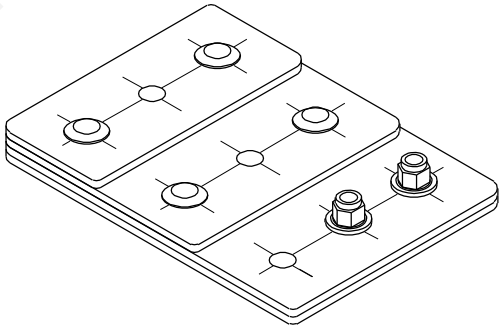
Fig 3



REMOVE THE MARKED FASTENERS

AFN3153H3

Fig 4

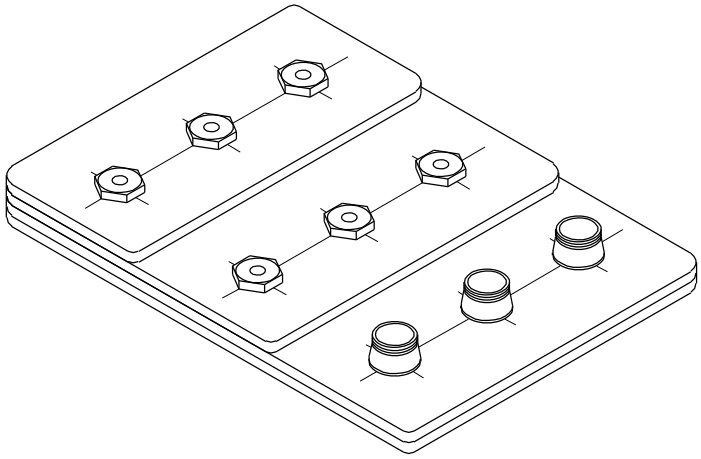


NOTE THE DEFECTS

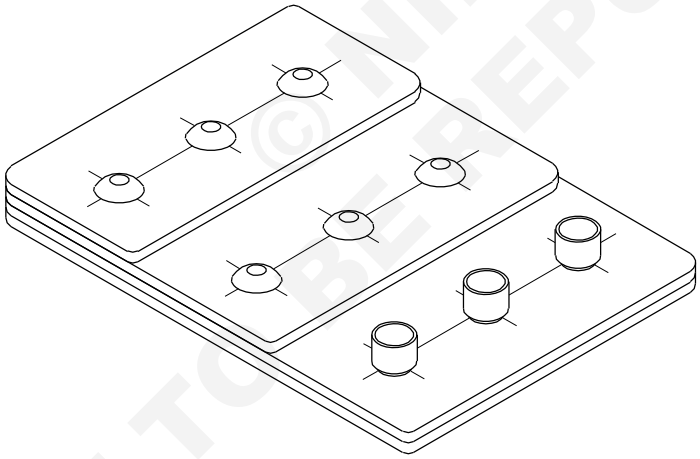
AFN3153H4

Refer Trade Theory for method

TASK 3



TASK 4

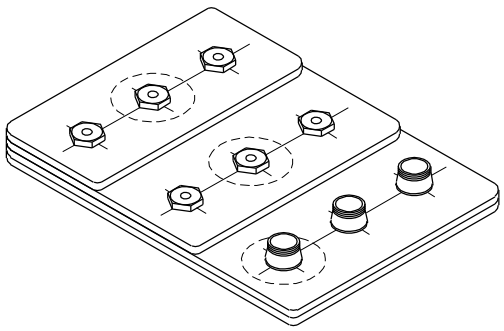


3	35 X 180 - Thick..2	-	AW-7075	-	-	3.1.53
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**TENSILE TEST SPECIMENS SPECIMEN 2**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3153E2	

TASK 3: **Jo-Bolt removal**

- Remove the 3 fasteners.

Fig 5

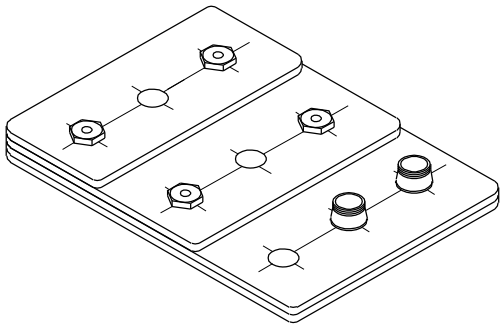


REMOVE THE MARKED FASTENERS

AFN3153H5

Refer Trade Theory for method.

Fig 6



NOTE THE DEFECTS

AFN3153H6

- Check holes and report defects in the drawing below.

— — — — — — — —

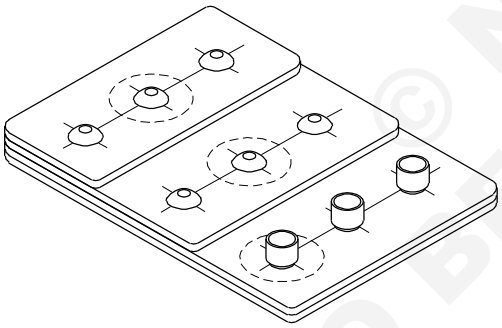
TASK 4: **Blind rivet removal**

- Remove the 3 fasteners.

Refer Trade Theory for method.

- Check holes and report defects in the drawing below.

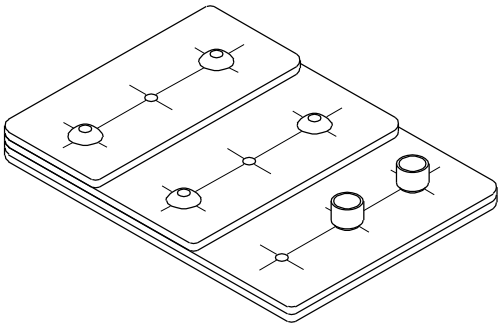
Fig 7



REMOVE THE MARKED FASTENERS

AFN3153H7

Fig 8



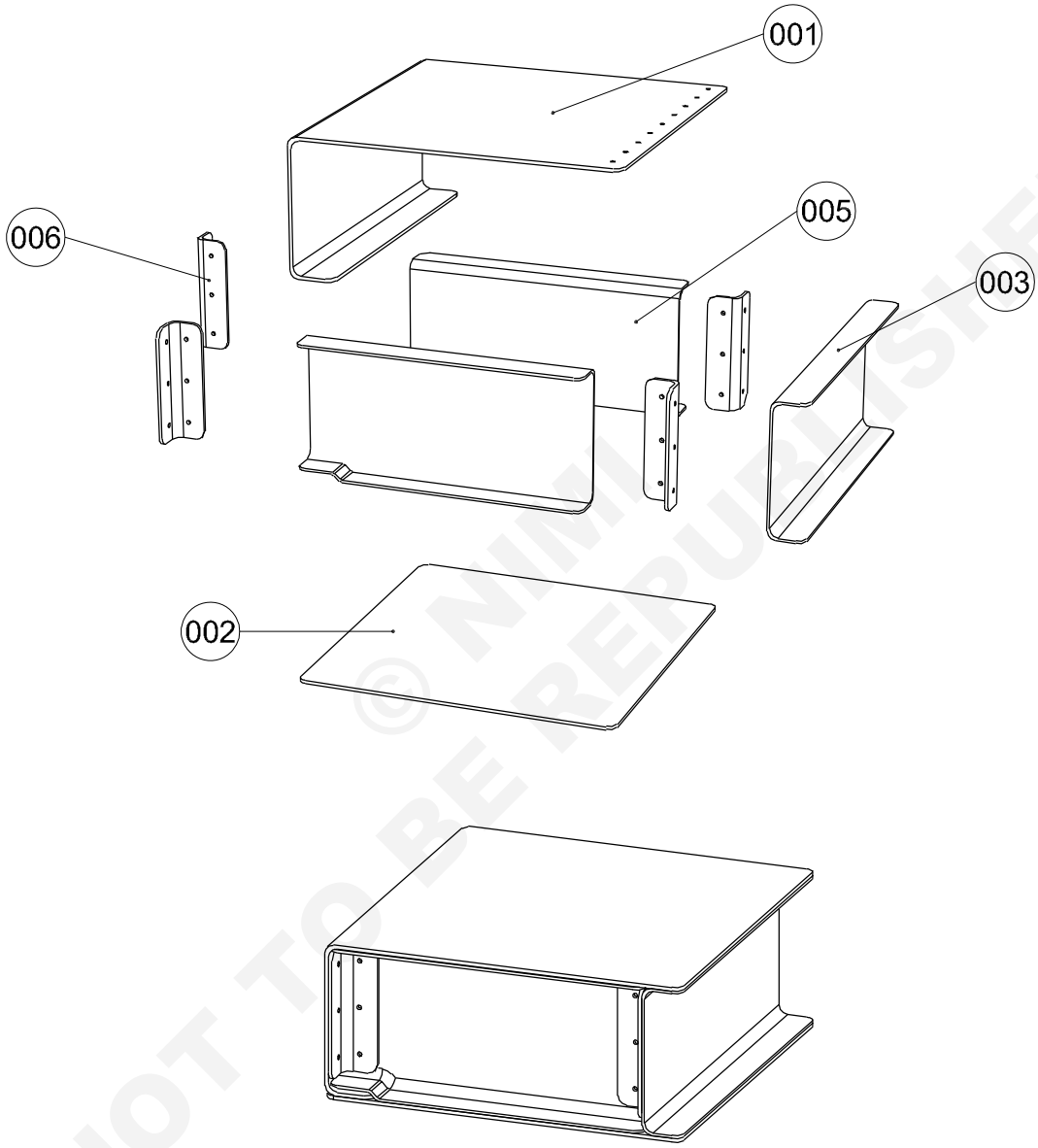
NOTE THE DEFECTS

AFN3153H8

— — — — — — — —

Metallic/composite riveted closed box - Parts manufacturing

Objectives: At the end of this exercise you shall be able to·
- **manufacture parts by bending and joggling**
- **manufacture parts by filling and drilling.**



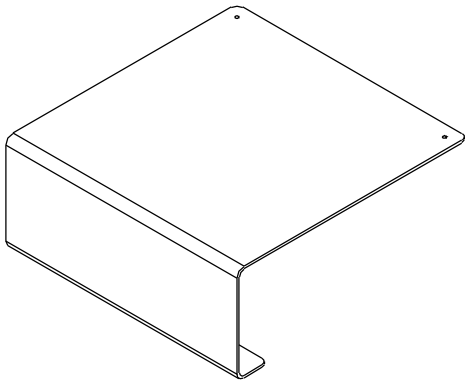
-	-	< 2.1.51	-	-	-	3.1.54
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**CLOSED BOX - OVERVIEW**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3154E1	

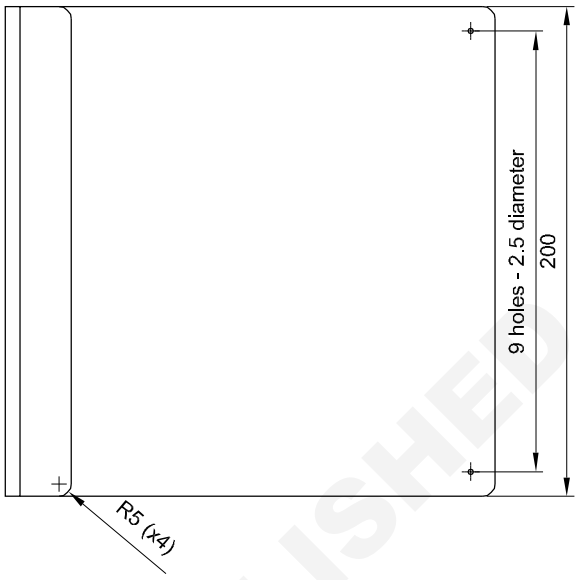
Job Sequence

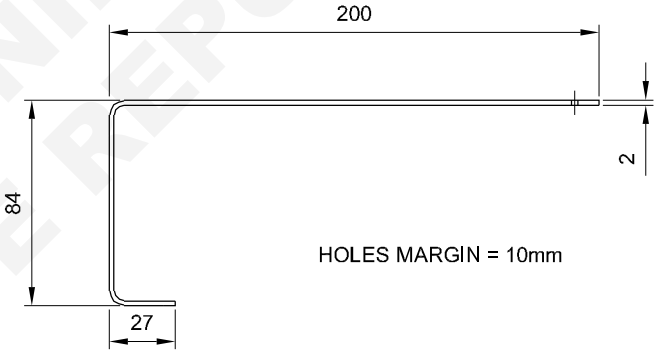
Item 001

- Check dimensions and thickness.
- Calculate the developed length.
- Mark and file external dimensions calculated above.

The grain direction must be perpendicular to the bending.





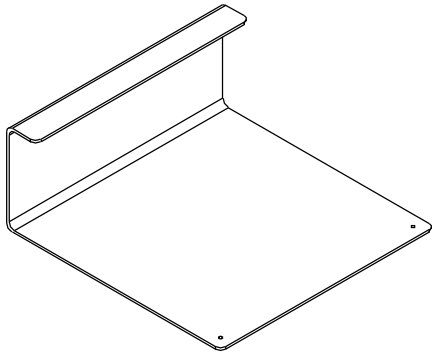


HOLES MARGIN = 10mm

THICKNESS: 2mm
QUANTITY: 1
HOLES MARGIN: 10mm
BENDING RADIUS: 4 to 5 mm

1	200X330 - Thick. 2	-	AW-2017	-	001	3.1.54
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**CLOSED BOX ITEM 001**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3154E2	

Fig 1



- Finish edges by draw filing.
- Deburr edges.
- Bend the angle using brake.
- Check the angle and the dimensions of flanges. File if necessary.

- Mark and file radii.
- Deburr edges.
- Mark the holes positions.
- Punch the centre of the holes.

Drilling diameter 2.5

- Hold the work piece and drill holes with hand drill.
- Deburr both sides.
- Check diameter and perpendicularity of each hole.

Record Sheet - Item 001

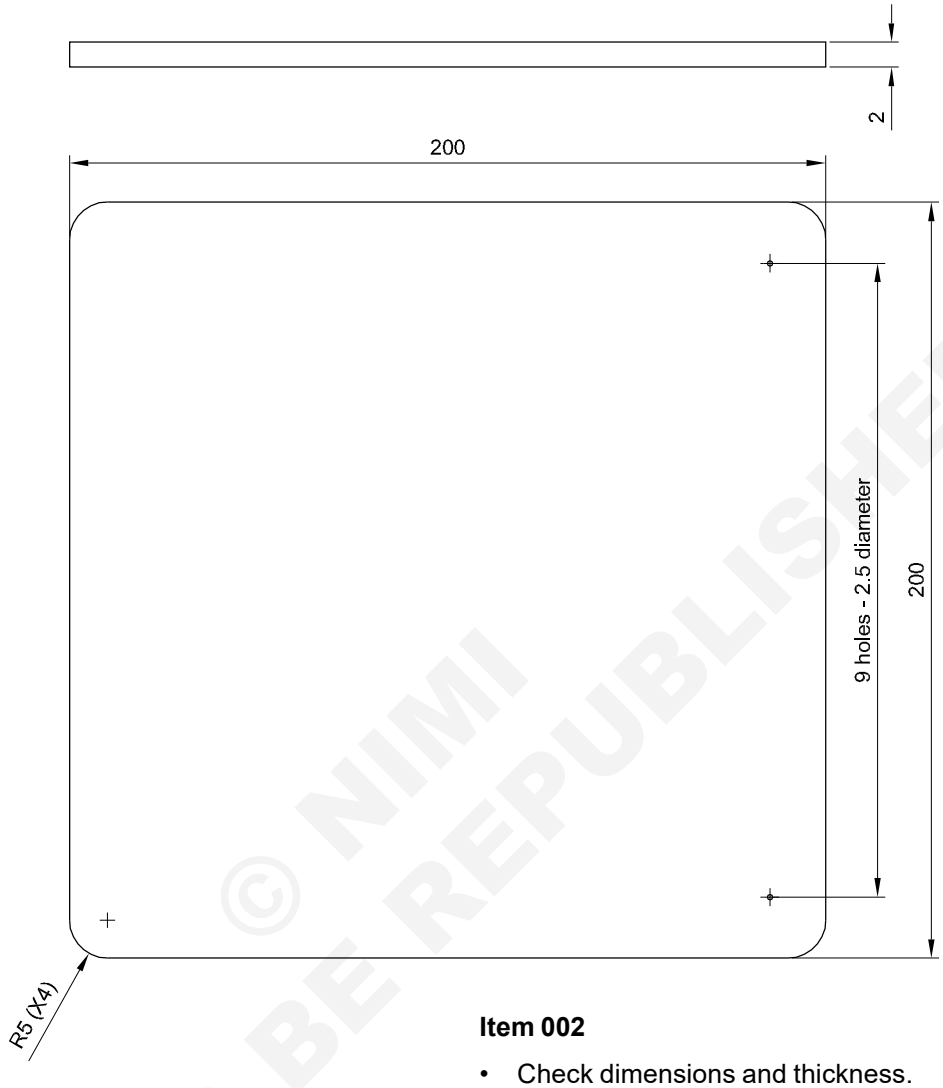
Dimensions	Theorical		Measured
External dimensions	200	±0.5	
	200	±0.5	
Height	84	±0.2	
Flange	27	±0.5	
Bending angles	90°	-	
Radius	R5	±0.5	
	R5	±0.5	
	R5	±0.5	
	R5	±0.5	

Drilling	Theorical		Measured
Edge distance	10	+1 / -0	
Number of holes	9		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches. ☐ CONFORM ☐ NOT CONFORM

Observations:



THICKNESS: 2mm
QUANTITY: 1
HOLES MARGIN: 10mm

Item 002

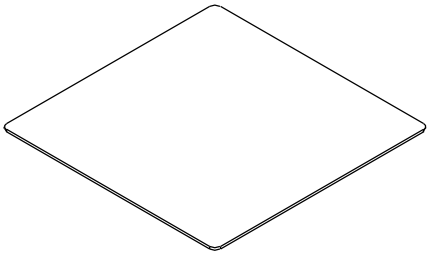
- Check dimensions and thickness.
- Mark and file external dimensions.
- Mark and file radii.
- Finish edges by draw filing.
- Deburr edges.
- Mark the holes positions.
- Punch the centre of the holes.

1	200X200 - Thick. 2	-	AISI 316L	-	002	3.1.54
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**CLOSED BOX ITEM 002**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3154E3	

Drilling diameter 2.5

- Hold the work piece and drill holes with hand drill.
- Deburr both sides.
- Check diameter and particularity of each hole.

Fig 2



Record Sheet - Item 002

Dimensions	Theorical		Measured
External dimensions	200	±0.5	
	200	±0.5	
Radius	R5	±0.5	
	R5	±0.5	
	R5	±0.5	
	R5	±0.5	

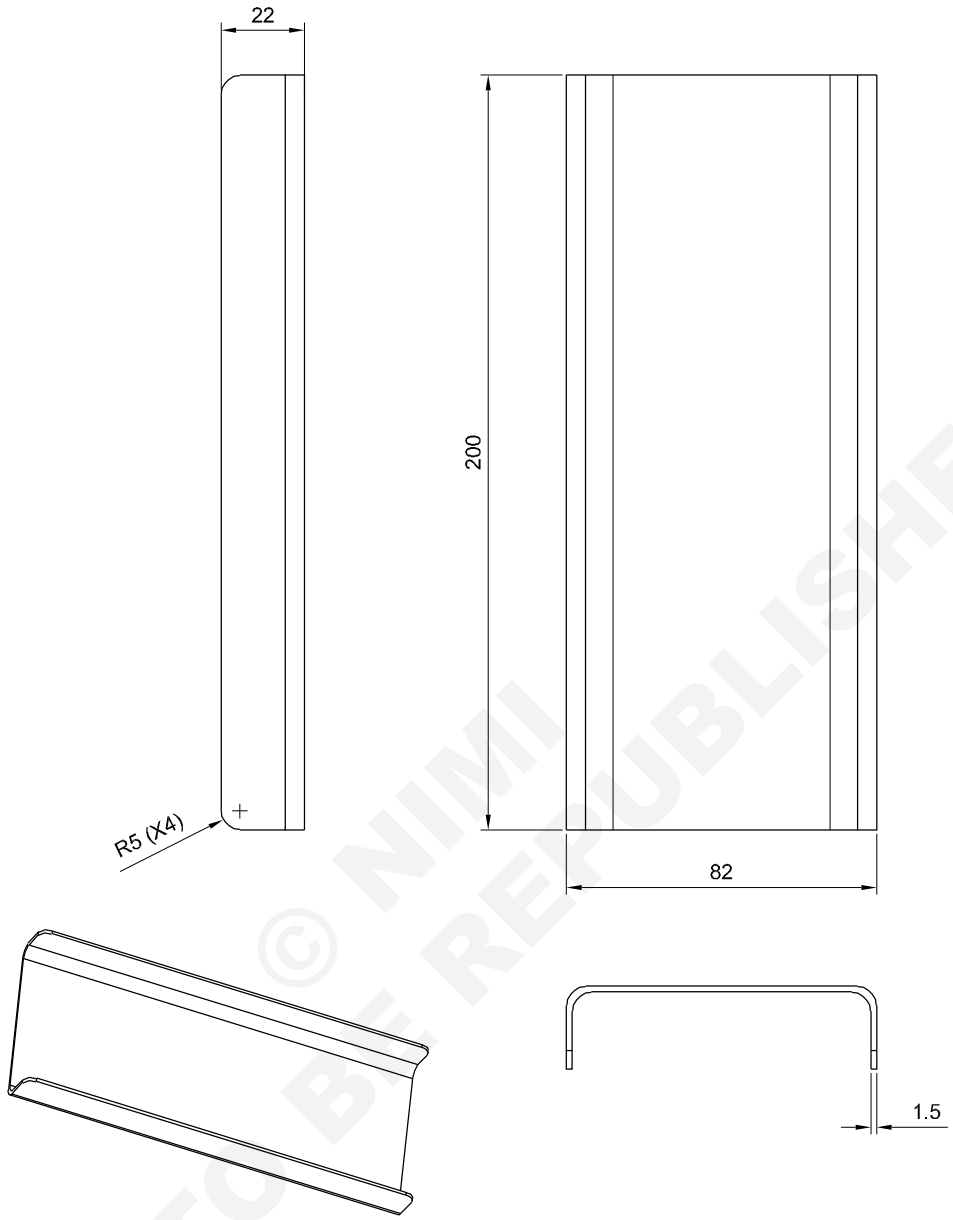
Drilling	Theorical		Measured
Edge distance	10	+1 / -0	
Number of holes	9		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Absence of burn marks ☐ CONFORM ☐ NOT CONFORM

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches ☐ CONFORM ☐ NOT CONFORM

Observations:



THICKNESS: 2mm
QUANTITY: 1
BENDING RADIUS: 4 to 5 mm

Item 003

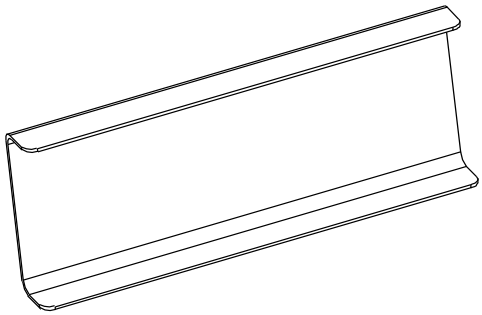
- Check dimensions and thickness.
- Calculate the developed length.
- Mark and file external dimensions calculated above.

The grain direction must be perpendicular to the bending.

-	200x130 - Thick.2	-	AW-2017	-	003	3.1.54
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**CLOSED BOX ITEM 003**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3154E4	

- Finish edges by draw filing.
- Deburr edges.
- Bend the angle using brake.
- Check the angle and the dimensions of flanges. File if necessary.
- Mark and file radii.
- Deburr edges.

Fig 3



AFN3154H3

Record Sheet - Item 003

Dimensions	Theorical		Measured
External dimensions	200	±0.5	
	82	±0.5	
Flange	22	±0.5	
Flange	22	±0.5	
Radius	R5	±0.5	
	R5	±0.5	
	R5	±0.5	
	R5	±0.5	

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches. ☐ CONFORM ☐ NOT CONFORM

Observations:

— — — — — — — —

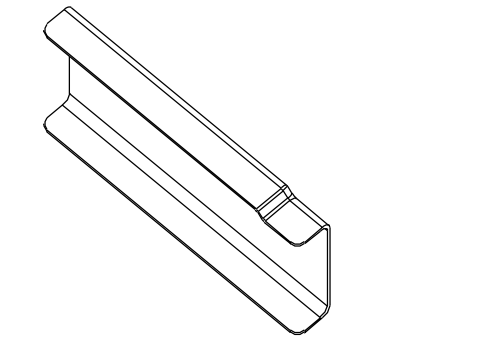
Item 004

- Fabrication with brake and joggling tool.
- Check dimensions and thickness.
- Calculate the developed length.
- Mark and file external dimensions calculated above.

The grain direction must be perpendicular to the bending.

- Finish edges by draw filing.
- Deburr edges.
- Bend the angle using brake.
- Check the angle and the dimensions of flanges. File if necessary.
- With a joggling tool, form the joggle.
- Check the angle and the dimensions of joggle.
- Mark and file radii.

Fig 4



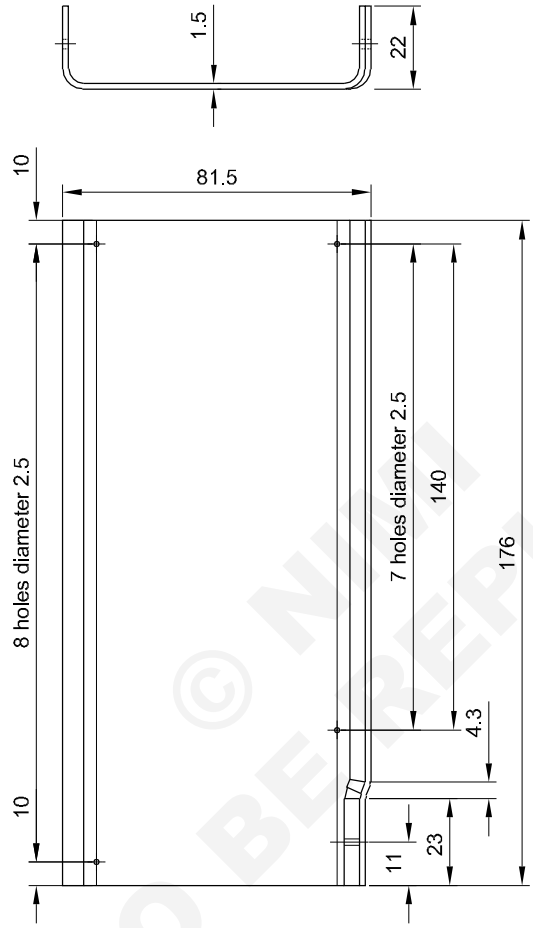
AFN3154H4

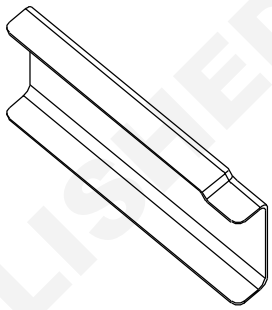
- Deburr edges.
- Mark the holes positions.
- Punch the centre of the holes.

Drilling diameter 2.5

- Hold the work piece and drill holes with hand drill.
- Deburr both sides.
- Check diameter and perpendicularity of each hole.

Item 004





THICKNESS: 2mm
QUANTITY: 1
HOLES MARGIN: 10mm
BENDING RADIUS: 4 to 5 mm
JOGGLE HEIGHT: 2 mm

1	180X130 - Thick. 1.5	-	AW-2017	-	004+005	3.1.54
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**CLOSED BOX** **ITEM 004 AND 005 SYMMETRICAL**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3154E5	

Record Sheet - Item 004 - RH Part

Dimensions	Theorical		Measured
External dimensions	176	±0.5	
	81.5	±0.2	
Height	84	±0.5	
Flange	22	±0.5	
Joggled flange	22	±0.5	
Bending angles	90°	-	
Radius	R5	±0.5	
	R5	±0.5	
	R5	±0.5	
	R5	±0.5	
Joggle length	23	±0.5	
Joggle height	2	±0.2	

Drilling	Theorical		Measured
Edge distance Joggle area	11	+1/-0	
Edge distance	10	+1 / -0	
Number of holes	16		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches. ☐ CONFORM ☐ NOT CONFORM

Observations:

Record Sheet - Item 004 - LH Part

Dimensions	Theorical		Measured
External dimensions	176	±0.5	
	81.5	±0.2	
Height	84	±0.5	
Flange	22	±0.5	
Joggled flange	22	±0.5	
Bending angles	90°	-	
Radius	R5	±0.5	
	R5	±0.5	
	R5	±0.5	
	R5	±0.5	
Joggle length	23	±0.5	
Joggle height	2	±0.2	

Drilling	Theorical		Measured
Edge distance Joggle area	11	+1/-0	
Edge distance	10	+1 / -0	
Number of holes	16		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Deburring quality ☐ CONFORM ☐ NOT CONFORM

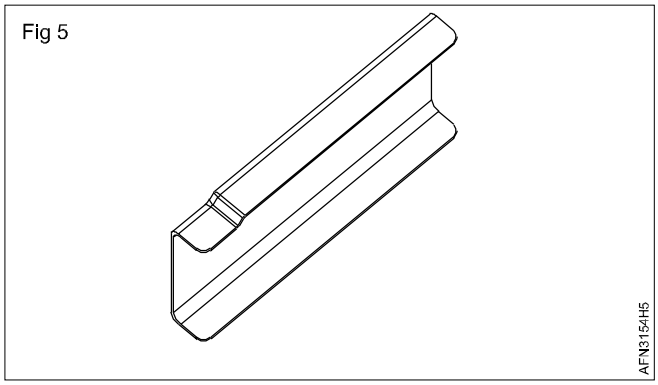
Absence of marks, impacts or scratches. ☐ CONFORM ☐ NOT CONFORM

Observations:

— — — — — — — —

Item 005 - Symmetrical to 004

Fig 5



- Fabrication with brake and joggling tool.
- Check dimensions and thickness.
- Calculate the developed length.
- Mark and file external dimensions calculated above.

The grain direction must be perpendicular to the bending.

- Finish edges by draw filing.
- Deburr edges.
- Bend the angle using brake.
- Check the angle and the dimensions of flanges. File if necessary.
- With a joggling tool, form the joggle.
- Check the angle and the dimensions of joggle.
- Mark and file radii.
- Deburr edges.
- Mark the holes positions.
- Punch the centre of the holes.

Drilling diameter 2.5

- Hold the work piece and drill holes with hand drill.
- Deburr both sides.
- Check diameter and perpendicularity of each hole.

Record Sheet - Item 005 - Number 1

Dimensions	Theorical		Measured
Length	71	±0.2	
Flange	20.6	±0.2	
Flange	20.6	±0.2	
Bending angles	90°	-	

Drilling	Theorical		Measured
Edge distance	10	+1 / -0	
Number of holes	6		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Absence of delamination	☐ CONFORM	☐ NOT CONFORM
Absence of burn marks	☐ CONFORM	☐ NOT CONFORM
Absence of debonding	☐ CONFORM	☐ NOT CONFORM
Absence of marks, impacts or scratches	☐ CONFORM	☐ NOT CONFORM

Record Sheet - Item 005 - Number 2

Dimensions	Theorical		Measured
Length	71	±0.2	
Flange	20.6	±0.2	
Flange	20.6	±0.2	
Bending angles	90°	-	

Drilling	Theorical		Measured
Edge distance	10	+1 / -0	
Number of holes	6		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Absence of delamination	☐ CONFORM	☐ NOT CONFORM
Absence of burn marks	☐ CONFORM	☐ NOT CONFORM
Absence of debonding	☐ CONFORM	☐ NOT CONFORM
Absence of marks, impacts or scratches	☐ CONFORM	☐ NOT CONFORM

Record Sheet - Item 005 - Number 3

Dimensions	Theorical		Measured
Length	71	±0.2	
Flange	20.6	±0.2	
Flange	20.6	±0.2	
Bending angles	90°	-	

Drilling	Theorical		Measured
Edge distance	10	+1 / -0	
Number of holes	6		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Absence of delamination	☐ CONFORM	☐ NOT CONFORM
Absence of burn marks	☐ CONFORM	☐ NOT CONFORM
Absence of debonding	☐ CONFORM	☐ NOT CONFORM
Absence of marks, impacts or scratches	☐ CONFORM	☐ NOT CONFORM

Record Sheet - Item 005 - Number 4

Dimensions	Theorical		Measured
Length	71	±0.2	
Flange	20.6	±0.2	
Flange	20.6	±0.2	
Bending angles	90°	-	

Drilling	Theorical	Measured
Edge distance	10 +1 / -0	
Number of holes	6	
Position	-	☐ OK ☐ NOK
Drilling quality	-	☐ OK ☐ NOK
Deburring quality	-	☐ OK ☐ NOK

Absence of delamination	☐ CONFORM	☐ NOT CONFORM
Absence of burn marks	☐ CONFORM	☐ NOT CONFORM
Absence of debonding	☐ CONFORM	☐ NOT CONFORM
Absence of marks, impacts or scratches	☐ CONFORM	☐ NOT CONFORM

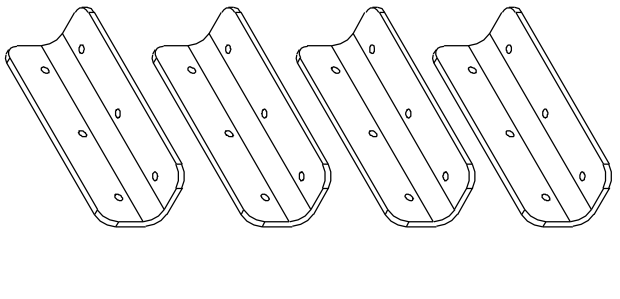
Item 006

- Check dimensions.
- Mark and file external dimensions.
- Mark and file radii.
- Finish edges by draw filing with abrasive pad.
- Deburr edges.
- Mark the holes positions.

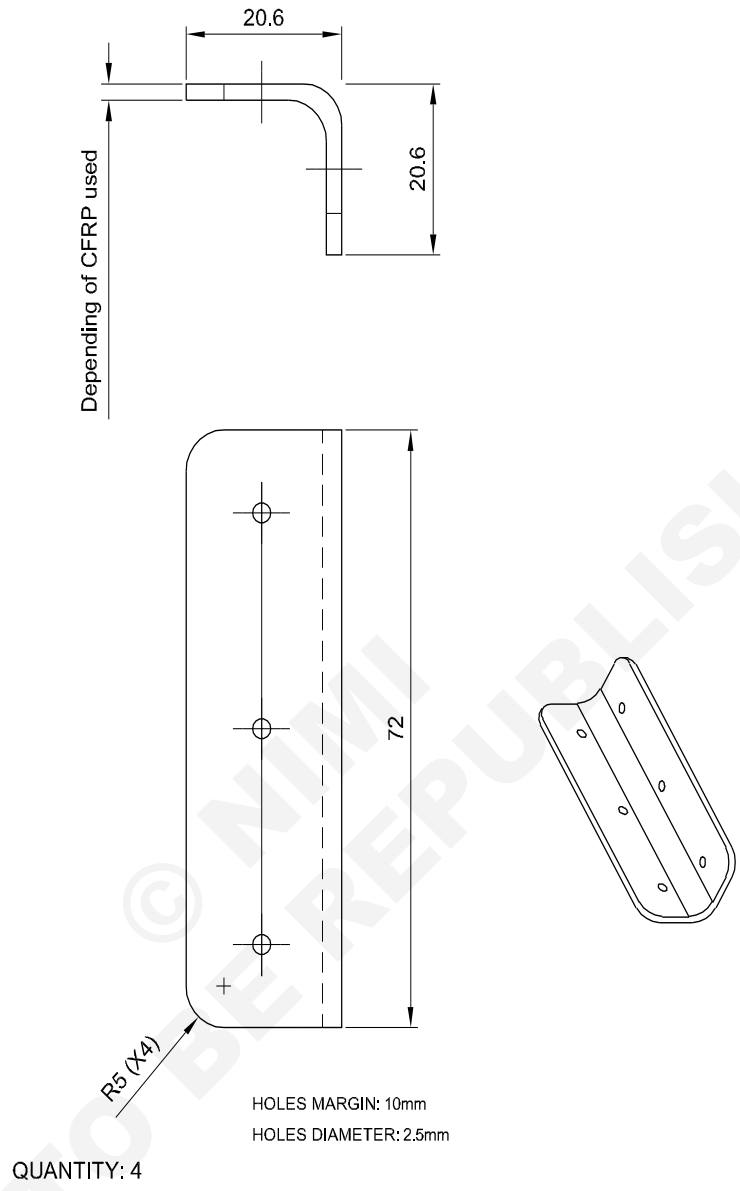
Drilling diameter 2.5

- Hold the work piece and drill holes with hand drill.
- Deburr both sides.
- Check diameter and perpendicularity of each hole.

Fig 6



Item 006

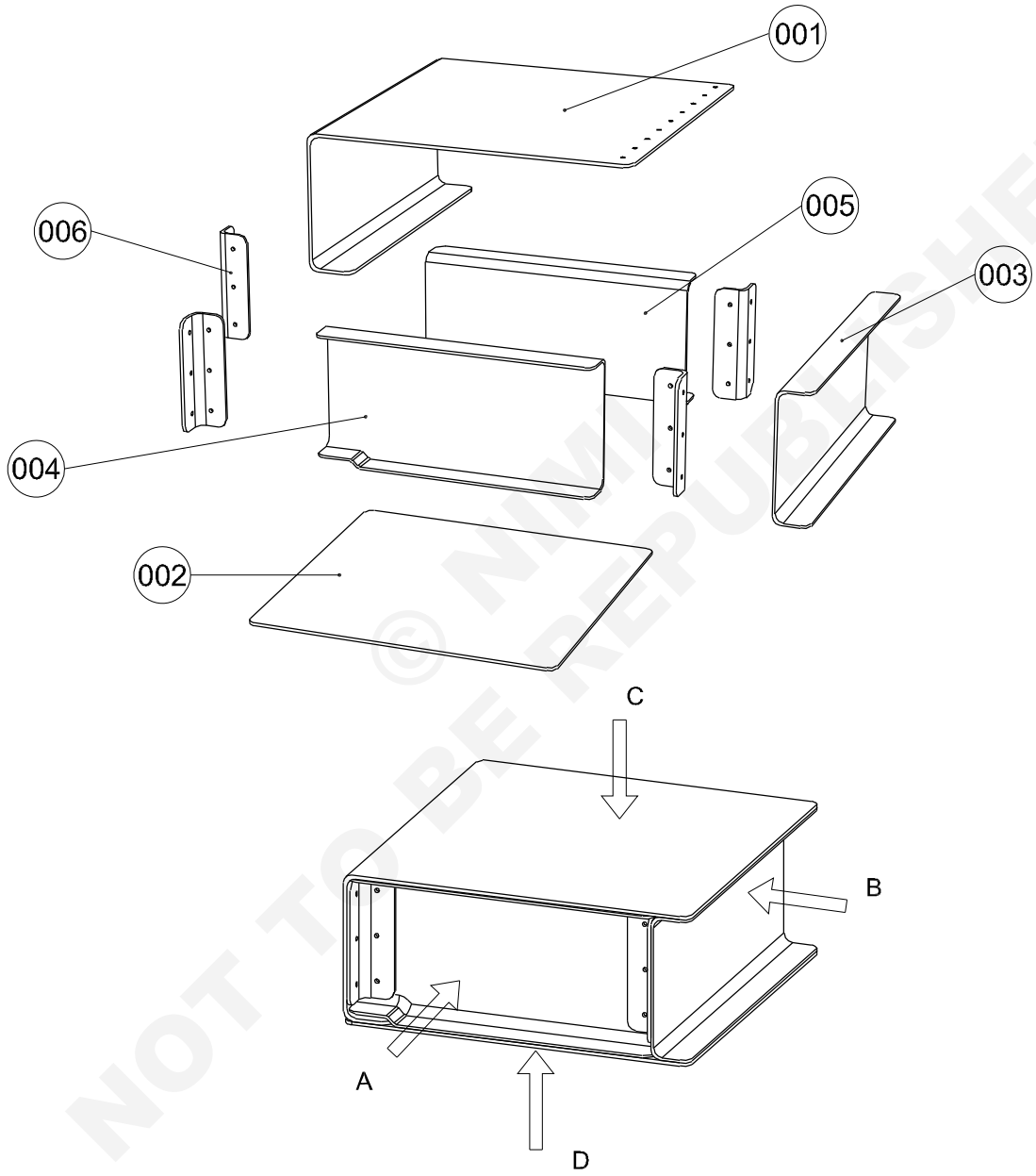


4	21X21 - L 75mm	-	CFRP	-	00004+005	3.1.54
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**CLOSED BOX ITEM 006**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3154E6	

Metallic/composite riveted closed box - Assembly

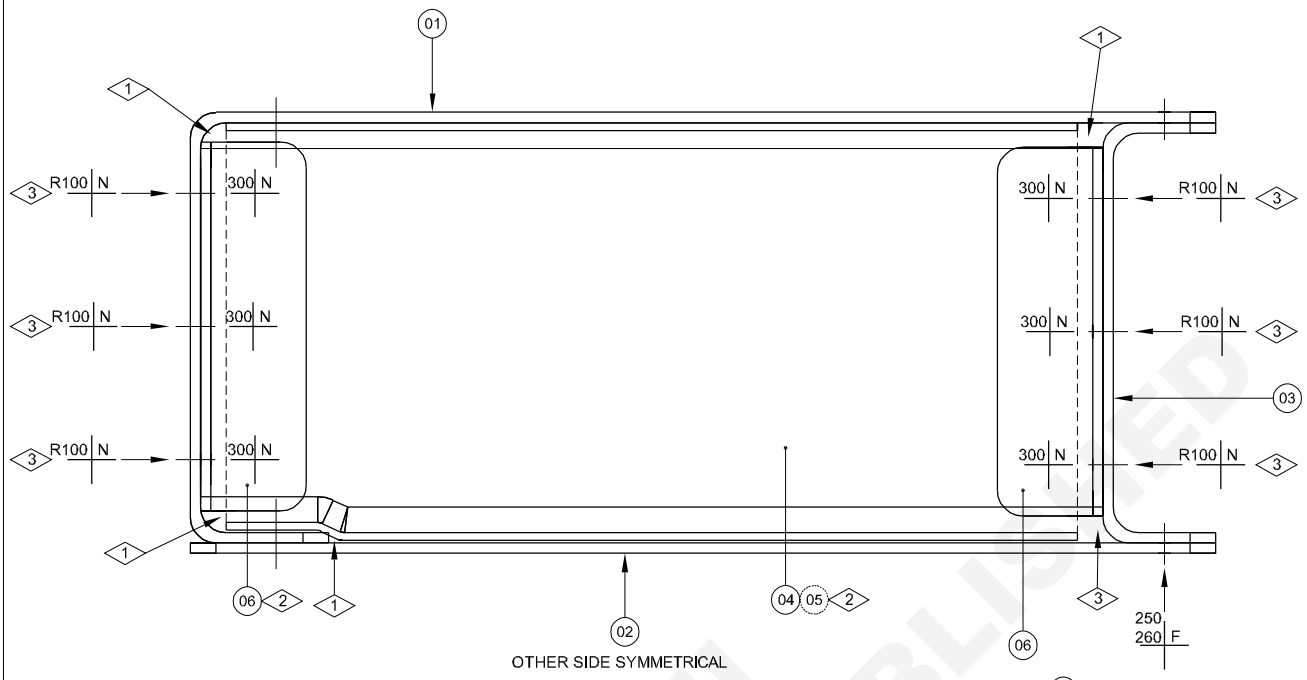
Objectives: At the end of this exercise you shall be able to·

- **determine the holes diameter**
- **determine the length of fasteners**
- **determine the order of fastening.**

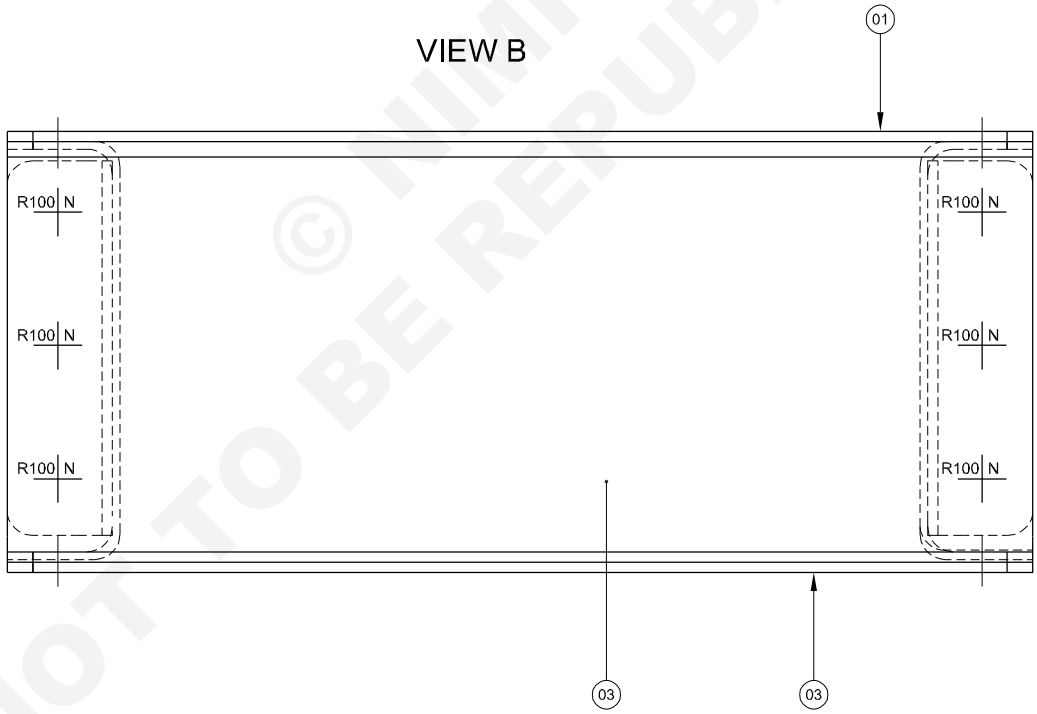


-	-	⟶3.1.54	-	-	-	3.1.55
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**CLOSED BOX ASSEMBLY OVERVIEW**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3155E1	

VIEW A

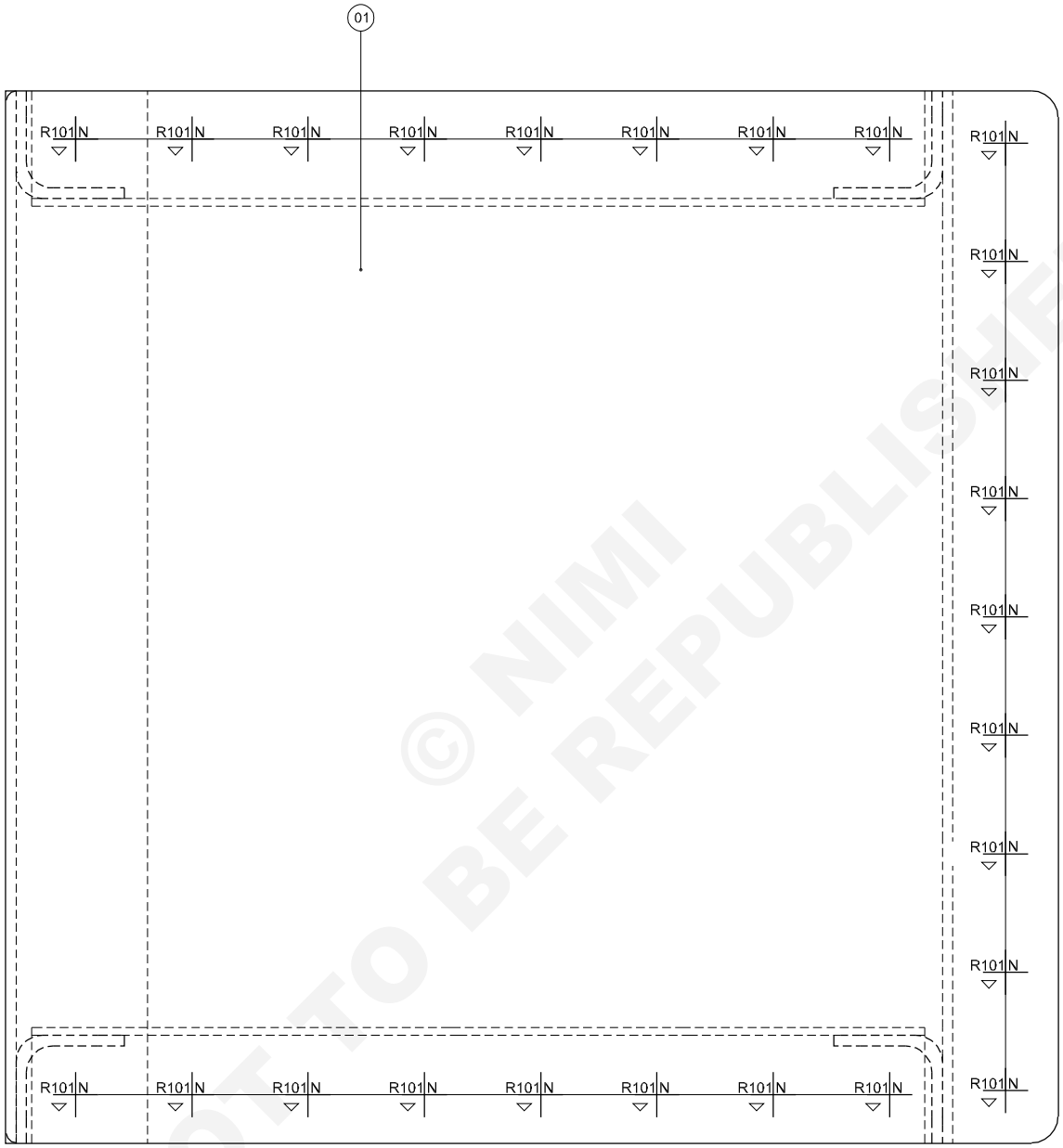


VIEW B



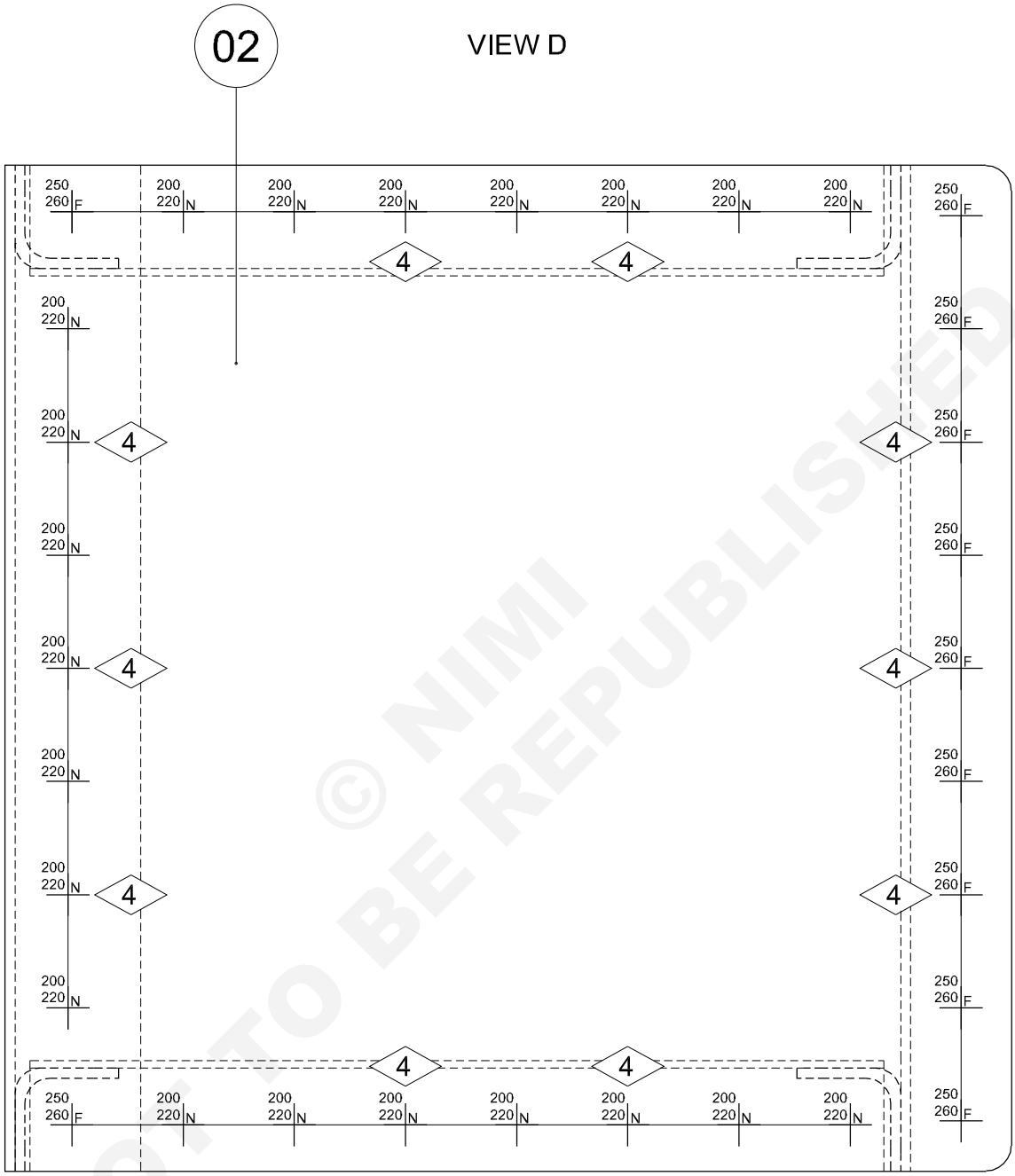
-	-	-	-	-	-	3.1.55
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**CLOSED BOX ASSEMBLY SHEET 1 - VIEWS A AND B**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3155E2	

VIEW C

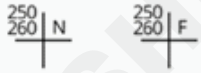
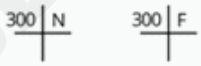


-	-	-	-	-	-	3.1.55
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE : NTS	**CLOSED BOX ASSEMBLY** **SHEET 2 - VIEW C**	DEVIATIONS	TIME : 20 Hrs
		CODE NO : AFN3155E3	



-	-	-	-	-	-	3.1.55
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**CLOSED BOX ASSEMBLY** **SHEET 3 - VIEW D**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3155E4	

Item Description	Reference and equilavences	Symbol
100 - UNIVERSAL HEAD SOLID RIVET	EN6081AD4-(..) NASM20470AD4-(..)	
101 - COUNTERSUNK HEAD SOLID RIVET	EN6101AD4-(..) EN6080AD4-(..) NASM20426AD4-(..)	
200 - HI-LITE PROTUDING HEAD	EN6115T3-(..) EN6115V3-(..) HST10-6-(..)	
220 - HI-LITE COLLAR	HST1479-6 HST1488-6	
250 - LOCKBOLT PROTUDING HEAD	GPL3SP-V06-(..) GPL8TP-V06-(..) LGP2SP-V06-(..) LGP4SP-V6-(..)	
260 - LOCKBOLT REGULAR COLLAR	2TC-C06 2TCC-C06	
300 - UNIVERSAL HEAD BLIND RIVET	NAS1738M-05-(..) CR2539-05-(..) NAS1919M05S(..)	

1. Ensure a gap
2. Ensure an identical gap on both sides.
3. Riveting with pneumatic squeezer is mandatory.
   Counter rivet washer mandatory.
4. The fastener must not be installed. Calibrated drilling and countersinking if necessary to be carried out.

NOTE:

- Class B mastic layer between all items unless specified otherwise.

FASTNERS HOLES DATA

HI-LITE AND LOCKBOLT FASTNERS IN COMPOSITE / COMPOSITE ASSEMBLIES
HOLE DIAMETERS FOR LOW CLEARANCE FIT ASSEMBLY WITH COATED BOLTS

Dimensions in mm

Diameter code	Nominal Diameter	Clearance		Hole Diameter 'D'							
				Standard		1st oversize (Code x)		2nd oversize (Code Y)		3rd oversize (Code Z)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
5	3.97	.002	.057	4.155	4.185	-	-	-	-	-	-
6	4.76	.002	.057	4.815	4.845	5.148	5.178	-	-	-	-
8	6.35	.002	.065	6.339	6.377	6.736	6.773	7.132	7.169	-	-

HI-LITE AND LOCKBOLT IN COMPOSITE / METALLIC, METALLIC/ METALLIC ASSEMBLY
HOLE DIAMETERS FOR TRANSITION FIT ASSEMBLY WITH SHEAR BOLTS

Dimensions in mm

Diameter code	Nominal Diameter	Clearance		Hole Diameter 'D'							
				Standard		1st oversize (Code x)		2nd oversize (Code Y)		3rd oversize (Code Z)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
5	3.97	-.028	.032	4.125	4.160	-	-	-	-	-	-
6	4.76	-.033	.032	4.780	4.820	5.113	5.153	-	-	-	-
8	6.35	-.027	.038	6.310	6.350	6.707	6.747	7.103	7.142	-	-

HI-LITE AND LOCKBOLT IN HARD METAL ASSEMBLY
HOLE DIAMETERS FOR CLEARANCE FIT ASSEMBLY WITH SHEAR BOLTS

Dimensions in mm

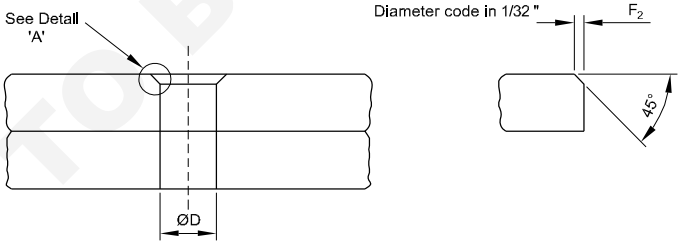
Diameter code	Nominal Diameter	Clearance		Hole Diameter 'D'							
				Standard		1st oversize (Code x)		2nd oversize (Code Y)		3rd oversize (Code Z)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
5	3.97	.010	.080	4.163	4.208	-	-	-	-	-	-
6	4.76	.010	.080	4.823	4.868	5.148	5.193	-	-	-	-
8	6.35	.010	.080	6.347	6.392	6.736	6.781	7.132	7.176	-	-

ALL BLIND RIVET FOR ALL ASSEMBLIES

Diameter code in 1/32 "

Dimensions in mm

Diameter code	Nominal Diameter	Clearance	
		Min	Max
04	3.2	3.25	3.37
05	4.0	4.05	4.17
06	4.8	4.85	4.97



Detail 'A'

Dimensions in mm

Diameter code	Nominal Diameter	Shear Bolts								Tension Bolts			
		Recommended				Reduced							
		Radius		Chamfer		Radius		Chamfer		Radius		Chamfer	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
2	3.97	0.6	0.9	0.6	0.9	0.6	0.7	-	-	-	-	-	-
3	4.76	0.6	0.9	0.6	0.9	0.6	0.7	-	-	1.0	1.3	1.05	1.15
8	6.35	0.6	0.9	0.6	0.9	0.6	0.7	-	-	1.0	1.3	1.05	1.15

Diameter code in 1/16 "

-	-	< 2.1.51	-	-	-	3.1.55
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE : NTS	**CLOSED BOX - ASSEMBLY** SHEET 5 - FASTENERS HOLES DATA	DEVIATIONS	TIME : 20 Hrs
		CODE NO : AFN3155E5	

Job Sequence

TASK 1: **PRE-Assembly**

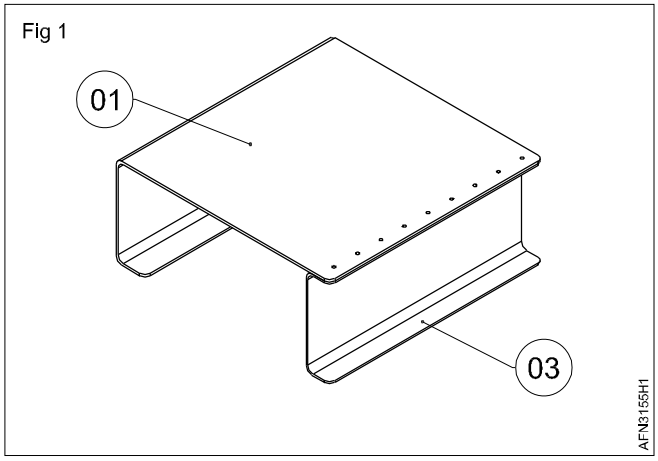
All counter drillings are realised to diameter 2,5mm.

Maintain a clean and well-organised workplace.

STEP 1

ITEM 01 WITH ITEM 03

Fig 1

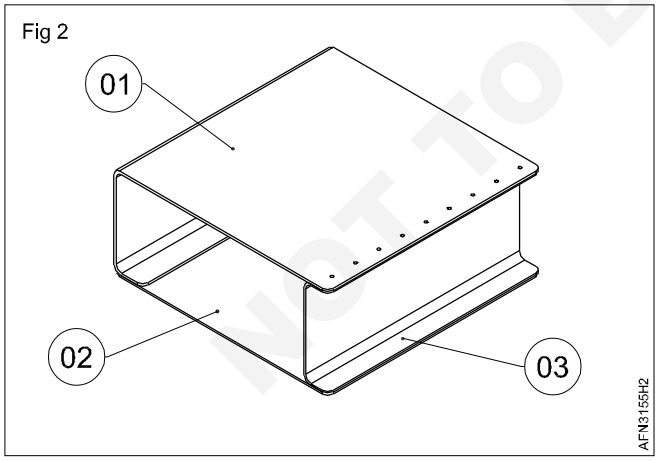


- On a plate, position items 01 and 03.
- Hold firmly with clamps.
- Counter drill and clamp as required.
- Check the positioning.
- Check the perpendicularity.
- Disassemble and deburr.
- Clamp at 33% minimum.

STEP 02

STEP 01 WITH ITEM 02

Fig 2

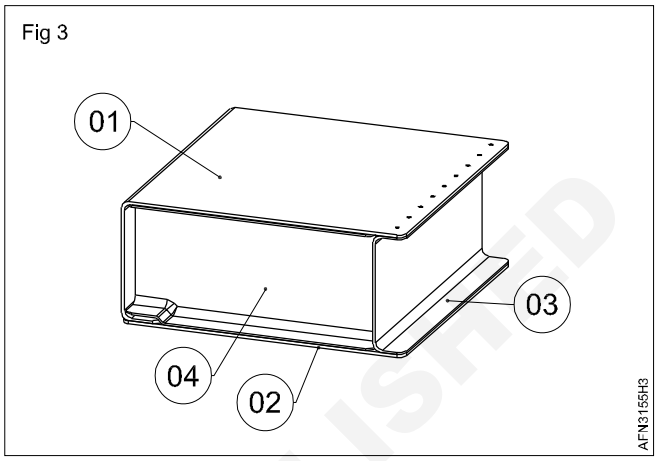


- On a plate, position items 01 and 03 assembled in step 01 with item 02.
- Hold firmly with clamps.
- Counter drill and clamp as required.
- Check the positioning.
- Check the perpendicularity.
- Disassemble and deburr.
- Clamp at 33% minimum.

STEP 03

STEP 02 WITH ITEM 04 and 05

Fig 3



- Put item 04 with the sub-assembly in position.

Respect the required gaps.

- Secure with clamps.
- Counter drill and clamp as required.
- Check positioning.
- Disassemble and deburr.
- Put item 05 with the sub-assembly in position.

Respect the required gaps.

- Secure with clamps.
- Counter drill and clamp as required.
- Check positioning.
- Disassemble and deburr.

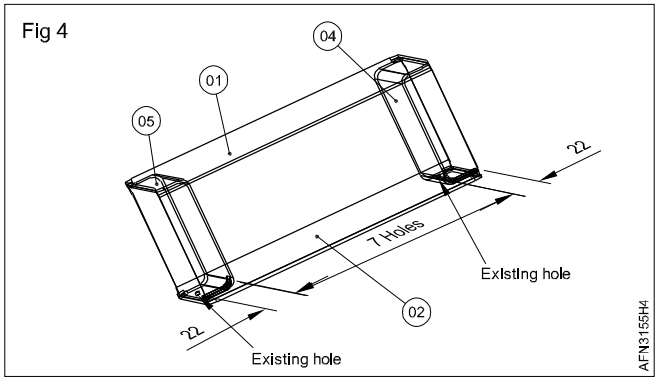
Check the required gaps on both sides.

- Clamp at 33% minimum.

STEP 04

Make a new drilling now

Fig 4



The holes joining item 01 and item 02 are to be created.

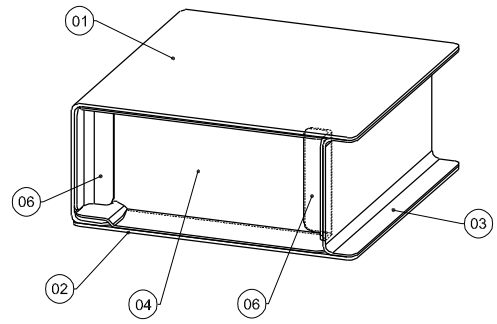
- Following the information in the figure above, mark the holes row.
- Disassemble the item 02.
- Dril the holes and deburr.
- Put the item 02 in position and secure with clamps.
- Counter drill and clamp as required.
- Check the positioning.
- Disassemble and deburr.
- Clamp at 33% minimum.

STEP 05

SUB-ASSEMBLY WITH ITEMS06

- Put item 06 with the sub-assembly in position.

Fig 5



Respect the required gaps.

- Secure with clamps.
- Counter drill and clamp as required.
- Check positioning.
- Disassemble and deburr.

Check the required gaps on both sides.

- Do the same with the 3 other angles.

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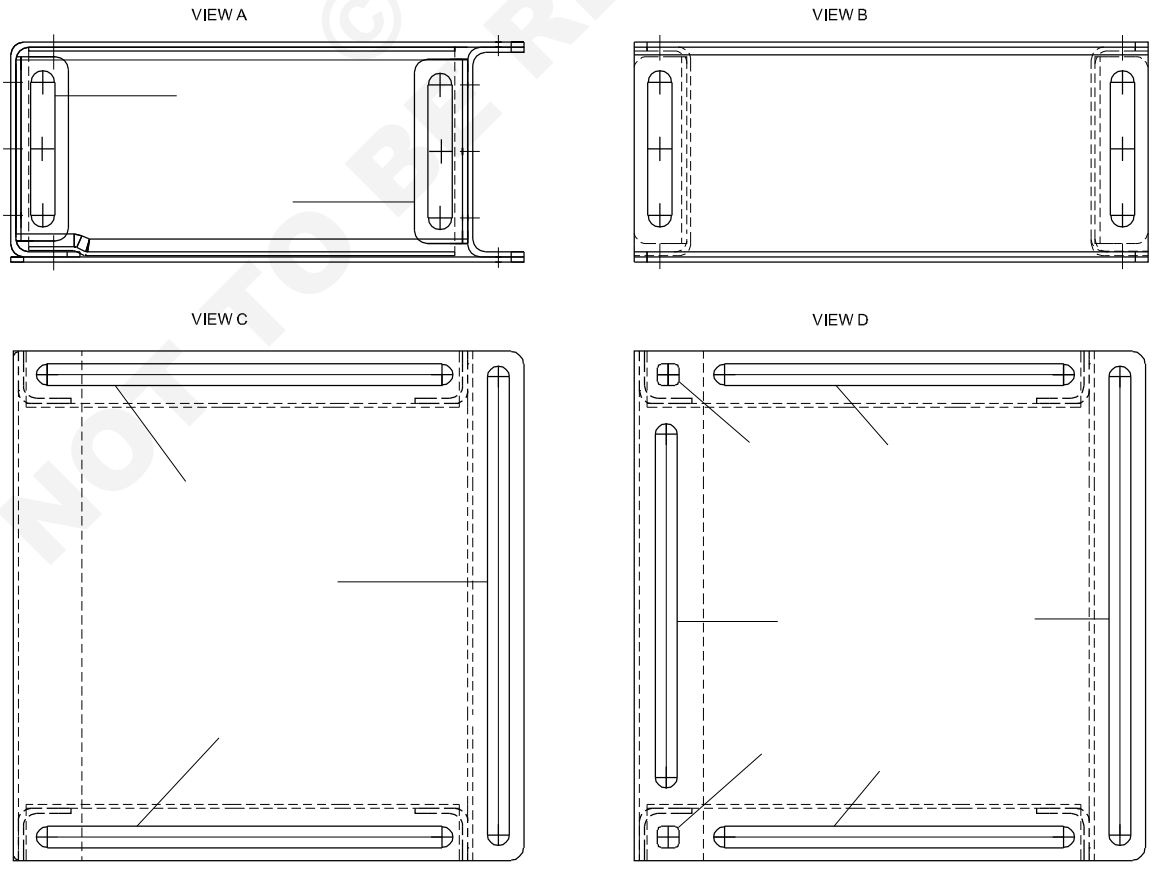
TASK 2: **Final diameter drilling**

- Using the drawing set and the drilling table above, determine the final diameter for each hole row.

Fig 6



The holes for the Hi-Lite and Lockbolt fasteners are then defined:

Aluminium/aluminium assembly > Transition or low interference fit

Aluminium/hard metal assembly >Clearance fit.

- Note the diameters in the figures below.
- Ask the trainer to check them.

- With all items clamped in position, counter-drill all holes using the most appropriate tools.
- Deburr carefully.
- Countersink if necessary.
- Make chamfers if necessary.
- Check holes.

— — — — — — — —

TASK 3: **Assembly**

- Measure the thicknesses (grip size) to be assembled for all fasteners to determine the length code for each.
- Depending on availability in the warehouse, choose a fastener or its equivalent.
- Note the complete fastener part numbers in the table below.

Ask the trainer to check them.

Item	Grip	Reference	QTY
100		Items 01 and 06 assembly	
100		Items 03 and 06 assembly	
101		Items 01 and 04 assembly	
101		Items 01 and 05 assembly	
101		Items 01 and 03 assembly	
200		Items 01 and 02 assembly	
200		Items 02 and 04 assembly	
200		Items 02 and 05 assembly	
220			
250		Items 02 and 03 assembly	
250		Items 01, 02 and 04 assembly	
250		Items 01, 02 and 05 assembly	
260			
300		Items 04 and 06 assembly	
300		Items 05 and 06 assembly	

- Note below the order of assembly following in below Table.

- Ask the trainer to check them.
- Assemble the components.
- Check the fasteners installation.
- Check the assembly conformity.

Report defects directly on the item with a marker or adhesive tape

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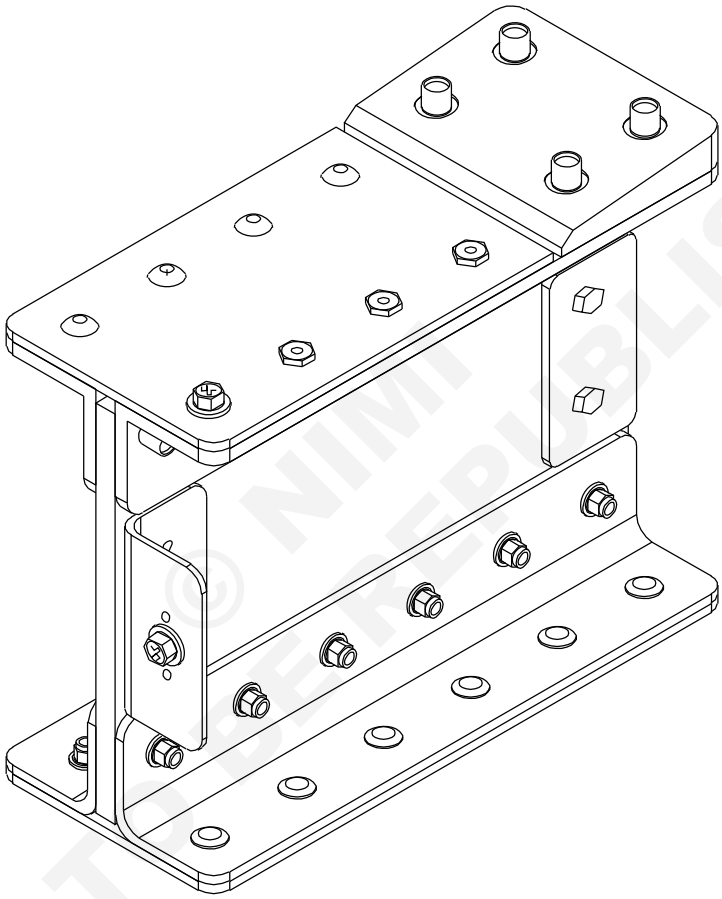
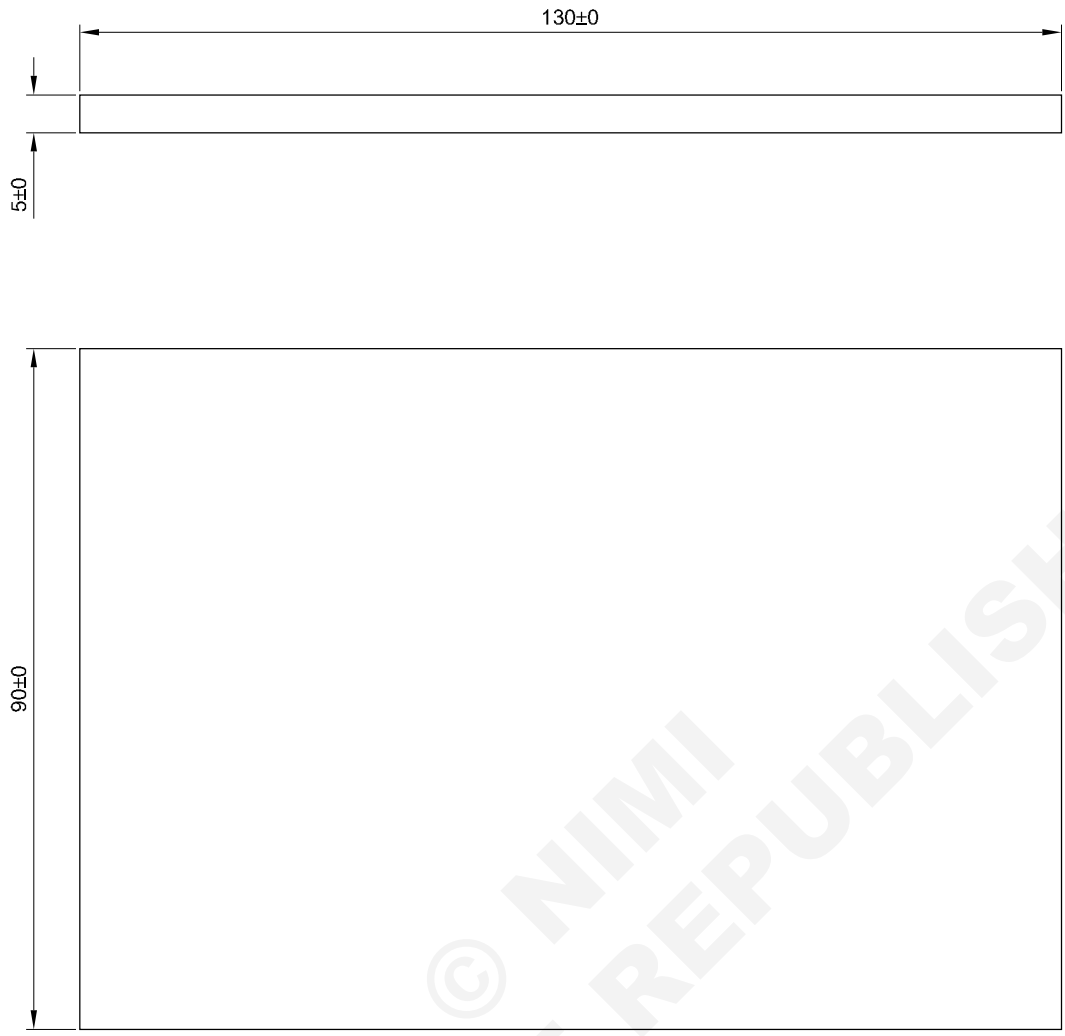
Metallic/composite riveted beam - Parts manufacturing

Objectives: At the end of this exercise you shall be able to·
• manufacture parts for a complex structural assembly.



-	-	-	-	-	-	3.1.56
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**BEAM MANUFACTURING - EXAMINATION OVERVIEW**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3156E1	

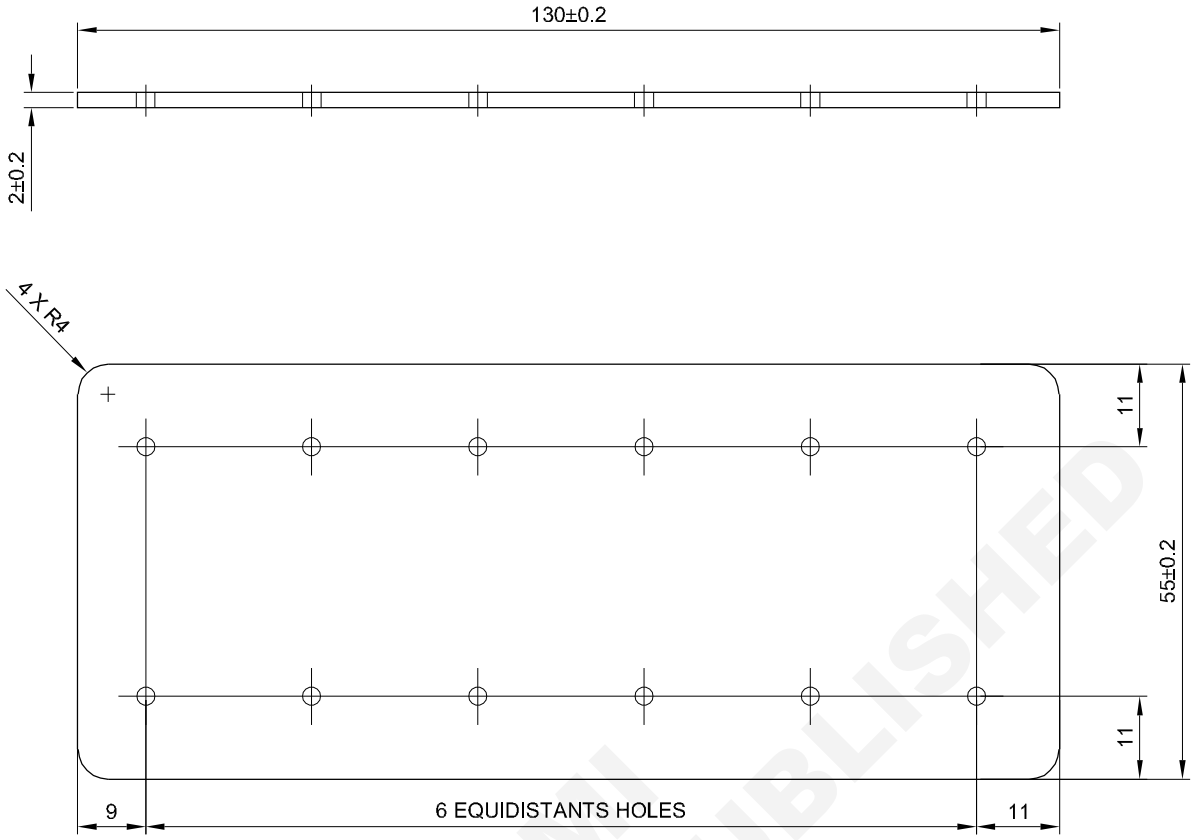


Job Sequence

Item 001

- Check dimensions and thickness.
- Mark external dimensions.
- File the external dimensions.
- Drawn filing all edges with abrasive hand pad.
- Deburr edges.
- Check dimensions.

1	90 x 130 - Thick. 5	-	CFRP	-	-	3.1.56
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**BEAM MANUFACTURING - EXAMINATION ITEM 001**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3156E2	



HOLES DIAMETER: 2.5mm

Item 002

- Check dimensions and thickness.
- Mark external dimensions and radii.
- File the external dimensions and radii.
- Drawn filing all edges.
- Deburr edges.
- Check dimensions.

Drilling diameter 2.5

- Mark the holes positions.
- Hold the workpiece and drill holes with hand drill.
- Deburr both sides.
- Check diameter and perpendicularity of each hole.

1	55 x 130 - Thick. 2	-	AW-2017	-	-	3.1.56
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**BEAM MANUFACTURING - EXAMINATION ITEM 002**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3156E3	

Record Sheet - Item 01

Dimensions	Theorical		Measured
External dimensions	130	±0.2	
	90	±0.2	

Absence of delamination ☐ CONFORM ☐ NOT CONFORM

Absence of burn marks ☐ CONFORM ☐ NOT CONFORM

Absence of debonding ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches ☐ CONFORM ☐ NOT CONFORM

Observations:

Record Sheet - Item 02

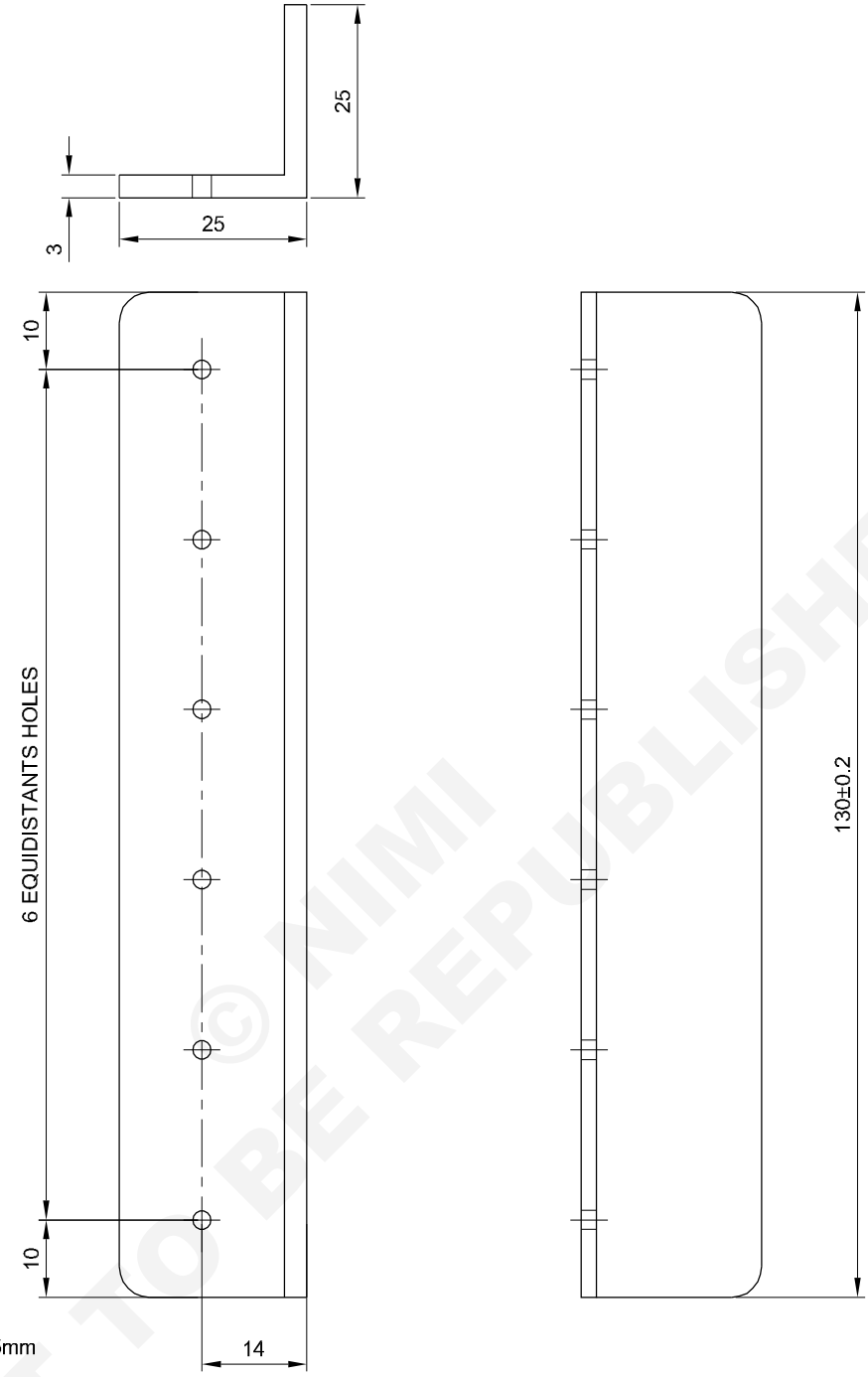
Dimensions	Theorical		Measured
External dimensions	130	±0.2	
	55	±0.2	
Radius	R4	±0.2	
Radius	R4	±0.2	
Radius	R4	±0.2	
Radius	R4	±0.2	

Drilling	Theorical		Measured
Edge distance 1	9	+1 / -0	
Edge distance 2	11	+1 / -0	
Number of holes	12		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches ☐ CONFORM ☐ NOT CONFORM

Observations:



HOLES DIAMETER: 2.5mm

RADIUS: 4mm

NOTE: Drill only one item. Do not drill the other one.

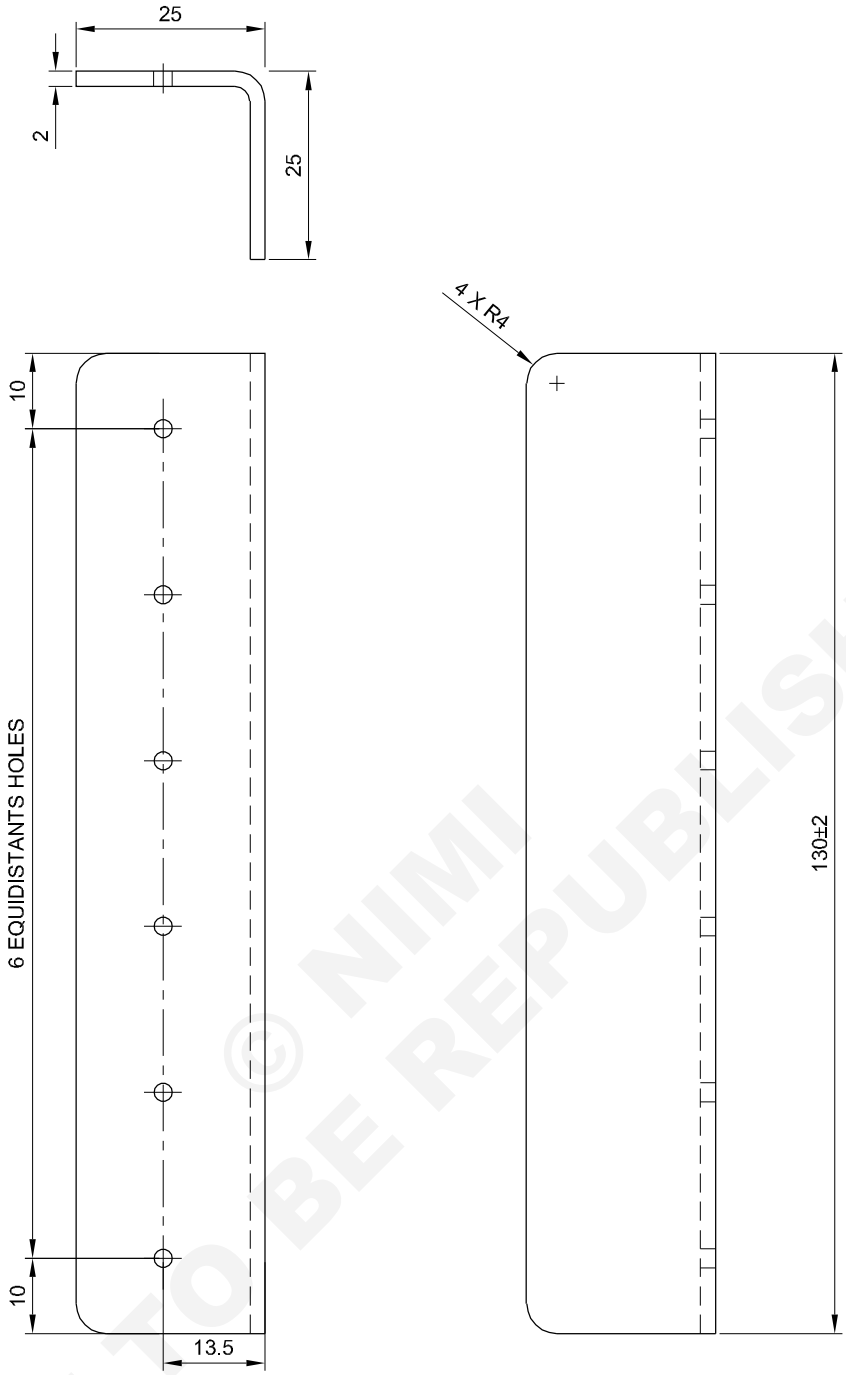
Item 003

- Check dimensions and thickness.
- Mark external dimensions and radii.
- File the external dimensions and radii.
- Drawn filing all edges.
- Deburr edges.
- Check dimensions.

Drilling diameter 2.5

- Mark the holes positions.
- Hold the workpiece and drill holes with hand drill.
- Deburr both sides.
- Check diameter and perpendicularity of each hole.

2	30 x 30 x 3 - L 130	-	AW-2017	-	-	3.1.56
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**BEAM MANUFACTURING - EXAMINATION ITEM 003**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3156E4	



HOLES DIAMETER: 2.5mm

NOTE: Drill only one item. Do not drill the other one.

Item 004

- Check dimensions and thickness.
- Mark external dimensions and radii.
- File the external dimensions and radii.
- Drawn filing all edges with abrasive hand pad.
- Deburr edges.
- Check dimensions.

Drilling diameter 2.5

- Mark the holes positions.
- Hold the workpiece and drill holes with hand drill.
- Deburr both sides.
- Check diameter and perpendicularity of each hole.

1	25 x 25 - L130	-	CFRP	-	-	3.1.56
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE : NTS	BEAM MANUFACTURING - EXAMINATION ITEM 004	DEVIATIONS	TIME : 20 Hrs
		CODE NO : AFN3156E5	

Record Sheet - Item 03 - Number 1 (Drilled Part)

Dimensions	Theorical		Measured
Flange	25	±0.5	
	25	±0.5	
Length	130	±0.2	
Radius	R4	±0.2	
Radius	R4	±0.2	
Radius	R4	±0.2	
Radius	R4	±0.2	

Drilling	Theorical		Measured
Edge distance 1	10	+1 / -0	
Edge distance 2	14	+0,5/ -0	
Number of holes	6		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches ☐ CONFORM ☐ NOT CONFORM

Observations:

Record Sheet - Item 03 - Number 2 (Un Drilled Part)

Dimensions	Theorical		Measured
Flange	25	±0.5	
	25	±0.5	
Radius	R4	±0.2	
Radius	R4	±0.2	
Radius	R4	±0.2	
Radius	R4	±0.2	
Length	130	±0.2	

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches ☐ CONFORM ☐ NOT CONFORM

Observations:

Record Sheet - Item 04 - Number 1 (Drilled Part)

Dimensions	Theorical		Measured
Flange	25	±0.5	
	25	±0.5	
Length	130	±0.2	
Radius	R4	±0.2	
Radius	R4	±0.2	
Radius	R4	±0.2	
Radius	R4	±0.2	

Drilling	Theorical		Measured
Edge distance 1	10	+1 / -0	
Edge distance 2	13.5	+0,5/ -0	
Number of holes	6		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches ☐ CONFORM ☐ NOT CONFORM

Observations:

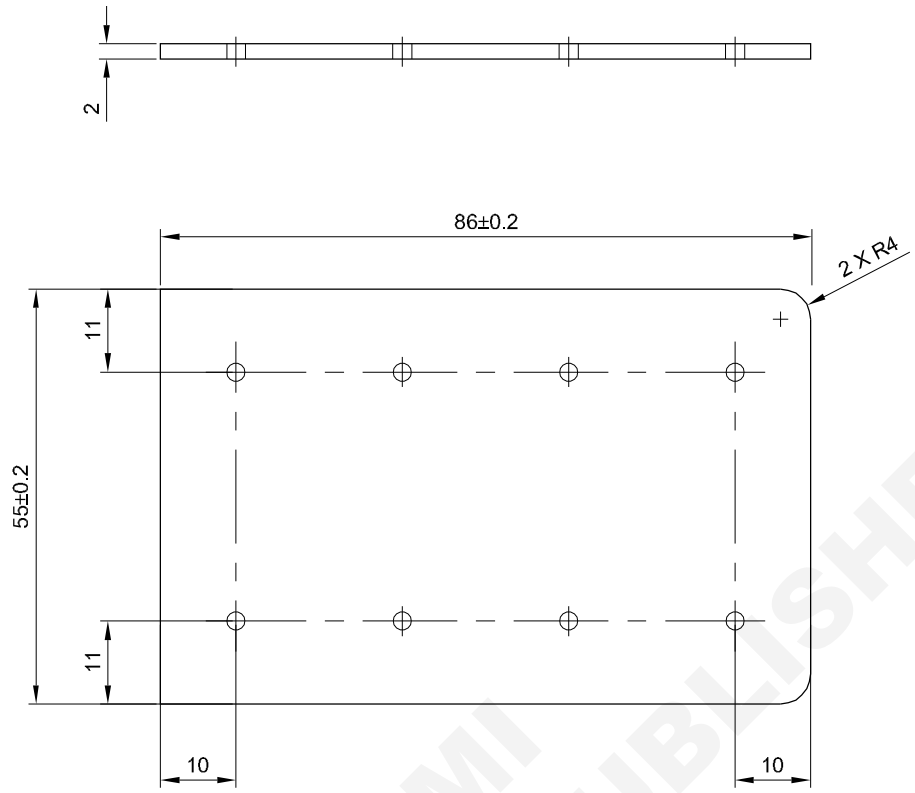
Record Sheet - Item 04 - Number 2 (Un Drilled Part)

Dimensions	Theorical		Measured
Flange	25	±0.5	
	25	±0.5	
Radius	R4	±0.2	
Radius	R4	±0.2	
Radius	R4	±0.2	
Radius	R4	±0.2	
Length	130	±0.2	

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches ☐ CONFORM ☐ NOT CONFORM

Observations:



HOLES DIAMETER: 2.5mm

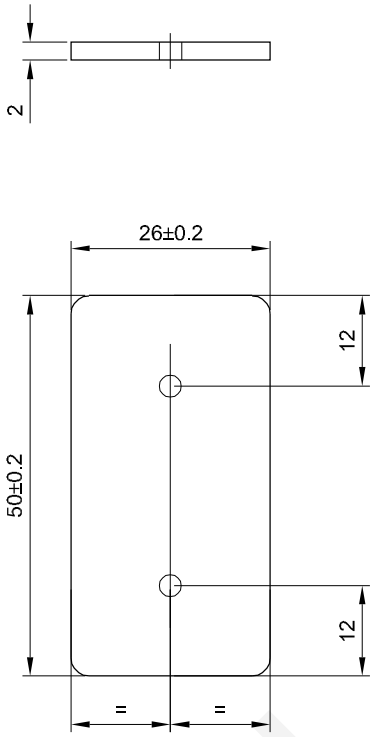
Item 005

- Check dimensions and thickness.
- Mark external dimensions and radii.
- File the external dimensions and radii.
- Drawn filing all edges.
- Deburr edges.
- Check dimensions.

Drilling diameter 2.5

- Mark the holes positions.
- Hold the workpiece and drill holes with hand drill.
- Deburr both sides.
- Check diameter and perpendicularity of each hole.

1	55 x 86 - Thick.2	-	AISI 316L	-	-	3.1.56
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**BEAM MANUFACTURING - EXAMINATION ITEM 005**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3156E6	



HOLES DIAMETER: 2.5mm

Item 006

- Check dimensions and thickness.
- Mark external dimensions and radii.
- File the external dimensions and radii.
- Drawn filing all edges.
- Deburr edges.
- Check dimensions.

Drilling diameter 2.5

- Mark the holes positions.
- Hold the workpiece and drill holes with hand drill.
- Deburr both sides.
- Check diameter and perpendicularity of each hole.

1	22 x 42 - Thick.2	-	TA - 6V	-	-	3.1.56
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**BEAM MANUFACTURING - EXAMINATION ITEM 006**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3156E7	

Record Sheet - Item 05

Dimensions	Theorical		Measured
External dimensions	86	±0.2	
	55	±0.2	
Radius	R4	±0.2	
Radius	R4	±0.2	

Drilling	Theorical		Measured
Edge distance 1	10	+1 / -0	
Edge distance 2	11	+1 / -0	
Hole position	14	+0.5 / -1	
Number of holes	8		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of burn marks ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches ☐ CONFORM ☐ NOT CONFORM

Observations:

Record Sheet - Item 06

Dimensions	Theorical		Measured
External dimensions	42	±0.2	
	22	±0.2	
Radius	R2	±0.2	
Radius	R2	±0.2	
Radius	R2	±0.2	
Radius	R2	±0.2	

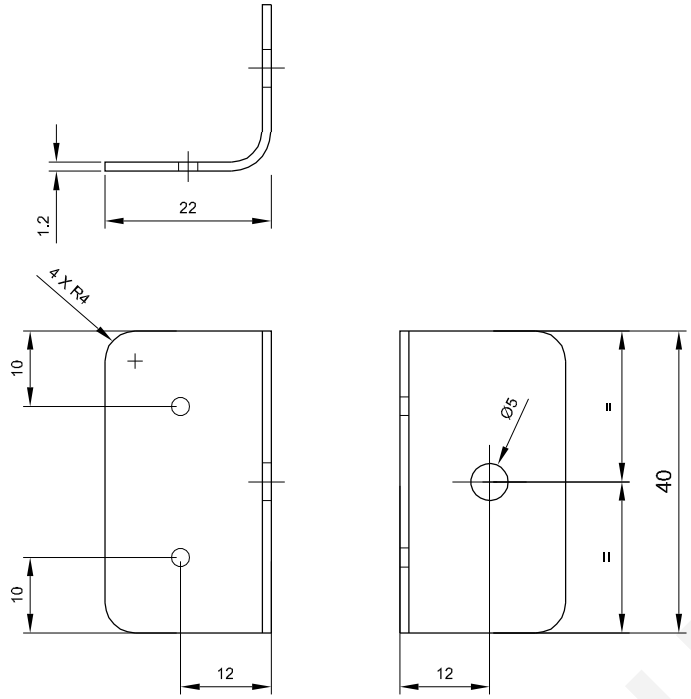
Drilling	Theorical		Measured
Edge distance 1	10	+1 / -0	
Number of holes	2		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of burn marks ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches ☐ CONFORM ☐ NOT CONFORM

Observations:



CHROMATATION AND PAINT FINISH
HOLES DIAMETER: 2.5mm

Item 007

- Check dimensions and thickness.
- Mark external dimensions and radii.
- File the external dimensions and radii.
- Drawn filing all edges.
- Deburr edges.
- Check dimensions.
- **Drilling diameter 2.5 and 5 mm**
- Mark the holes positions.
- Hold the workpiece and drill holes with hand drill.
- Deburr both sides.
- Check diameter and perpendicularity of each hole.

Surface protection

- Prepare the surfaces with Scotch Brite.
- Clean and degrease carefully.
- Apply chromating to all surfaces (Alodine).
- Apply a primer paint (wash primer).

1	40 x 45 - Thick. 1.2	-	AW - 2017	-	-	3.1.56
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**BEAM MANUFACTURING - EXAMINATION ITEM 007**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3156E8	

Record Sheet - Item 07

Dimensions	Theorical		Measured
Flange	22	±0.5	
Flange	22	±0.5	
Length	40	±0.5	
Radius	R4	±0.2	
Radius	R4	±0.2	
Radius	R4	±0.2	
Radius	R4	±0.2	

Drilling ∅ 2.5	Theorical		Measured
Edge distance 1	10	+1 / -0	
Number of holes	2		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Drilling ∅ 5	Theorical		Measured
Edge distance 1	12	+1 / -0	
Number of holes	2		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

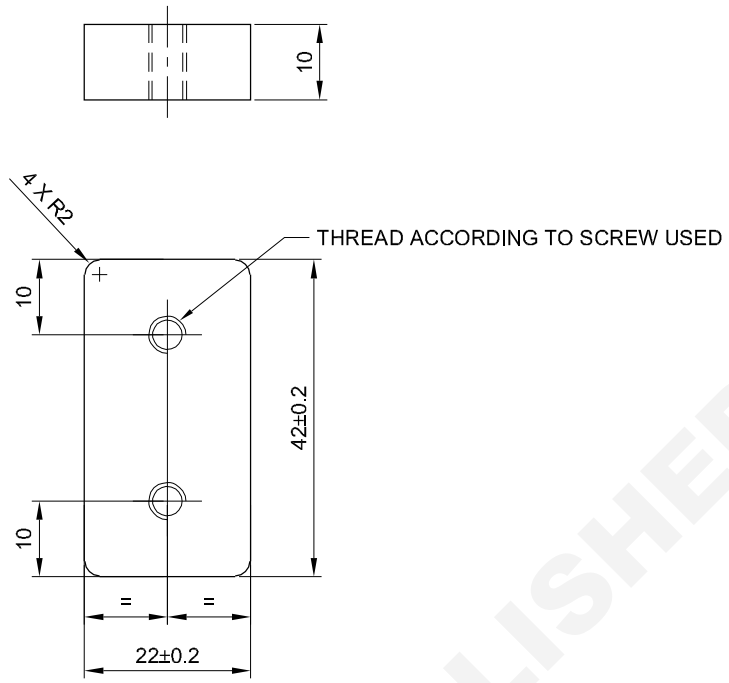
Alodine application ☐ CONFORM ☐ NOT CONFORM

Paint uniformity ☐ CONFORM ☐ NOT CONFORM

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches ☐ CONFORM ☐ NOT CONFORM

Observations:



NOTE: THE THREADING IS CARRIESD OUT DURING THE ASSEMBLY PROCESS.

HOLES DIAMETER: 2.5mm

Item 008

- Check dimensions and thickness.
- Mark external dimensions and radii.
- File the external dimensions and radii.
- Drawn filing all edges.
- Deburr edges.
- Check dimensions.

Drilling diameter 2.5

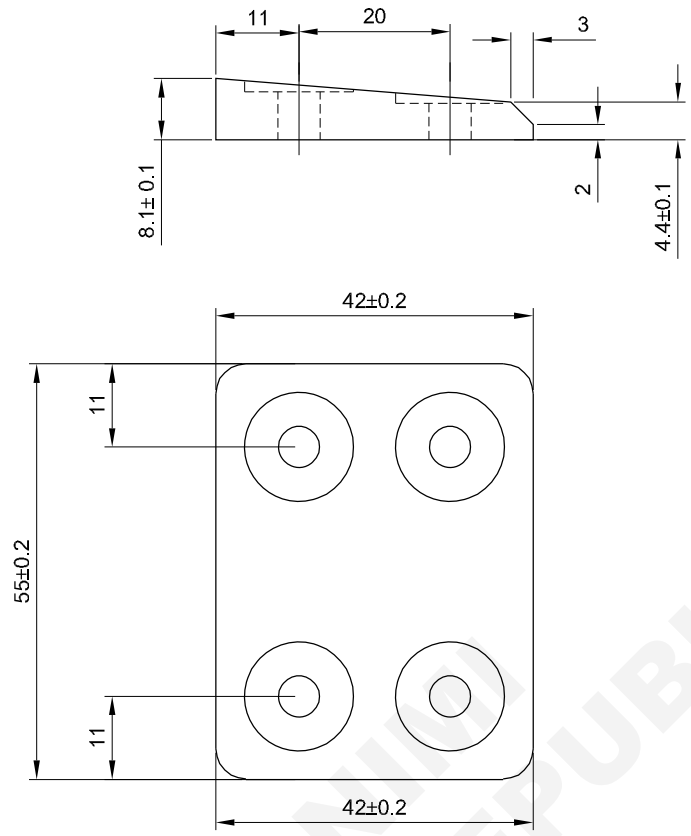
- Mark the holes positions.
- Hold the workpiece and drill holes with hand drill.
- Deburr both sides.
- Check diameter and perpendicularity of each hole.

Do not thread the holes.

This operation will be performed during assembly.

1	22 x 42 - Thick. 10	-	AW - 2017	-	-	3.1.56
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**BEAM MANUFACTURING - EXAMINATION ITEM 008**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3156E9	

SPOT FACING DIAMETER ACCORDING TO JOB CARD



NOTE: THE SPOT FACE IS CARRIED OUT DURING THE ASSEMBLY PROCESS.

HOLES DIAMETER: 2.5mm
RADIUS: 4mm

Item 009

- Check dimensions and thickness.
- Mark external dimensions and radii.
- File the external dimensions and radii.
- Drawn filing all edges.
- Deburr edges.
- Check dimensions.
- Mark the chamfers and file with rasp.
- Check the angles, dimensions and flatness.
- Deburr edges.

Drilling diameter 2.5

- Mark the holes positions.
- Hold the workpiece and drill holes with hand drill.
- Deburr both sides.
- Check diameter and perpendicularity of each hole.

Do not counterbore (spot facing) the holes.

This operation will be performed during assembly.

1	22 x 42 - Thick. 10	-	AW - 2017	-	-	3.1.56
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**BEAM MANUFACTURING - EXAMINATION ITEM 009**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3156EA	

Record Sheet - Item 08

Dimensions	Theorical		Measured
External dimensions	42	±0.2	
	22	±0.2	
Radius	R2	±0.2	
Radius	R2	±0.2	
Radius	R2	±0.2	
Radius	R2	±0.2	

Drilling	Theorical		Measured
External web distance	10	+1 / -0	
Number of holes	2		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

NOT threaded ☐ CONFORM ☐ NOT CONFORM

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches ☐ CONFORM ☐ NOT CONFORM

Observations:

Record Sheet - Item 09

Dimensions	Theorical		Measured
External dimensions	42	±0.2	
	55	±0.2	
Radius	R4	±0.2	
Radius	R4	±0.2	
Main chamfer	8.1	±0.1	
	4.4	±0.1	
Tip chamfer	3	±0.2	
	2	±0.2	

Drilling	Theorical		Measured
Edge distance	11	+0 / -1	
Holes pitch	20	±0.5	
Number of holes	4		
Position	-		☐ OK ☐ NOK
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

NOT threaded ☐ CONFORM ☐ NOT CONFORM

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches ☐ CONFORM ☐ NOT CONFORM

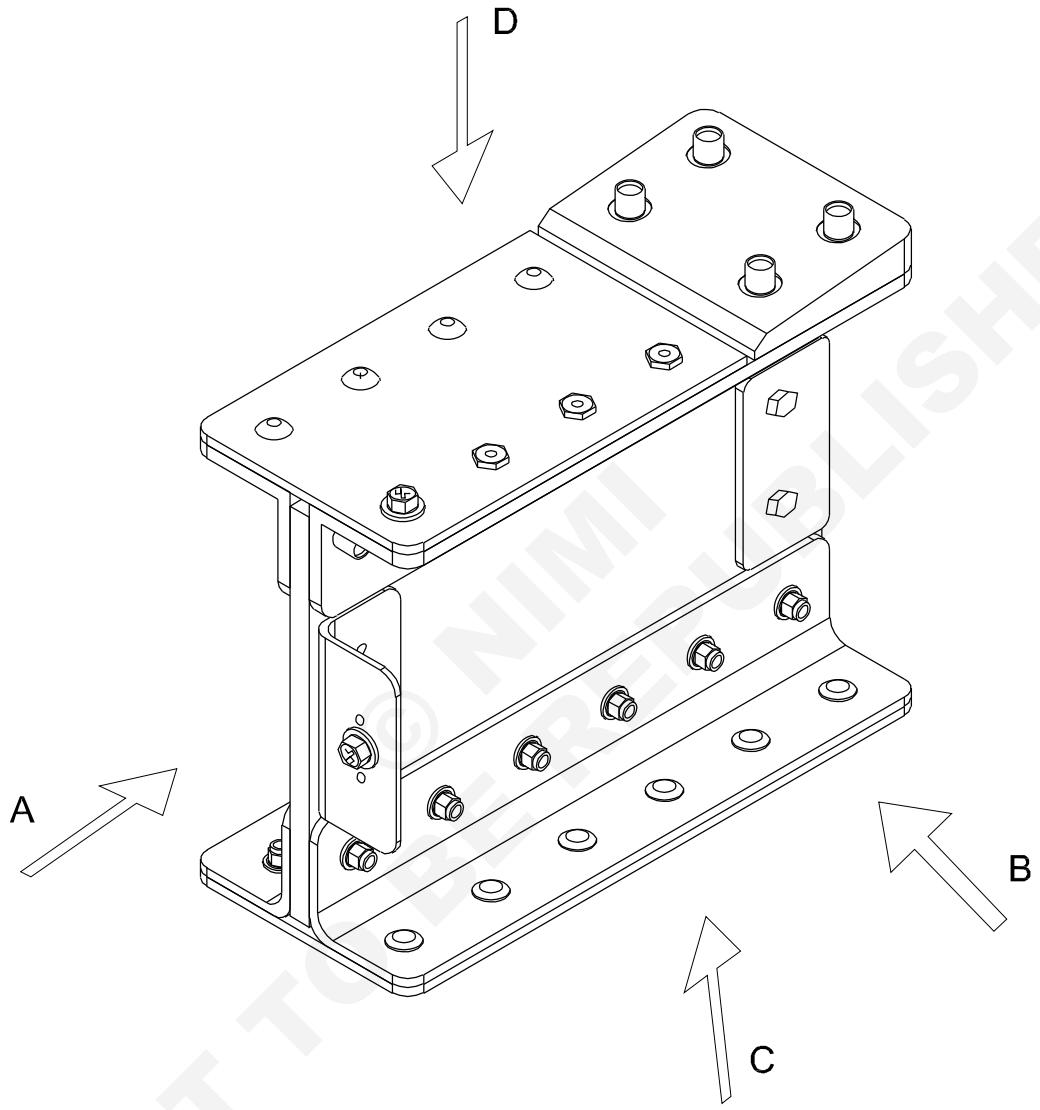
Observations:

Job Sequence

Metallic/composite riveted beam- assembly

Objectives: At the end of this exercise you shall be able to·

• manufacture parts for a complex structural assembly.



-	-	-	-	-	-	3.1.56
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**BEAM MANUFACTURING - ASSEMBLY** **SHEET 1 - OVERVIEW**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3156EB	

1. Ensure a gap of 1.5 to 2.5 mm.

2. Ensure an identical gap of 1 to 2.5 mm on both sides.

3. Riveting with pneumatic squeezer is mandatory.
Counter rivet washer mandatory.

4. The fastener must not be installed. Calibrated drilling and countersinking if necessary to be carried out.

5. Riveting with pneumatic squeezer is mandatory.

NOTE:

- Class B mastic layer between all items unless specified otherwise.

Item Description	Reference and equilavences
100 - UNIVERSAL HEAD SOLID RIVET	EN6081AD4-(..) NASM20470AD4-(..)
101 - COUNTERSUNK HEAD SOLID RIVET	EN6101AD4-(..) EN6080AD4-(..) NASM20426AD4-(..)
200 - HI-LITE PROTUDING HEAD	EN6115T3-(..) EN6115V3-(..) HST10-6-(..)
220 - HI-LITE COLLAR	HST1479-6 HST1488-6
230 - HI-LITE COUNTERSUNK HEAD	EN6114T3-(..) EN6114V3-(..) HST11-6-(..)
250 - LOCKBOLT PROTUDING HEAD	GPL3SP-V06-(..) GPL8TP-V06-(..) LGP2SP-V06-(..) LGP4SP-V6-(..)
260 - LOCKBOLT REGULAR COLLAR	2TC-C06 2TCC-C06
300 - UNIVERSAL HEAD BLIND RIVET	NAS1738M-05-(..) CR2539-05-(..) NAS1919M05S(..)
350 - HEXAGONAL HEAD BLIND BOLT	PLT210-06-(..) PLT5210-06-(..) NAS1669-06DL-(..) NAS1669-06L-(..)
600 - HEXAGONAL HEAD BOLT	NASM1801-3-(..)
601 - FLAT WASHER	NAS1149F0332P
605 - HEXAGONAL NUT	NAS1726-3
800 - STRAIGHT TWO LUGS NUT PLATE	NASM 21047-3 NASM 21059-3

-	-	-	-	-	-	-
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO
SCALE: NTS	**BEAM MANUFACTURING - ASSEMBLY** **SHEET 2–FASTENERS LIST AND NOTES**				DEVIATIONS	TIME
					CODE NO.	

HI-LITE AND LOCKBOLT FASTNERS IN COMPOSITE / COMPOSITE ASSEMBLIES
HOLE DIAMETERS FOR LOW CLEARANCE FIT ASSEMBLY WITH COATED BOLTS

Dimensions in mm

Diameter code	Nominal Diameter	Clearance		Hole Diameter 'D'							
				Standard		1st oversize (Code x)		2nd oversize (Code Y)		3rd oversize (Code Z)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
5	3.97	.002	.057	4.155	4.185	-	-	-	-	-	-
6	4.76	.002	.057	4.815	4.845	5.148	5.178	-	-	-	-
8	6.35	.002	.065	6.339	6.377	6.736	6.773	7.132	7.169	-	-

HI-LITE AND LOCKBOLT IN COMPOSITE / METALLIC, METALLIC/ METALLIC ASSEMBLY
HOLE DIAMETERS FOR TRANSITION FIT ASSEMBLY WITH SHEAR BOLTS

Dimensions in mm

Diameter code	Nominal Diameter	Clearance		Hole Diameter 'D'							
				Standard		1st oversize (Code x)		2nd oversize (Code Y)		3rd oversize (Code Z)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
5	3.97	-.028	.032	4.125	4.160	-	-	-	-	-	-
6	4.76	-.033	.032	4.780	4.820	5.113	5.153	-	-	-	-
8	6.35	-.027	.038	6.310	6.350	6.707	6.747	7.103	7.142	-	-

HI-LITE AND LOCKBOLT IN HARD METAL ASSEMBLY
HOLE DIAMETERS FOR CLEARANCE FIT ASSEMBLY WITH SHEAR BOLTS

Dimensions in mm

Diameter code	Nominal Diameter	Clearance		Hole Diameter 'D'							
				Standard		1st oversize (Code x)		2nd oversize (Code Y)		3rd oversize (Code Z)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
5	3.97	.010	.080	4.163	4.208	-	-	-	-	-	-
6	4.76	.010	.080	4.823	4.868	5.148	5.193	-	-	-	-
8	6.35	.010	.080	6.347	6.392	6.736	6.781	7.132	7.176	-	-

Diameter code In 1/32 "

ALL BLIND RIVET FOR ALL ASSEMBLIES

Dimensions in mm

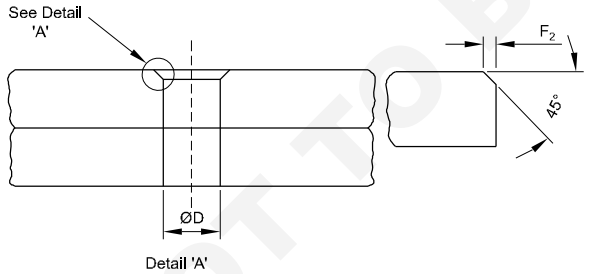
Diameter code	Nominal Diameter	Clearance	
		Min	Max
04	3.2	3.25	3.37
05	4.0	4.05	4.17
06	4.8	4.85	4.97

BLIND BOLT THREADED TYPE FOR ALL ASSEMBLIES

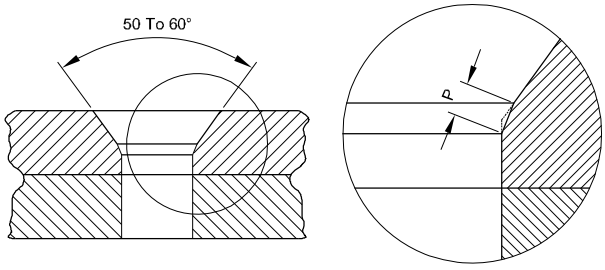
Dimensions in mm

Diameter code	Nominal Diameter	Hole Diameter			
		Type A		Type B	
		Min	Max	Min	Max
06	4.8	4.840	4.862	4.827	4.902
08	6.4	6.338	6.360	6.325	6.401

Diameter code in 1/32 "



Diameter code in 1/32 "



Dimensions in mm

Diameter code	Nominal Diameter	Shear Bolts		Reduced		Tension Bolts	
		Recommended		Reduced			
		Chamfer		Chamfer		Chamfer	
		Min	Max	Min	Max	Min	Max
2	3.97	0.6	0.9	-	-	-	-
3	4.76	0.6	0.9	-	-	1.05	1.15
4	6.35	0.6	0.9	-	-	1.05	1.15

Diameter code 1/16"

Dimensions in mm

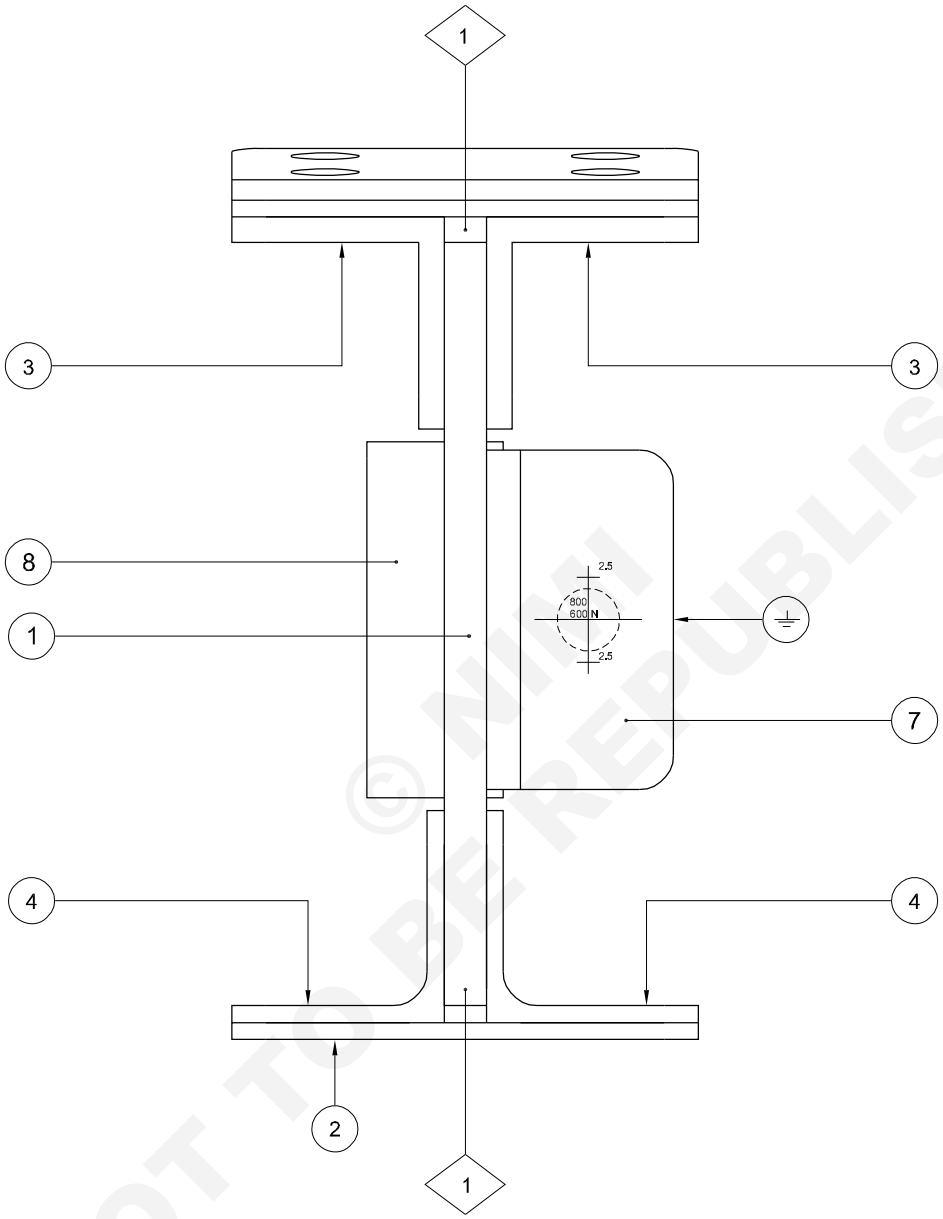
Diameter code	Nominal Diameter	Recommended		Reduced	
		F		F	
		Min	Max	Min	Max
2	3.97	0.6	0.9	0.4	0.6
3	4.76	0.6	0.9	0.4	0.6
4	6.35	0.6	0.9	0.4	0.6

Diameter code 1/16"

-	-	-	-	-	-	3.1.56
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE : NTS	**BEAM MANUFACTURING - ASSEMBLY** **SHEET 3 - HOLES AND DRILL DATA**	DEVIATIONS	TIME : 20 Hrs
		CODE NO : AFN3156EC	

VIEW A



-	-	-	-	-	-	3.1.56
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**BEAM MANUFACTURING - ASSEMBLY** **SHEET 4 - A VIEW**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3156ED	

TASK 1: **PRE-Assembly**

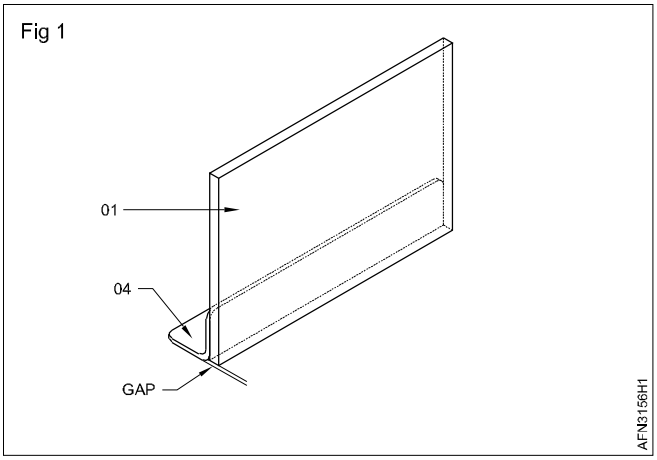
All counter drillings are realised to diameter 2,5mm.

Maintain a clean and well-organised workplace.

STEP 01

Item 01 with drilled item 04 assembly

Fig 1



- On a plate with a shim corresponding to the desired gap, position items 04 and 01.

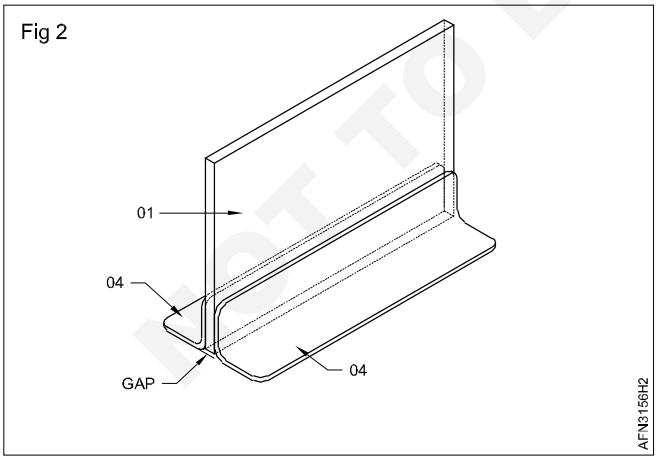
The item 04 used is the one drilled during the manufacturing phase.

- Hold firmly with clamps and counter-drill.
- Check the positioning.
- Check the gap.
- Check the perpendicularity.
- Disassemble and deburr.

STEP 02

STEP 01 with Undrilled item 04 assembly

Fig 2



- On a plate with a shim corresponding to the desired gap, position the second item 04 with 01.

The item 04 used is the one undrilled in the manufacturing phase.

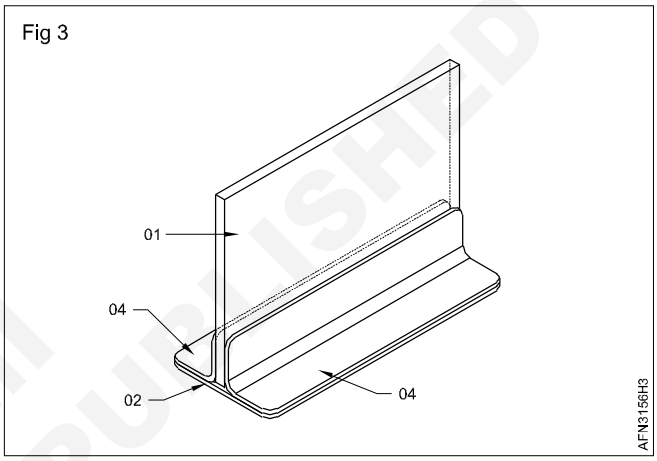
The first item 04 positioned in step 01 is not installed during positioning.

- Hold firmly with clamps and counter-drill.
- Check the positioning.
- Check the gap.
- Check the perpendicularity.
- Check the flatness.
- Disassemble and deburr.
- Assemble the two angle sections item 04 with item 01.
- Clamp at 33% minimum.

STEP 03

STEP 02 with ITEM 02 Assembly

Fig 3



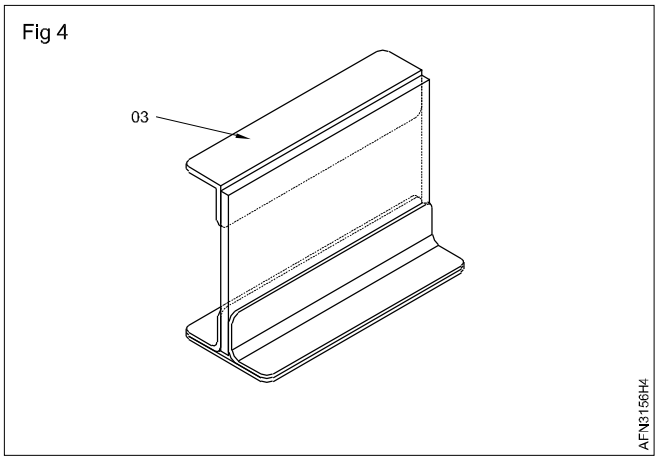
- Put item 02 with the sub-assembly in position.
- Secure with clamps.
- Counter drill and clamp as required.
- Check positioning.
- Disassemble and deburr.
- Clamp at 33% minimum.

STEP 04

STEP 03 with drilled ITEM 03 Assembly

- On a plate with a shim corresponding to the desired gap, position items 03 and 01.

Fig 4



The item 03 used is the one drilled during the manufacturing phase.

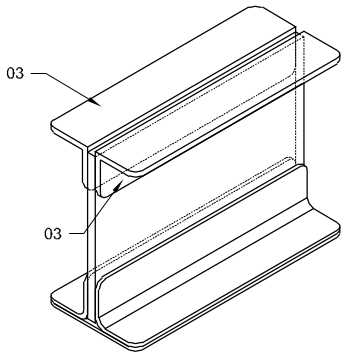
Respect the required gap.

- Hold firmly with clamps and counter-drill.
- Check the positioning.
- Check the gap.
- Check the perpendicularity.
- Disassemble and deburr.

STEP 06

STEP 05 with Undrilled ITEM 03 Assembly

Fig 5



On a plate with a shim corresponding to the desired gap, position the second item 03 with 01.

The item 03 used is the one undrilled in the manufacturing phase.

The first item 03 positioned in step 04 is not installed during positioning.

Hold firmly with clamps and counter-drill.

Check the positioning.

Check the gap.

Check the perpendicularity.

Check the flatness.

Disassemble and deburr.

Assemble the two angle sections item 03 with item 01.

Clamp at 33% minimum.

STEP 07

STEP 06 with ITEM 05 Assembly

Put item 05 with the sub-assembly in position.

Secure with clamps.

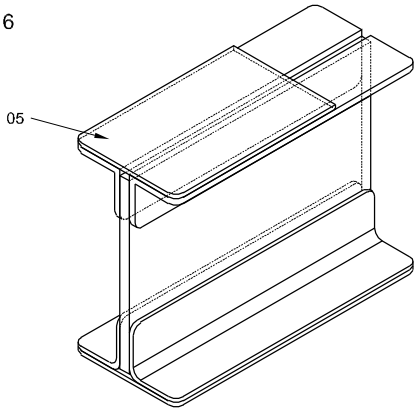
Counter drill and clamp as required.

Check positioning.

Disassemble and deburr.

Clamp at 33% minimum.

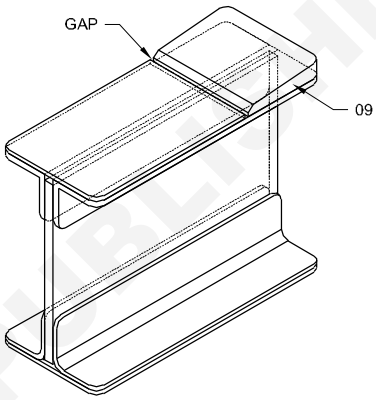
Fig 6



STEP 08

STEP 07 with ITEM 09 Assembly

Fig 7



- Put item 09 with the sub-assembly in position.

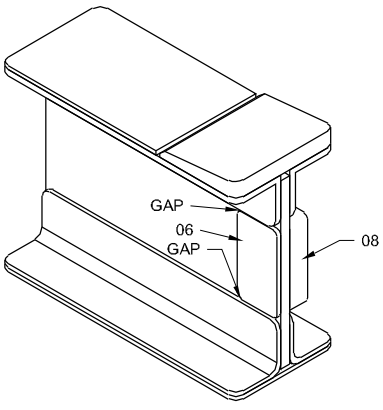
Respect the required gap.

- Secure with clamps.
- Counter drill and clamp as required.
- Check positioning.
- Disassemble and deburr.
- Clamp at 33% minimum.

STEP 09

STEP 08 with ITEM 06 and 08 Assembly

Fig 8



- Put item 06 with the sub-assembly in position.

Respect the required gaps.

- Secure with clamps.
- Counter drill and clamp as required.
- Check positioning.
- Disassemble and deburr.
- Put item 08 with the sub-assembly in position.
- Clamp together the sub-assembly with items 06 and 08.

Check the required gaps on both sides.

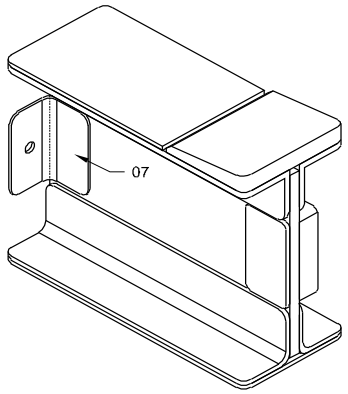
STEP 10

STEP 09 WITH ITEM 07 ASSEMBLY

- Put item 07 in position with the sub-assembly.

Respect the required gaps.

Fig 9



- Secure with clamps.
- Counter drill and clamp as required.
- Check positioning.
- Disassemble and deburr.
- Clamp.

— — — — — — — —

TASK 2: **Drilling to final diameter**

- Using the drawing set and the drilling tables above, determine the final diameter for each holes row.

The holes for the Hi-Lite and Lockbolt fasteners are then defined:

Aluminium/aluminium assembly > Transition or low interference fit

Hard metal/others assembly > Clearance fit.

Aluminium/composite, composite/composite assembly > clearance or low interference fit.

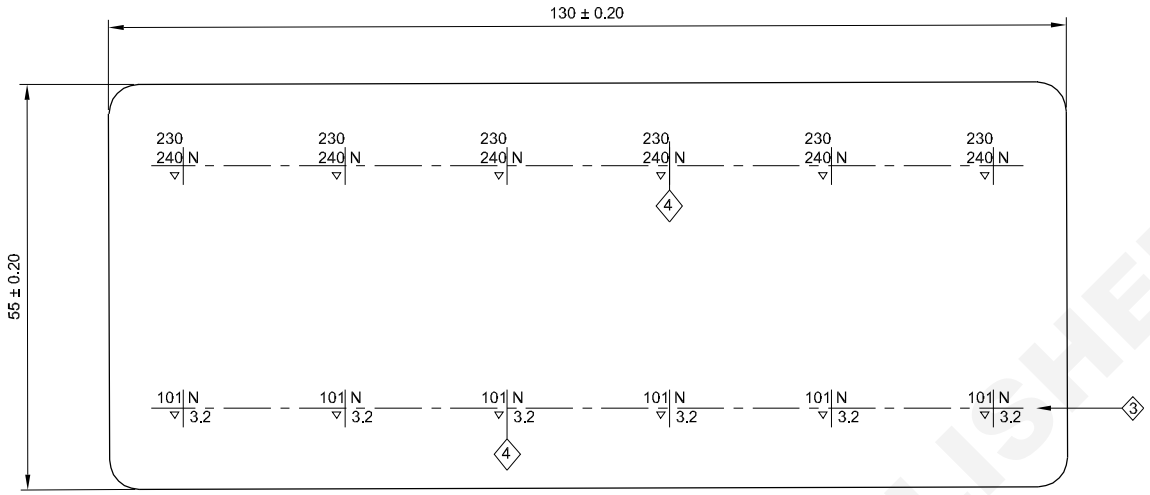
- Note the diameters in the figures below.

Ask the trainer to check them.

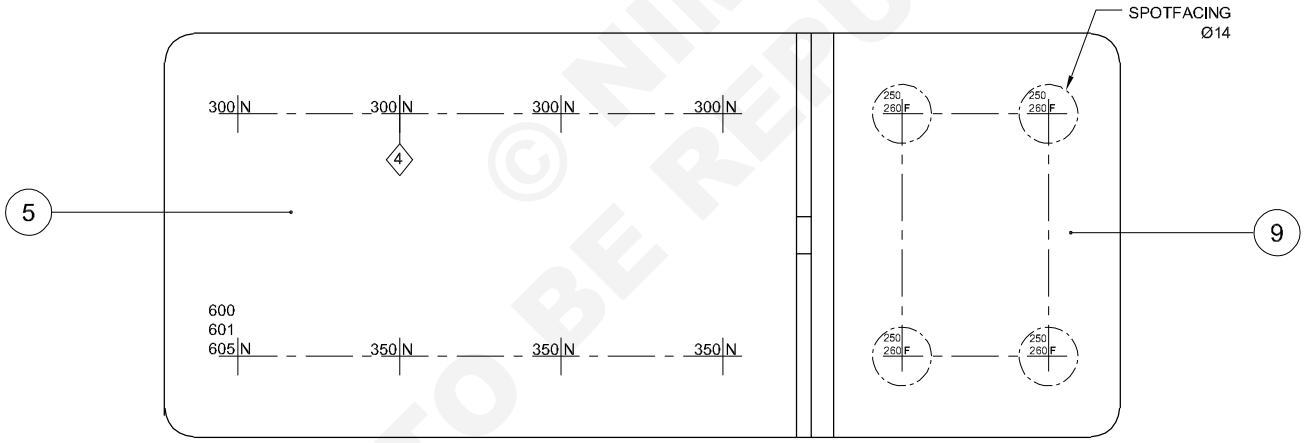
Fastener item Items fastening	**Diameters Drill/Reamer used**
FASTENERS ITEM 100 01/07 ASSEMBLY	
FASTENERS 101 02/04 ASSEMBLY	
FASTENERS 200/220 04/01/04 ASSEMBLY	
FASTENERS 230/220 04/02 ASSEMBLY	
FASTENERS 250/260 03/01/03 ASSEMBLY	
FASTENERS 250/260 09/03-09/03 ASSEMBLIES	
FASTENERS 300 03/05 ASSEMBLY	
FASTENERS 350 03/05 ASSEMBLY	
FASTENER 600/601/605 03/05 ASSEMBLY	5mm
FASTNER 600 07 PART*	6.5mm
FASTENERS 600 06 PART	5mm

- Final diameter for central hole
- With all items clamped in position, counter-drill all holes using the most appropriate tools.
- Deburr carefully.
- Countersink if necessary.
- Make chamfers if necessary.
- Spot face the four holes of item 09.
- Thread the two holes of item 08 according to the thread of the screw used.
- Check holes.

VIEW B



VIEW D



-	-	-	-	-	-	3.1.56
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**BEAM MANUFACTURING - ASSEMBLY** **SHEET 5 - B AND D VIEW**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3156EE	

TASK 3: **Assembly**

- Measure the thicknesses (grip size) to be assembled for all fasteners to determine the length code for each.
- Depending on availability in the warehouse, choose a fastener or its equivalent.
- Note the complete fastener part numbers in the table below.

Item	grip size	Assembly Fasteners reference	qty
100		01/07 ASSEMBLY	
101		02/04 ASSEMBLY	
200		04/01/04 ASSEMBLY	
230		04/02 ASSEMBLY	
220		200 AND 230 FASTENERS	
250		03/01/03 ASSEMBLY	
250		09/03-09/03 ASSEMBLIES	
260		250 FASTENERS	
300		03/05 ASSEMBLY	
350		03/05 ASSEMBLY	
600		03/05 ASSEMBLY	
600		07 PART	
600		06 PART	
601			
605			
800			

- Two positions

Ask the trainer to check them.

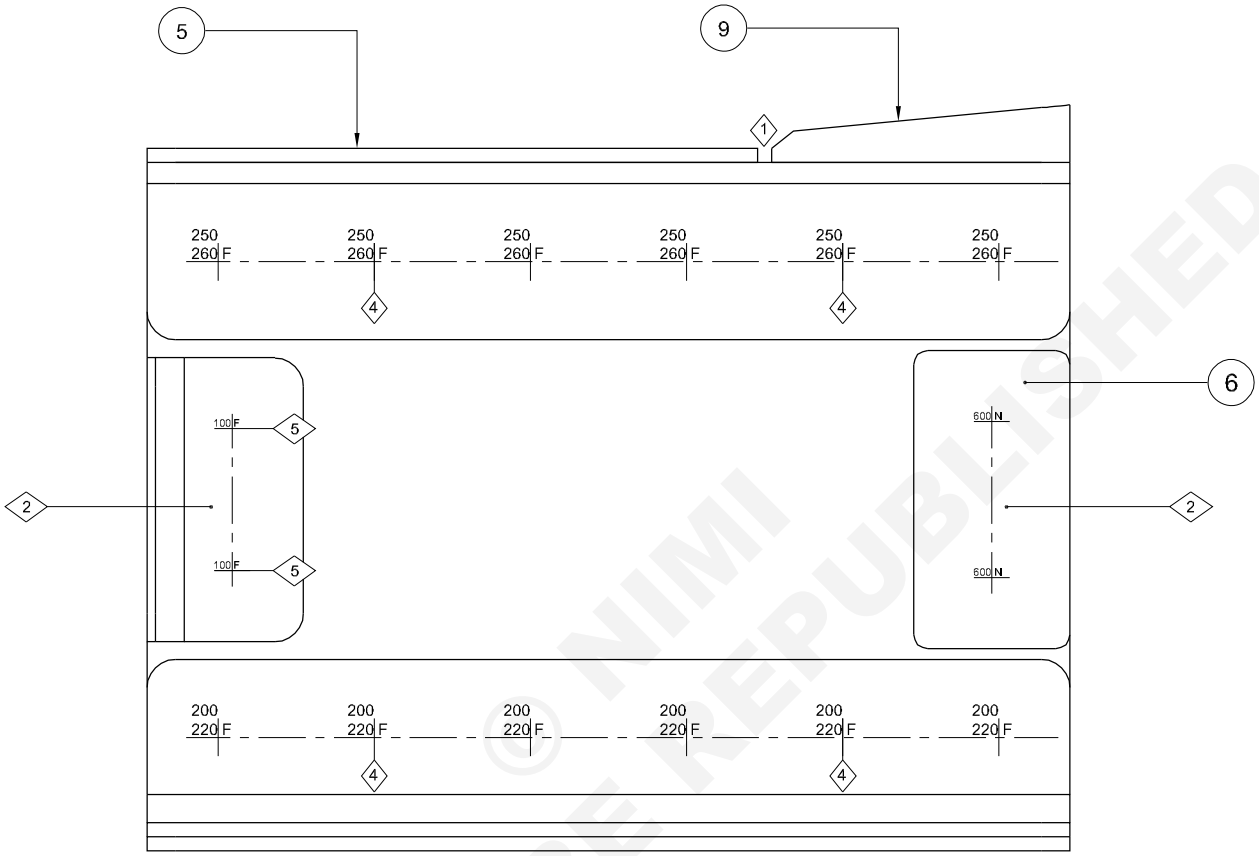
- Perform the required brushing bounding on the angle section.
- Diameter of bounding +2 to 4 mm according to the standard.
- Rivet the nut plate 008 with two rivets.
- Assemble all items with the required fasteners.

Note: Items 06 and 08 are not mounted with sealant.

- The order of assembly is left to your choice.
- Observe the areas where the fasteners are not fitted<4>.
- Check the installation of the fasteners.
- Check that the assembly is in conformity.

Report defects directly on the item with a marker or adhesive tape.

VIEW C



-	-	-	GFRP	-	-	3.1.56
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**BEAM MANUFACTURING - ASSEMBLY** **SHEET 6 - C VIEW**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3156EF	

Reception of a pipe

Objectives: At the end of this exercise you shall be able to·
• identify the defects on pipes and hoses
• record the defects found correctly.

Job Sequence

The instructor will present the different types of pipes and hoses and the mistake, the possible damages, they cause.

He shall put 10 different pipe and hoses with defects.

He will ask the trainees to look for them and write them down in Table 1.

Trainees will:

- Note down the defects on each pipe and hose.
- Record them in Table 1.

The instructor will check for correctness.

Example of defects: lack of impact on the pipes, missing protections, corrosion, etc.

Table 1

Pipe and hose .No	Defect found	Origin / How to avoid
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Fill up and get it checked by your instructor.

Operation before mounting piping

Objectives: At the end of this exercise you shall be able to·
• prepare pipe for mounting
• check the conformity of the pipe and plugs for mounting
• Install plugs on pipe.

Job Sequence

TASK 1: **Prepare a list of non-conformities in pipes, caps, plugs**

The instructor will present the different types of pipes, caps and plugs.

He shall put:

- **Different pipe with expiry date (conforms and not).**
- **Different plugs with and without defects.**
- **Requisition sheet with equipment part number mistakes.**

He will ask the trainees to look for:

- **Identification of plug shutter.**
- **Checking elements have not been damaged.**
- **Checking the expiration date.**
- **Checking the correspondence of the part number with the requisition sheet.**

Trainees will:

- Prepare the list of non-conformities found.

  The instructor will check for correctness.

— — — — — — — —

TASK 2: **Installation of plugs**

The instructor will present the different types of pipes, caps and plugs.

He shall put:

- **Different pipes.**
- **Different plugs.**

He will ask the trainees to perform the installation of the corresponding plugs.

The instructor will check for correctness.

— — — — — — — —

Identify the aircraft systems assembly phases by team of 2 students

Objectives: At the end of this exercise you shall be able to·
• recognise the different elements of a system.
• associate each element with a symbol.
• assemble elements of a system.

Note: The panels are made with the material available at each training site. It is made up of real aircraft components (pipes, pumps, by-pass, filters, tank, actuator, relief valve, valves, etc.) mounted on panels in compliance with aeronautical rules.

A diagram is associated with each panel.

The pipes can be dismantled, and a panel-specific work card is provided to enable students to carry out the assembly work.

The documentation will be available directly on the panel.

Job Sequence

TASK 1: **Hydraulic system**

On hydraulic system structure panels and mock-up, the instructor will:

- **Present the different elements and explanations of their role.**
- **Present the system operating.**
- **Speak about the hazards on the system.**
- **Associate each element of the panel with its symbol in diagram.**
- **Discuss the order of assembly of each element.**
- **Show how to assemble the different elements.**

Trainees will make the:

- Identification of the different elements.
- Brief presentation of the system operating.
- Identification of the hazards.
- Association of each element of the panel its symbol on the corresponding diagram.
- Identifying in the work card the order of assembly of each element.
- Assembly on the mock-up all the different elements.
- Cross checking by another team according to the technical documentation.

— — — — — — — —

TASK 2: **Pneumatic system**

On pneumatic system structure panels and mock-up, the instructor will:

- **Present the different elements and explanations of their role.**
- **Present the system operating.**
- **Speak about the hazards on the system.**
- **Associate each element of the panel with its symbol in diagram.**
- **Discuss the order of assembly of each element.**
- **Show how to assemble the different elements.**

Trainees will make the:

- Identification of the different elements.
- Brief presentation of the system operating.
- Identification of the hazards.
- Association of each element of the panel its symbol on the corresponding diagram.
- Identifying in the work card the order of assembly of each element.
- Assembly on the mock-up all the different elements.
- Cross checking by another team according to the technical documentation.

TASK 3: **Fuel system**

On structure panels and mock-up, the instructor will:

- **Present the different elements and explanations of their role.**
- **Present the system operating.**
- **Speak about the hazards on the system.**
- **Associate each element of the panel with its symbol in diagram.**
- **Discuss the order of assembly of each element.**
- **Show how to assemble the different elements.**

Trainees will make the:

- Identification of the different elements.
- Brief presentation of the system operating.
- Identification of the hazards.
- Association of each element of the panel its symbol on the corresponding diagram.
- Identifying in the work card the order of assembly of each element.
- Assembly on the mock-up all the different elements.
- Crosschecking by another team according to the technical documentation.

— — — — — — — —

Task 4: **Oxygen system**

On structure panels and mock-up, the instructor will:

- **Present the different elements and explanations of their role.**
- **Present the system operating.**
- **Speak about the hazards on the system.**
- **Associate each element of the panel with its symbol in diagram.**
- **Discuss the order of assembly of each element.**
- **Show how to assemble the different elements.**

Trainees will make the:

- Identification of the different elements.
- Brief presentation of the system operating.
- Identification of the hazards.
- Association of each element of the panel its symbol on the corresponding diagram.
- Identifying in the work card the order of assembly of each element.
- Assembly on the mock-up all the different elements.
- Crosschecking by another team according to the technical documentation.

— — — — — — — —

TASK 5: **Flight controls system**

On flight controls system structure panels and mock-up, the instructor will:

- **Present the different elements and explanations of their role.**
- **Present the system operating.**
- **Speak about the hazards on the system.**
- **Associate each element of the panel with its symbol in diagram.**
- **Discuss the order of assembly of each element.**
- **Show how to assemble the different elements.**

Trainees will make the:

- Identification of the different elements.
- Brief presentation of the system operating.
- Identification of the hazards.
- Association of each element of the panel its symbol on the corresponding diagram.
- Identifying in the work card the order of assembly of each element.
- Assembly on the mock-up all the different elements.
- Crosschecking by another team according to the technical documentation.

Pipe routing on a diagram

Objectives: At the end of this exercise you shall be able to·
• identify the pipes and the direction of flow
• determine the necessary tools and equipment
• check the condition of the connections
• prepare the structure for installation.

Note: The panels are made with the material available at each training site. It is made up of real aircraft components (pipes, pumps, by-pass, filters, tank, actuator, relief valve, valves, etc.) mounted on panels in compliance with aeronautical rules.

A diagram is associated with each panel.

The pipes can be dismantled, and a panel-specific work card is provided to enable students to carry out the assembly work.

The documentation will be available directly on the panel.

Job Sequence

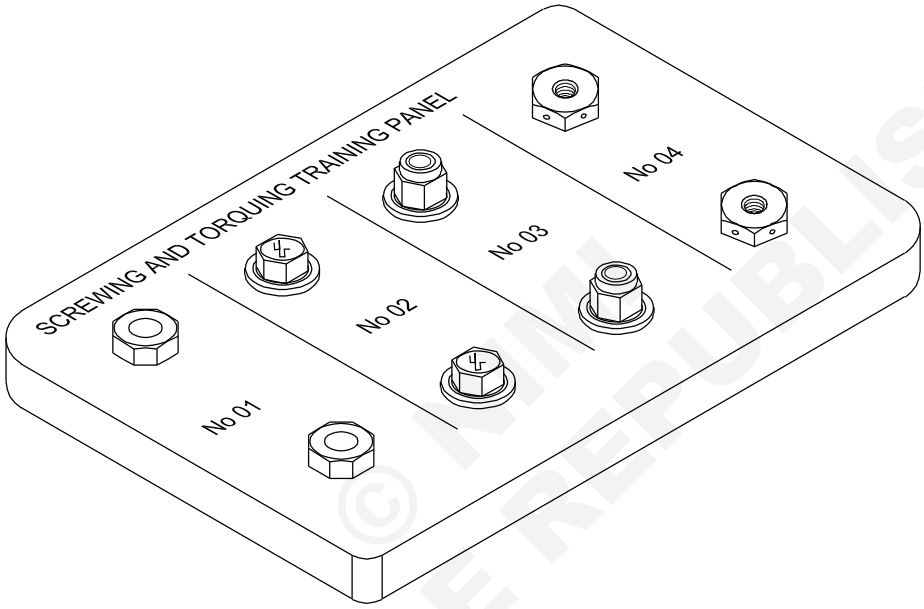
On mock-up with technical documentation, perform operations of:

- Identification of each pipe mentioned in the work card diagram.
- Identification of the fluid flow direction
- Identification of tools and equipment.
- Checking the condition of the connection ends.
- Preparation of the structure panel and mark.

Screwing and torquing operations

Objectives: At the end of this exercise you shall be able to·
• screw different types of bolts and nuts.

EXAMPLE OF SCREWING AND TORQUING TRAINING PANEL



THE ASSOCIATED JOB CARD INDICATES THE TORQUE FOR EACH BOLT AND NUT.

-	-	-	-	-	-	3.2.61
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**SCREWING AND TORQUING TRAINING PANEL EXAMPLE**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3261E1	

Job Sequence

Note: each training panel have different bolts, screws and nut. Check the reference of the fastener before search the torque value on the table.

- Following the instructions of the specific training panel job card, screw and torque bolts and nut.
- Refer to the table below for torque value.

TORQUE VALUESCHART

For training only

Bolt, Stud or Screw Size		Torque Values in Inch-Pounds for Tightening Nuts		
		On standard bolts, studs and screws having a tensile strength of 125,000 to 140,000 psi AN3 through AN20 AN42 through AN49 AN73 through AN81 MS20033 through MS20046 MS20073 and MS20074 AN509 AN525 MS24694 and MS27039		On bolts, studs, and screws having a tensile strength of 140,000 to 160,000 psi MS20004 through MS20024 NAS144 through NAS158 NAS333 through NAS340 NAS583 through NAS590 NAS624 through NAS644 NAS1303 through NAS1320 NAS172 and NAS174 NAS517
		Shear type nuts AN320, AN364, NAS1022, MS17826, MS20364	Tension type nuts and threaded machine AN310 & AN315, AN363 & AN365, NAS1021, MS20365, MS21042, MS21045, NAS679	Any nut, except shear type AN310 & AN315, AN363 & AN365, NAS1021, MS20365, MS21042, MS21045, NAS679
8–32	8–36	7–9	12–15	14–17
10–24	10–32	12–15	20–25	23–30
1/4–20		25–30	40–50	45–49
	1/4–28	30–40	50–70	60–80
5/16–18		48–55	80–90	85–117
	5/16–24	60–85	100–140	120–172
3/8–16		95–110	160–185	173–217
	3/8–24	95–110	160–190	175–271
7/16–14		140–155	235–255	245–342
	7/16–20	270–300	450–500	475–628
1/2–13		240–290	400–480	440–636
	1/2–20	290–410	480–690	585–840
9/16–12		300–420	500–700	600–845
	9/16–18	480–600	800–1000	900–1,220

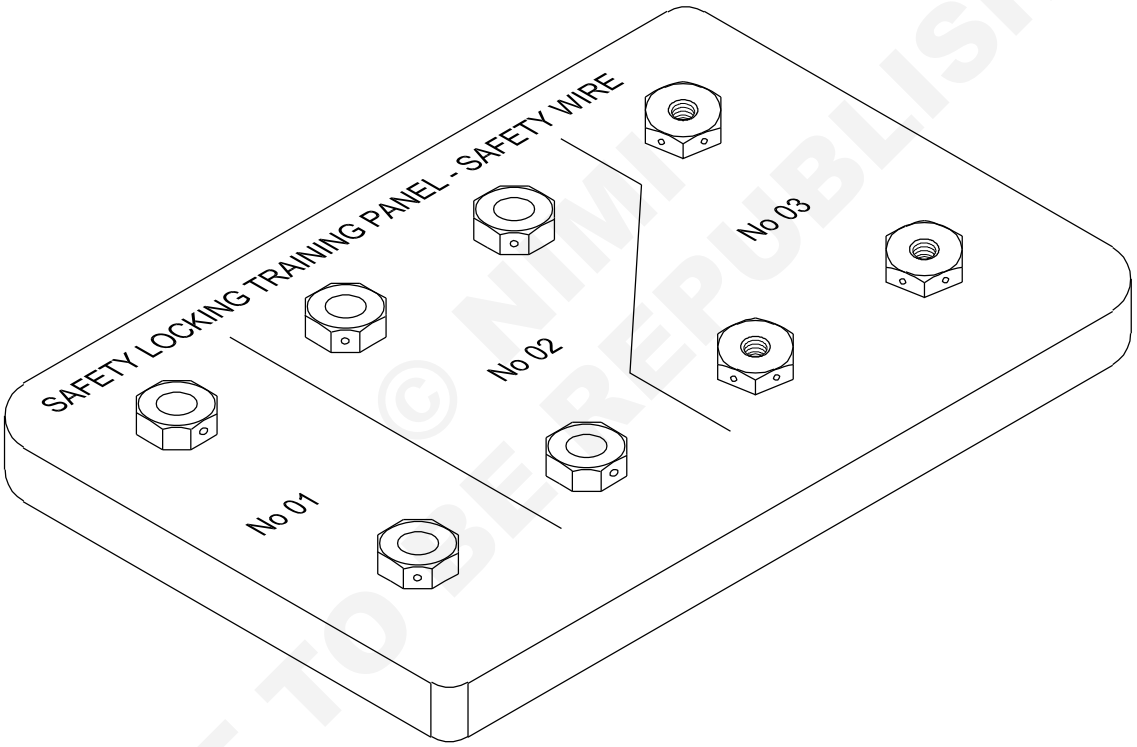
Bolt, Stud or Screw Size		Torque Values in Inch-Pounds for Tightening Nuts		
		On standard bolts, studs and screws having a tensile strength of 125,000 to 140,000 psi AN3 through AN20 AN42 through AN49 AN73 through AN81 MS20033 through MS20046 MS20073 and MS20074 AN509 AN525 MS24694 and MS27039		On bolts, studs, and screws having a tensile strength of 140,000 to 160,000 psi MS20004 through MS20024 NAS144 through NAS158 NAS333 through NAS340 NAS583 through NAS590 NAS624 through NAS644 NAS1303 through NAS1320 NAS172 and NAS174 NAS517
		Shear type nuts AN320, AN364, NAS1022, MS17826, MS20364	Tension type nuts and threaded machine AN310 & AN315, AN363 & AN365, NAS1021, MS20365, MS21042, MS21045, NAS679	Any nut, except shear type AN310 & AN315, AN363 & AN365, NAS1021, MS20365, MS21042, MS21045, NAS679
5/8–11		420–540	700–900	800–1,125
	5/8–18	660–780	1,100–1,300	1,200–1,730
3/4–10		700–950	1,150–1,600	1,380–1,925
	3/4–16	1,300–1,500	2,300–2,500	2,400–3,500
7/8–9		1,300–1,800	2,200–3,000	2,600–3,570
	7/8–14	1,500–1,800	2,500–3,000	2,750–4,650
1"–8		2,200–3,000	3,700–5,000	4,350–5,920
	1"–14	2,200–3,300	3,700–5,500	4,600–7,250
1 1/8–8		3,300–4,000	5,500–6,500	6,000–8,650
	1 1/8–12	3,000–4,200	5,000–7,000	6,000–10,250
1 1/4–8		4,000–5,000	6,500–8,000	7,250–11,000
	1 1/4–12	5,400–6,600	9,000–11,000	10,000–16,750

Note: other torquing chart can be provided by the teacher or the specific job card.

Locking technique

Objectives: At the end of this exercise you shall be able to·
- **prepare locking device**
- **tight fastener with specified torque.**

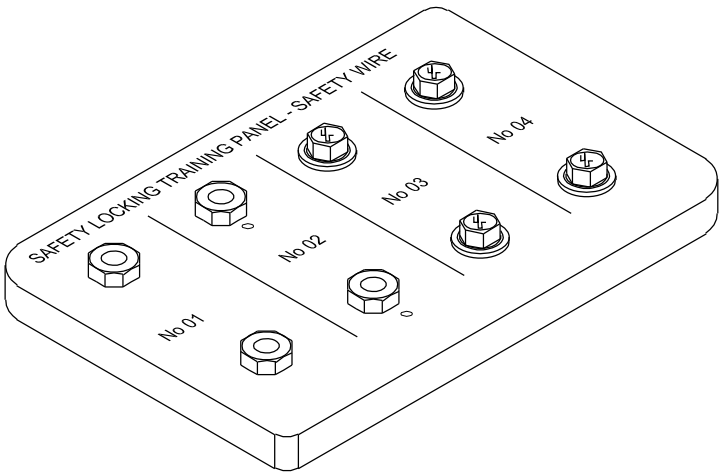
EXAMPLE OF SAFETY LOCKING TRAINING PANEL



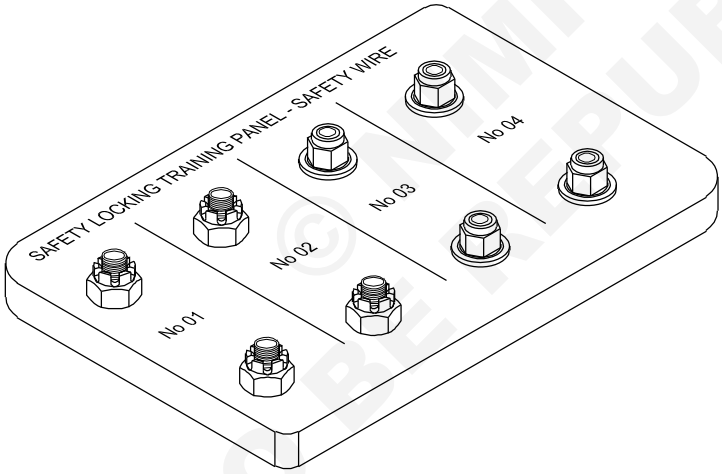
SAFETY WIRE LOCKING

-	-	-	-	-	-	3.2.62
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**SAFETY LOCKING TRAINING PANEL EXAMPLE**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3262E1	

EXAMPLE OF SAFETY LOCKING TRAINING PANEL



LOCKING AND TAB WASHER



LOCKING BY PIN AND SELF - LOCKING NUTS

-	-	-	-	-	-	3.2.62
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**SAFETY LOCKING TRAINING PANEL EXAMPLE**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3262E2	

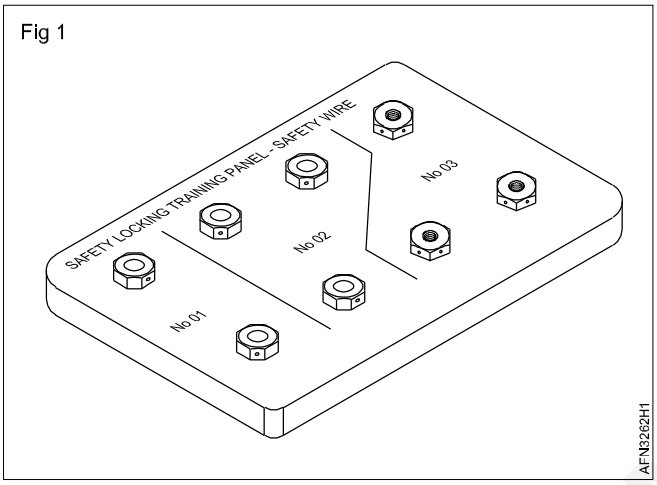
Job Sequence

Note: each training panel have different bolts, screws and nut to be locked. Follow the specific job card for consumable material used.

- Following the instructions of the specific training panel job card, lock bolts and nut.

TASK 1: **Wire locking technique**

Fig 1



Position No 1

- Lock the 2 one-hole bolts together by twisted safety wire.
- Check wire locking.

Position No 2

- Lock the 3 one-hole bolts together by twisted safety wire.
- Check wire locking.

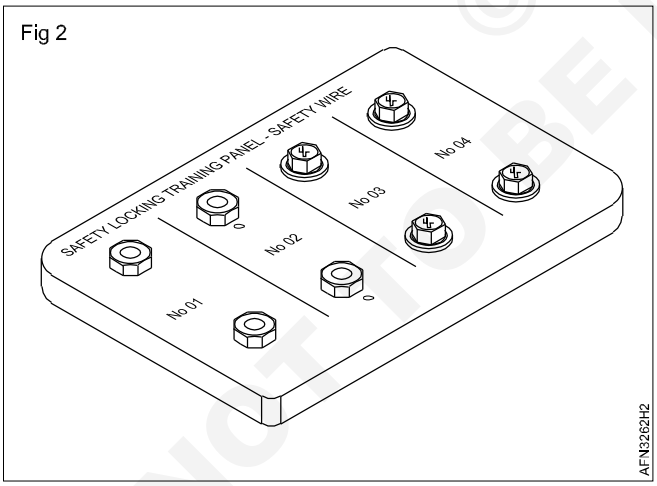
Position No 3

- Lock the 3 three-hole bolts together by twisted safety wire.
- Check wire locking.

— — — — — — — —

TASK 2: **Locking-washer and tab washer locking technique**

Fig 2



Position No 1

- Lock the 2 bolts with tab washer on the edge (type DIN125 or equivalent)
- Check the locking.

Position No 2

- Lock the 2 bolts with tab washer on the hole (type MS9276, MS9582 or equivalent)
- Check the locking.

Position No 3

- Lock the 2 bolts with spring washer (type MS25338 or equivalent)
- Check the locking.

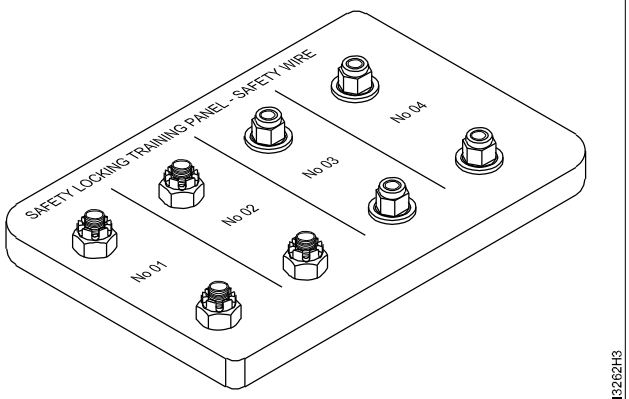
Position No 4

- Lock the 2 bolts with external tooth lock-washer (type MS35335 or equivalent)
- Check the locking.

— — — — — — — —

TASK 3: **Cotter pin locking with castle nut, self-locking nutand liquid locking technique**

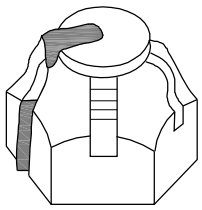
Fig 3



Position No 1

- Lock the 2 bolts with cotter pin (MS24665 or equivalent).
- **Use the method show in the figure below.**

Fig 4

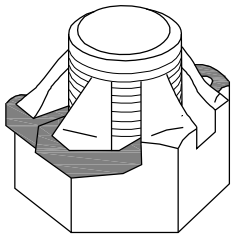


- Check the locking.

Position No 2

- Lock the 2 bolts with cotter pin (MS24665 or equivalent).
- **Use the method show in the figure below.**
- Check the locking.

Fig 5



Position No 3

- Put 2 self-locking nuts (1 nylon ring locking and 1 elliptic locking)
- Check the locking.

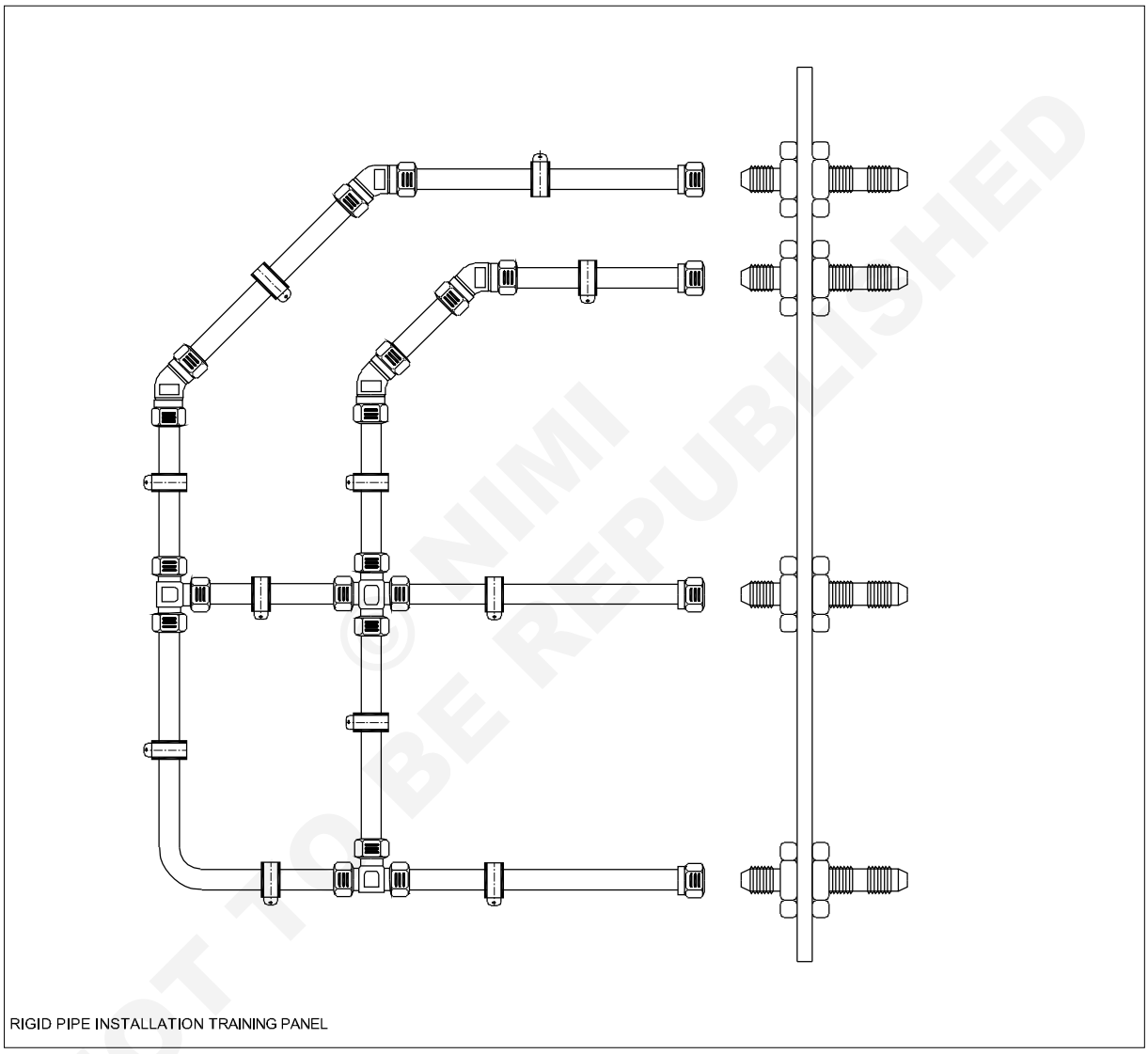
Position No 4

- Lock the 2 nuts with external tooth lock-washer (type LoctiteTM or equivalent)
- Check the locking

Metallic pipe installation

Objectives: At the end of this exercise you shall be able to·
• install metallic pipe on aircraft.

EXAMPLE OF HOME-MADE TRAINING PANEL WITH REAL AIRCRAFT PARTS
AVAILABLE ON TRAINING INSTITUTE



RIGID PIPE INSTALLATION TRAINING PANEL

-	-	-	-	-	-	3.2.63
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**EXAMPLE OF TRAINING PANEL**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3263E1	

Job Sequence

METALLIC PIPE INSTALLATION PANEL

Following the specific job card

- Prepare the task.
- Connect the pipes in accordance with job card.
- Ensure electrical continuity with bonding leads.
- Check the assembly.

Note: The following pages give an example of a work card for this chapter.

Depending on the available material, it will need to be adapted.

The material mentioned is only given as an example. Procurement will be based on the real specific exercise set up.

Metallic pipe installation - Typical job card

Objectives: At the end of this exercise you shall be able to·
• practice on metallic pipe installation panel

Job Sequence

Metallic pipe installation panel

- Check the correct assembly of the AN832 bulkhead fittings with the AN924 nut.
- Check the general condition of these fittings (absence of marks, cracks, damage, etc.).
- Check the presence and the state of the nut plates.
- Check each pipe delivered (condition of the pipe, condition of the spread, condition of the nut, etc.).

Before installing a line assembly in an aircraft, inspect the line carefully.

Be sure all nuts and sleeves are snugly mated and securely fitted by proper flaring of the tubing.

The line assembly should be clean and free of all foreign matters.

- Pre-position the pipes by hand tightening each one.
- The pipes must be perfectly aligned with the fitting.

Never apply compound to the faces of the fitting or the flare, for it will destroy the metal-to-metal contact between the fitting and flare, a contact which is necessary to produce the seal.

If lubrication of the fittings is necessary (while not essential to all fittings, lubrication must be applied to some and is a good practice for others), only use the lubricant requested in the process. In the application of a lubricant, it is important that none of the lubricant enter the tubing unless the lubricant is the same material that will be used in the system.

When lubrication has to be performed, the following rules apply:

- Lubricate nuts and fittings on the outside of the sleeve and on the male threads of the fittings, except for the starting threads.
- Lubricate coupling nuts and fittings on the outside of the flare, and lubricate the female threads, except for the starting threads.

Be sure that the line assembly is properly aligned before tightening the fittings.

Do not pull the installation into place with torque on the nut.

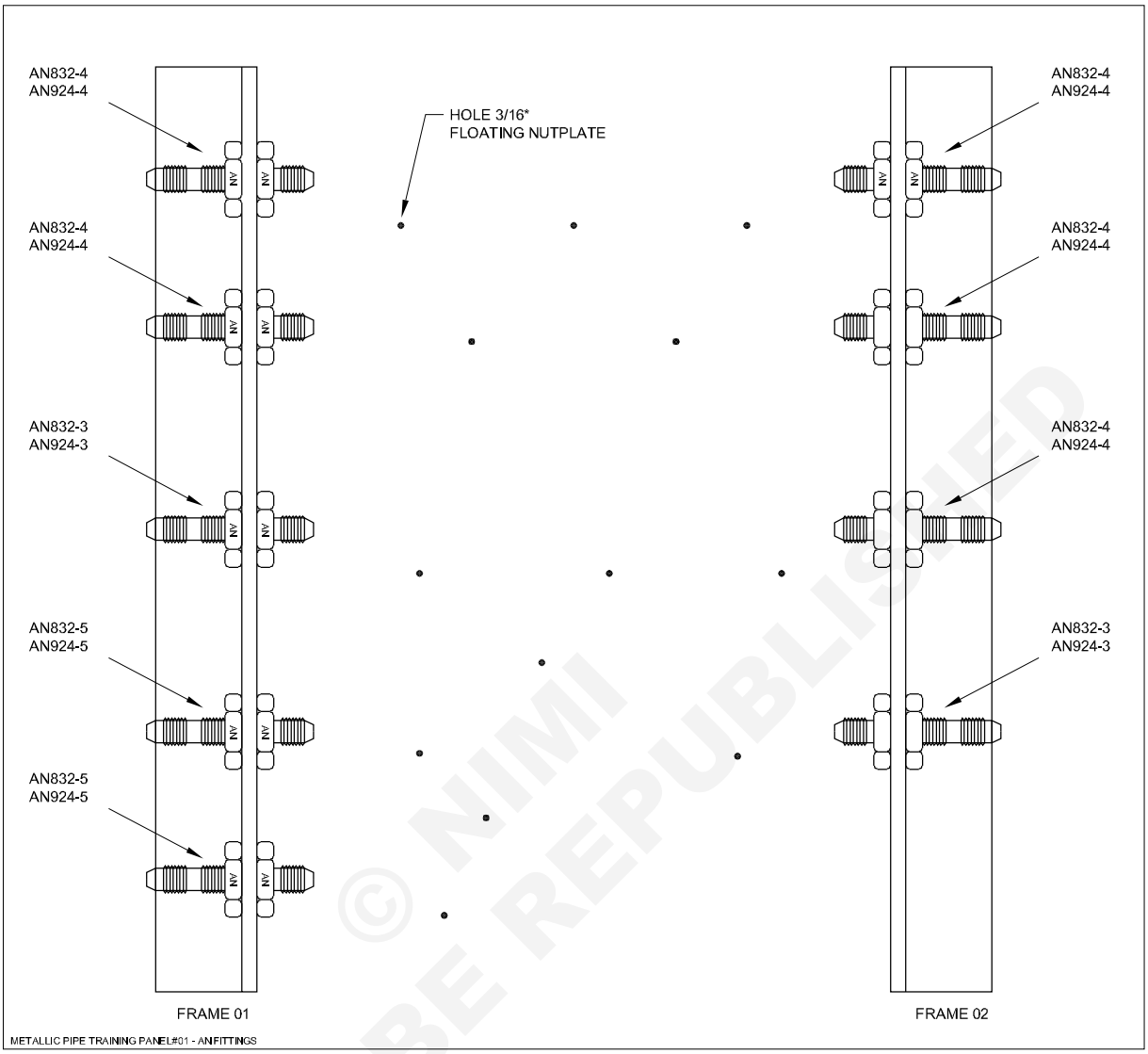
- Install, without tightening them, the MS clamps.
- Check their orientation and the protective device placement.
- Tighten the pipe fittings to the correct torque.

  Proper torque values are given in Table below.

Tubing o.d (inches)	Fitting bolt or Nut size	Aluminium Alloy tubing Bolt,fitting or Nut Torque (in-lb)	Steel Tubing - bolt Fitting, of Nut Torque (in-lb)
1/8	-2	20-30	
3/16	-3	30-40	90-100
1/4	-4	40-65	135-150
5/16	-5	60-5	180-200
3/8	-6	75-125	270-300

Always tighten fittings to the correct torque value when installing a tube assembly.

TYPICAL TRAINING PANEL EQUIPMENT



THE AN FITTINGS CAN BE IN ALUMINIUM (CODE D) OR STEEL (WITHOUT CODE)

-	-	-	-	-	-	3.2.63
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**METALLIC PIPES TRAINING PANEL TYPICAL JOB CARD FOR EXAMPLE**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3263E2	

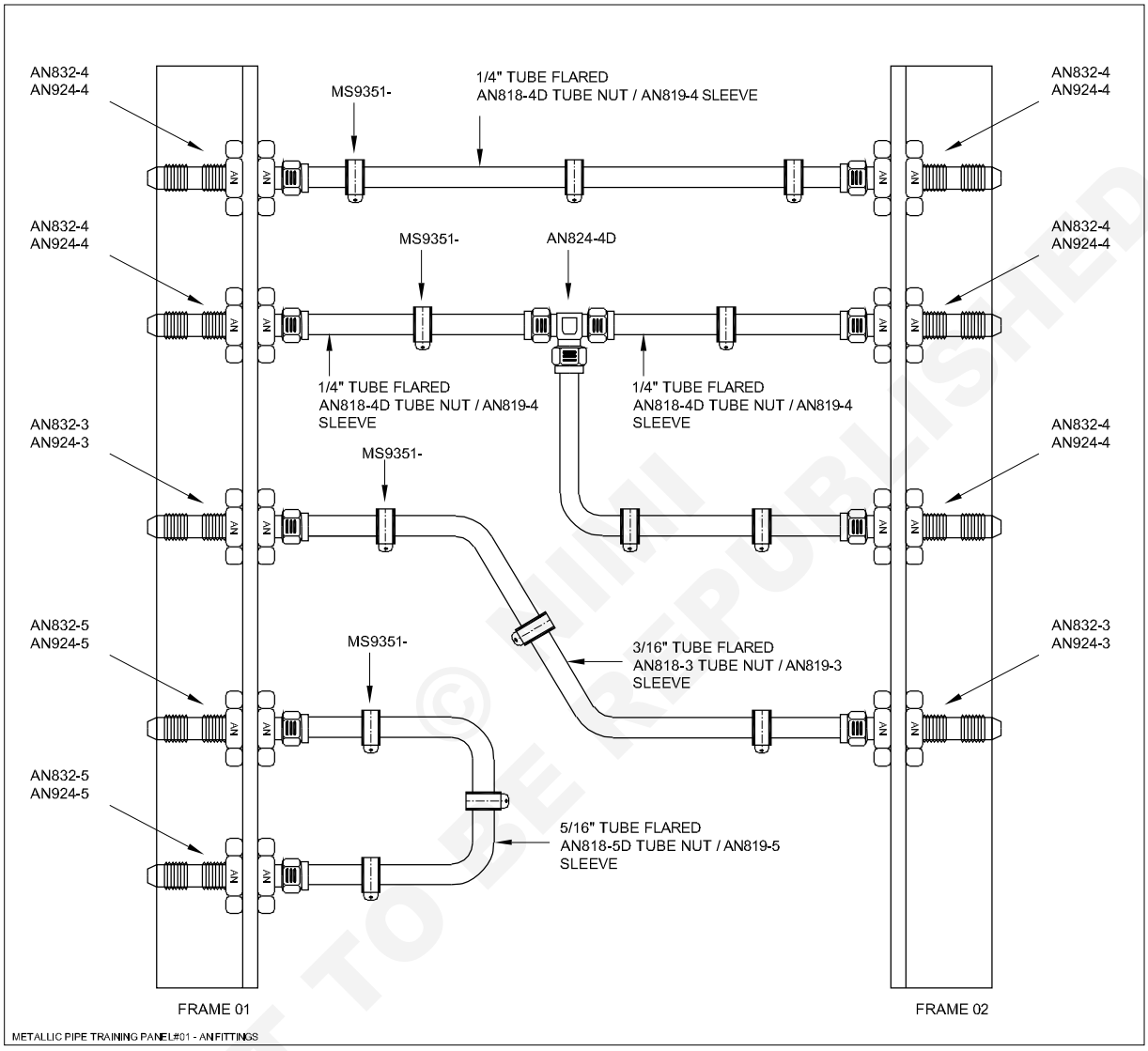
Over-tightening a fitting may damage or completely cut off the tube flare, or it may ruin the sleeve or fitting nut.

The use of torque wrenches prevents over-tightening or under-tightening.

Note: If a tube fitting assembly is tightened properly, it may be removed and retightened many times before re-flaring is necessary.

- Tighten the clamps.
- Check the correct positioning.

TYPICAL TRAINING PANEL WITH PIPES



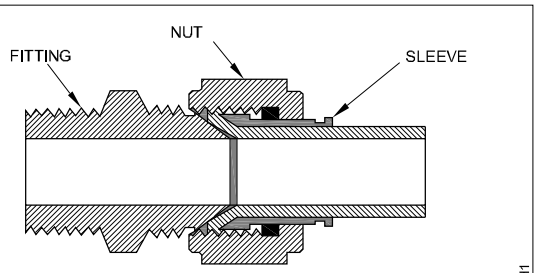
IF AN BULKHEAD FITTINGS ARE USED, STEEL AN818 NUTS CAN BE USED TO PREVENT RAPID DETERIORATION

-	-	-	-	-	-	3.2.63
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**METALLIC PIPES TRAINING PANEL TYPICAL JOB CARD FOR EXAMPLE**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3263E3	

Technical information about AN fitting

The basic components of a flared connection are the AN818 nut, the AN819 sleeve, and one of a number of fittings with a cone to match the tube's flare (Fig 1).

Fig 1



Flared-Fittings Designations.

Fittings are designated by an AN or MS number, which indicates the function of the fitting.

The fitting is sized by the OD of the tube it is used with. The outside diameter of the tube is expressed in sixteenths of an inch.

An AN819 fitting for a 1/4-inch tube would have a designation of AN819-4, and for a 3/4-inch tube it would be AN819- 12.

Aluminium-alloy fittings are indicated by a D before the dash.

The letter C indicates the fitting is made from corrosion-resistant steel.

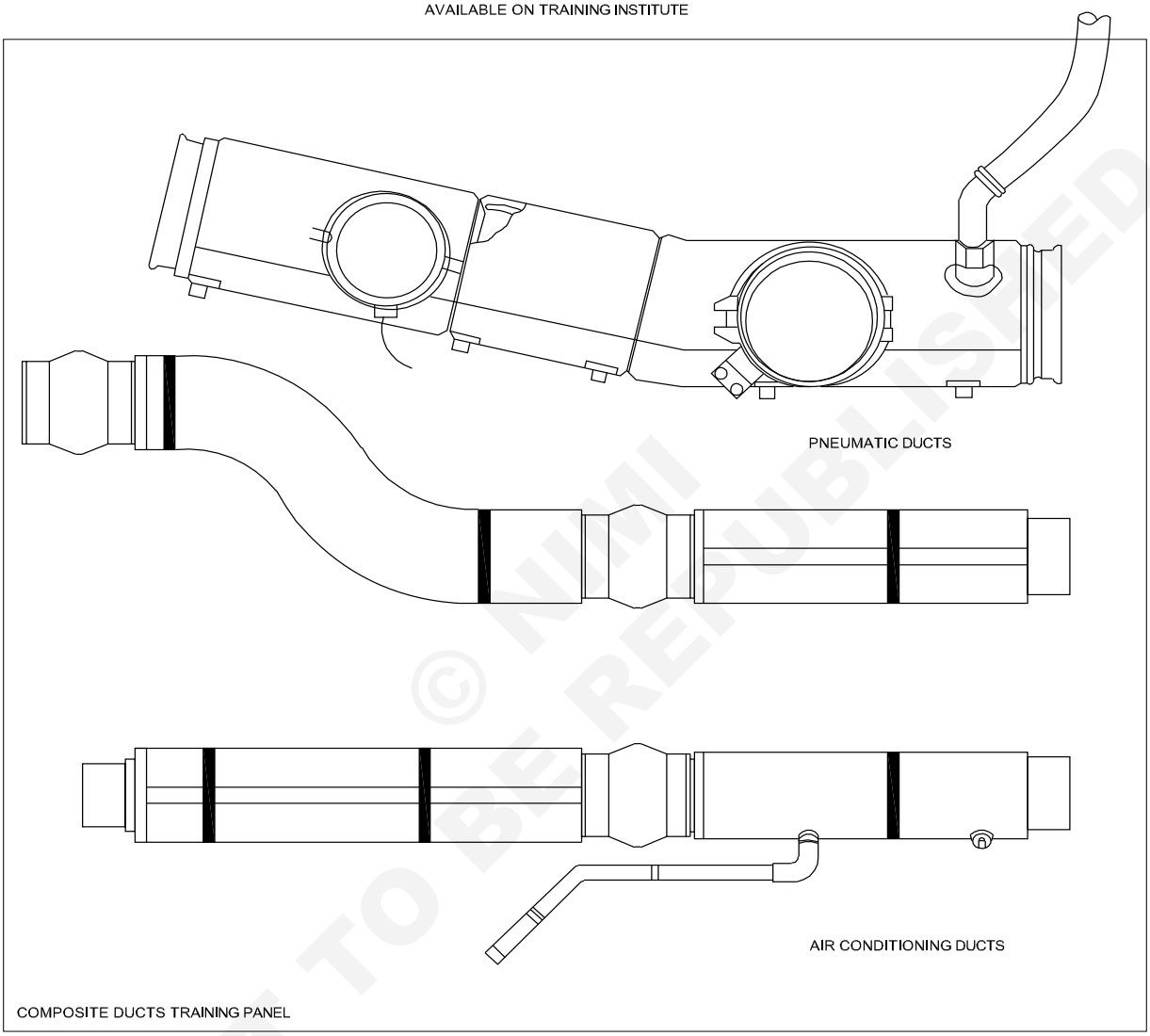
No letter before the dash number indicates that the material is steel.

— — — — — — — —

Composite duct installation

Objectives: At the end of this exercise you shall be able to·
• install metallic composite ducts on aircraft.

EXAMPLE OF HOME-MADE TRAINING PANEL WITH REAL AIRCRAFT PARTS
AVAILABLE ON TRAINING INSTITUTE



-	-	-	-	-	-	3.2.64
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	EXAMPLE OF TRAINING PANEL				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3264E1	

Job Sequence

Composite ducts installation panel

Following the specific job card

- Prepare the task.
- Connect the ducts in accordance with job card.
- Check the assembly.

Note:The following pages give an example of a work card for this chapter.

Depending on the available material, it will need to be adapted.

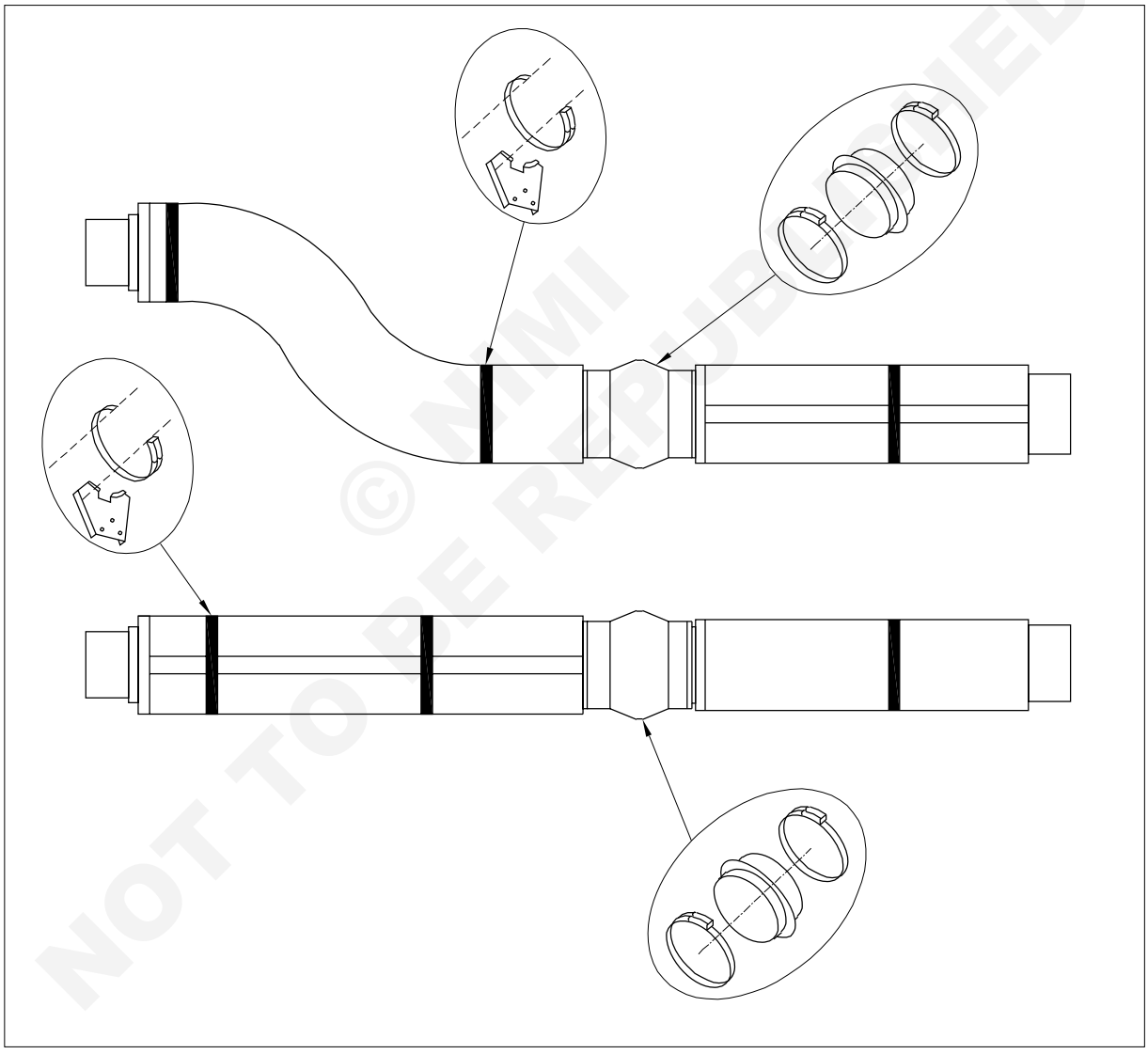
The material mentioned is only given as an example. Procurement will be based on the real specific exercise set up.

Composite duct installation - Typical job card

Objectives: At the end of this exercise you shall be able to·

• practice on composite ducts installation

TYPICAL DUCTS INSTALLATION TRAINING PANEL



-	-	-	-	-	-	3.2.64
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**COMPOSITE DUCT TRAINING PANEL TYPICAL JOB CARD FOR EXAMPLE**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3264E2	

Job Sequence

Composite ducts installation panel

Note: The brackets are mounted in the training panel.

Parts list

- ducts,
- sleeves and bellows,
- metallic clamps,
- Prepare the task.
- Check the components.

Ducts shall not show any signs of damage such as crazing, scratches, holes, etc.

The pipes must have a good general appearance.

The inside of the pipe must be free from irregularities and the outside of the pipe must have a uniform appearance.

The ends fitting areas must be free from irregularities.

Connection end fittings, expansion joints, flanges and couplings are not damaged.

The covering (sound/heat insulation) is not damaged.

The inside and the outside of the duct are clean and that there are no foreign bodies inside.

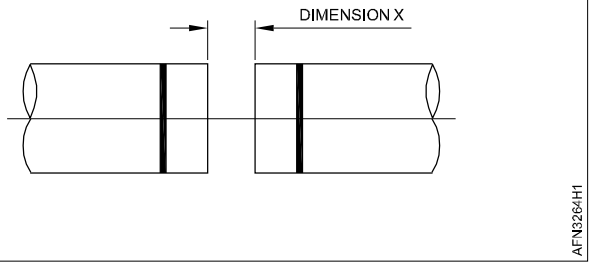
All the items ensuring the attachment of the pipes (rods, supports, fittings) for correct installation and for correct condition.

- Put the ducts in position on the bracket. Put the clamps in position.

An adhesive tape is provided circumferentially on the duct at the location of attachment or fastening of the collar. The adhesive tape is designed as a protection against mechanical damaging. The bracket shall be positioned at the center of the adhesive tape.

- To ensure correct installation, air conditioning ducts shall be aligned as shown in figure below.

Fig 1



X = 5 to 10mm

Fasten and clamp the ducts only after having adjusted all devices to the correct position.

All duct installation will be stress free. Adjust the bracket and clamp to eliminate stress.

Don't force on the pipes to be installed: the pipes should not be deformed.

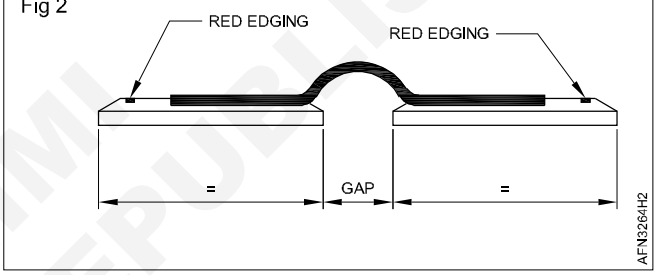
After torque tightening, the clamp lock must have full contact with the air duct. It must fit closely to the adhesive tape.

- Slide the sleeve onto the ends of the duct.
- Position the duct to be installed and the clamps attaching the duct to the support.

  Measure the distance between the ends of the ducts.

  Centre the sleeve on the two ducts to be connected in relation to the red lines or the reinforcements (Fig 2).

Fig 2



- Position the clamps so as not to damage the duct.
- Install the clamps in such a way that the screws remain accessible.

Circumferential red marking rings are provided at the duct ends. The sleeve shall lie between the red markings after clamp tightening to maintain the optimum distance between the duct ends.

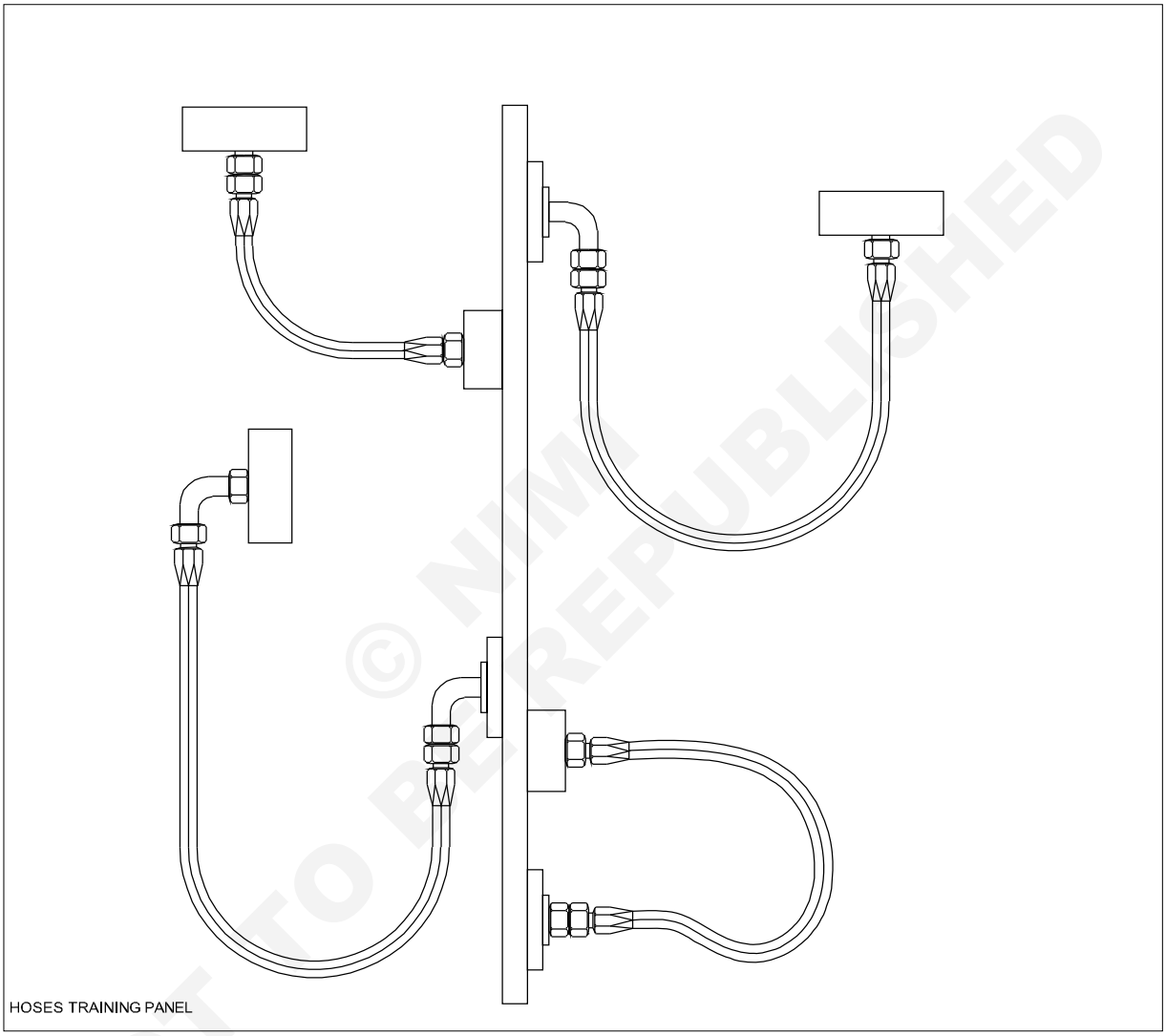
Red lines have to remain visible.

- Tighten the clamps.

Flexible hose installation

Objective: At the end of this exercise you shall be able to·
• install flexible hoses on aircraft.

EXAMPLE OF HOME-MADE TRAINING PANEL WITH REAL AIRCRAFT PARTS
AVAILABLE ON TRAINING INSTITUTE



-	-	-	-	-	-	3.2.65
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS					DEVIATIONS	TIME : 20 Hrs
	EXAMPLE OF TRAINING PANEL				CODE NO : AFN3265E1	

Job Sequence

Flexible hoses installation panel

Following the specific job card

- Prepare the task.
- Connect the pipes in accordance with job card.
- Ensure electrical continuity with bonding leads.
- Check the assembly.

Note: The following pages give an example of a job card for this chapter.

Depending on the available material, it will need to be adapted.

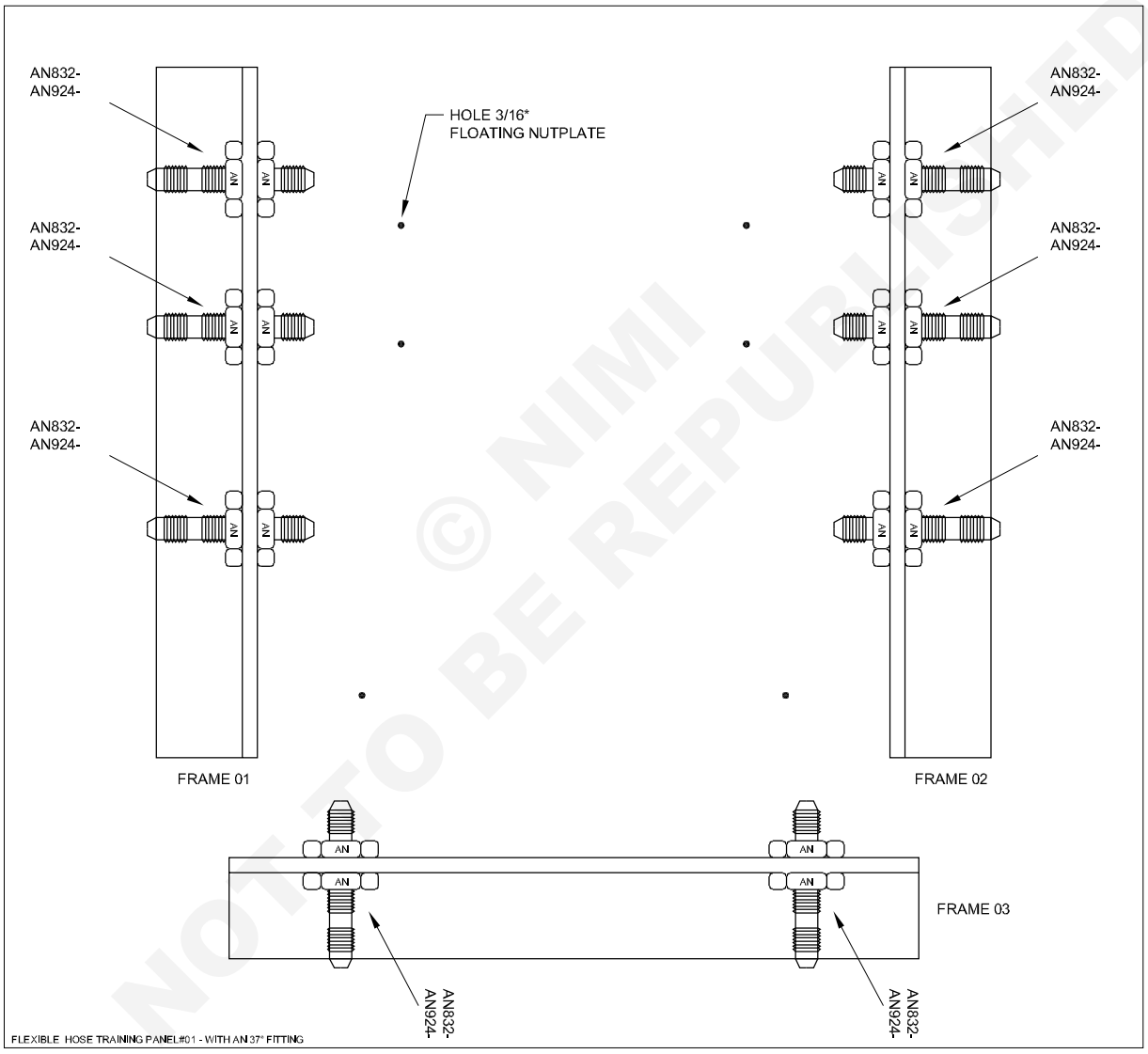
The material mentioned is only given as an example. Procurement will be based on the real specific exercise set up.

Flexible hose installation - Typical job card

Objective: At the end of this exercise you shall be able to·

• practice on flexible hose installation

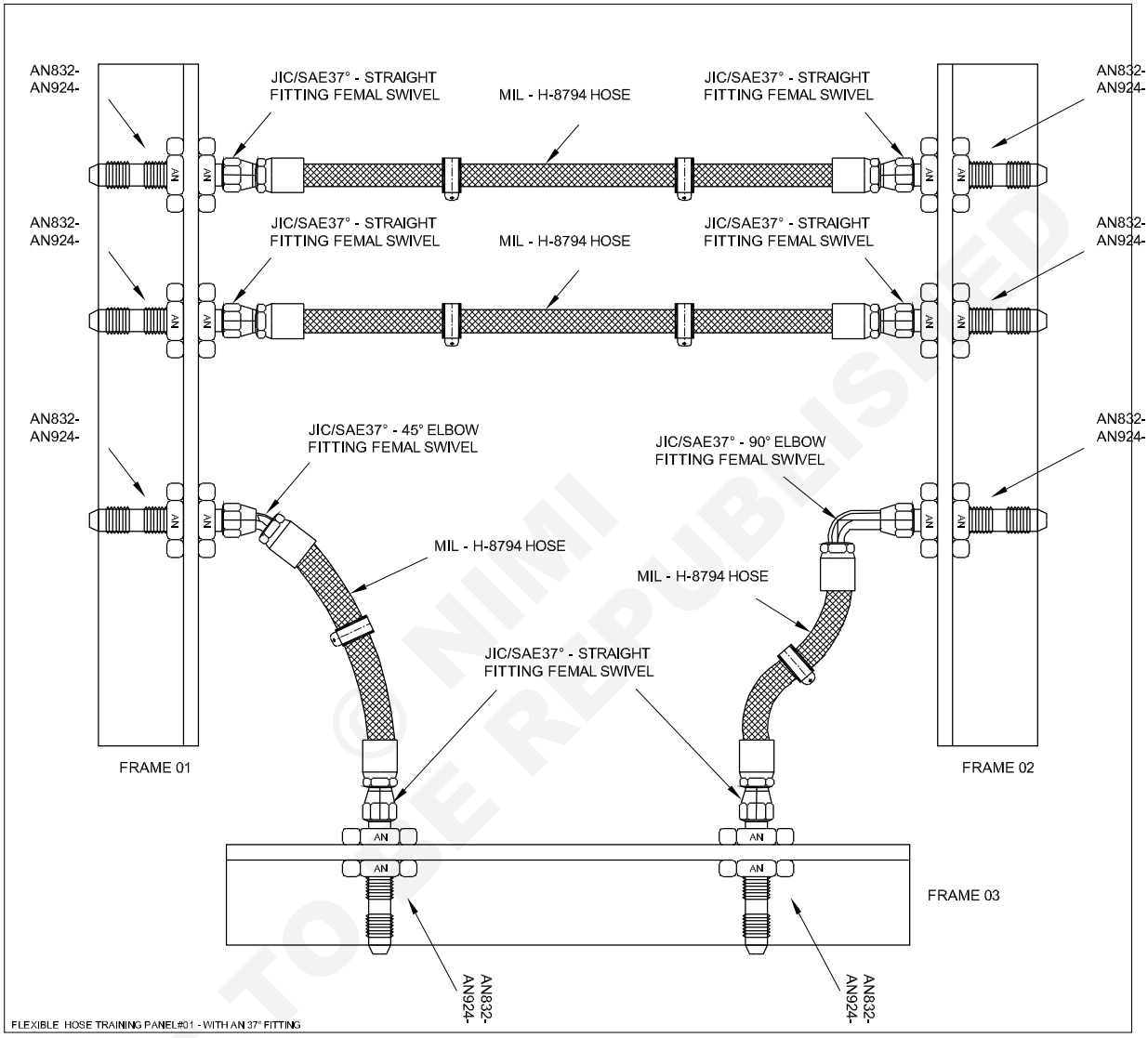
TYPICAL TRAINING PANEL EQUIPMENT



THE AN FITTINGS CAN BE IN ALUMINIUM (CODE D) OR STEEL (WITHOUT CODE)

-	-	-	-	-	-	3.2.65
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**METALLIC PIPES TRAINING PANEL TYPICAL JOB CARD FOR EXAMPLE**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3265E2	

TYPICAL TRAINING PANEL WITH MEDIUM PRESSURE HOSES



THE AN FITTINGS CAN BE IN ALUMINIUM (CODE D) OR STEEL (WITHOUT CODE)

-	-	-	-	-	-	3.2.65
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**METALLIC PIPES TRAINING PANEL TYPICAL JOB CARD FOR EXAMPLE**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3265E3	

Job Sequence

Flexible hoses installation panel

Following the specific job card

- Check the correct assembly of the AN832 bulkhead fittings with the AN924 nut.
- Check the general condition of these fittings (absence of marks, cracks, damage, etc.).
- Check the presence and the state of the nut plates.
- Check each hose delivered (condition of the hose tube, condition of the fitting, swivel, etc.).

Before installation, the hose should be thoroughly inspected as previously explained.

If the hose is straight, the inside can be examined by looking through it toward a light source. If there is an elbow on one end, a flashlight or other light source can be used to illuminate the inside of the elbow, and the interior of the tube can be examined by looking in the opposite end.

The hose should be of sufficient length to provide about 5 to 8% slack.

- Pre-position the hose by hand tightening one each end.
- The hose must be perfectly aligned with the fitting.

The hose should be installed without twisting by keeping the lay line on the hose straight.

Bends in the hose should not have a radius less than 12 times the ID of the hose for normal installations.

- Install, without tightening them, the MS clamps.
- Check their orientation and the protective device placement.

Clamps should not be over tightened because of the danger of damaging the hose.

- Tighten the hoses fittings to the correct torque.

  Proper torque values are given in Table below (in-lb).

Tubing O.D. (inches)	Fitting bolt or Nut size	House end fittings and Hose assmblies	
		Minimum	Maximum
3/16	-3	70	120
1/4	-4	100	250
5/16	-5	210	420
3/8	-6	300	450
1/2	-8	500	850

Commons installation defects

Slack

Hose assemblies must not be installed in a manner that will cause a mechanical load on the hose.

When installing flexible hose, provide slack or bend in the hose line from 5 to 8 percent of its total length

to provide for changes in length that will occur when pressure is applied. Flexible hose contracts in length and expands in diameter when pressurized.

Twisting

Hoses must be installed without twisting to avoid possible rupture of the hose or loosening of the attaching nuts. Use of swivel connections at one or both ends will relieve twist stresses. Twisting of the hose can be determined from the identification stripe running along its length. This stripe should not spiral around the hose.

Bending

To avoid sharp bends in the hose assembly, use elbow fittings, hose with elbow-type end fittings, or the appropriate bend radii.

Technical information

Hose fittings are made in a variety of configurations, such as straight, 45°, and 90°. They are made to mate with either flared tube fittings (AN and MS types) and flare less fittings (MS types).

Hose fittings designed to mate with flared tube fittings incorporate a 37° bevel to match the cone of the fitting.

Checking insulation sleeve

Objectives: At the end of this exercise you shall be able to·
• check insulation sleeve on pipe and ducts.

Job Sequence

The instructor will present the different types of insulation sleeves and the possible damages, they causes.

He shall put 10 different insulation sleeves with defects.

He will ask the trainees to look for them and write them down in Table 1.

Trainees will:

- note down the defects.
- record them in Table 1.

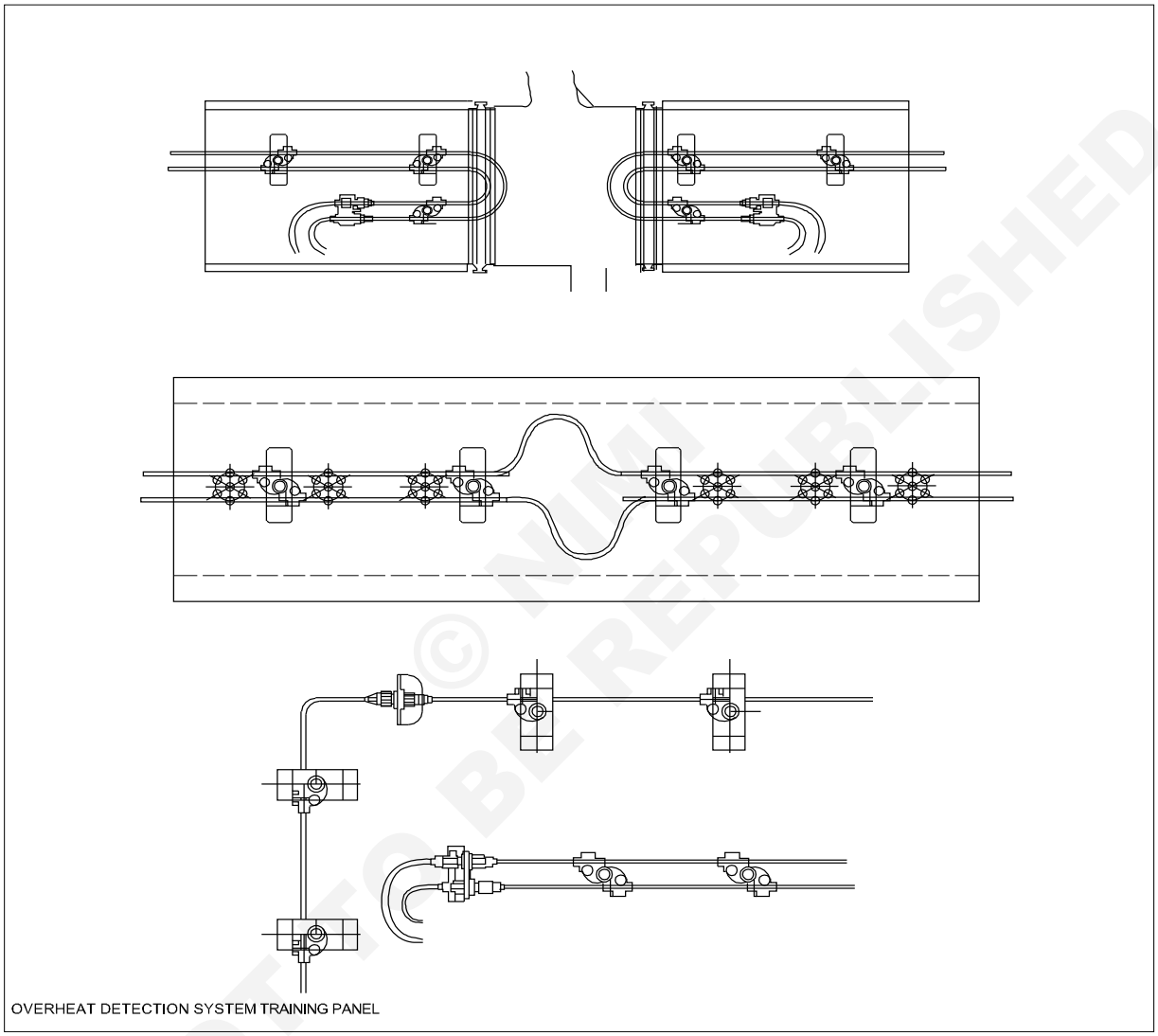
The instructor will check for correctness.

Part .No	Defect found	Origin / How to avoid
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Perform assembly/disassembly of Over Heat Detection System

Objectives: At the end of this exercise you shall be able to·
• install OHDS on aircraft components.

EXAMPLE OF HOME-MADE TRAINING PANEL WITH REAL AIRCRAFT PARTS
AVAILABLE ON TRAINING INSTITUTE



OVERHEAT DETECTION SYSTEM TRAINING PANEL

3	35X180 -Thick...2	-	AW-2024	-	-	3.2.67
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	EXAMPLE OF TRAINING PANEL				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3267E1	

Job Sequence

OHDS installation panel

Following the specific job card

- Prepare the task.
- Bend and assemble in accordance with job card.
- Check the assembly.

Note: The following pages give an example of a job card for this chapter.

Depending on the available material, it will need to be adapted.

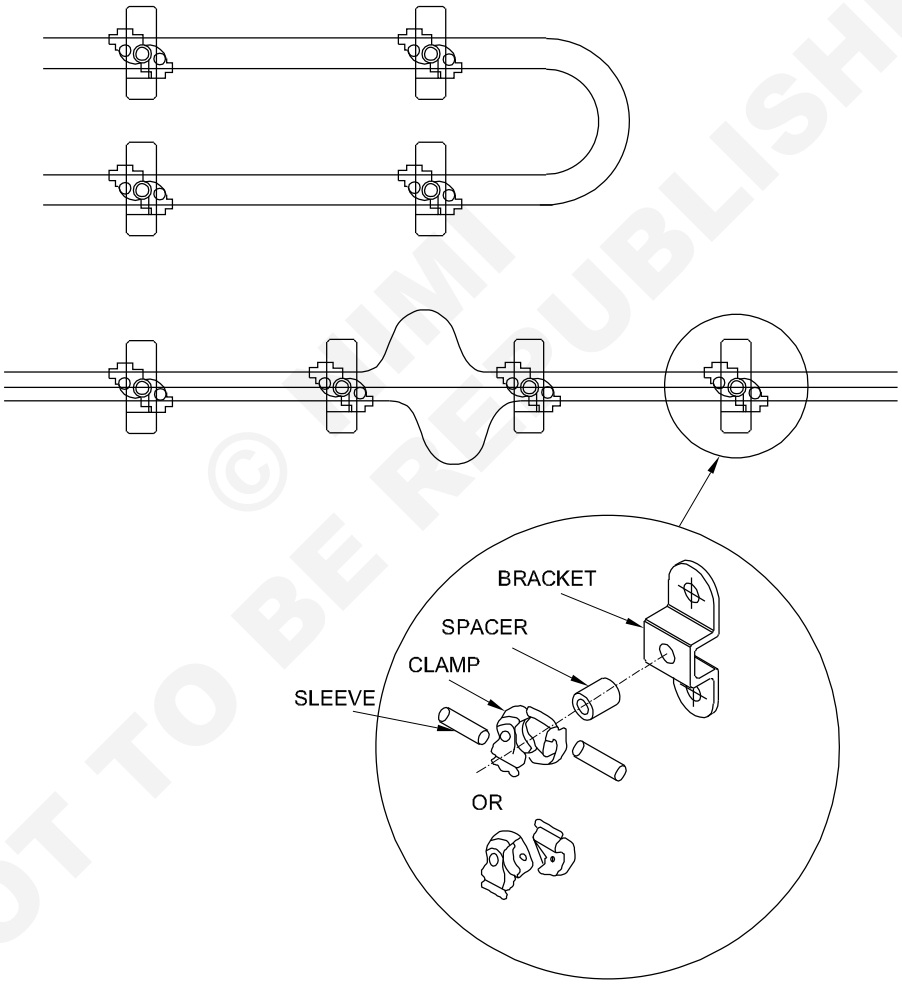
The material mentioned is only given as an example. Procurement will be based on the real specific exercise set up.

Perform assembly/disassembly of Over Heat Detection System

Objectives: At the end of this exercise you shall be able to·

• assemble/disassemble over heat detection system

TYPICAL OHDS INSTALLATION TRAINING PANEL



OVERHEAT DETECTION SYSTEM TRAINING PANEL

-	-	-	-	-	-	3.2.67
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**OHDS TRAINING PANEL TYPICAL JOB CARD FOR EXAMPLE**				DEVIATIONS	TIME : 20 Hrs
					CODE NO : AFN3267E2	

Job Sequence

OHDS installation panel

Note: The brackets are mounted in the training panel

Parts List

- Continuous sensitive element.
- Clamp.
- Protective sleeve.
- Spacer.
- Screw

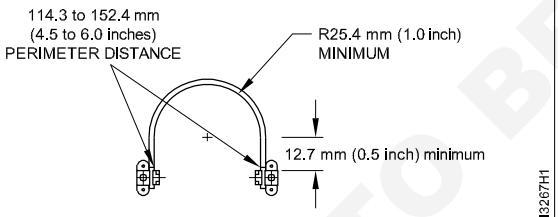
- Prepare the task.
- Inspect all parts and the structure brackets.
- Install all mounting clamps before installing the sensing element.

The mounting clamp that support the sensing loops are attached to brackets along the pipe or the structure.

They are fixed by means of a main fixing screw and a spacer.

- Route the sensor element over the mounting clamps as shown in the drawing.
- Insert the sleeve. When mounting silicone sleeve, the opening must be on the outside.

Fig 1



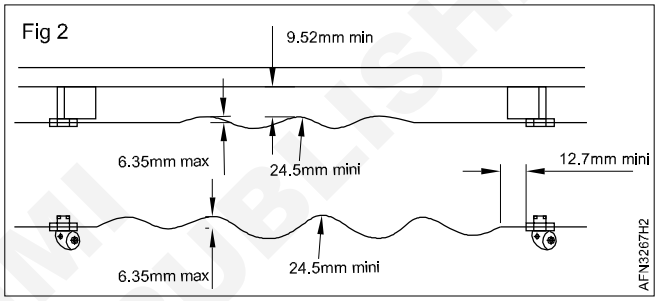
- Close the mounting clamps by turning the mounting head 90° clockwise.
- The slot of the fixing screw must be parallel to the direction of the sensing element.

To prevent the sleeve opening, the sensing elements must remain straight and free of curvature for a minimum length of 12.7 mm in the proximity of the mounting clamps.

Throughout the length of the sensing element, the minimum bending radius (see Figures below) must not be less than 25.4 mm and the maximum undulation must be 6.35 mm.

- For final loop mounting, the values given in the figure below (inner line) must be observed.

Fig 2



Perform assembly/disassembly of different mechanical subassemblies

Objectives: At the end of this exercise you shall be able to·
• disassemble mechanical subassemblies
• assemble mechanical subassemblies.

Job Sequence

Note: Each training centre can have different aircraft components and subassemblies. If they're no aircraft, manufacture a training panel with the available components.

Mechanical part 01

Following the specific job card

- Prepare the task.
- Assemble the mechanical subassembly.
- Check the assembly.

NOTE: Aeronautical mechanical equipment is very varied, and the assembly methods are different. In fact, it is not possible to propose a typical job card as an example.

Each training centre will draw up an exercise based on the equipment that will have been supplied and based on the manufacturer's or builder's documentation.

Wiring technical documentation identification and use

Objectives: At the end of this exercise you shall be able to·
• state the different wiring technical document
• use the wiring technical document.

Job Sequence

TASK 1: **Practice on wiring technical documentation**

The instructor will present the different types of wiring technical documentation.

He shall put:

- **Wiring diagram.**
- **Wiring graph.**
- **Etc.**

He will ask the trainees to look for:

- **The different symbols used.**
- **Explain the information given in the documents.**

Trainees will:

- Explain the symbols and information.

The instructor will check for correctness.

TASK 2: **Practice on wiring by using graph.**

Exercise 1

With the wiring graph WG01 below:

- Calculate the lengths required for the wiring.

Exercise 2

With the wiring graph WG02 below:

- Calculate the lengths required for the wiring.

Fig 1

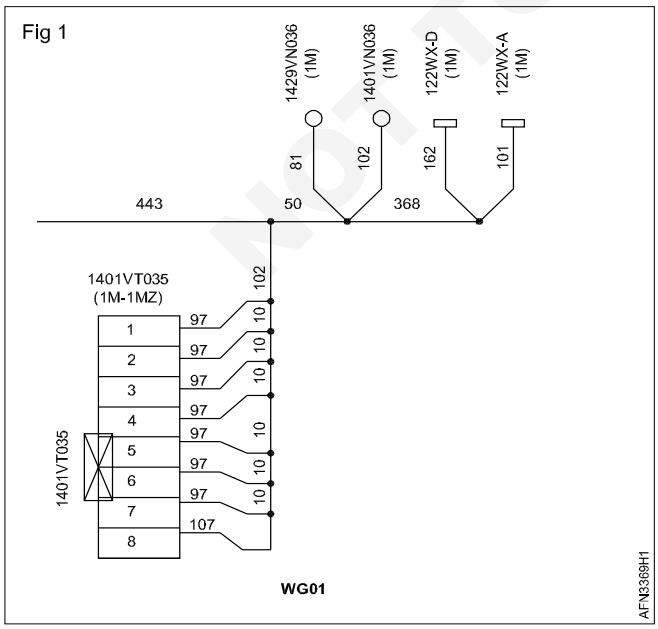
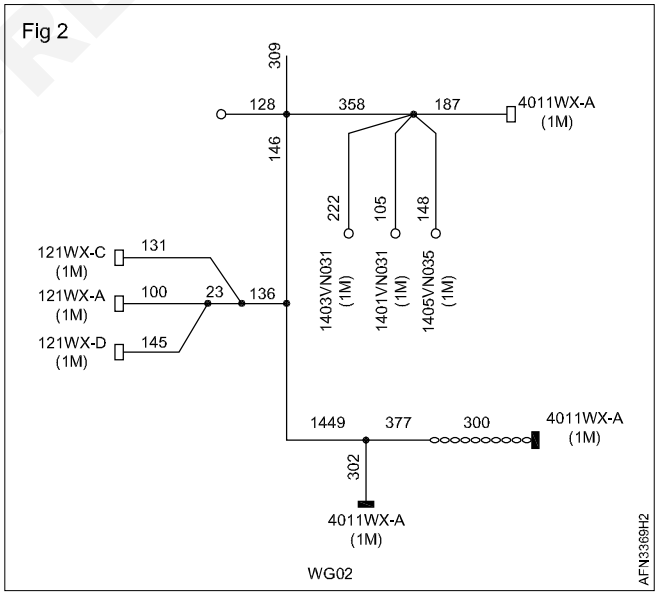


Fig 2

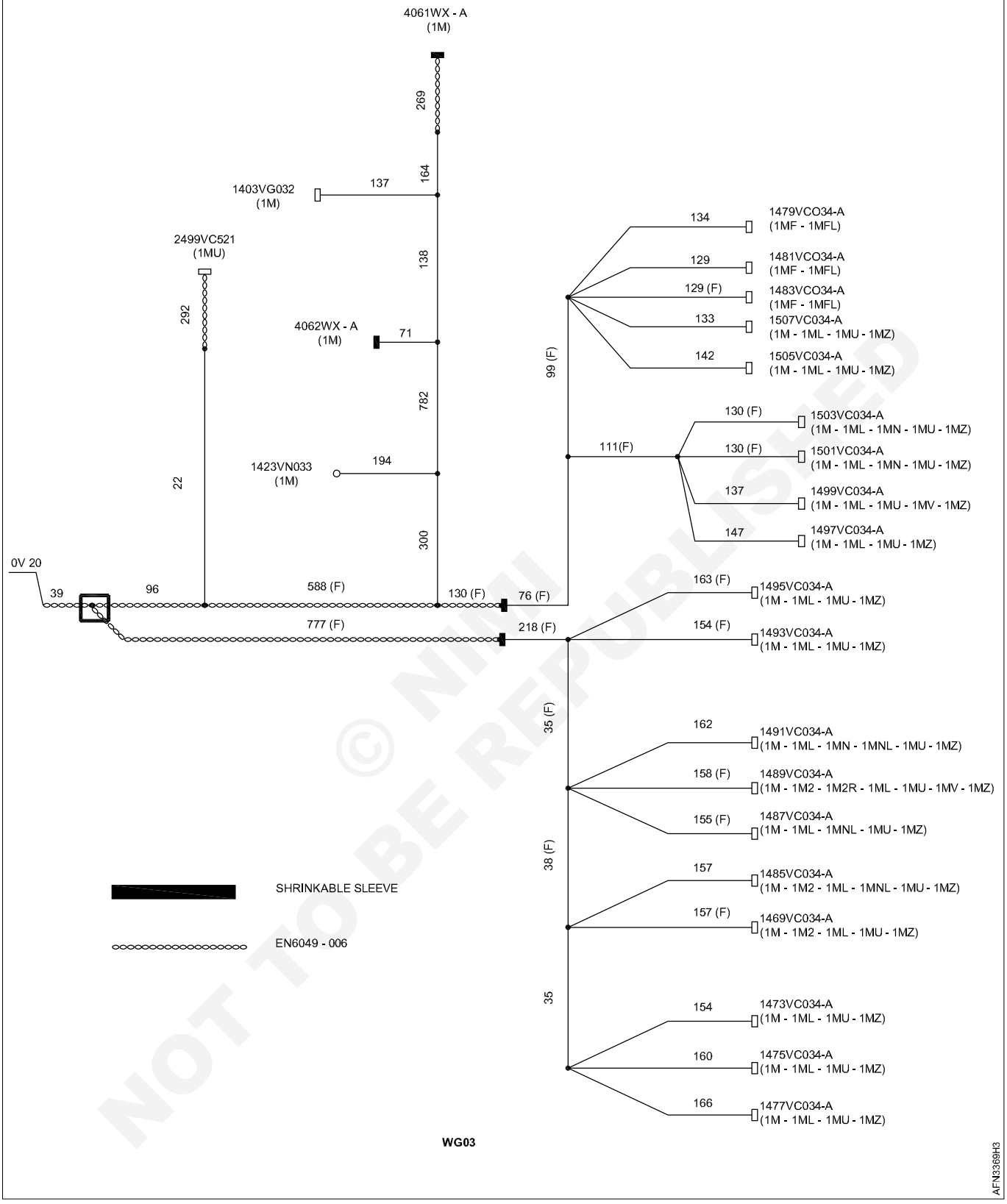


Exercise 3

With the wiring graph WG03 below:

- Calculate the lengths required for the wiring.

Fig 3



Harness kit preparation

Objectives: At the end of this exercise you shall be able to·
• cut different wires/cables types according to length definitions
• use wiring graph and wiring diagram to prepare wires.

Job Sequence

TASK 1: **Cut different wires/cables types according to length definitions**

Using different types of wires and gauges provided by your trainer:

- Make clean end cuts.
- Check the work carried out.

The wires must be cut at 90°.

The insulation must not be damaged.

The pliers used must be in accordance with the type and gauge of the cable.

Each wire will have a length of 100mm.

— — — — — — — —

TASK 2: **Use wiring graph and wiring diagram to prepare wires.**

- Determine the wires and their lengths according to the wiring graph and wiring diagram below.
- Complete the table.
- Cut and identify the wires for a next exercise.
- Add 5 cm to each length to allow for future wiring.

Fig 1

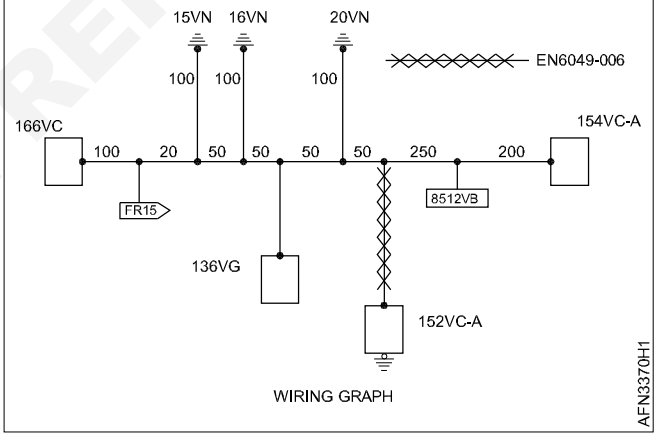
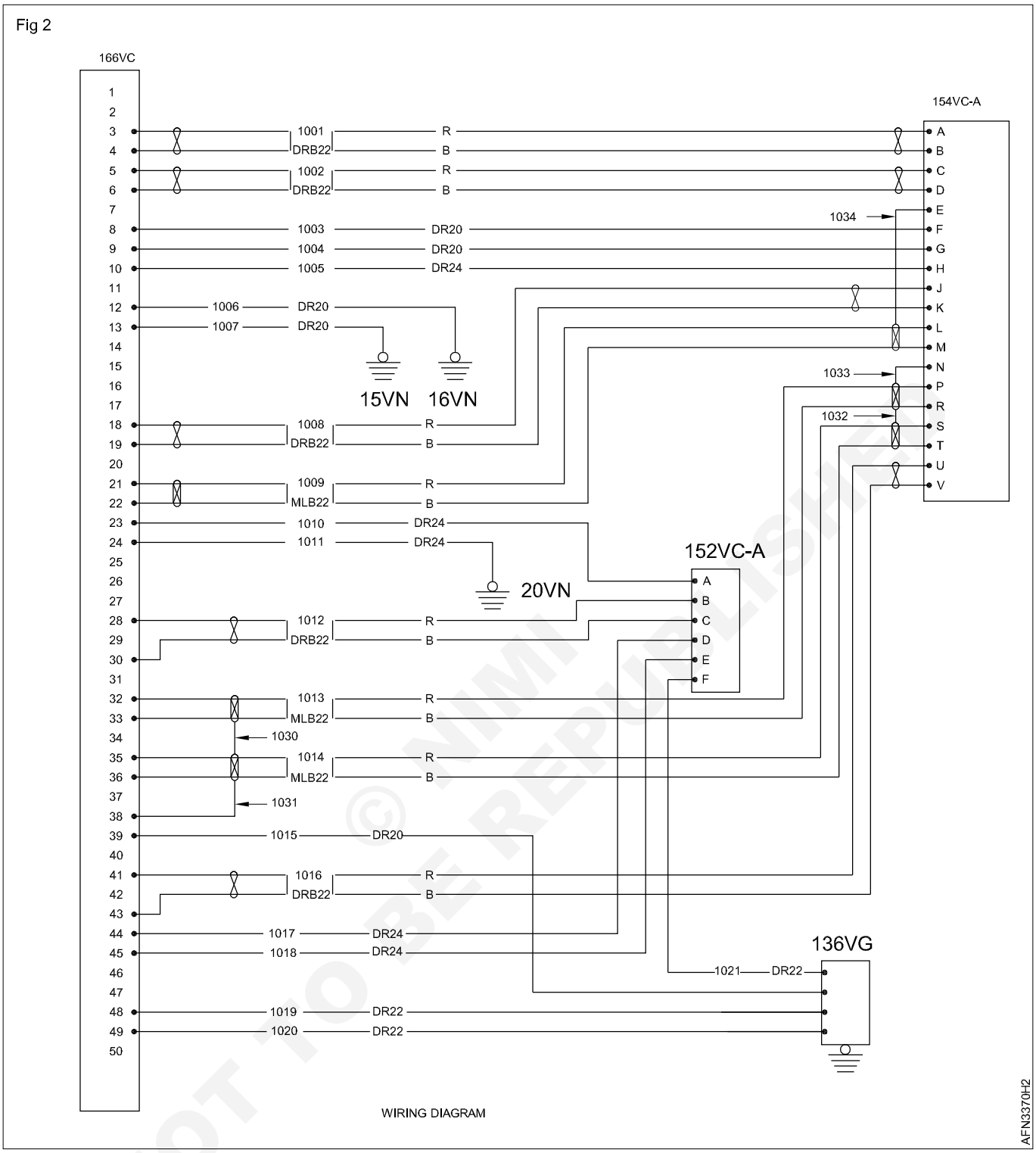


Fig 2



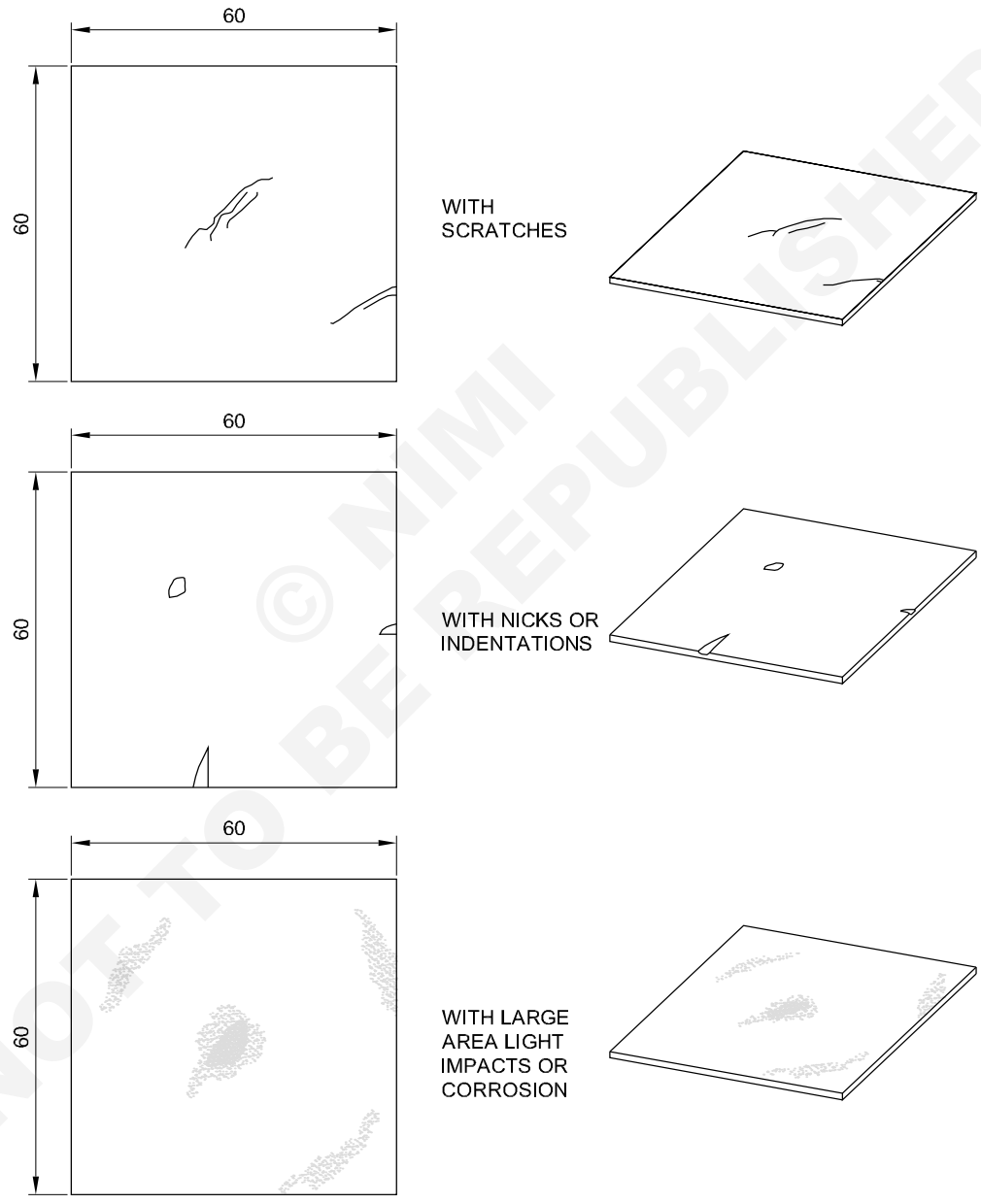
WIRE PREPARATION TABLE

Complete the table Bellow

Type of wire	Reference	Qty x Length	Wire code
Single core wire	EN2267-010A002S	1 x 50 cm	DR24 (For cutting wires No 1030 to 1034)
……..	EN2267-010A002S	3 x …… cm	……
		1 x ……cm	
……..	EN2267-010A004S	4 x ……cm	……
……..	EN2267-010A006S	1 x ……cm	……
		1 x ……cm	
		1 x ……cm	
		1 x ……cm	
……..	EN2267-009B004P	1 x ……cm	……
		3 x ……cm	
……..	EN2267-009B006P	1 x ……cm	……
……..	EN2267-013B004F	3 x ……cm	……

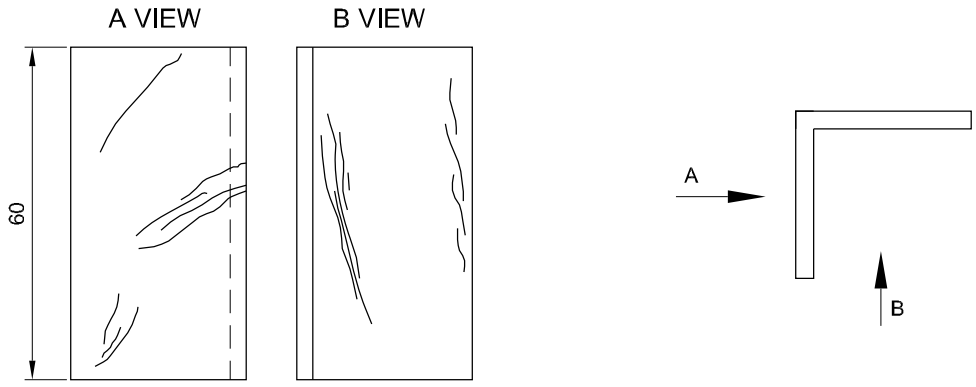
Perform surface treatments

Objectives: At the end of this exercise you shall be able to·
- **sand surface using hand pad and power tools**
- **rework scratches on flat surface**
- **rework nick or indentation on edges**
- **perform Alodine touch-up on reworked area**
- **perform painting touch-up after rework.**

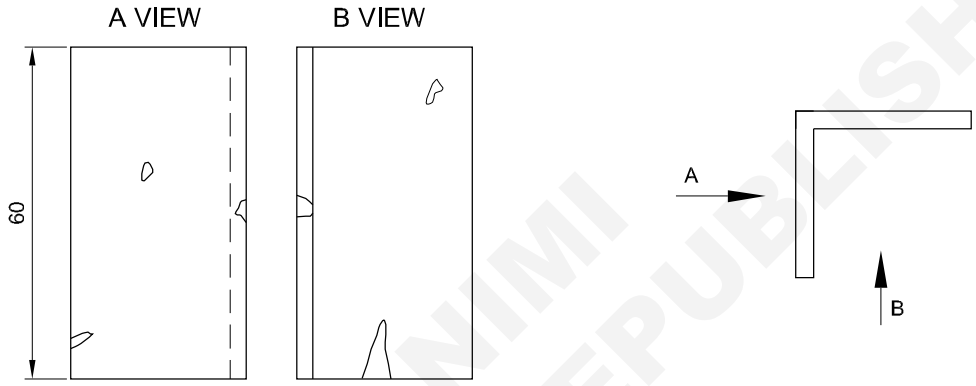


3	60x60x2	-	AW2017	-	-	4.1.80
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

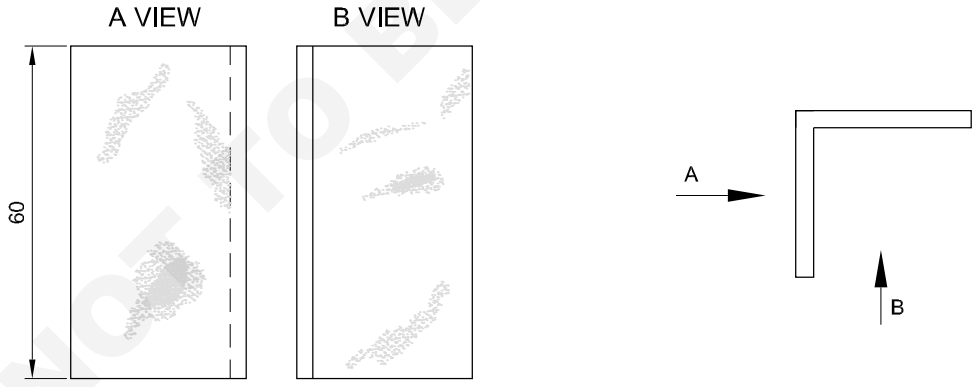
SCALE NTS	PERFORM SURFACE TREATMENTS TASK 1 TO 3	DEVIATIONS	TIME 20hrs
		CODE NO. AFN4180E1	



WITH SCRATCHES



WITH NICK OR INDENTATION



WITH LARGE AREA WITH LIGHT IMPACTS OR CORROSION

3	ANGLE 30x30x3-L.60	-	AW6060	-	-	4.1.80
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE NTS	**PERFORM SURFACE TREATMENTS TASK 4 TO 5**				DEVIATIONS	TIME 20hrs
					CODE NO. AFN4180E1	

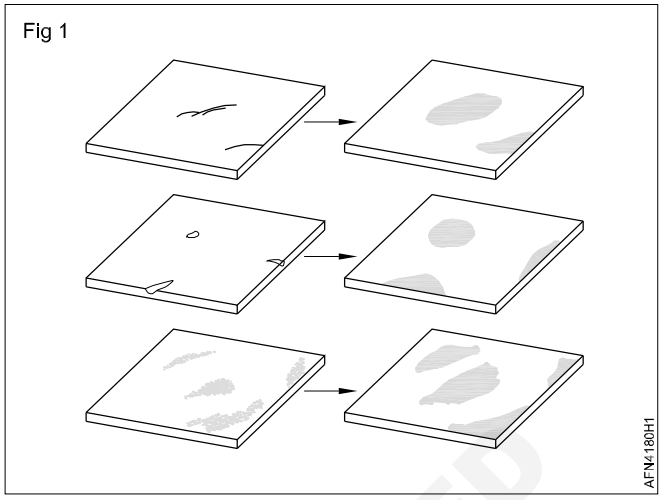
Job Sequence

TASK 1: **Rework**

Using different painted aluminium flat components with defects like scratches, nick, etc. provided by your trainer:

- Rework the defect by manual sanding.
- Rework the defect using power tool.
- Measure the reworked area.
- Check the work carried out.

Fig 1

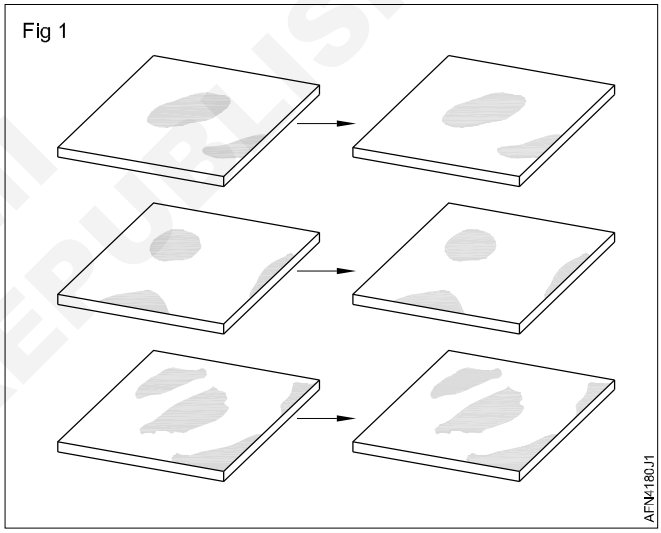


TASK 2: **Protect with Alodine**

Using the task 1 reworked components:

- Prepare by cleaning the surfaces.
- Perform surface protection with Alodine 1132 touch-up.
- Check the work carried out.

Fig 1

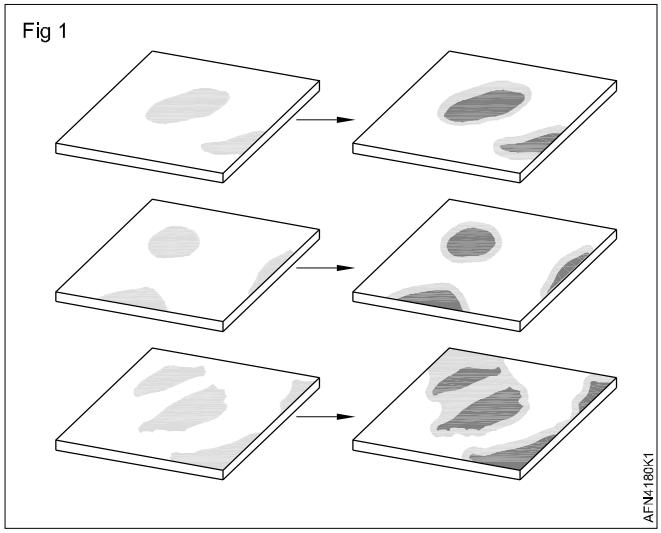


TASK 3: **Finish with primer**

Using the task 2 prepared components:

- Check the surfaces.
- Perform surface protection with wash primer or other structural paint touch-up.
- Check the work carried out.

Fig 1



TASK 4: **Rework 3 angles**

Using different aluminium painted angles with defects like scratches, nick, etc. provided by your trainer:

- Rework the defect by manual sanding.
- Rework the defect using power tool.
- Measure the reworked area.
- Check the work carried out.

— — — — — — — —

TASK 5 : **Protect with Alodine 3 angles**

Using the TASK 1 reworked components:

- Prepare by cleaning the surfaces.
- Perform surface protection with Alodine 1132 touch up.
- Check the work carried out.

— — — — — — — —

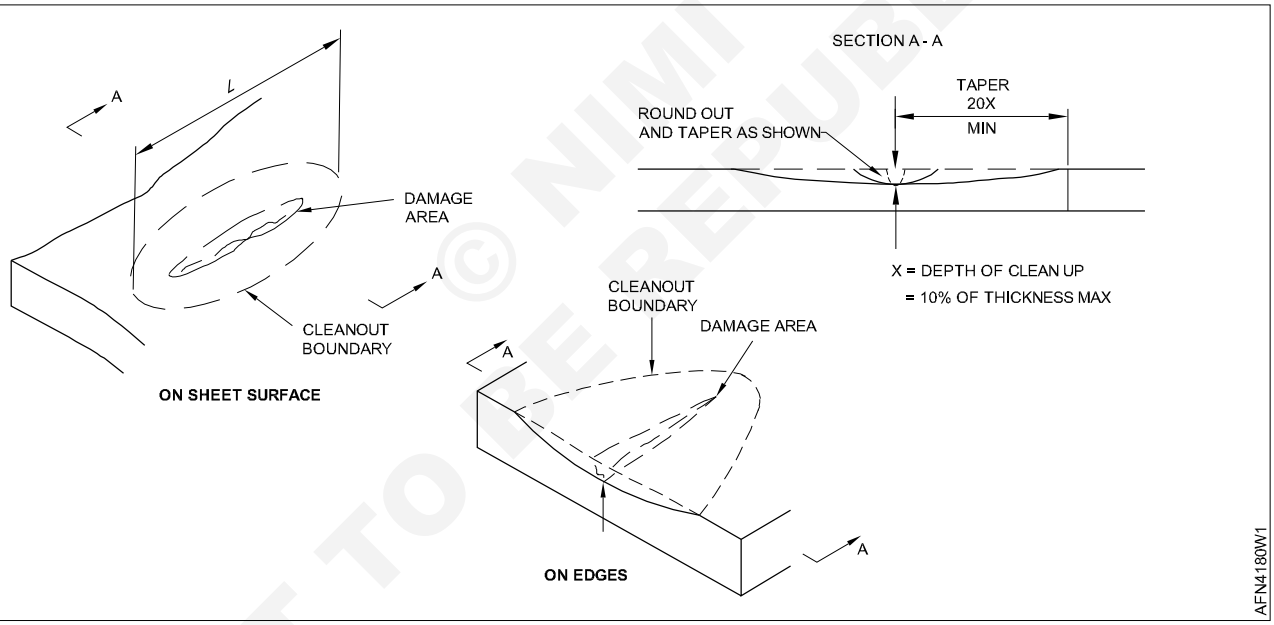
TASK 6 : **Finish with primer 3 angles**

Using the TASK 2 prepared components:

- Check the surfaces.
- Perform surface protection with wash primer or other structural paint touch-up.
- Check the work carried out.

Check all reworking following these values

Fig 1



Skill Sequence

Damage evaluation

Objectives: This shall help you to·
• decide what type of damage is found.

You must decide what type of damage has occurred to a structural member or to a structural material. The definitions of the different types of damage that can occur to the external skin of the airplane panels are given in the that follow:

Abrasion

A damaged area that is the result of scuffing, rubbing, or another surface erosion. This type of damage is usually rough and has an irregular shape.

Corrosion

Damage that is the result of a complex electro-chemical action and gives a cross-sectional area change. The depth of this damage must be determined by a cleanup or a removal operation. This type of damage occurs on the surfaces, hole bores, or edges of structural elements.

Crack

A partial fracture or a full break in the material that causes a significant cross-sectional area change. This damage usually has an irregular line and is often the result of fatigue in the material.

Dent

A damaged area that is pushed in from its normal contour with no change in the cross-sectional area of the material. The edges of the damaged area are smooth. This damage is usually caused by a hit from a smoothly contoured object. The length of the dent is the longest distance from one end to the other end. The width of the dent is the second longest distance across the dent, measured at 90 degrees to the direction of the length.

Gouge

A damaged area where the result is a cross-sectional change caused by a sharp object and gives a continuous, sharp or smooth groove in the material.

Nick

A local gouge with sharp edges. You can consider a series of nicks in a line pattern to be equal to a gouge.

Scratch

A line of damage in the material where the result is a cross-sectional area change. This damage is usually caused by contact with a very sharp object.

Remove corrosion, nicks, scratches and gouges

Objectives: This shall help you to·
• remove corrosion, nicks, scratches and gouges.

Do not use a carbon steel brush or steel wool on aluminum metal surfaces. If you do not obey, then tiny dissimilar metal particles will become embedded in the surface of the metal. This can cause corrosion and more damage to the part.

Abrade to remove all of the paint in the damaged area.

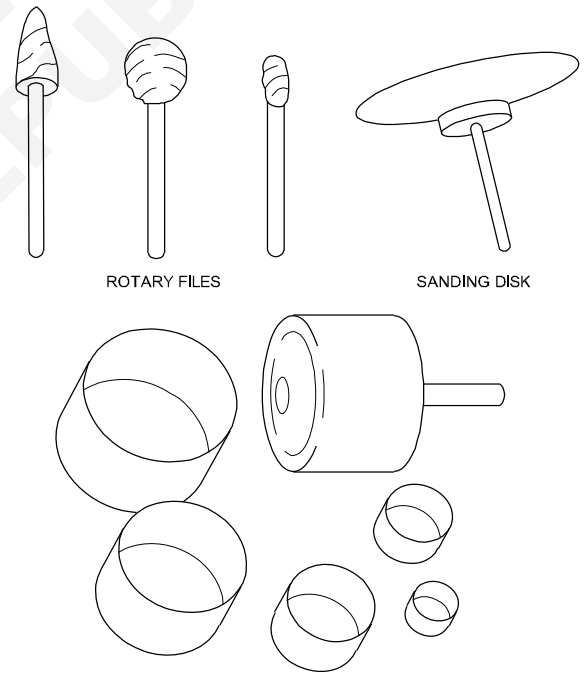
Use the abrasives given in Figure 1 to blend out the damaged area.

After you complete the surface rework, then you must make a visual inspection to make sure that the area does not have cracks. Do a visual inspection with a 10-power magnifying glass to make sure all of the corrosion is removed and to find possible cracks.

Clean the damaged area with a soft cloth moist with cleaning solvent.

Apply a protective treatment and primer to the base metal surface.

Fig 1



Protective treatment by AlodineTM

Objectives: This shall help you to·
• protect surfaces of aluminium alloy.

When you do a rework procedure that breaks the surface of an initial structure, you must apply a protective treatment. The treatment makes a base for the paint and inhibits corrosion when you apply it before the installation of the repair parts.

Aluminum alloys in initial structure need a subsequent chemical conversion coating when the repair processes open the areas to corrosion.

Aluminum alloy repair parts need a protective treatment before you apply a primer.

Use Alodine 1200 or Alodine 1132 on aluminum.

Use mechanical cleanup procedures to remove burrs or sharp edges.

The products that follow are approved for use to make a chemical film on aluminum alloys: These film layers are softer than the anodic treatment. However, they give a satisfactory protective layer and paint base.

Alodine® 1200™ powder

Alodine is a registered trade name for a proprietary procedure owned by Henkel Corp.

use extreme care when you work with corrosive chemicals.

use a respirator, goggles, rubber or neoprene gloves, boots and aprons made of acid-resistant materials when you work with the powder or apply the solution.

corrosive chemicals can cause injury to persons.

do not permit the chemical to touch your skin. wash it off immediately with water.

if the chemical gets in your eyes, wash with water followed by an eye wash.

discard them. if you do not, they can become a fire hazard.

Prepare the chemical conversion coating solution.

Mix the powderwith deionized water in a stainless or acid-resistant container.

NOTE: Prepare the solution in small quantities. A solution that is not used in 24 hours is not usable and should be thrown away.

Stir to mix until the powder is fully dissolved. Let the solution stand for one hour before use. You can

disregard small amounts of insoluble material which may appear.

Abrade the surface to be treated with Scotchbrite pads.

Clean the area to be chemical conversion coated with a solvent or degreaser and a clean brush or rags.

Apply the coating fully and equally with a fiber or nylon brush or clean cheesecloth.

Let the solution stay for 3 to 4 minutes to form a coating. Keep the area moist during this period by gently blotting with a cheesecloth moist with the chemical conversion solution.

Do not allow the applied film to become dry before it is rinsed with water.

Rinse with water by gently blotting with a moist (not soaked) cheesecloth.

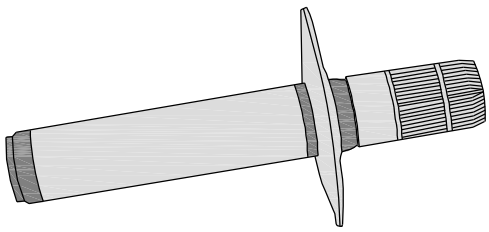
Blot gently for 1 to 2 minutes then use a clean cheesecloth.

Apply the final finish (primer) as soon as possible after drying but within 16 hours. Wear clean gloves to keep the part clean and dry and to prevent surface contamination.

Alodine® 1132™Touch-N-Prep® Coating

BONDERITE M-CR 1132 AERO

Fig 1



Corrosive chemicals can cause injury to persons.

Do not permit the chemical to touch your skin. Wash it off immediately with water.

If the chemical gets in your eyes, wash with water followed by an eye wash.

Discard them. If you do not, they can become a fire hazard.

Alodine 1132 Touch-N-Prep no-rinse conversion coating effectively repairs bare aluminum substrates to prevent corrosion. It does not require rinsing and can be air dried or force-dried with hot air.

Before applying the coating, the treated surface must be cleaned using the following process:

Use a moistened abrasive pad to remove oxides from the surface of the metal.

Wipe substrate with a damp lint-free cloth to ensure complete removal of soils and dislodged oxides generated from the previous step.

Allow surface to dry before Touch-N-Prep application.

To activate, hold the Touch-N-Prep pen upright, pop off the cap and hold the pen tip down onto a clean surface to begin the flow of solution to the tip. Do not twist or turn to remove the cap, since this may result in the pen leaking.

Press the pen tip down on the surface until solution fills the pen

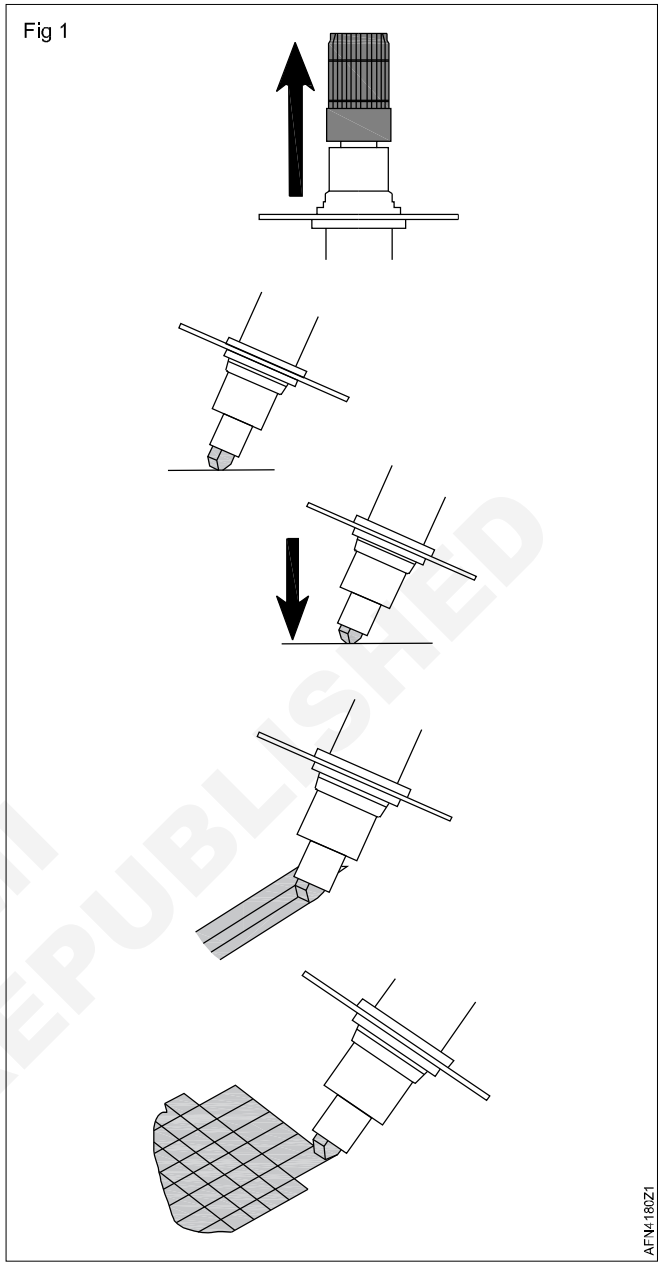
tip. Apply the Alodine 1132 solution to the metal surface with firm, smooth, even strokes, covering all edges. Overlap each stroke and allow to dry.

Within 5 minutes of the first coat, apply a second coat at a 90° angle to the first coat with the same smooth, firm stroke.

Allow the Alodine Touch-N-Prep coating to air dry thoroughly.

Always immediately replace the cap when not in use to avoid evaporation and contamination.

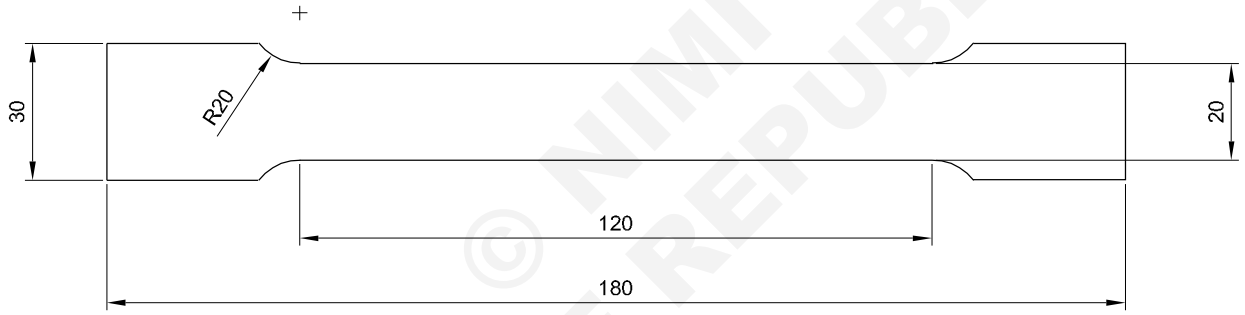
Fig 1



Tensile Test n°4 Heat treatment

Objectives: At the end of this exercise you shall be able to·
- **prepare component to be heat treated**
- **perform heat treatment following instruction**
- **check the correct application of the heat treatment.**

SPECIMEN 1



MATERIAL: ALUMINIUM 2024

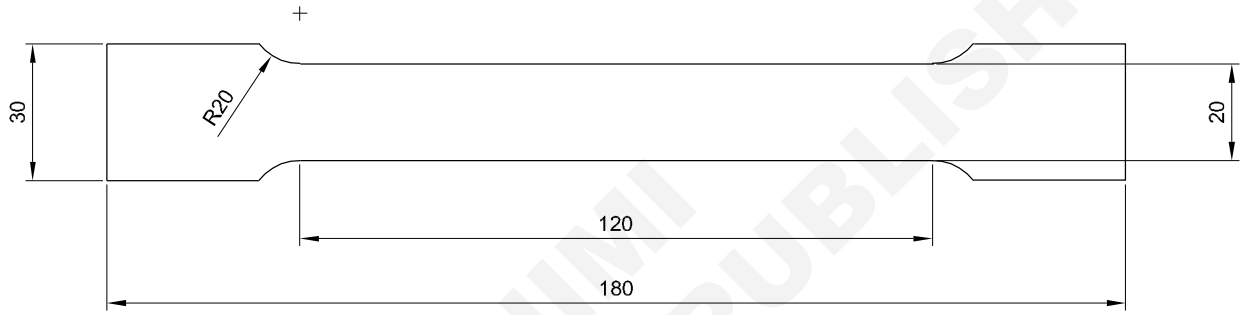
THICKNESS: 2MM

QUANTITY: 3

TOLERANCES: SEE TRADE THEORY, 2.1.33

3	35 x 180 - THICKNESS 2	--	AW-2024	--	–	4.1.81
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE NTS	**HEAT TREATMENT TENSILE TEST SPECIMENS SPECIMEN 1**				DEVIATIONS	TIME 3hrs
					CODE NO. AFN4181E1	

SPECIMEN 2



MATERIAL: ALUMINIUM 7075

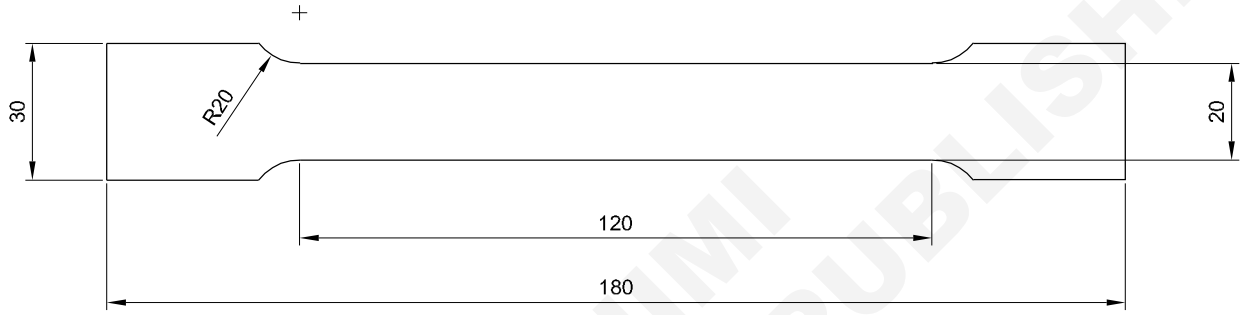
THICKNESS: 2MM

QUANTITY: 3

TOLERANCES: SEE TRADE THEORY, 2.1.33

3	35 x 180 - THICKNESS 2	--	AW-7075	--	--	4.1.81
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE NTS	**HEAT TREATMENT TENSILE TEST SPECIMENS SPECIMEN 2**				DEVIATIONS	TIME 3hrs
					CODE NO. AFN4181E2	

SPECIMEN 3



MATERIAL: ALUMINIUM 5056

THICKNESS: 2MM

QUANTITY: 3

TOLERANCES: SEE TRADE THEORY, 2.1.33

3	35 x 180 - THICKNESS 2	--	AW-5056	--	–	4.1.81
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE NTS	**HEAT TREATMENT TENSILE TEST SPECIMENS SPECIMEN 3**				DEVIATIONS	TIME 3hrs
					CODE NO. AFN4181E3	

Job Sequence

TASK 1: **********

SPECIMEN 1 - Aluminium 2024

3 specimens

- Check dimensions and thickness.
- Mark external dimensions and radii.
- File the external dimensions and radii.
- Drawn filing all edges.
- Deburr edges.
- Check dimensions.

The dimensions and geometries are conform.

YES ☐ NO ☐

The quality of the surfaces is in conformity.

YES ☐ NO ☐

SPECIMEN 2 - Aluminium 7075

3 specimens

- Check dimensions and thickness.
- Mark external dimensions and radii.
- File the external dimensions and radii.
- Drawn filing all edges.
- Deburr edges.
- Check dimensions.

The dimensions and geometries are conform.

YES ☐ NO ☐

The quality of the surfaces is in conformity.

YES ☐ NO ☐

SPECIMEN 3 - Aluminium 5056

3 specimens

- Check dimensions and thickness.
- Mark external dimensions and radii.
- File the external dimensions and radii.
- Drawn filing all edges.
- Deburr edges.
- Check dimensions.

The dimensions and geometries are conform.

YES ☐ NO ☐

The quality of the surfaces is in conformity.

YES ☐ NO ☐

— — — — — — —

TASK 2: **Perform heat treatment on each specimen.**

For specimens 1:

Make heat treatment following technical data.

Note the information below:

Solution temperature: ……

Soak time: ……

Tranfert time: ……..

For specimens 2:

Make heat treatment following technical data.

Note the information below:

Solution temperature: ……

Soak time: ……

Tranfert time: ……..

For specimens 3:

Make heat treatment following technical data.

Note the information below:

Solution temperature: ……

Soak time: ……

Tranfert time: ……..

— — — — — — — —

TASK 3: **Perform a tensile test on each specimen.**

Compare with the curves produced in 2.1.29 exercise for each specimen and material.

With your trainer, compare the results and explain.

Solution heat treatment temperature: 495°C ± 5°C (923°F ± 9°F)

THICKNESS OF MATERIAL (Th.) mm (in.)	SOAK TIME (mn.)		MAXIMUM TRANSFER TIME(S)	COOLING
	MINIMUM PLATED PRODUCTS	MINIMUM NON-PLATED PRODUCTS		
Th. ≤ 0.6 (0.0236)	20	15	≤ 5	Water ≤ 30°C (86°F)
0.6 < Th. ≤ 0.8 (0.0236) (0.031)	25	20	≤ 7	
0.8 < Th. ≤ 1.6 (0.031) (0.063)	30	25	≤ 10	
1.6 < Th. ≤ 2.5 (0.063) (0.098)	35	30	≤ 10	
2.5 < Th. ≤ 6 (0.098) (0.236)	50	40	≤ 10	
6 < Th. ≤ 10 (0.236) (0.394)	60	50	≤ 10	

AGEING - Temperature: ambient. Minimum time: 4 days

TEMPERING - Temperature: 190 ± 3°C (374 ± 5.4°F), time: 10 hours.
Cooling: in free air.

RECRYSTALLIZATION ANNEALING - Temperature: 385 ± 5°C (725 ± 9°F),
time: 1 hour.
Cooling: in oven (< 35°C/h) (95°F/h) until
250°C (482°F), then in still air.

RECOVERY ANNEALING - Temperature: 300 ± 10°C (572 ± 18°F), time: 30 to 60 mn.
Cooling: in free air.

TECHNICAL DATA – AW5056, 5086

INITIAL CONDITION	FINAL CONDITION	TREATMENT TO BE PERFORMED
F or H	O	Recrystallisation annealing

RECRYSTALLIZATION ANNEALING - Temperature: 385 ± 10°C (725 ± 18°F),
time: 1 hour.
Cooling: in free air.

STRESS RELIEVING - Temperature: 275 ± 10°C (527 ± 18°F), time: 1 hour.
Cooling: slow, in oven.

Solution heat treatment temperature: 465°C ± 5°C (869°F ± 9°F)

THICKNESS OF MATERIAL (Th.) mm (in.)	SOAK TIME (mn.)		MAXIMUM TRANSFER TIME(S)	COOLING
	MINIMUM PLATED PRODUCTS	MINIMUM NON-PLATED PRODUCTS		
Th. ≤ 0.6 (0.0236)	20	15	≤ 5	Water ≤ 30°C (86°F)
0.6 < Th. ≤ 0.8 (0.0236 < Th. ≤ 0.031)	25	20	≤ 7	
0.8 < Th. ≤ 1.6 (0.031 < Th. ≤ 0.063)	30	25	≤ 10	
1.6 < Th. ≤ 2.5 (0.063 < Th. ≤ 0.098)	35	30	≤ 10	
2.5 < Th. ≤ 6 (0.098 < Th. ≤ 0.236)	50	40	≤ 10	
6 < Th. ≤ 10 (0.236 < Th. ≤ 0.394)	60	50	≤ 10	

TEMPERING - Temperature: 135 ± 3°C (275 ± 5.4°F), time: 12 to 16 h.
Cooling: in free air.

RECRYSTALLIZATION ANNEALING - Temperature: 440 ± 10°C (824 ± 18°F), time: 2 h.
Cooling in air + 6 h at 230 ± 10°C (446 ± 18°F)
+
RECOVERY ANNEALING - Temperature: 300 ± 10°C (572 ± 18°F), time: 30 to 60 mn.
Cooling: in free air.

STRESS RELIEVING - Temperature: 135 ± 3°C (275 ± 5.4°F), time: 1 h
Cooling: in free air

Damage evaluation

Objectives: This shall help you to·
- **prepare components for heat treatment**
- **realise heat treatment in aluminium alloys.**

The parts that are to be heat treated must be cleaned before heat treatment.

Heat treatment of wrought aluminium alloys is conditioned by two main characteristics:

- accuracy and homogeneity of treatment temperature,
- rapid transfer of parts to quenching medium, which implies use of adapted equipment.

Quenching means

The most currently used quenching equipment is a water tank.

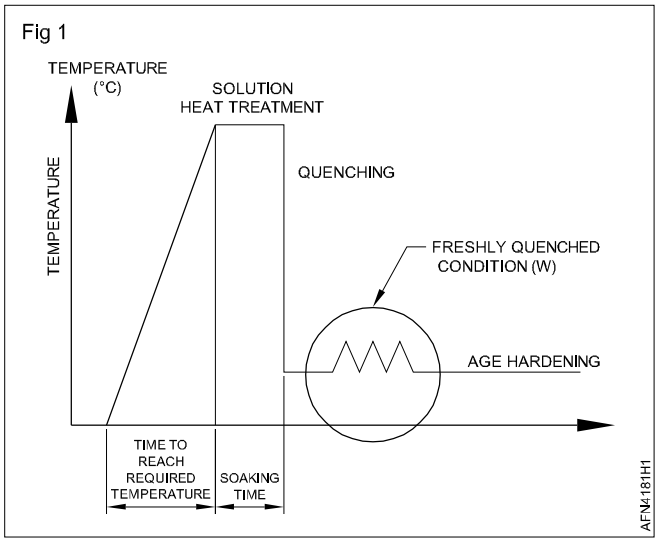
Volume must be sufficient so that there is no noticeable rise in liquid temperature during quenching, even if repeated at specified rates.

Solution heat treatment

This process consists of heating the alloy in a convection oven to a certain temperature and for a certain duration of time and the cooling rapidly in cooling bath. The temperature and the time have been mentioned in table.

Indicated times are measured from the moment when temperature, recorded in different points of oven, is at least equal to minimum resulting from specified tolerance value.

Fig 1



When a batch comprises sections of various thicknesses, the duration of time must be determined with respect to the section of maximum thickness.

Soaking time

Soaking times are estimated from when the solution has reached the specified temperature range.

When a charge includes materials of various thicknesses, including assembled parts and overlapping members, the soaking time should be determined by the greatest material thickness.

Transfer

The time required for transferring the alloy from the over is defined as the time counted from the complete opening of oven door to total immersion of batch in quenching medium.

Quenching

After taking out the batch from the oven, it is to be cooled rapidly in a bath. The cooling must be as rapid as necessary to obtain the required hardness.

Age hardening

After quenching all alloy harden when placed at ambient temperature. This process is called Age Hardening or natural hardening. The time necessary for the complete age hardening is mentioned in the tables. The speed of the phenomenon depends of the chemical composition of the alloy.

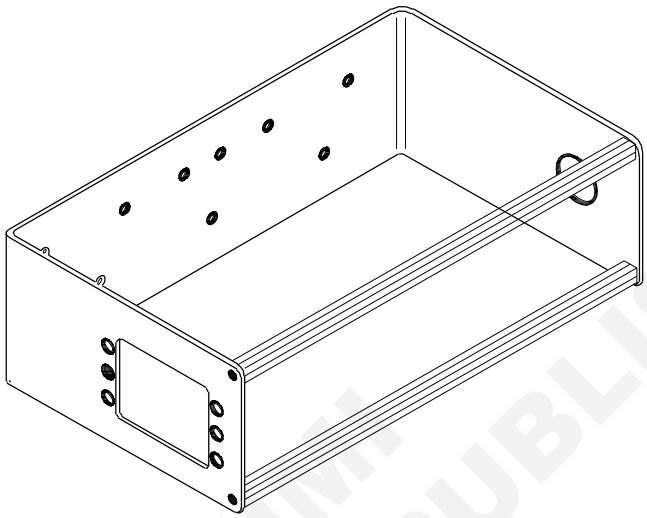
It is slowed down if the temperature is lowered. For conserving the "W" condition (just after quenching), the alloy is kept in a lower temperature in refrigerator.

The plasticity of the alloy decreases as the time of age hardening passes. At the beginning of the age hardening, the plasticity is still sufficient to withstand major deformation operations. This is called the "freshly quenched" conditioned.

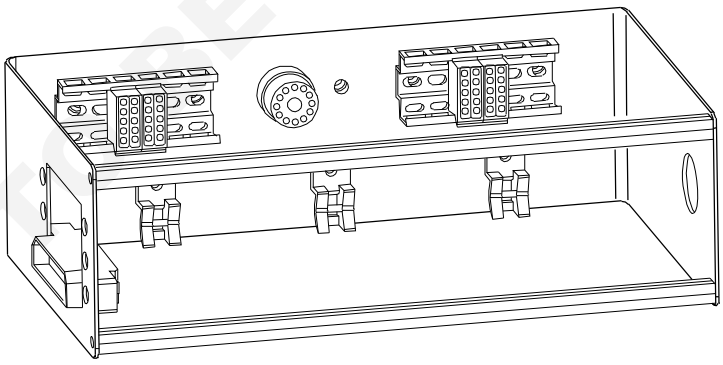
After a few days (for example 2017A) or a few weeks (for example 7075), the mechanical characteristics of the alloy remain relatively stable.

Sheet metal boxes assembly

Objectives: At the end of this exercise you shall be able to·
• make an assembly for electrical integration..



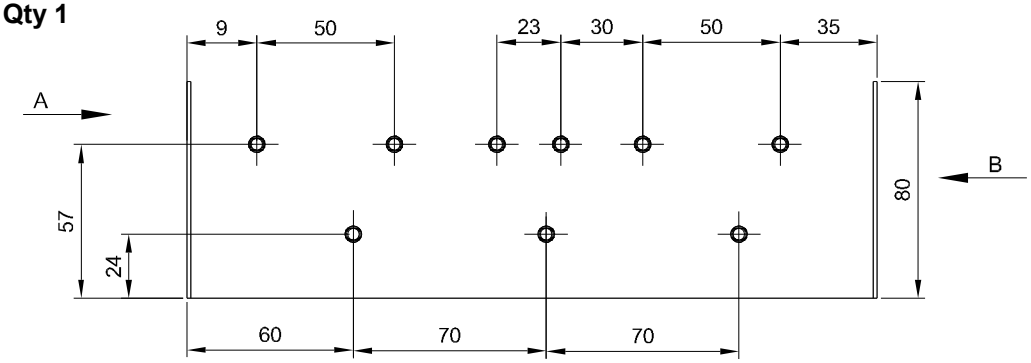
BOX WITHOUT EQUIPMENT - AS FABRICATED IN THIS EXERCISE

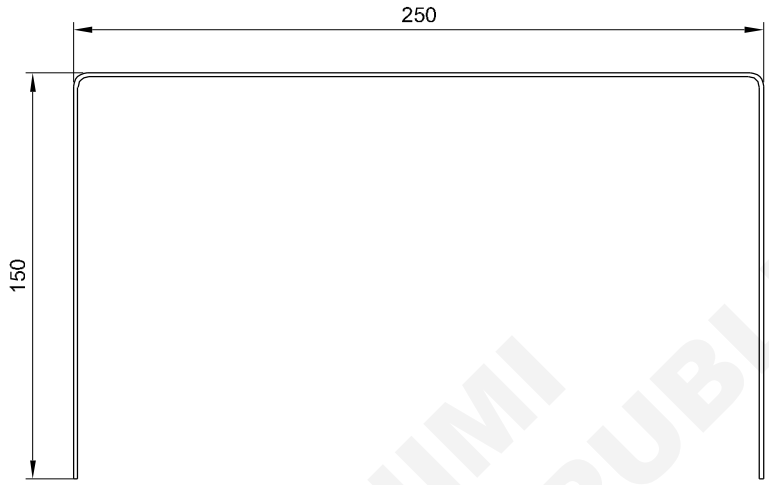


BOX WITH EQUIPMENT FOR ELECTRICAL EXERCISE

-	-	-	-	-	-	4.1.82
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE NTS	**ELECTRICAL BOX ASSEMBLY OVERVIEW**				TOLERANCE ±1	TIME 20hrs
					CODE NO. WL20N1219E1	

Item 001 - Qty 1





Job Sequence

TASK 1: **Parts fabrication**

Item 001 - Qty 1

- Check dimensions and thickness.
- Calculate the developed length.
- Mark and file external dimensions calculated above.

The grain direction must be perpendicular to the bending.

- Finish edges by draw filing.
- Deburr edges.
- Bend the angle using brake.
- Check the angle and the dimensions of flanges. File if necessary.
- Mark and file radii.
- Deburr edges.
- Mark the holes positions.
- Punch the centre of the holes.

Drilling diameter 2.5 and counter drilling

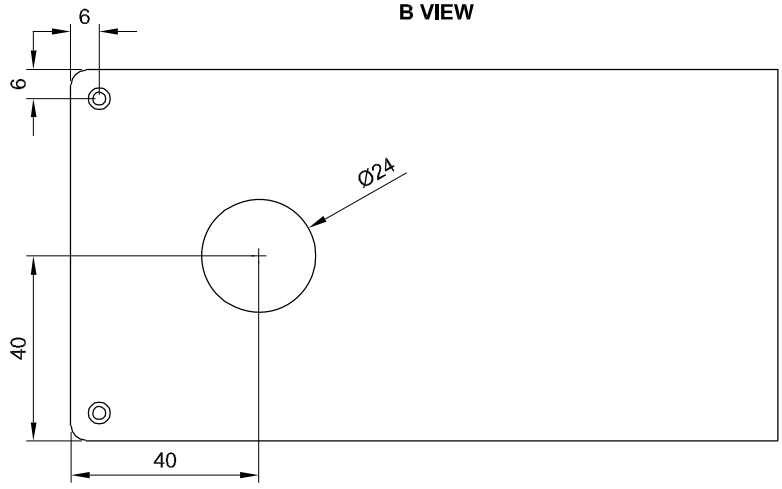
- Hold the workpiece and drill holes with hand drill.
- Deburr both sides.
- Check diameter and perpendicularity of each hole.
- Counter drill to final diameter (5mm)

BEND RADIUS: 4mm
DRILLING: 5mm
THICKNESS: 1.5mm
ANGLE RADII: 4mm

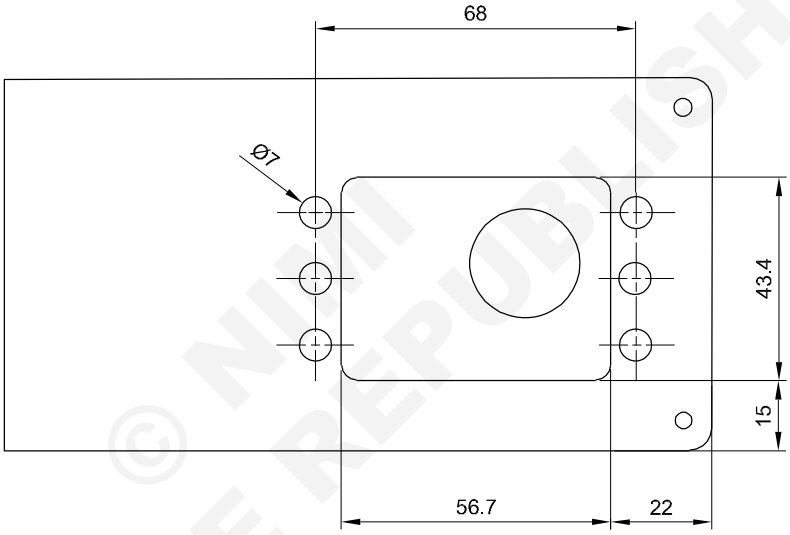
1	550*150- Th. 1.5	--	AW2017	--	--	4.1.82
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE :NTS	**ELECTRICAL BOX ASSEMBLY PART 1 - SHEET 1**				DEVIATIONS	TIME 20hrs
					CODE NO. AFN4182E2	

Item 001 - Qty 1

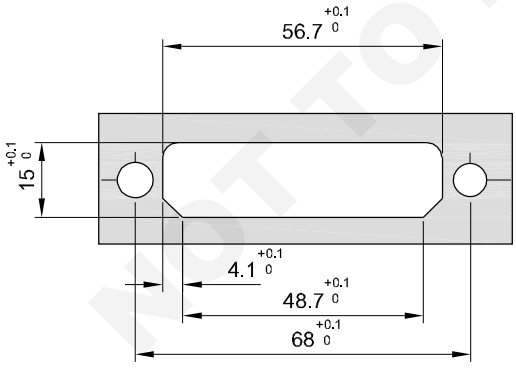
B VIEW



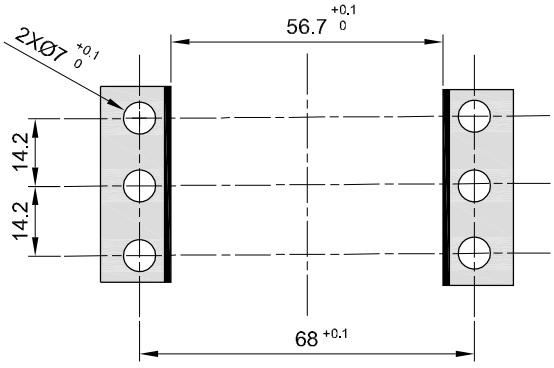
A VIEW



CONNECTOR CUTOUT



SINGLE CUTOUT



MULTIPLE CUTOUT

Drilling: 4mm

1	550x150 – Th. 1.5	-	AW2017	-	-	4.1.82
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE NTS	**ELECTRICAL BOX ASSEMBLY PART 1 - Sheet 2**				TOLERANCE ±1	TIME 20hrs
					CODE NO. AFN4182E3	

REPORT SHEET - ITEM 001

Dimensions	Theorical		Measured
External dimensions	80	±0.5	
	250	±0.5	
Bending angles	150	±0.5	
	90°	-	OK NOK
Radius	R4	±0.5	
	R4	±0.5	
	R4	±0.5	
	R4	±0.5	

Drilling Dia. 4	Theorical		Measured
Edge distance	6	+1 / -0	
Number of holes	4		
Drilling quality	-		☐ OK ☐ NOK
Deburring quality	-		☐ OK ☐ NOK

Drilling Dia. 5	Theorical	Measured
Bottom line	3 holes	☐ OK ☐ NOK
	24	☐ OK ☐ NOK
	70	☐ OK ☐ NOK
	70	☐ OK ☐ NOK
Upper line	6 holes	☐ OK ☐ NOK
	57	☐ OK ☐ NOK
	50	☐ OK ☐ NOK
	35	☐ OK ☐ NOK
	50	☐ OK ☐ NOK
	30	☐ OK ☐ NOK
	23	☐ OK ☐ NOK

Deburring quality ☐ CONFORM ☐ NOT CONFORM

Absence of marks, impacts or scratches ☐ CONFORM ☐ NOT CONFORM

Observations:

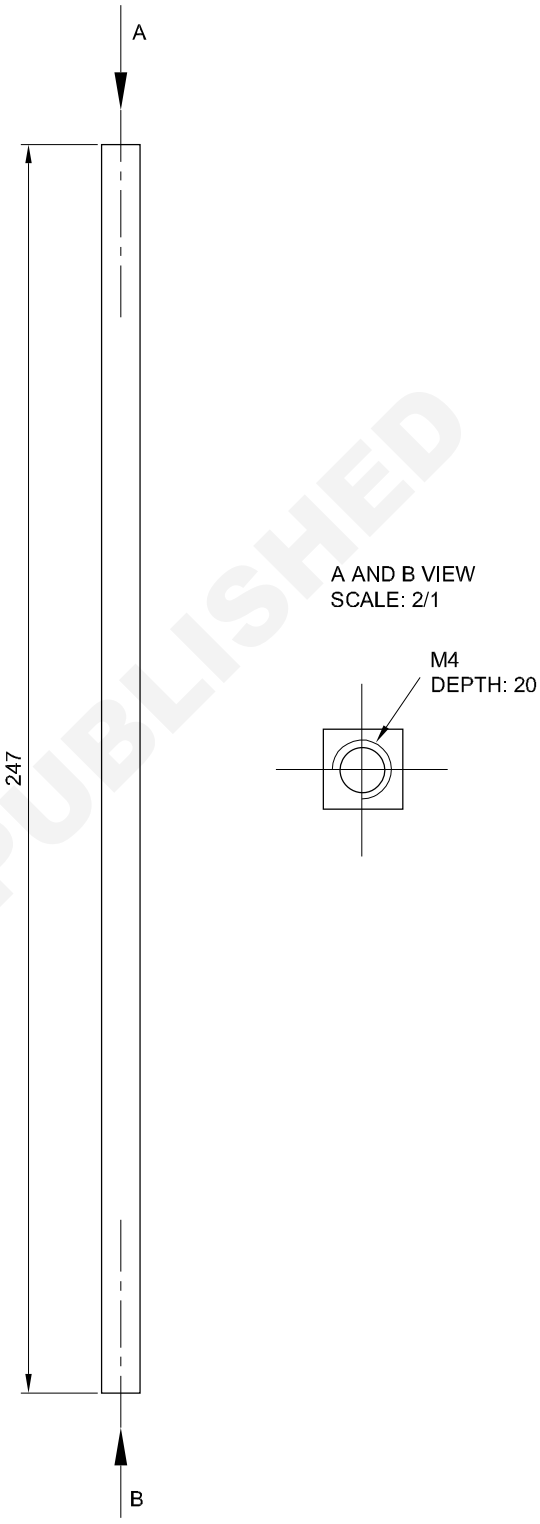
Item 002 - Qty 2

- Check dimensions and shape.
- Mark, cut and file external dimensions.
- Finish edges by cross filing.
- Deburr edges.
- Mark the holes positions.
- Punch the centre of the holes.
- Drilling diameter 2.5
- Hold the workpiece and drill holes with hand drill.
- Deburr both sides.
- Check diameter and perpendicularity of each hole.
- Threading M4
- Hold the workpiece and drill holes with hand drill.
- Deburr both sides.
- Thread each hole to M4.
- Check conformity, diameter and perpendicularity of each hole with a screw.

Manufactured rail for junction module - Qty 2

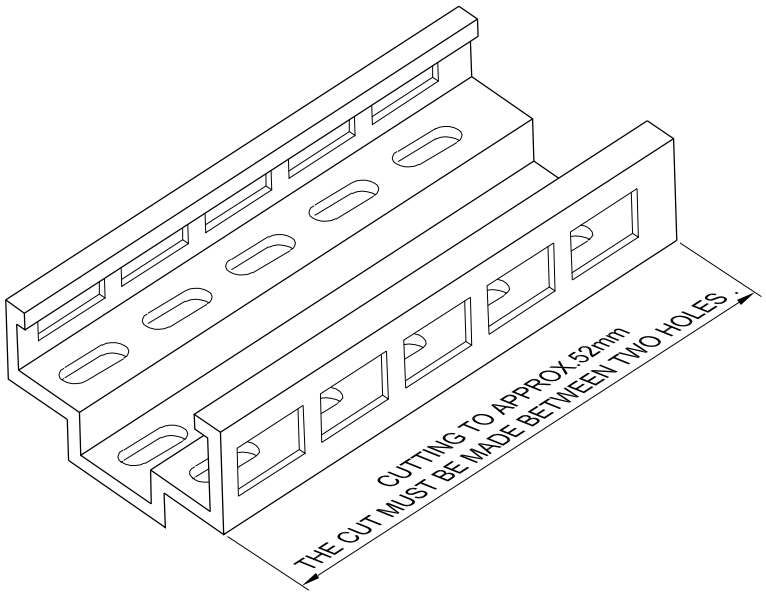
- Check dimensions and shape.
- Mark, cut and file external dimensions.
- Finish edges by draw filing.
- Deburr edges.
- Mark the holes positions.
- Protect cutting edges with Alodine.
- Check conformity.

Store the part for later use.



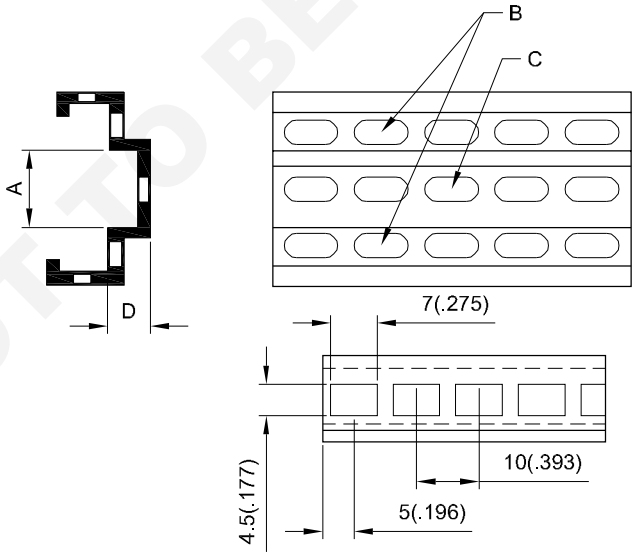
Square rod 8x8

2	8x8 – L.250	-	AW6060	-	-	4.1.82
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE NTS	**ELECTRICAL BOX ASSEMBLY PART 2**				TOLERANCE ±1	TIME 20hrs
					CODE NO. AFN4182E4	



RAIL TYPE II - FOR 1100 & 1200 MODULES
ANODIZED DICHROMATED 6000 SERIES ALUMINIUM ALLOY RAIL
AMPHENOL APRT NUMBER
1 METER :00110190210
2 METER :00110192210

L		PART NUMBER	WEIGHT	A		B		C		D	
mm	inch		g	mm	inch	mm	inch	mm	inch	mm	inch
1000	39.37	001101 20210	156.0	10	.393	2.3 x 7.5	.091 x .295	4.2	.165 x	3	.118
2000	78.74	001101 22210	312.0					x 8	.315		
1000	39.37	001101 90210	164.0	12.6	.496			5.1	.201 x	4	.157
2000	78.74	001101 92210	328.0					x 8	.315		



2	L. 65mm	SEE ABOVE	-	-	-	4.1.82
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE NTS	**ELECTRICAL BOX ASSEMBLY RAIL FOR JUNCTION MODULE**	TOLERANCE ±1	TIME 20hrs
		CODE NO. AFN4182E5	

REPORT SHEET – ITEM 002

UPPER PART

Dimensions	Theorical		Measured
External dimension	247	±0.5	

Drilling	Theorical	Measured
Edge distance	Centred	☐ OK ☐ NOK
M4	-	☐ OK ☐ NOK
M4	-	☐ OK ☐ NOK
Deburring quality	-	☐ OK ☐ NOK

Absence of burn marks	☐ CONFORM	☐ NOT CONFORM
Deburring quality	☐ CONFORM	☐ NOT CONFORM
Absence of marks, impacts or scratches	☐ CONFORM	☐ NOT CONFORM

Observations:

LOWER PART

Dimensions	Theorical		Measured
External dimension	247	±0.5	

Drilling	Theorical	Measured
Edge distance	Centred	☐ OK ☐ NOK
M4	-	☐ OK ☐ NOK
M4	-	☐ OK ☐ NOK
Deburring quality	-	☐ OK ☐ NOK

Absence of burn marks	☐ CONFORM	☐ NOT CONFORM
Deburring quality	☐ CONFORM	☐ NOT CONFORM
Absence of marks, impacts or scratches	☐ CONFORM	☐ NOT CONFORM

Observations:

REPORT SHEET – RAIL FOR JUNCTION MODULE

PART - 01

Dimensions	Theorical	Measured
External dimension	About 62mm	
Cut position	Between holes	☐ OK ☐ NOK

Absence of burn marks	☐ CONFORM	☐ NOT CONFORM
Deburring quality	☐ CONFORM	☐ NOT CONFORM
Absence of marks, impacts or scratches	☐ CONFORM	☐ NOT CONFORM
Alodine application	☐ CONFORM	☐ NOT CONFORM

PART #02

Dimensions	Theorical	Measured
External dimension	About 62mm	
Cut position	Between holes	☐ OK ☐ NOK

Absence of burn marks	☐ CONFORM	☐ NOT CONFORM
Deburring quality	☐ CONFORM	☐ NOT CONFORM
Absence of marks, impacts or scratches	☐ CONFORM	☐ NOT CONFORM
Alodine application	☐ CONFORM	☐ NOT CONFORM

Observations:

— — — — — — — —

TASK 1: **Parts assembly**

Nut plate equipment of the item 001

- Drill 2.5 mm holes using nut plate jig on each hole (see drawing for orientation).
- Deburr holes.
- Countersink 2.5 mm hole.

Protrusion head: +0/-0.1mm

The shop heads are in the internal side.

- Counter-drill the centre hole following the table 1.

Table 1 - Recommended centre hole diameter

Centre drilling		Screw	
MIN	**MAX**	**Diameter Code**	**Nominal Diameter**
3.0	3.1	04	2.85 mm
3.7	3.8	06	3.50 mm
4.3	4.4	08	4.17 mm
5.0	5.1	3	4.83 mm
6.5	6.6	4	6.35 mm
8.1	8.2	5	7.94 mm
9.7	9.8	6	9.52 mm
12.9	13.0	8	12.7 mm

Rivets used:

- Countersunk head rivet.
- Material 2117
- Diameter 2.4 mm (3/32)
- Rivet the nut plates with countersunk head rivet.

Assembly of items 002

- With screws and locking washer, assemble item 002 in position.
- Check assembly.

NUT PLATE

Use two lugs floating nut plate.

Suggested references:

MS21059-3 (Steel) - Preferred

MS21060-3 (CRES)

MS21075-3 (Reduced, steel)

MS21076-3 (Reduced, CRES)

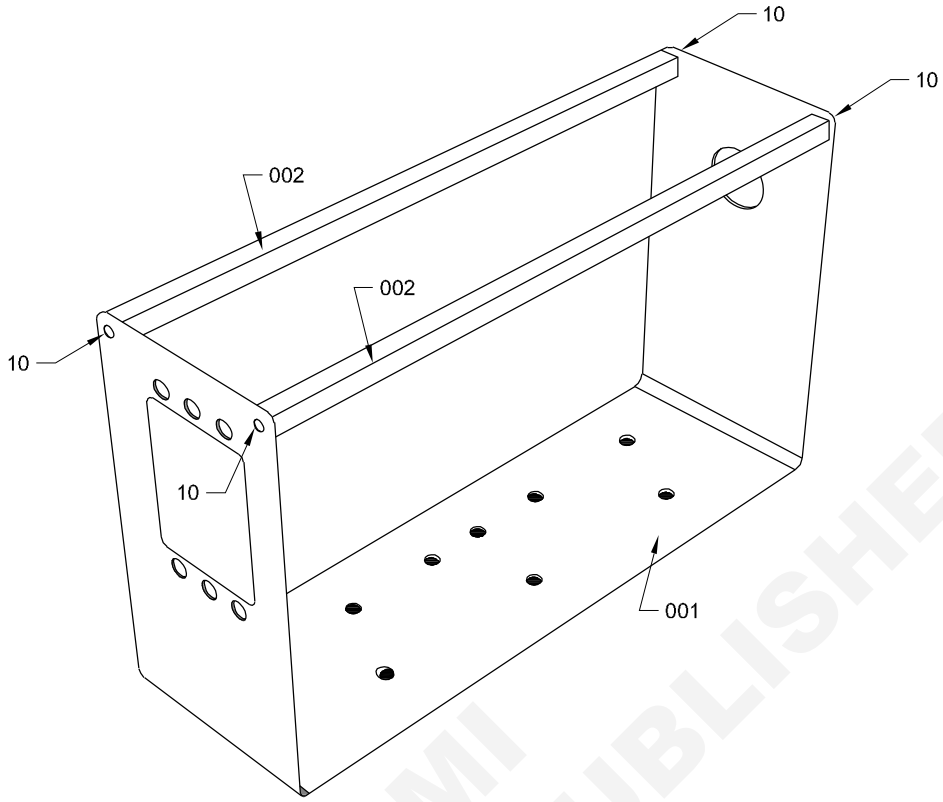
NAS1791A-3 (Steel)

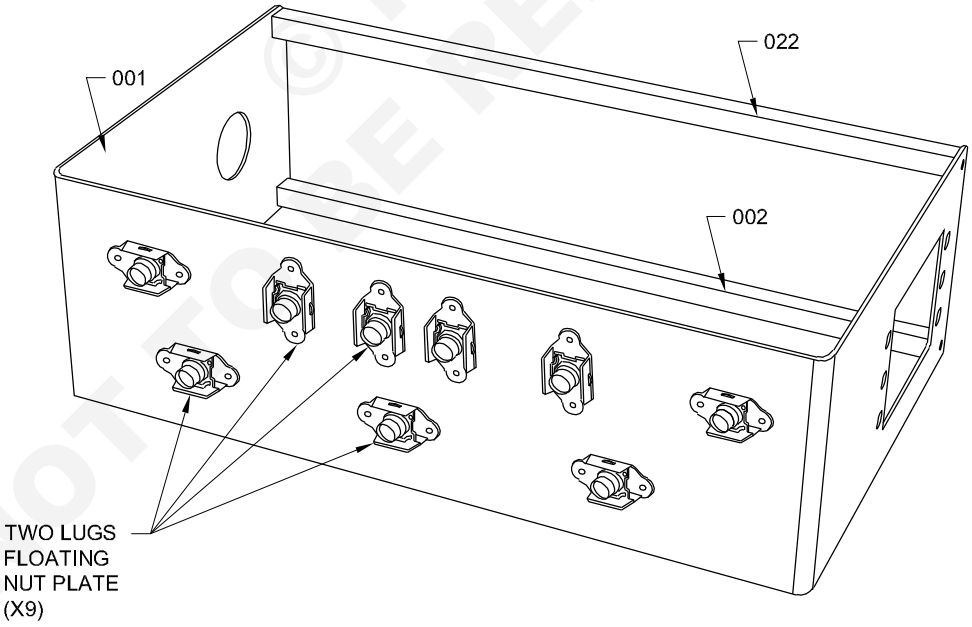
NAS1791C-3 (CRES)

SCREW AND WASHER

No reference needed.

Use M6 screw and washer available in the workshop.





--	-	-	--	--	-	4.1.82
NO.OFF	STOCK SIZE		SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE					DEVIATIONS	TIME 20hrs
	ELECTRICAL BOX ASSEMBLY				CODE NO. AFN4182E6	

Perform Quality Inspection on an existing installation

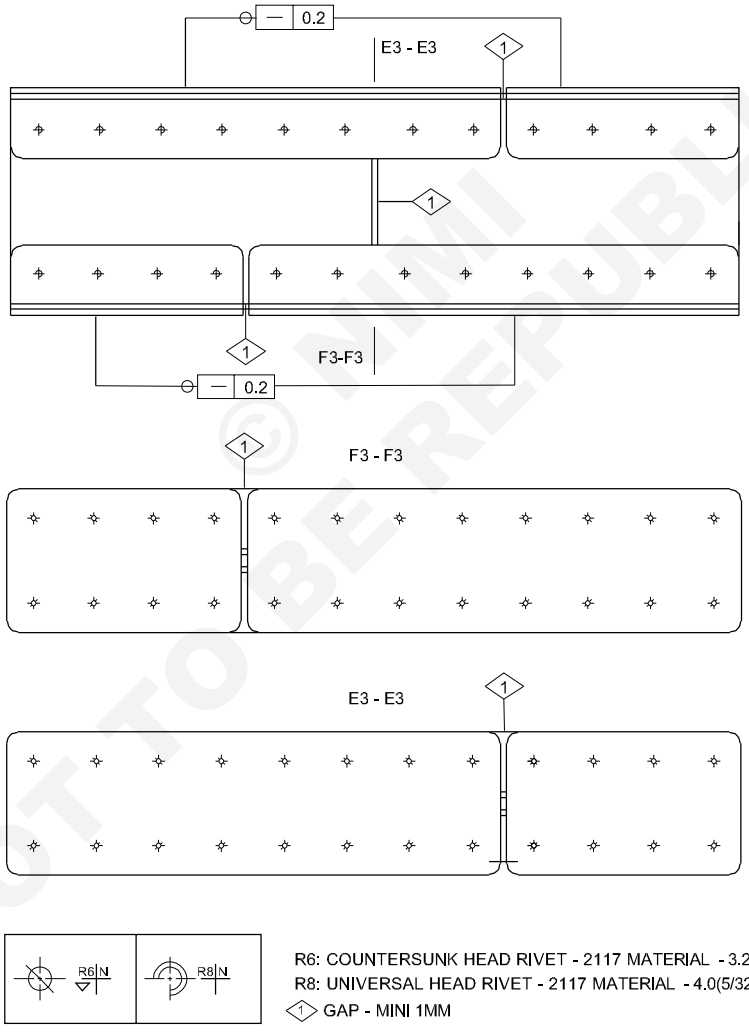
Objectives: At the end of this exercise you shall be able to·
• make a quality inspection on structural assembly.

Job Sequence

TASK 1:

- Using a assembly produced by another learner:
- Inspect the 2.1.44 training beam assembly and report the values and defects in the record sheet.
- Compare the results with the previous record sheet.

TASK 1 - Assembly quality inspection

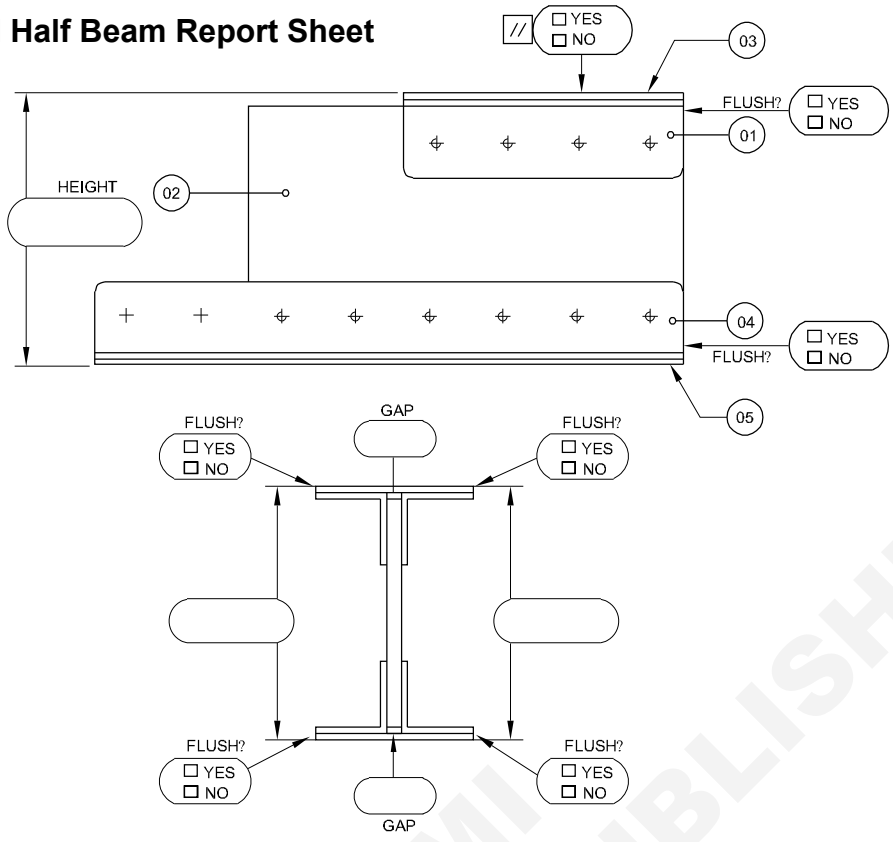


R6: COUNTERSUNK HEAD RIVET - 2117 MATERIAL - 3.2(1/8") DIAMETER
R8: UNIVERSAL HEAD RIVET - 2117 MATERIAL - 4.0(5/32") DIAMETER
1 GAP - MINI 1MM

-	-	> 2.1.44	-	-	-	4.1.83
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE NTS	**TRAINING BEAM DRAWING ASSEMBLY**				TOLERANCE ±1	TIME 20hrs
					CODE NO. AFN4183E1	

Fig 1

Left Hand Half Beam Report Sheet

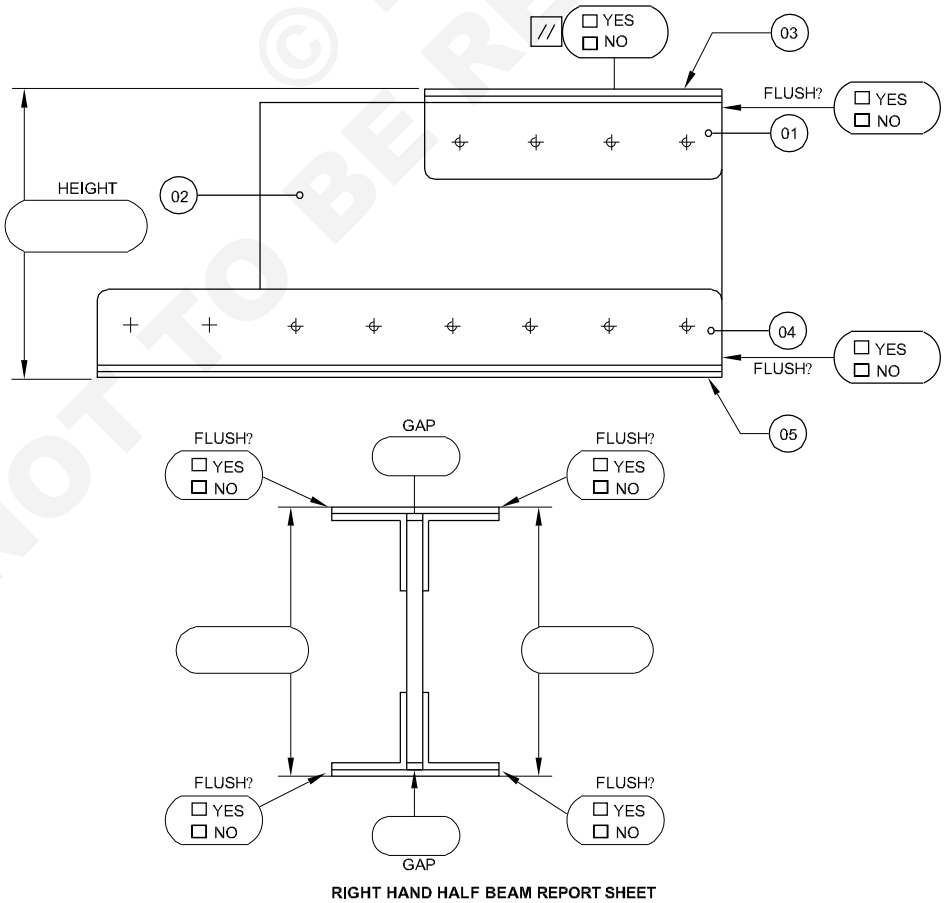


LEFT HAND HALF BEAM REPORT SHEET

AFN4183H1

Right Hand Half Beam Report Sheet

Fig 2

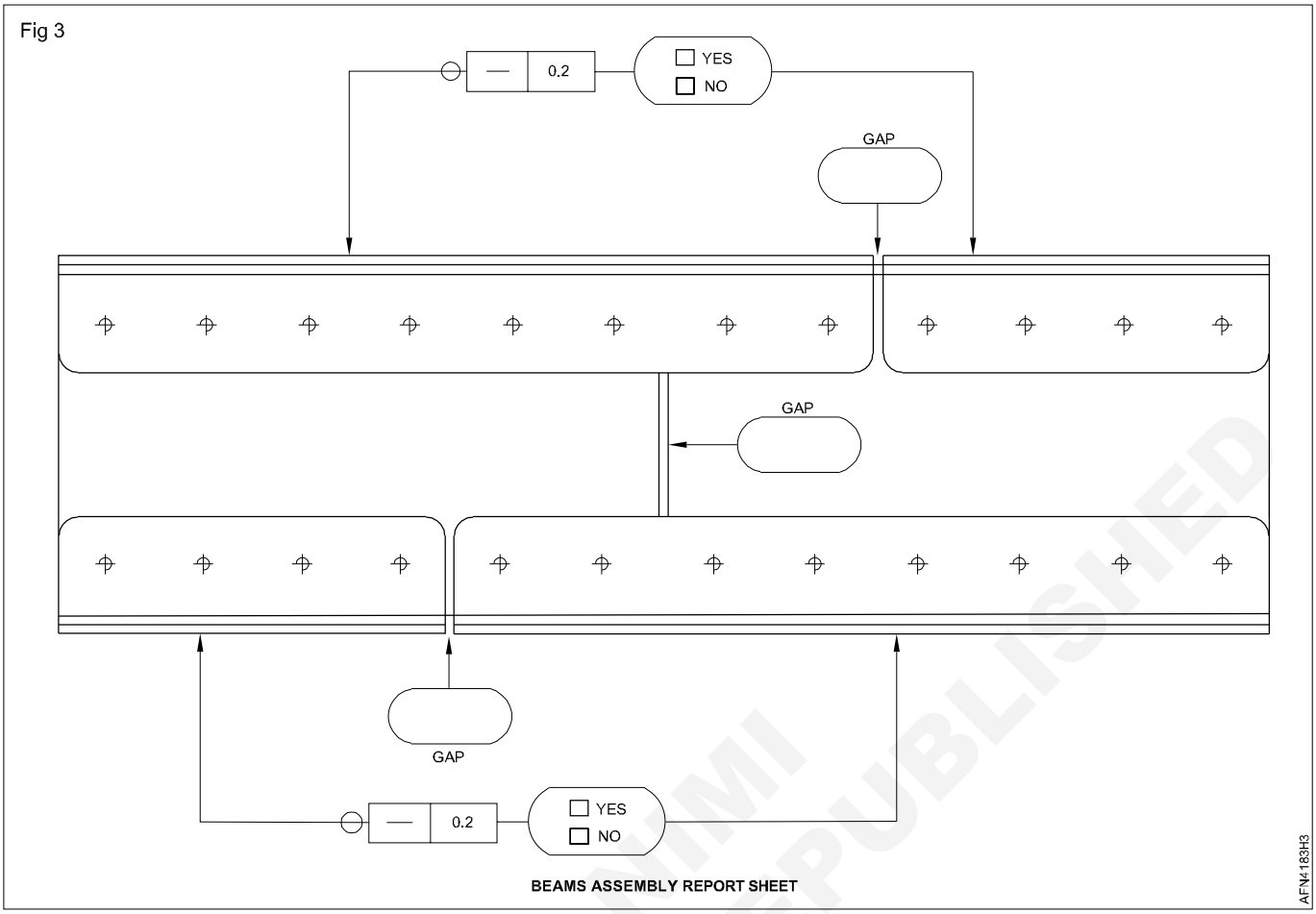


RIGHT HAND HALF BEAM REPORT SHEET

AFN4183H2

Beams Assembly Report Sheet

Fig 3

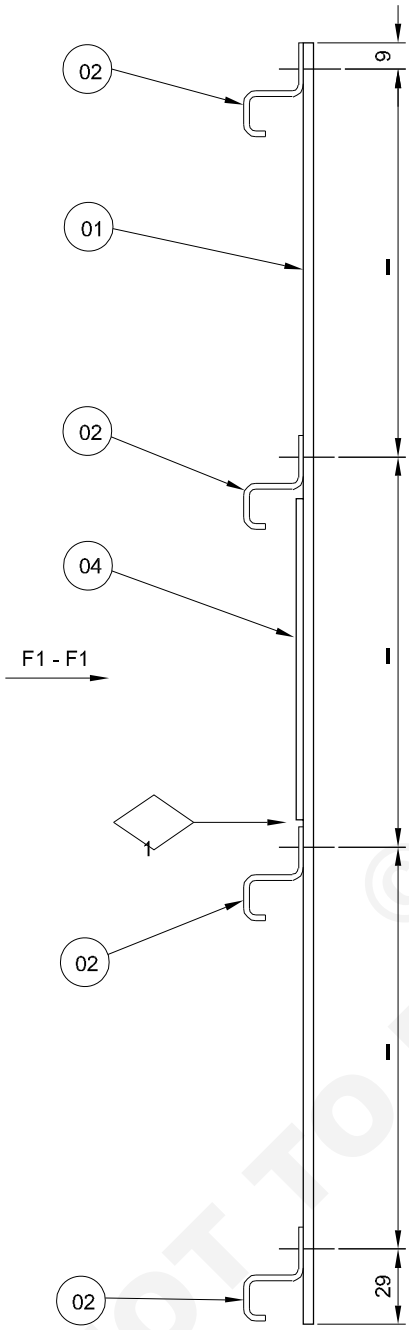


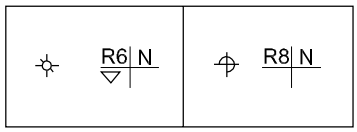
Observation:

_ _ _ _ _ _ _ _

TASK 2:

- Using a assembly produced by another learner:
- Inspect the 2.1.44 flat panel assembly and report the values and defects in the record sheet.
- Compare the results with the previous record sheet.





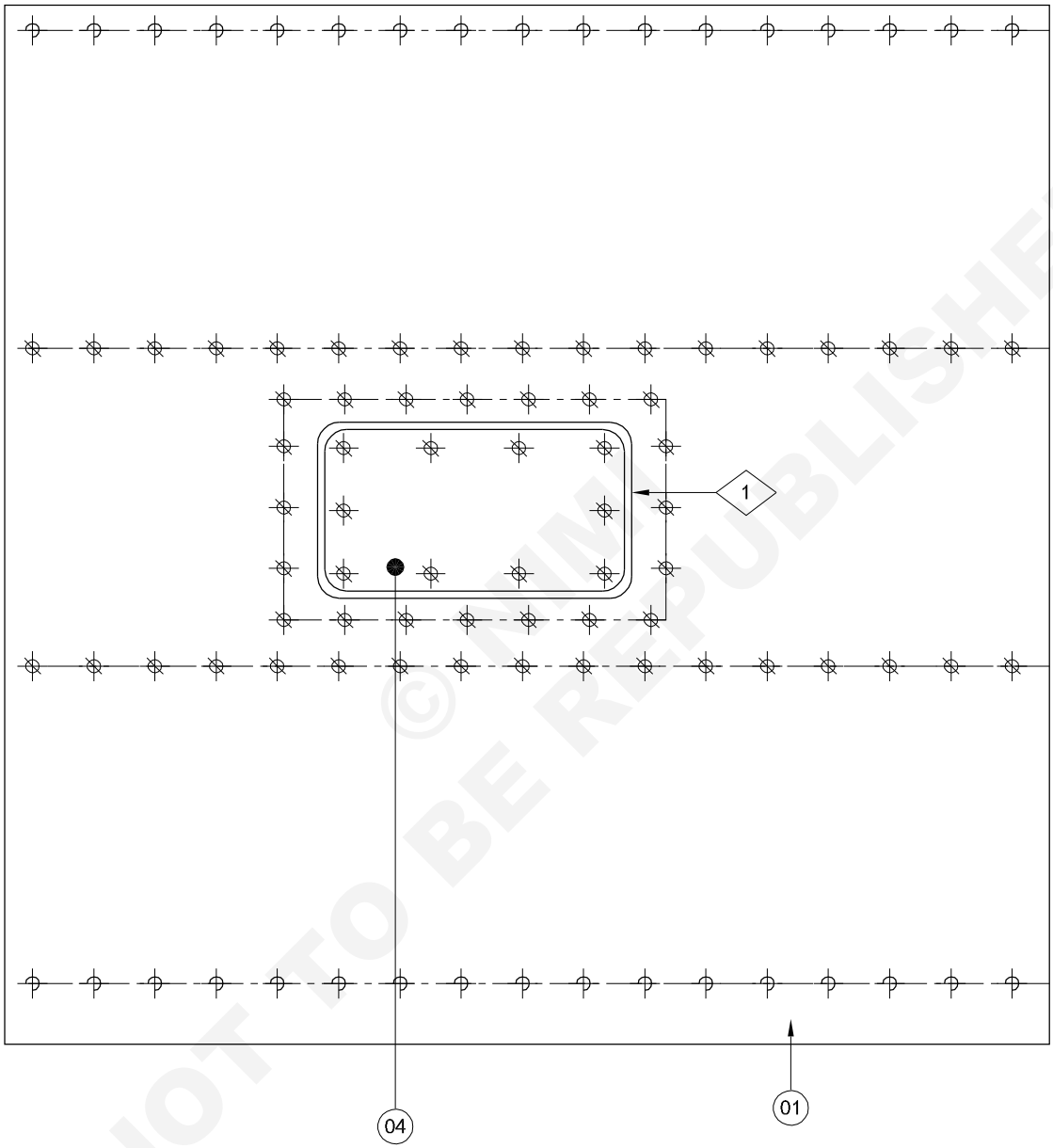
R6: COUNTERSUNK HEAD RIVET - 2117 MATERIAL - 3.2(1/8") DIAMETER

R8: UNIVERSAL HEAD RIVET - 2117 MATERIAL - 4.0(5/32") DIAMETER

1 GAP - MINI 1MM

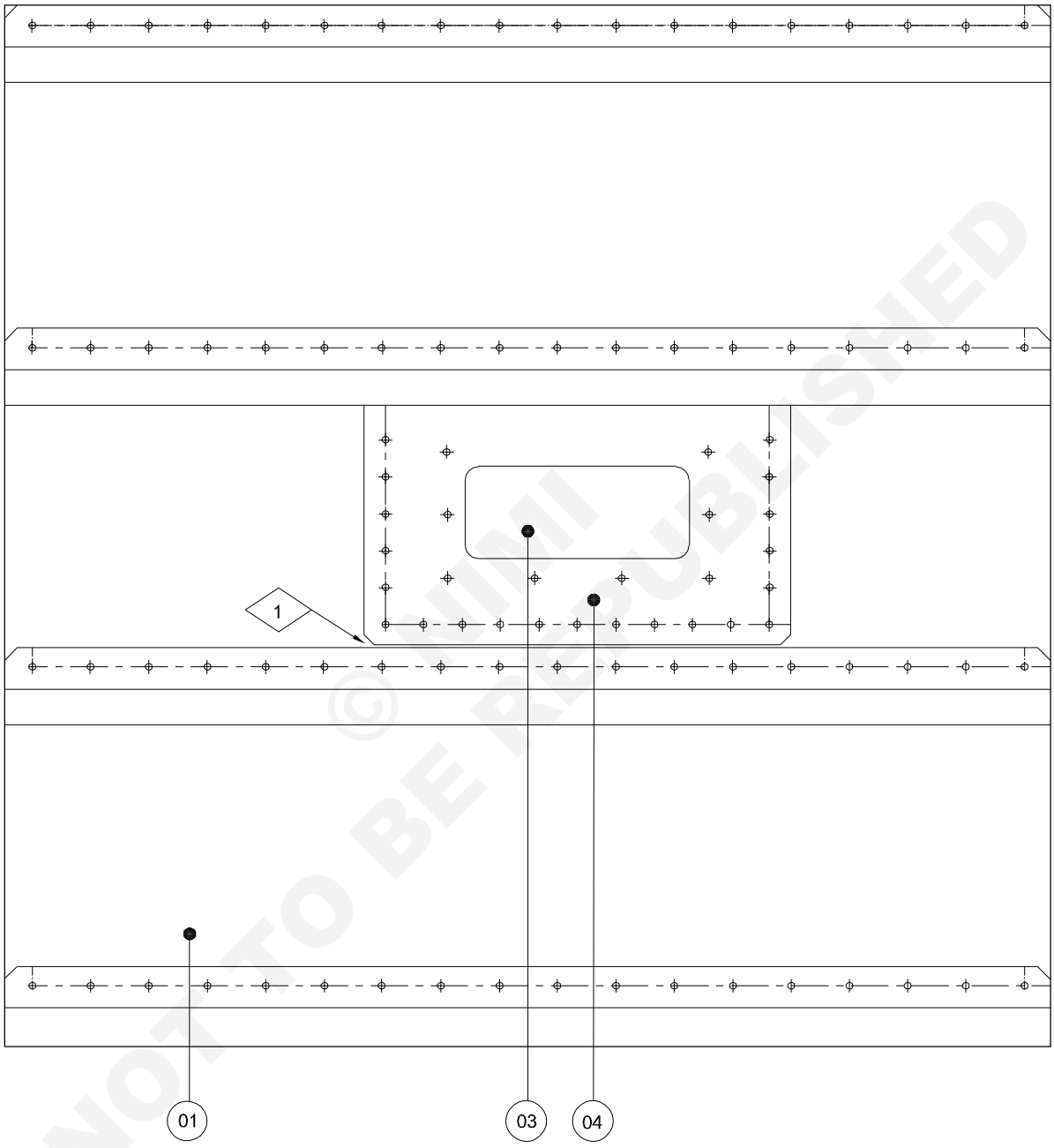
-	-	>3.1.61	-	-	-	4.1.83
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**FLAT PANEL DRAWING ASSEMBLY - SHEET 1**				DEVIATIONS	TIME 5hrs
					CODE NO. AFN4183E2	

G1-G1



-	-	>3.1.61	-	-	-	4.1.83
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**FLAT PANEL DRAWING ASSEMBLY - SHEET 2**				DEVIATIONS	TIME 5hrs
					CODE NO. AFN4183E3	

F1 - F1



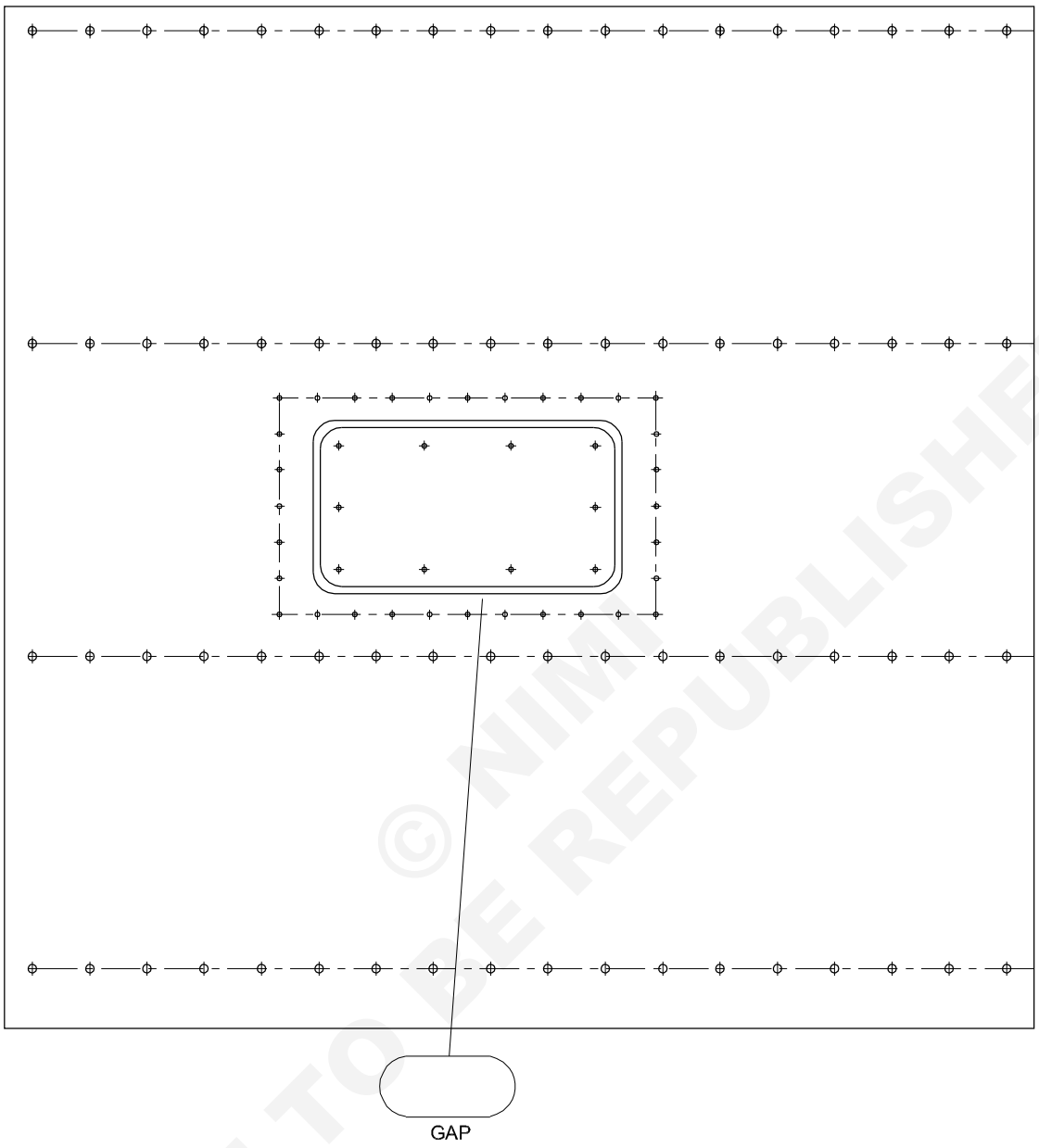
-	-	>3.1.61	-	-	-	4.1.83
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE : NTS	**FLAT PANEL** **DRAWING ASSEMBLY - SHEET 3**	DEVIATIONS	TIME 5hrs
		CODE NO. AFN4183E4	

External Inspection Report Sheet

Report by drawing the scratches, defects on rivets, etc. with a simple identification of the defect

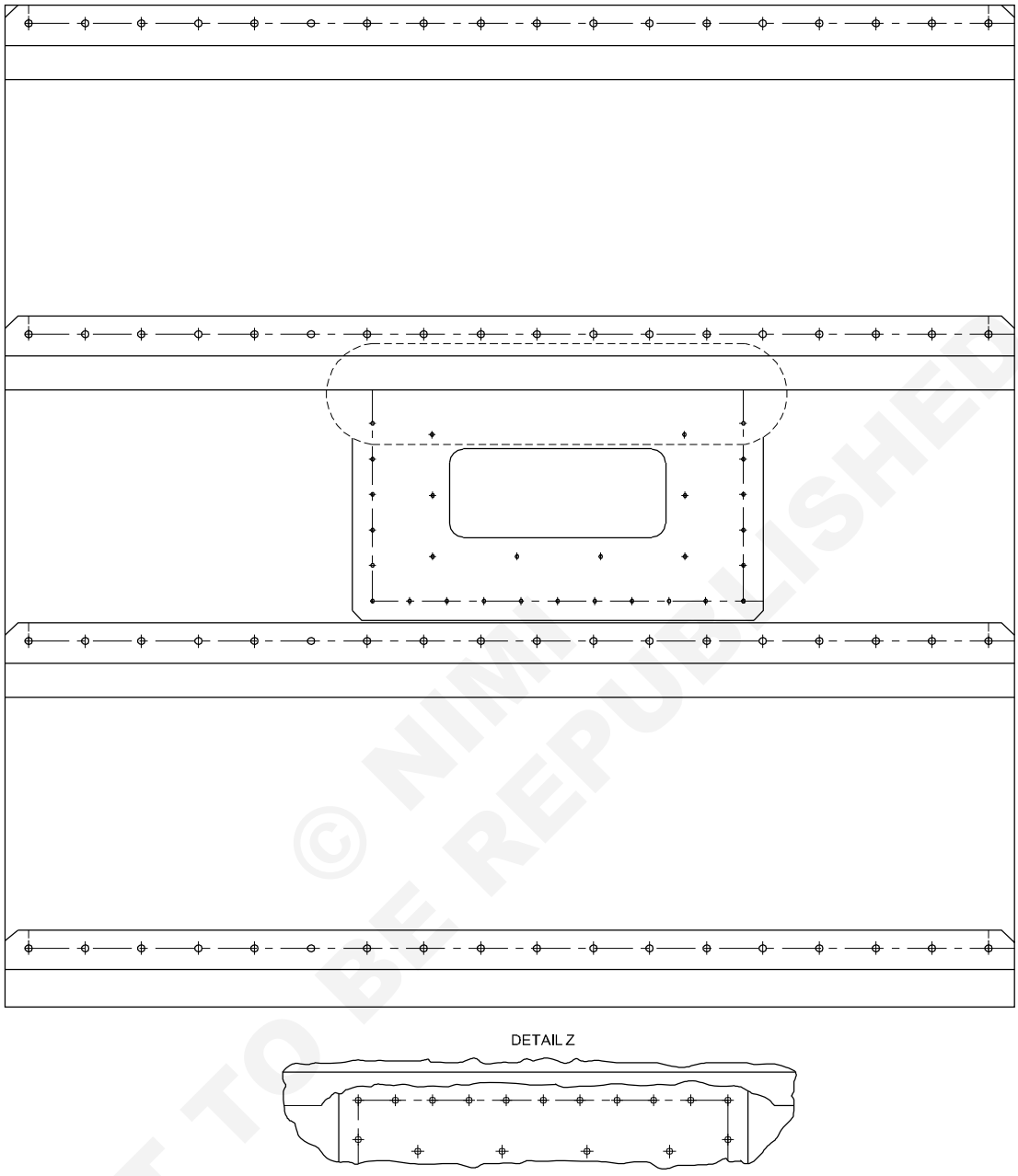
Fig 4



Internal Inspection Report Sheet

Report by drawing the scratches, defects on rivets, etc. with a simple identification of the defect

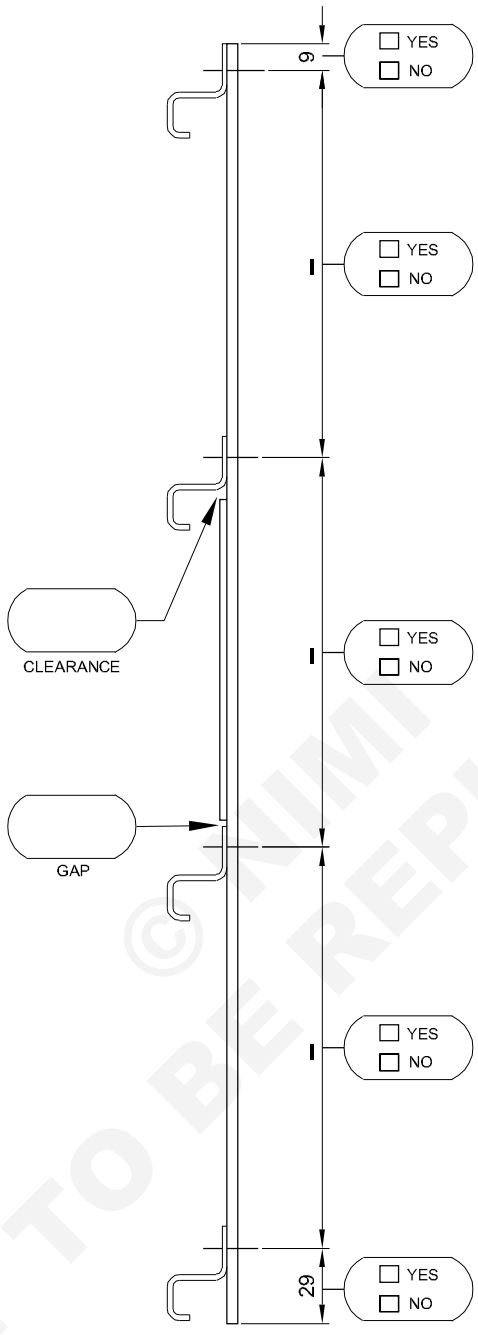
Fig 5



Gap and Positionning Report Sheet

Complete the report sheet below

Fig 6



Corrosion treatment elimination

Objectives: At the end of this exercise you shall be able to·
• remove corrosion on metallic parts.

Job Sequence

With various aluminium and steel parts with corrosion prepared by your instructor, remove corrosion following these instructions.

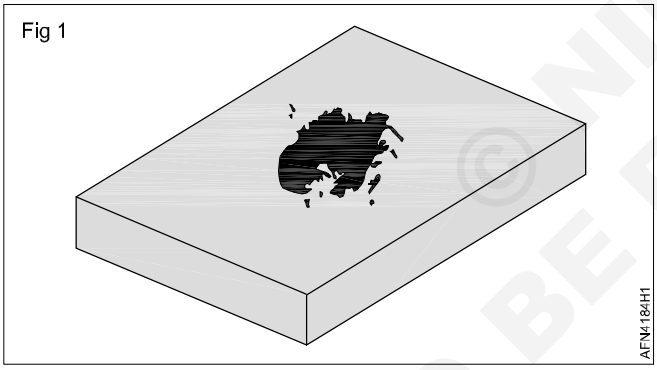
This job card is an example.

Complete removal of corrosion products may result in metal removal that exceeds the amount allowed by specific aircraft or equipment repair handbooks. Prior to corrosion removal, the allowable limits specified in aircraft and equipment manuals and technical orders must be checked. Metal removal damage is cumulative: prior metal removal, including areas on the opposite side of the part, must be considered when assessing corrosion damage.

STEP 1

Corrosion damage before rework

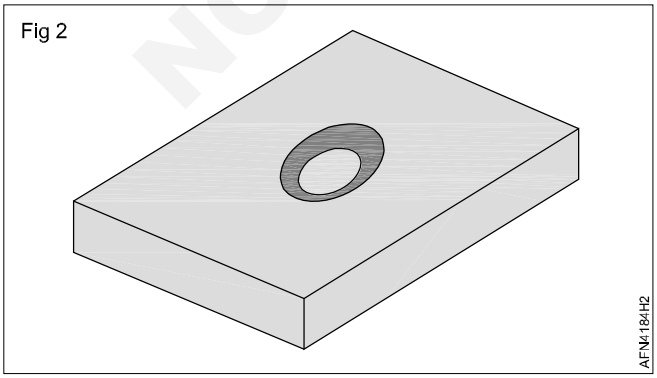
Fig 1



STEP 2

- Depression after corrosion removal
- Rough edges have been smoothed and all corrosion has been removed.
- However, depression has not been shaped.

Fig 2

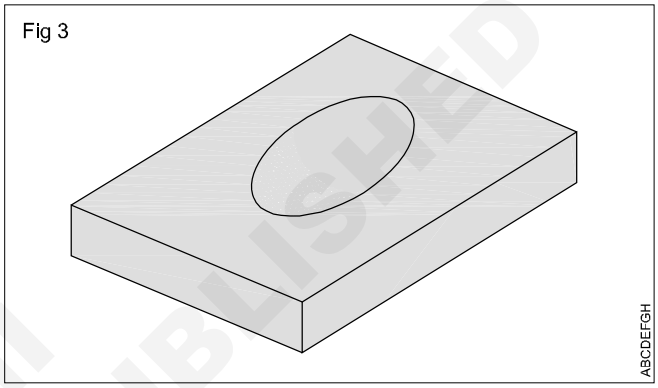


STEP 3

Dish-out after blending

Blending has been accomplished.

Fig 3



The following warnings and cautions shall be observed during corrosion removal operations.

- All powered corrosion removal procedures create airborne particles. Respirators and eye protection are required.
- Do not use flap brushes, abrasive wheels, or wire brush wheels above their authorized RPM.
- Protect areas adjacent to corrosion removal operations from chips, dust, and other debris which could produce dissimilar metal corrosion on previously uncorroded surfaces.
- Before abrading, clean the affected area to remove grease and soil
- When complete corrosion removal has been attained, blend or fair out the edges of the damaged areas using fine abrasive paper or cloth.

See exercise 2.4.71 for acceptable rework limits.

Non-Destructive Testing

Objectives: At the end of this exercise you shall be able to·
• perform non-destructive inspections.

Job Sequence

- With various open and closed parts with defects prepared by your instructor, perform non-destructive inspection as follow.

Follow the job card provided by your instructor for each inspection.

- Trade theory booklet can help you in your task.
- You have to perform the following NDT:

Perform tape testing inspection

- With flat and sandwich panel, perform tape testing inspection to find delamination and debonding defects.

Perform ultrasonic inspection

- Following the user manual of the material used, perform ultrasonic inspection on different components provided by your instructor.
- Report inspection.

Perform dye penetrant inspection

- Following the user manual of the material used, perform dye penetrant inspection on different components with dent and crack defects provided by your instructor.

Perform visual camera inspection

- Following the user manual of the camera used, perform visual inspection on different closed components with defects provided by your instructor.

Perform assembly of flight controls

Objectives: At the end of this exercise you shall be able to
- **assemble the flight control components.**
- **checking flight control functionality.**

Job Sequence

Following the specific job card to:

- Assembly the components a flight control chain: control rod, cable, pulley, shaft...
- Tightening according to the standard torque Aluminium mentioned in work card
- Bonding/grounding: screw the ground termination, apply varnish on different pipes
- Checking flight controls functionality.
- Constraint checking / tension of a cable

The following pages give an example of a work card for this chapter.

The Aircraft Maintenance Manual used for this example is that for the Falcon 20.

Depending on the available material in the ITI, the work cards will correspond to the existing real element available.

If available, the material mentioned is only given as an example. Procurement will be based on the real specific exercise set up.

AVIONS MARCEL DASSAULT
FAN JET FALCON
MAINTENANCE MANUAL

Flight control linkages in fuselage and empennage

Routine servicing

1 General

Flight control linkage points not provided with grease fittings are protected from corrosion by lubrication. Lubrication points of elevator, rudder and aileron flight control linkage hinge points in the fuselage and empennage are specified hereinafter.

NOTES: A - Lubrication of aileron flight control hinge points is covered in Section 27-00-2.

B - Flight control hinge points covered in this Section are those located in box structures open for inspection and to which access is gained by removing doors and floor sections.

C - Directly accessible hinge points (i.e. hinge points subjected to weathering) are dealt with in chapter 12.

2 - Tools and servicing materials

Oil AIR 1504 (MIL. C. 6529 B type III).

3 - Preliminary steps

A - Remove the pilot, co-pilot, and RH side passenger seats.

B - Remove the crew compartment floors.

C - Remove the right hand passenger cabin floors.

D - Clean the joints with a dry rag or clean brush.

E - Using a vacuum-cleaner, remove any possible foreign matter from the structure.

4- Lubrication (See figures 301, 302, 303, 304 and 305)

Using an oil can, lubricate :

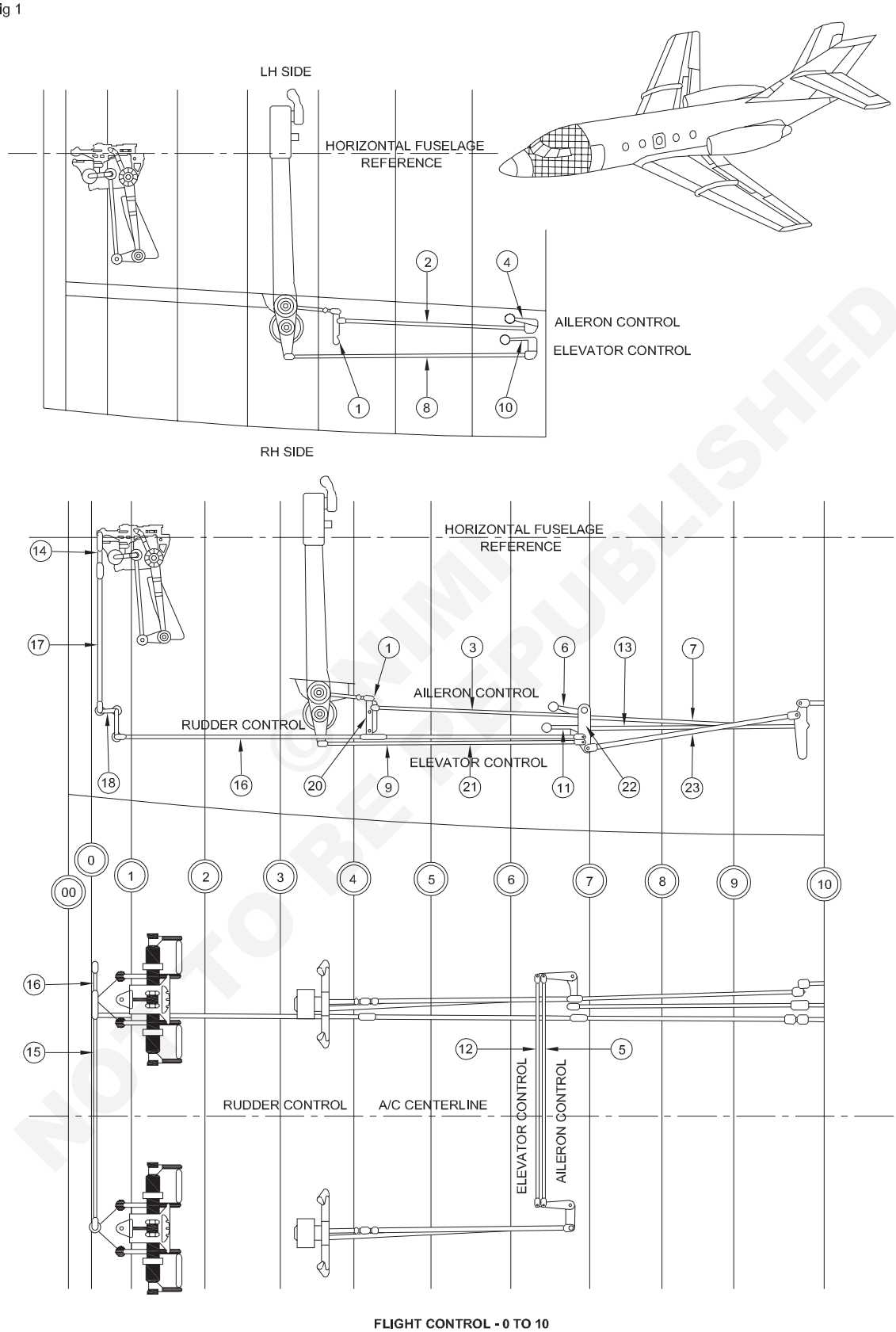
- the pins joining the bell-cranks to their supports

- the pins connecting the rods to the bell-cranks.

A Flight control hinge points between frames 0 and 10

Index no.	Description of lubrication points	Number	Access
	AILERON CONTROL		
1	Bellcrank hinge-pin	1+1	Pilot's floor
2	Rod connecting pins	2 LH	Pilot's floor
3	Rod connecting pins	2 RH	Pilot's floor
4	Bellcrank hinge-pin	1 LH	Pilot's floor
5	Rod connecting pins	2	Pilot's floor
6	Bellcrank hinge-pin	1 RH	Pilot's floor
7	Rod connecting pins	2	Pilot's floor
	ELEVATOR CONTROL		
8	Rod connecting pins	2 LH	Pilot's floor
9	Rod connecting pins	2 RH	Pilot's floor
10	Bellcrank hinge-pin	1 LH	Pilot's floor
11	Bellcrank hinge-pin	1 RH	Pilot's floor
12	Rod connecting pins	2	Pilot's floor
13	Rod connecting pins	2	Pilot's floor
	RUDDER CONTROL		
14	Bellcrank hinge-pin	1 RH	Door 400
15	Rod connecting pins	2	Flight compartment
16	Rod connecting pins	2	Flight compartment
17	Rod connecting pins	2	Flight compartment
18	Bellcrank hinge-pin	1 RH	Door 400
19	Rod connecting pins	2	Pilot's floor
20	Bellcrank hinge-pin	1RH	Pilot's floor
21	Rod connecting pins	2	Pilot's floor
22	Bellcrank hinge-pin	1	Pilot's floor
23	Rod connecting pins	2	Pilot's floor

Fig 1



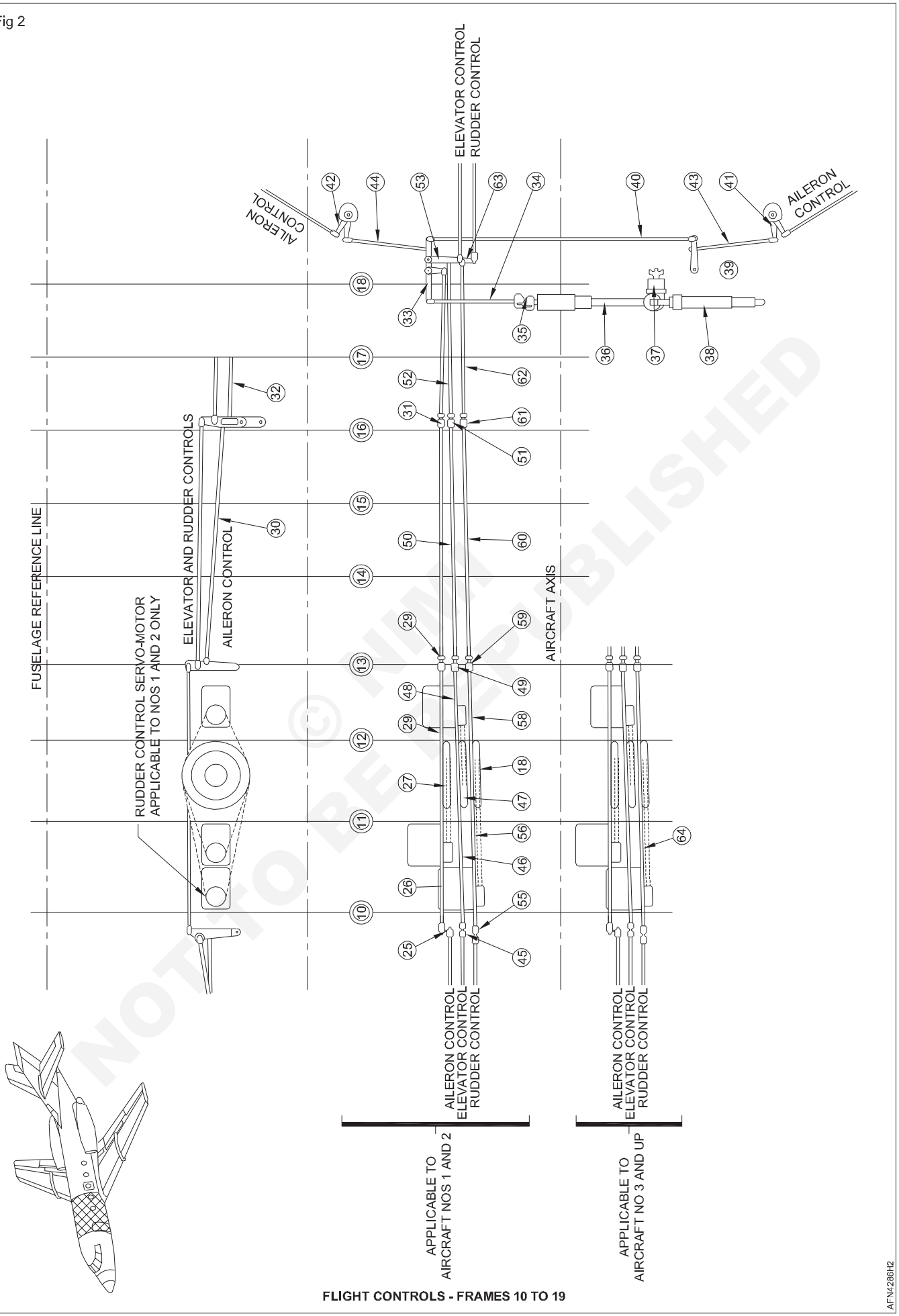
FLIGHT CONTROL - 0 TO 10

B Flight control hinges between frames 10 and 19

Index no.	Description of lubrication points	Number	Access
	Aileron Control		
25	Bell-crank hinge-pin	1	Coatroom floor
26	Rod connecting pins	2	Coatroom floor
27	Quadrant hinge-pin	1	Coatroom floor
28	Rod connecting pins	2	Coatroom floor
29	Bell-crank hinge-pin	1	Coatroom floor
30	Rod connecting pins	2	RH passenger floor
31	Bell-crank hinge-pin	1	RH passenger floor
32	Rod connecting pins	2	RH passenger floor
33	Sealed box bell-crank hinge-pin	1	RH passenger floor
34	Rod connecting pins	2	RH passenger floor
35	Bell-crank hinge-pin	1	Aisle floor
36	Trim connecting pins	2	Aisle floor
37	ARTHUR connecting pins and ARTHUR ball joint	3	LH passenger floor
38	A. F. U. connecting pin	1	LH passenger floor
39	Bell-crank hinge-pin	1LH	Door 269 LH
40	Rod connecting pins	2	269 RH and LH
41	Bell-crank hinge-pin	1LH	269LH
42	Bell-crank hinge-pin	1RH	269RH
43	Rod connecting pins	2LH	269LH
44		2RH	269RH

Index no.	Description of lubrication points	Number	Access
	Bellcrank hinge-pin		Coatroom floor
45	Rod connecting pins	1	Coatroom floor
46	Rod connecting pins	2	Coatroom floor
47	Quadrant hinge-pin	2	Coatroom floor
48	Rod connecting pins	2	Coatroom floor
49	Bellcrank hinge-pin	1	RH passenger floor
50	Rod connecting pins	2	RH passenger floor
51	Bellcrank hinge-pin	1	RH passenger floor
52	Rod connecting pins	2	RH passenger floor
53	Sealed box bellcrank hinge-pin	1	RH passenger floor
	RUDDER CONTROL		Coatroom floor
54	Bellcrank hinge-pin	1	Coatroom floor
55	Rod connecting pins(A/C 1 and 2)	2	Coatroom floor
56	Quadrant hinge-pin (A/C 1 and 2)	1	Coatroom floor
57	Rod connecting pins(A/C 1 and 2)	2	Coatroom floor
58	Rod connecting pins	1	RH passenger floor
59	Bellcrank hinge-pin	2	RH passenger floor
60	Rod connecting pins	1	RH passenger floor
61	Bellcrank hinge-pin	2	RH passenger floor
62	Rod connecting pins	1	
63	Sealed box bellcrank hinge-pin	2	
64	Rod connecting pins		

Fig 2

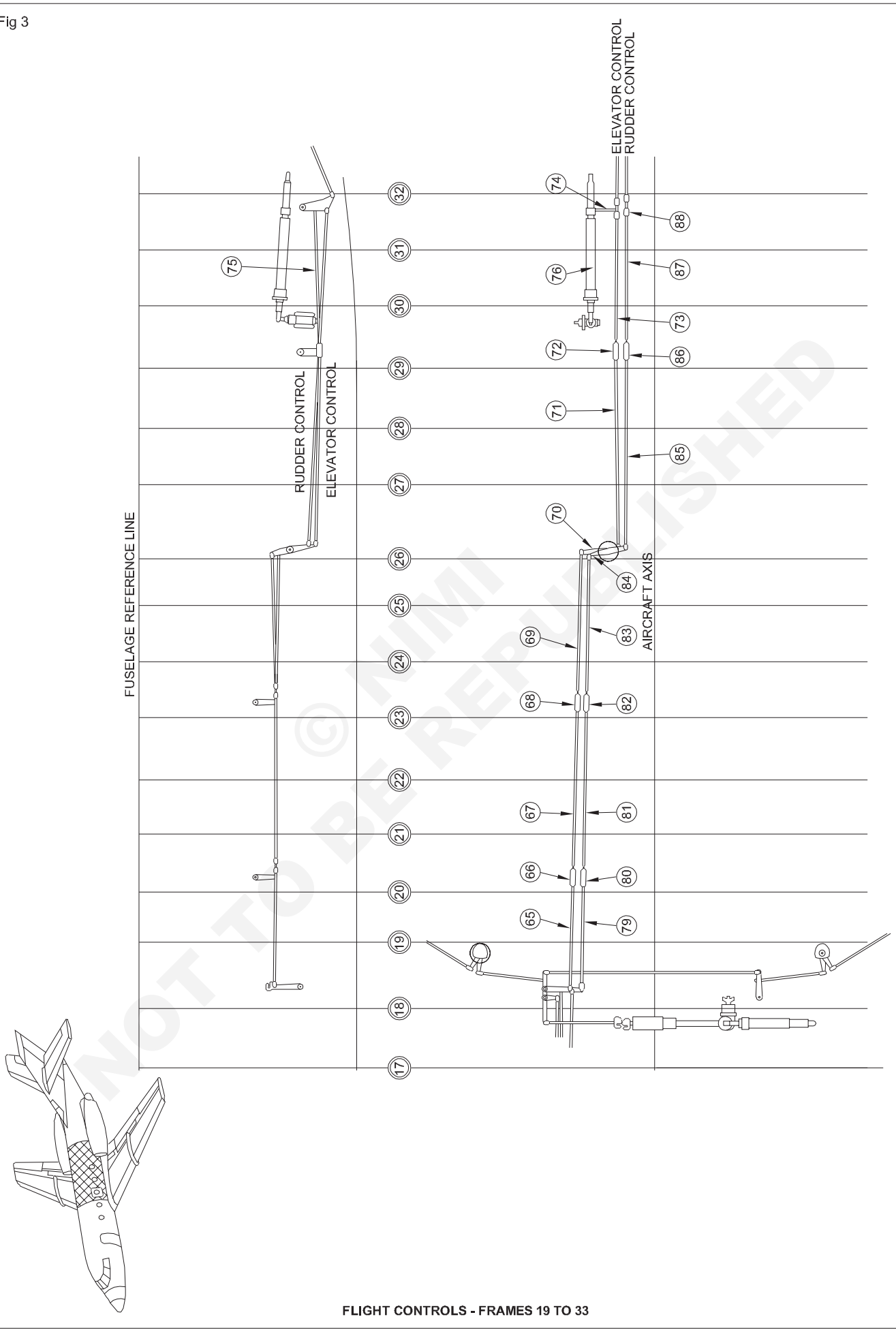


FLIGHT CONTROLS - FRAMES 10 TO 19

C- Elevator and rudder control hinge points between frames 19 and 33.

Index no.	Description of lubrication points	Number	Access
	Elevator control		
65	Rod connecting pins	2	Door 402
66	Bellcrank hinge-pin	1	Door 402
67	Rod connecting pins	2	Door 402
68	Bellcrank hinge-pin	1	Door 405
69	Rod connecting pins	2	Door 405
70	Bellcrank hinge-pin	1	Door 264
71	Rod connecting pins	2	Door 264
72	Bellcrank hinge-pin	1	Door 261
73	Rod connecting pins	2	Door 261
74	Pressure-sealed uint bell-crank hinge-pin	2	Door 261
75	Rod connecting pins	2	Tollet floor
76	A.F.U. ARTHUR-fixed point and ARTHUR ball-joint connecting pins	1	Tollet Floor
	Rudder Control		
79	Rod connecting pins	2	Door 402
80	Bellcrank hinge-pin	1	Door 402
81	Rod connecting pins	2	Door 402
82	Bellcrank hinge-pin	1	Door 405
83	Rod connecting pins	2	Door 405
84	Bellcrank hinge-pin	1	Door 264
85	Rod connecting pins	2	Door 264
86	Bellcrank hinge-pin	1	Door 261
87	Rod connecting pins	2	Door 261
88	Bellcrank hinge-pin	1	Door 261

Fig 3



FLIGHT CONTROLS - FRAMES 19 TO 33

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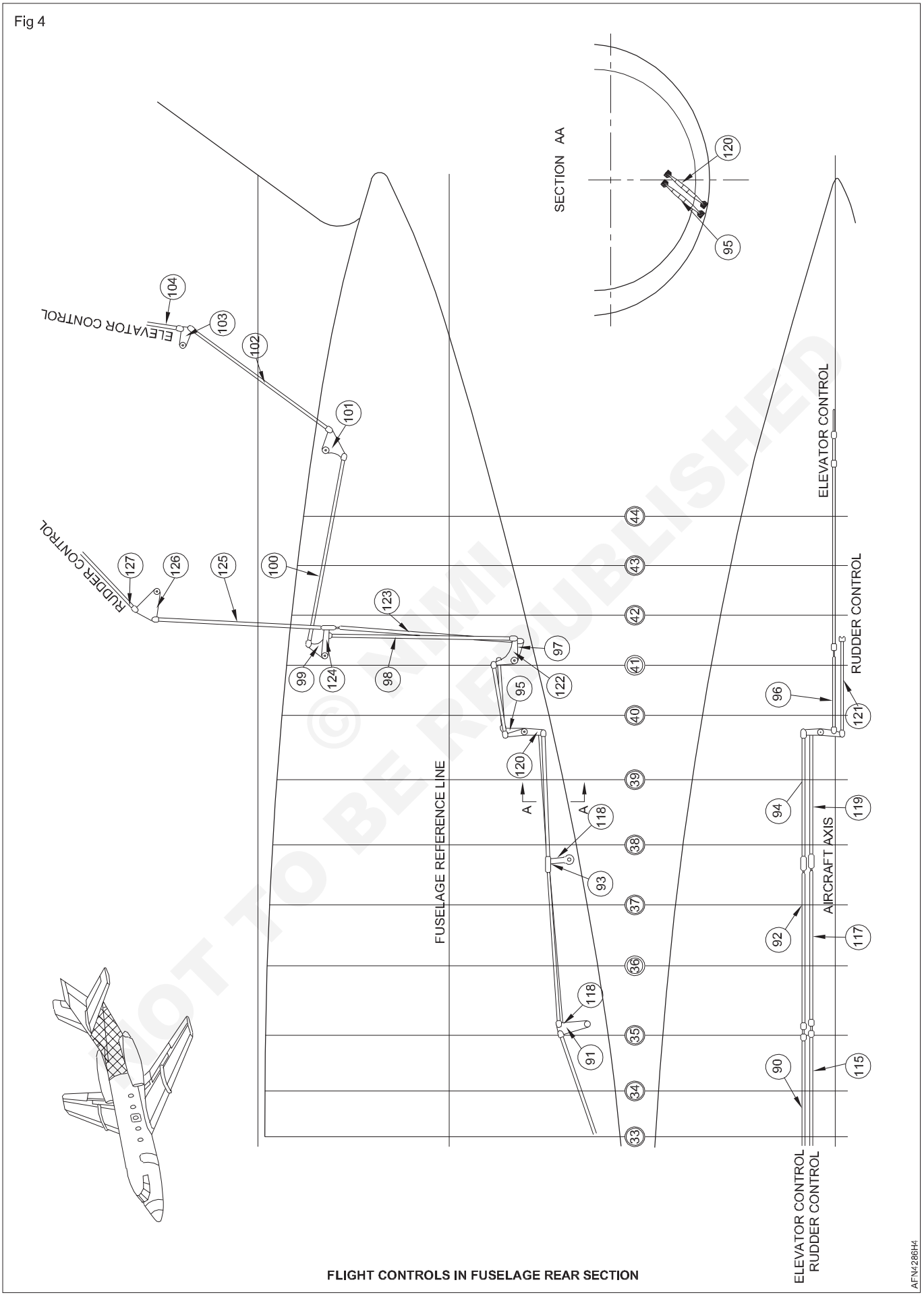
D- Elevator and rudder control hinge points between frames 19 and 33.

Index no.	Description of lubrication points	Number	Access
	ELEVATOR CONTROL		
90	Rod connecting pins	2	Rear compartment floor
91	Bellcrank hinge-pin	1	Rear compartment floor
92	Rod connecting pins	2	Rear compartment floor
93	Bellcrank hinge-pin	1	Rear compartment floor
94	Rod connecting pins	2	Rear compartment floor
95	Bellcrank hinge-pin	1	Rear compartment
96	Rod connecting pins	2	Rear compartment
97	Bellcrank hinge-pin	1	Rear compartment
98	Rod connecting pins	2	Rear compartment
99	Bellcrank hinge-pin	1	Rear compartment
100	Rod connecting pins	2	Rear compartment
101	Bellcrank hinge-pin	1	Door 214
102	Rod connecting pins	2	Door 214
103	Bellcrank hinge-pin	1	Door 215
104	Rod connecting pins	2	Door 215
	RUDDER CONTROL		
115	Rod connecting pins	2	Rear compartment floor
116	Bellcrank hinge-pin	1	Rear compartment floor
117	Rod connecting pins	2	Rear compartment floor
118	Bellcrank hinge-pin	1	Rear compartment floor
119	Rod connecting pins	2	Rear compartment floor
120	Bellcrank hinge-pin	1	Rear compartment
121	Rod connecting pins	2	Rear compartment
122	Bellcrank hinge-pin	1	Rear compartment
123	Rod connecting pins	2	Rear compartment
124	Bellcrank hinge-pin Rod connecting pins	1	Rear compartment
125	Rod connecting pins	2	Door 210 LH
126	Bellcrank hinge-pin	1	Door 210 LH
127	Rod connecting pins	2	Door 210 LH

Fig 4

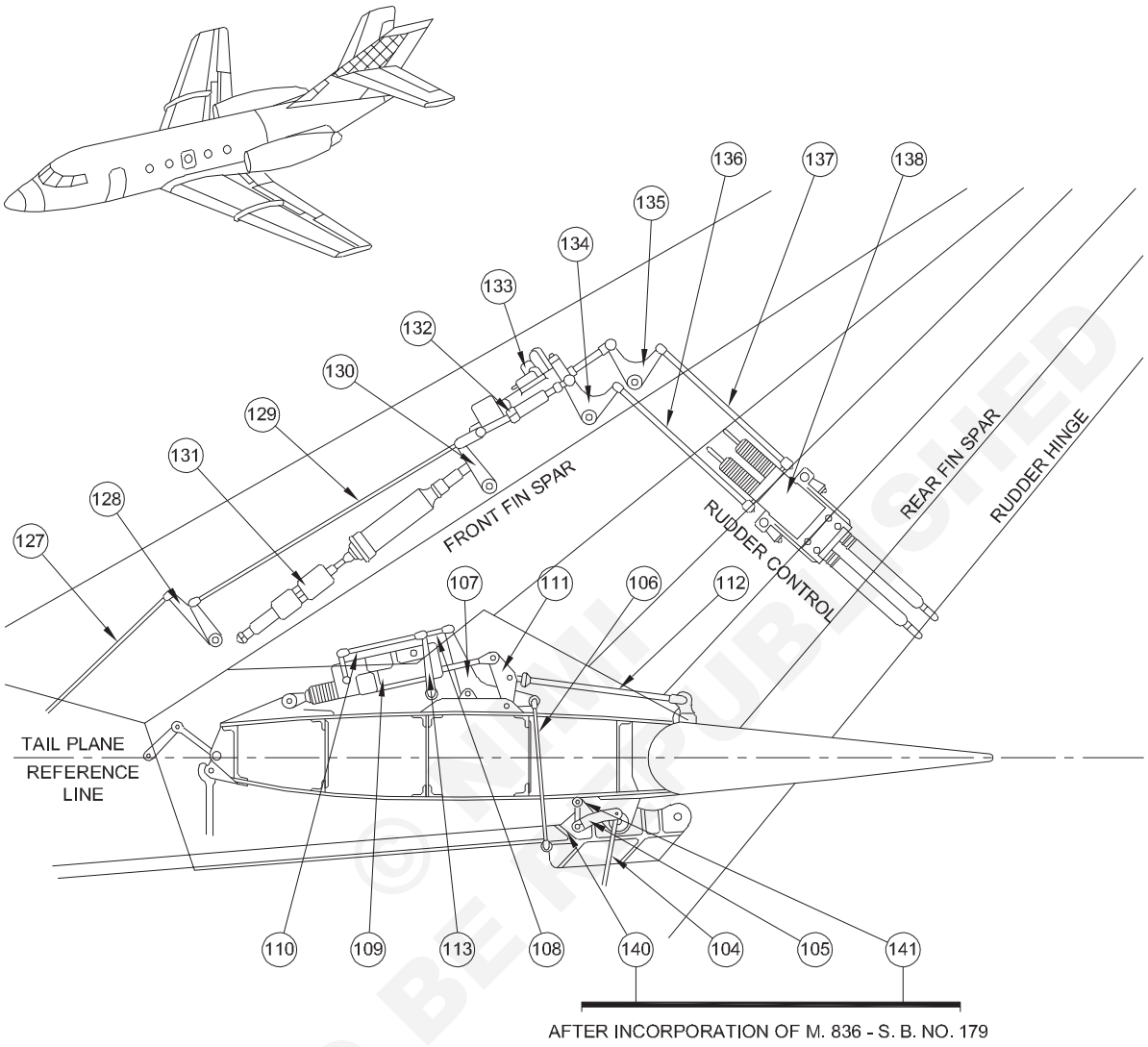


FLIGHT CONTROLS IN FUSELAGE REAR SECTION

E - Elevator and rudder control hinge points in empennage

Index no.	Description of lubrication points	Number	Access
	ELEVATOR CONTROL		
105	Bellcrank hinge-pin	1	Door 310
106	Rod connecting pins	2	Door 310
107	Bellcrank hinge-pin	1	Spring fillets
108	Rod connecting pins	2	Spring fillets
109	Servo-control attaching pins	4	Door 302
110	Rod connecting pins	2	Spring fillets
111	Bellcrank hinge-pin	1	Spring fillets
112	Rod connecting pins	4	Door 302
113	Secondary A. F. U. attaching pins	2	Spring fillets
	RUDDER CONTROL		
128	Bellcrank hinge-pin	1	Door 303
129	Rod connecting pins	2	Door 303
130	Bellcrank hinge-pin	1	Door 303
131	Trim-to-A, F. U. connecting pins	2	Door 303
132	Spring-rod connecting pins	2	Door 303
133	Damper connecting pins	2	Door 303
134	Bellcrank hinge-pin	1	Door 303
135	Bellcrank hinge-pin	1	Door 303
136	Micrometric rod connecting pins	2	Door 308
137	Micrometric rod connecting pins	2	Door 308
138	Rudder servo-control connecting pins	4	Door 308
	TAIL PLANE MICROSWITCH		
	Mod. 836 (S.B. No. 179) incorporated	1	
140	Rocker hinge-pin	1	Spring fillets
141	Roller pivot-pin on adjustable stop		Spring fillets

Fig 5



FLIGHT CONTROLS IN EMPENNAGE

ELEVATOR PRESSURE SEAL AT FRAME 32 – REMOVAL/INSTALLATION FOR LUBRICATION OF BEARINGS

1 Equipment and materials

- Electrician's heater
- PR 1422 B2 (MIL-S-8802B)
- Spares Seal AN 6230-3 for pressure seal support on structure.

2 Removal/Installation

A. Removal

(1) From outside the aircraft:

(a) Remove the rear central panel (261) (see 12-00-10) to gain access to the bellcrank.

(b) To facilitate access to the bellcrank, remove the two rods and the rudder control bellcrank located nearby.

(c) Disconnect the two elevator control rods from the bellcrank.

(2) From inside the cabin:

(a) Remove floor section 417 (see 12-00-10) under the RH rear coatroom to gain access to the bell-crank.

(b) To facilitate access to the bellcrank, uncouple the elevator AFU at the anchor side.

(c) Disconnect rod MY20 273.63 from bellcrank MY20 273.19.840.

(d) Remove the 14 self-locking nuts securing the pressure seal to the structure.

NOTE: Have an assis-tant to hold the screw heads outside the aircraft.

(e) Heat the sealed support assembly for approximately 5 minutes with an electrician's heater.

NOTE: The PR interlay and sealing compound is softened when heated, thereby facilitating removal.

(f) After heating, withdraw the pressure seal/support assembly, by balancing the extraction forces.

(g) Remove and discard the seal.

(h) Lubricate the bearings as described in paragraph 3 hereafter.

B. Installation

NOTE: Installation of the box presents no special difficulties.

(1) Reinstall a new seal.

(2) Apply a light coat of PR 1422 B2 sealant to the bearing face.

(3) Gradually tighten the sealed box attaching screws in turn.

3 Lubrication of bearings

NOTE 1: The pressure seal is fitted with sealed bearings which are to be manually lubricated (not pressurized) after removal of the outer seal.

NOTE 2: Bellcrank MY20 273.19.840 is fitted with a KN6 bearing which is to be pressure lubricated using the equipment contained in kit T.MY20 27601.

A Equipment and materials

- Fine-nosed pliers
- Pointed tool with handle
- Spatula, 2 to 3 mm wide. - Dry lintfree cloths
- Grease AIR 4210B (MIL-G-23827A)

C Lubrication of sealed bearings

(1) Access to sealed bearings

(a) Remove bellcrank MY20 273.19.840 on cabin side.

- Remove the two attachment pins.
- Remove the cones with a plastic drift.
- Disengage the bellcrank from its shaft.

(b) Push the bellcrank shaft so as to separate the shaft from its bearings.

(2) Inspect the bellcrank shaft for condition and appearance of the inner circular seal bearing face.

(3) Inspect the bearings for condition, corrosion and binding.

(4) Inspect the inner circular seal for condition and depression through the inside of the box.

(5) Gain access to the balls of each bearing for lubrication purposes as follows:

CAUTION: TAKE CARE NOT TO DAMAGE THE CIRCLIP AND THE SEAL.

(a) Remove the bearing seal retaining circlip.

NOTE: Prior to removing the circlip, measure its approximate gap so that the same gap is retained upon reinstallation.

Using the fine-nosed pliers, grip the circlip at the gap by applying a slight force and disengage it from the groove with a pointed tool; discard the circlip.

Then remove the seal.

(b) Check the balls for condition, corrosion, binding and snagging. Any defect shall be cause for bearing replacement.

(6) Lubrication of sealed bearing

(a) Clean the bearing balls as well as possible.

(b) Using a brush, apply a reasonable quantity of grease AIR 4210.

(c) Rotate the bearing several times to ensure penetration of the grease, then apply grease again until the lubrication is satisfactory.

(d) Wipe off any excess grease.

(7) Seal the bearing

(a) Position the seal and apply it with a spatula so as to preclude any damage.

(b) Install the circlip and check that it is properly engaged in its groove. Check that the resulting gap is approximately the same as that measured prior to removal.

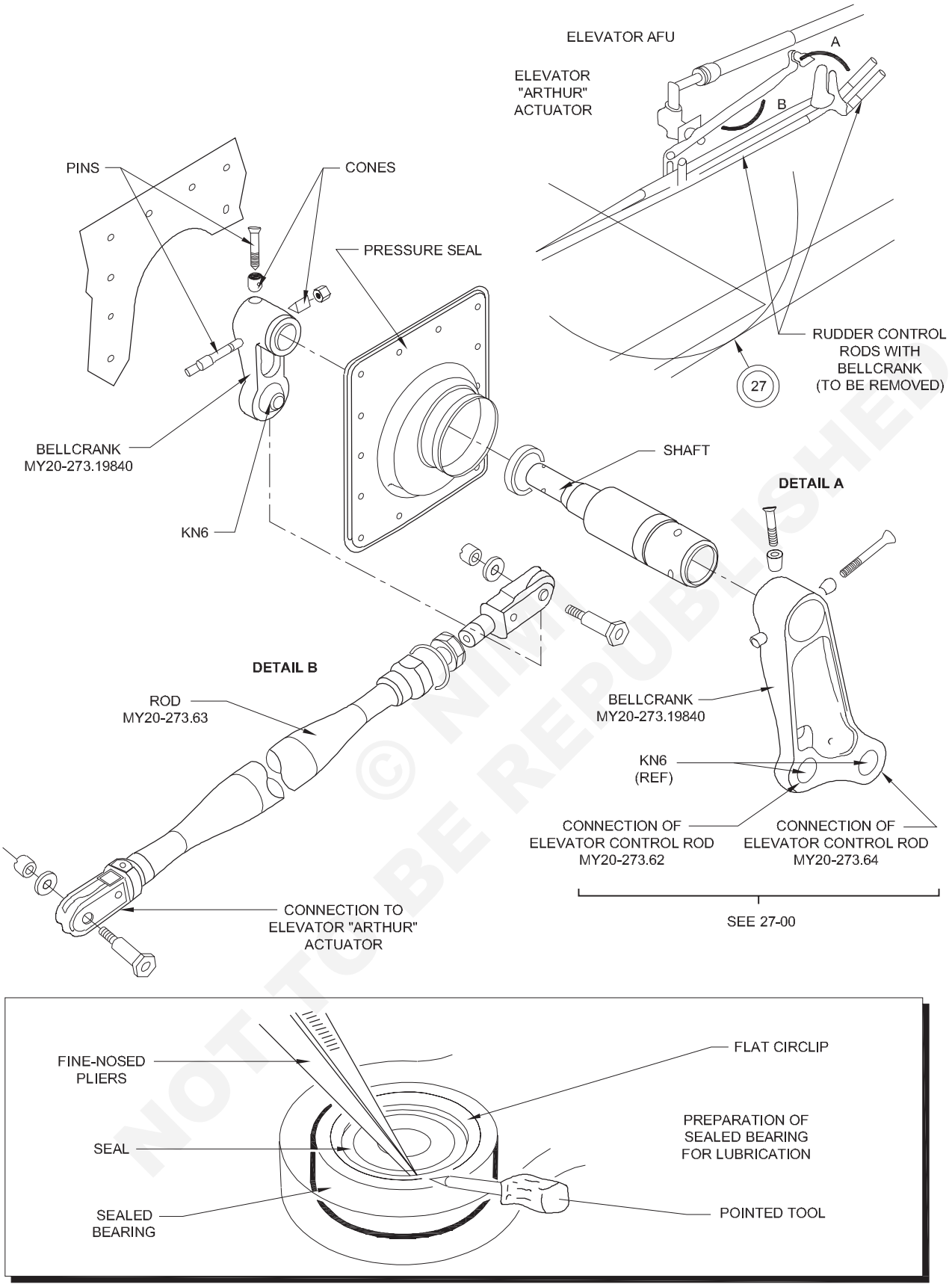
NOTE: If the circlip or the seal are damaged during removal/installation, replace the bearing.

(8) Reinstallation of components

(a) Apply o thin film of grease to all the contact surfaces (circular seal, fitted pins).

(b) Reinstall the bellcrank on its shaft. Tightening torque of pins on cones: 0.7 m.daN.

Fig 6



AFN4286H6

ELEVATOR PRESSURE SEAL AT FRAME 32
"LUBRICATION OF BEARINGS"

Perform assembly on the Hydraulic system

Objectives: At the end of this exercise you shall be able to
- **perform assembly on the Hydraulic system.**

Job Sequence

Following the specific job card to:

- Assembly of the Hydraulic system components: valve, pump, actuators.
- Position parts relative to each other
- Tightening according to the standard torque Aluminium mentioned in work card
- Bonding/grounding: screw the ground termination, apply varnish on different pipes
- Functionality check according to the technical documentation

Note

The following pages give an example of a work card for this chapter.

The Aircraft Maintenance Manual used for this example is that for the Falcon 20.

Depending on the available material in the ITI, the work cards will correspond to the existing real element available.

If available, the material mentioned is only given as an example. Procurement will be based on the real specific exercise set up.

AVIONS MARCEL DASSAULT

FAN JET FALCON

MAINTENANCE MANUAL

FILTERS/ROUTINE SERVICING

1. General

A. The cleaning of the hydraulic reservoir filling filter and the replacement of the elements belonging to the filters located in the hydraulic reservoirs or built in the various systems, is carried out at regular intervals. They will also have to be carried out in case of heavy damage to a hydraulic equipment.

B. The cleaning of the filtering cartridges of the filters installed on the:

- pressure lines of the circuits 1 and 2 (P/N 575-019)
- pressure line of the electric-motor-driven pump (P/N 671-023)
- case drain lines of the pumps on circuits 1 and 2 (P/N GA 69802 or GA 70050)

shall be accomplished at higher repair level (ultrasonic cleaning).

C CAUTION: IT IS FORBIDDEN TO USE A CHLORINATED PRODUCT FOR CLEANING. ONLY WHITE SPIRIT IS AUTHORIZED.

IMPORTANT NOTE CONCERNING CLEANABLE FILTER ELEMENTS

(1) Upon removal, the element to be cleaned is to be placed, still fitted with its gaskets, in a clean plastic packet and is not to be sponged or dried. The time between removal and cleaning should be kept to a minimum.

(2) The ultrasonic cleaning operation (accompanied by flushing with fluid flow in reverse direction) must be :

- preceded by measurement of pressure drop in order to assess degree of clogging,
- followed by a further pressure drop measurement with measurement of bubble point,
- completed by drying with dry, filtered air. The filter element is then to be placed in a plastic packet ready for reinstallation.

If these mandatory requirements cannot be respected because suitable industrial equipment is not available, it is better to consider the cleaning operation to be impossible and discard the soiled filter element.

2. Preparation for the work

A. To replace the filter elements of the pressure filters of systems 1 and 2:

- Connect a hydraulic pressure bench to the system corresponding to the affected filter.

B. To replace the filter elements of the filters located in the reservoirs :

- Drain the reservoir corresponding to the affected filter (see 29-30-3).

3. Replacing the filter elements of the exhaust filters in systems 1 and 2

A. Disassembly

(1) Unlock and unscrew sump (1).

(2) Remove circlips (2).

(3) Remove the filter assembly (3).

(4) Remove the gasket (4).

B. Cleaning

(1) Check for perfect condition of gasket (4) and replace it if necessary.

(2) Carefully clean the interior of sump (1) with white spirit, dry with dehydrated compressed air.

C. Reassembly

(1) Replace gasket (4).

(2) Insert a new or reconditioned filter assembly (3) in sump (1). NOTE: Cleaning the entire filter unit is done at a higher repair level.

(3) Position circlips (2).

(4) Coat gasket (4) lightly with hydraulic fluid

(5) Manually screw on sump (1) and lock it (annealed wire 0.8 mm dia.).

D. Checks, tests

(1) Using a hydraulic pressure bench, put the system corresponding to the replaced filter element under pressure.

(2) Check that the filter is perfectly seal-tight.

E. Completion

Disconnect the hydraulic pressure bench.

4. Replacing the filtering element (Ref. 671.023) of the electric pump exhaust filter (see figure 201)

A. Disassembly

(1) Unlock and unscrew the filter assembly (1).

(2) Remove the gasket (2).

B. Reassembly

(1) Replace the gasket (2) and coat it lightly with hydraulic fluid.

(2) Screw and lock a new or reconditioned filter assembly, lock with annealed wire 0.8 mm dia.

NOTE: Cleaning the entire assembly is done at a higher repair level.

C. Checking

Start the electric pump and check for perfect seal of the filter.

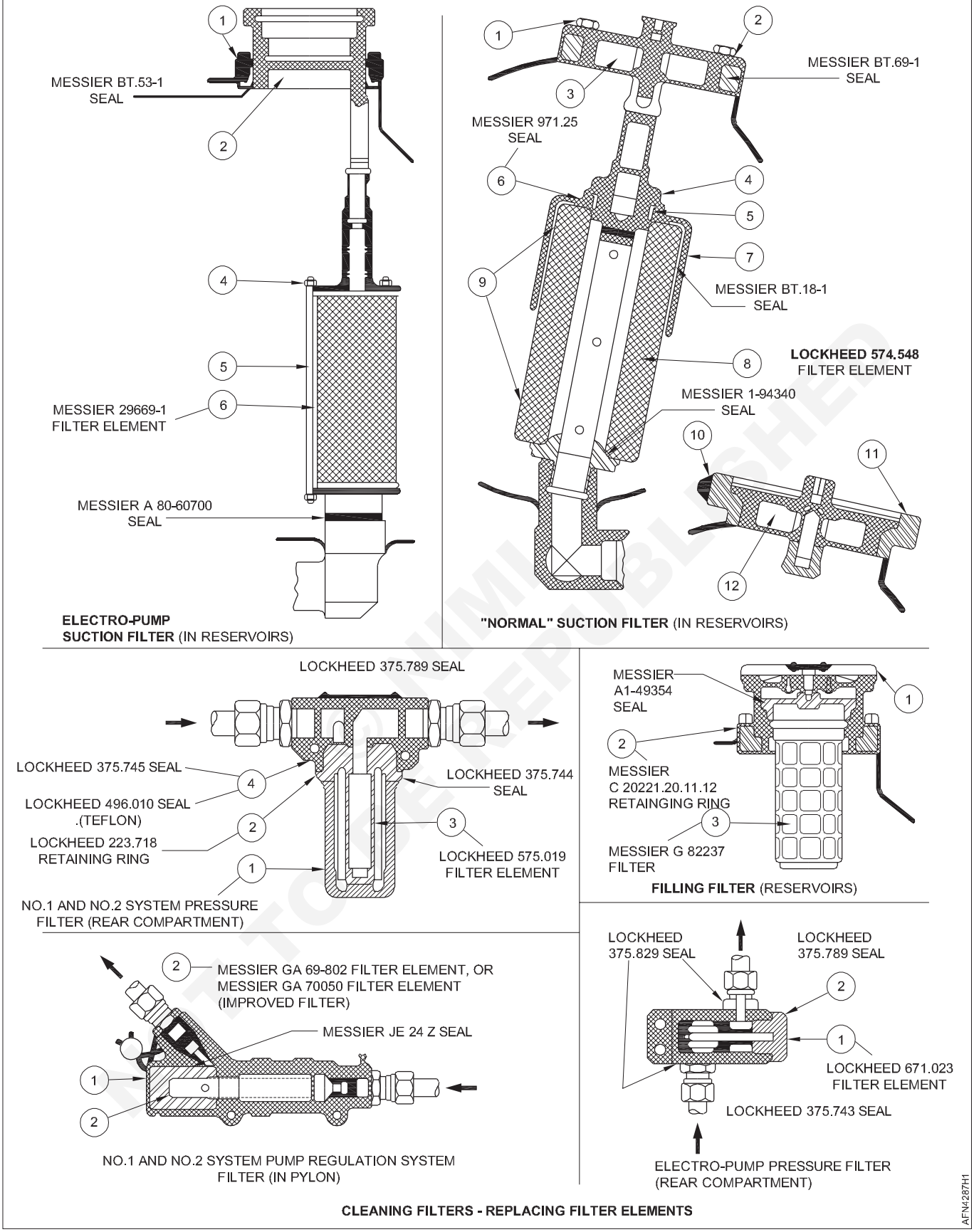
5. Replacing the filter elements (Ref. GA 69802 or GA 70050) of the filters built into the return lines for systems 1 and 2 pumps (see figure 201)

A. Disassembly

(1) Unlock, unscres screw (1)

(2) Using threaded rod 8-32, extract the filter assembly (2).

Fig 1



CLEANING FILTERS - REPLACING FILTER ELEMENTS

B. Reassembly

(1) Re-install a new or reconditioned filter assembly after first coating the gasket with a light coat of hydraulic fluid.

NOTE: Cleaning of the entire filter assembly is done at a higher repair level.

(2) Manually screw screw (1) and lock with annealed wire 0.8 mm dia.

C. Checking

- Check for perfect seal-tightness of the filter during a run-up test.

6. Filters located in the reservoirs

REMINDER: DRAIN THE RESERVOIR (see procedure in chap. 29-10-3).

A. Replacing the filter element (P/N 574.548)) in the normal suction filter.

(1) Removal

- For reservoirs with part numbers A 23738 or A 23739

(a) Unlock and remove screws (1), retain the washers (2).

(b) Extract the plug (3) with attache spring.

(c) Extract the filter assembly.

- For reservoirs with part numbers A 10-23738 or A 10-23739

(a) Unscrew the attachment screw of the FLEXINOX clamp (10), remove the clamp and two-part ring

(b) Extract the plug (12) with attached spring.

(c) Extract the filter assembly.

(2) Disassembly

(a) Unscrew nut (4) and remove in this order ring (5), rubber seal (6) and mask (7).

(b) Remove and discard filter element (8); if it is not fitted with glued cork gaskets, retain rubber gaskets (9).

(c) Remove gaskets.

(3) Cleaning Checking

(a) Carefully clean the filter support with white spirit and dry with dry compressed air.

(b) Check for perfect condition of the gaskets and replace them if necessary.

(4) Reassembly

(a) Refit the gaskets, giving them a light coat of hydraulic fluid.

(b) Install a new filter element (install gaskets (8) J 44-1 if the filter element is not fitted with glued cork gaskets).

(c) Install mask (7) and rubber seal (6), then push in ring (5) against (6). (d) Screw nut (4) until its face comes to rest against ring (5) and then give it an additional turn.

(5) Installation

(a) Insert the filter assembly into the reservoir and carefully engage its lower end into its housing.

(b) Install the plug (3) or (12) as applicable, making sure its spring correctly engages the filter assembly rod.

(c) Secure the plug

- Plug (3) is secured by screws (1) equipped with washers (2) and locked with annealed wire (0.6 mm dia.)
- Plug (12) is secured by means of the two-part ring (11) held by the FLEXINOX clamp (10)

B. Disassembly and cleaning the filling filter (Ref: G 8237)

(1) Remove filler plug (1)

(2) Extract snap ring (2)

(3) Extract filter (3)

(4) Clean filter with white spirit, then dry with dehydrated compressed air

C. Replacing the filter element (Ref. 29669-1) of the electric pump suction filter

(1) Removal

(a) Unscrew screws (1)

(b) Extract the base (2), marking its angular position in relation to the reservoir

(c) Extract the filter assembly

(2) Disassembly

(a) Unscrew nuts (4) from rods (5)

(b) Extract the rods

(c) Remove the filter element (6). Discard it

(d) Remove the gaskets

(3) Cleaning Checking

(a) Carefully clean the filter support with white spirit, dry with dehydrated compressed air

(b) Check for perfect condition of gaskets

(4) Reassembly

(a) Place a new filter element (6) between the upper and lower flanges of the filter unit. Check that it is perfectly centered on its flanges

(b) Position rods (5), screw and moderately tighten nuts (4)

(c) Refit the gaskets and coat them lightly with hydraulic fluid

(5) Installation

(a) Insert the filter assembly into the reservoir and carefully engage its lower end into its housing

(b) Replace the bottom (2) respecting its original position. Check that the lug of its collar fits well into the upper tube of the filter assembly

(c) Screw, block and lock (annealed wire 0.8 mm dia.) screws (1)

D. Reassembling the filling filter

(1) Insert the filling filter (3) into the tank

(2) Replace clip (2)

(3) Replace filler plug (1) (see 12-10-31)

7. Completion

Filling the hydraulic fluid reservoirs (see 12-10-31).

1. General

   The No. 1 hydraulic system consists of a pump-fed generation system and of three hydraulic power distribution lines. A power reserve is provided by an accumulator and by a transfer jack for a number of ancillaries.

2. Pressure generation (Figure 1)

   The pressure generation system consists of:

   - a pressurized reservoir (1) provided with a gaging unit and comprising two capacities, i.e. a normal capacity and an emergency capacity. The total reservoir capacity is 15.3 liters (4 US gal.), the usable capacity being 14 liters (3.7 US gal.).

     NOTE: A lighter reservoir is installed on aircraft No. 21 and on, with a total capacity of 14.7 liters (3.85 US gal.) and a usable capacity of 13.4 liters (3.58 US gal.).

   - a self-regulating pump (2) which is driven by the LH engine and is capable of delivering a maximum flow of 26,5 liters/minute (7 gal./min.) at a pressure of 200 bar (3000 psi). The pump suction system passes through a bulkhead coupling (3) fitted with a self-sealing valve. The pump regulation system is connected to the reservoir return system through a check valve (4) and a filter (5).
   - a delivery system check valve (6).
   - a delivery filter (7).
   - a pump failure warning pressure-switch.

3. Distribution lines (Figure 1)

   Three distribution lines are provided as follows:

   A. A line supplying the flight controls (aileron, rudder and elevator controls) through a check valve (8).

   After incorporation of S.B. No. 537

   The check valve is suppressed.

   B. A line supplying the landing gear, a transfer jack (11), normal braking system, through a check valve (9) and the lift dumpers (airbrakes) through a check valve (12).

   C. A line distributing hydraulic pressure to the following ancillaries :

      - nose gear steering system
      - high-lift devices: - wing flaps through a check valve (18)
        - droop leading edges.

4. Hydraulic power reserve (Figure 1)

   A. An accumulator (10) charged to 100 bar (1450 psi) provides a hydraulic power reserve for the flight control distribution system.

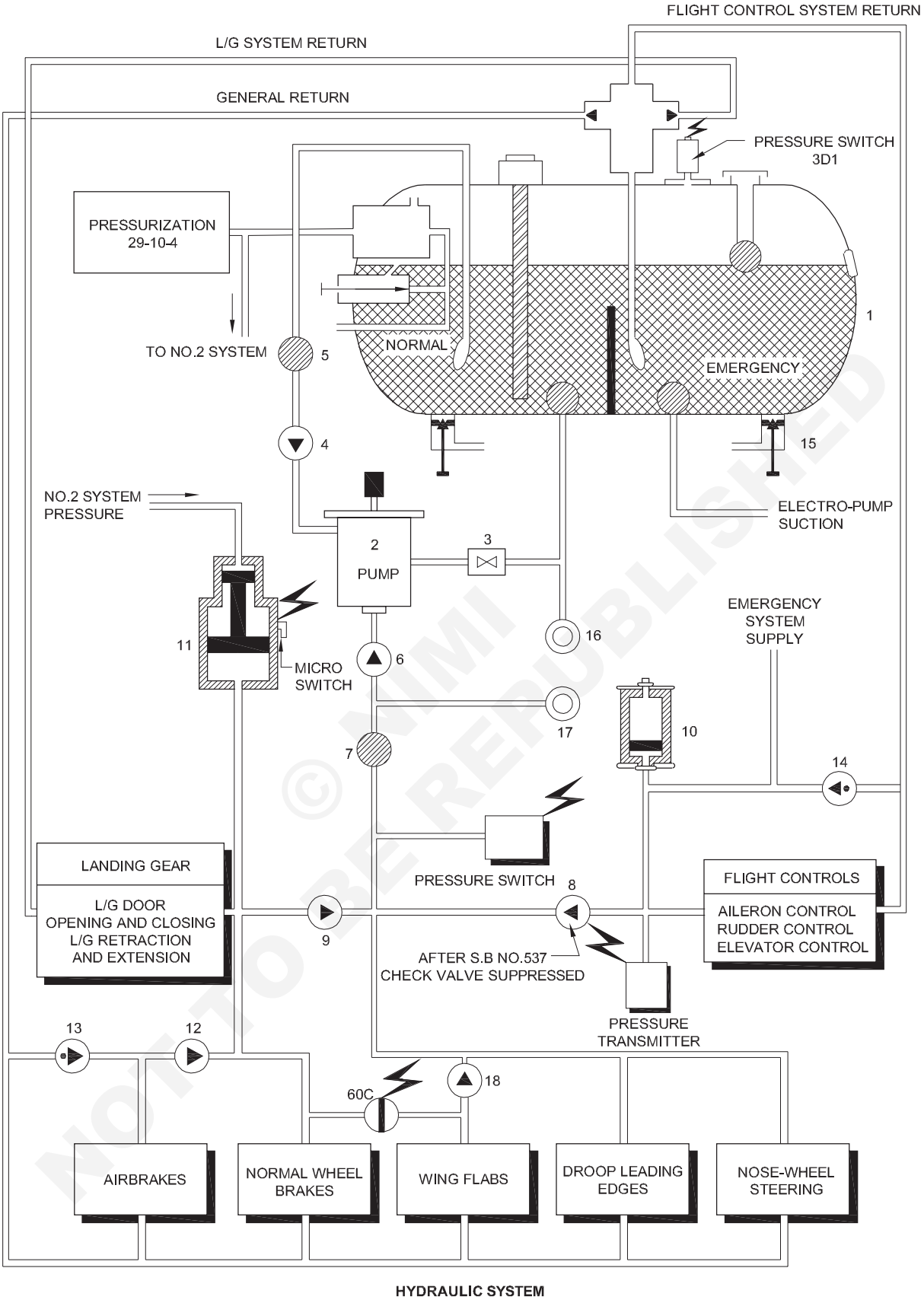
   B. Transfer jack (11)

      Supplied by system No. 1 and pressurized by system No. 2, the transfer jack provides for safety at take-off in case of No. 1 system failure.

      Under a pressure of 175 bar (2500 psi), it supplies:

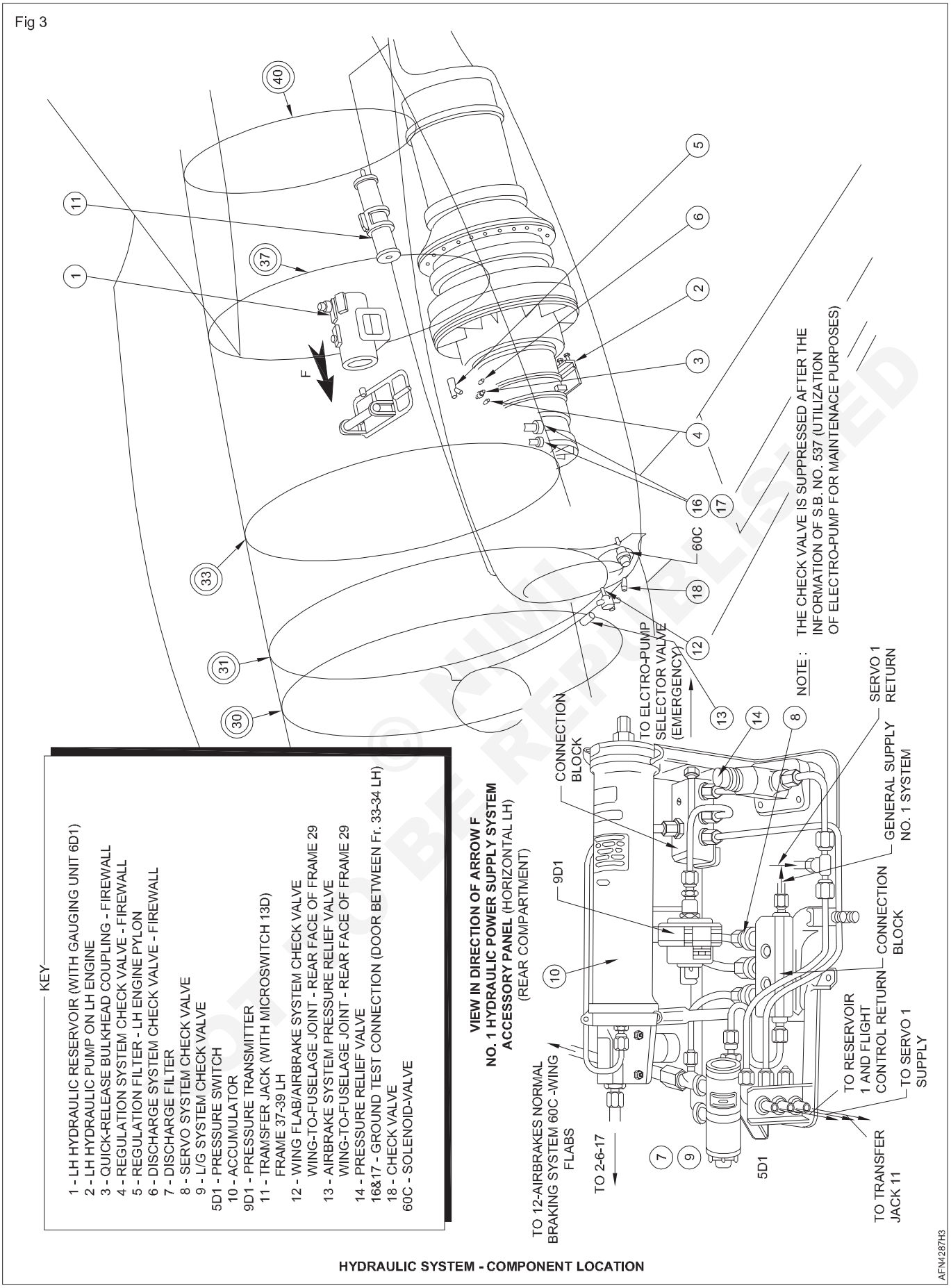
      - the landing gear system (retraction) if landing gear retraction is required,
      - the airbrake and normal braking systems when take-off is aborted,
      - the wing flap selector valve through solenoid valve 60C.

Fig 2



HYDRAULIC SYSTEM

Fig 3



HYDRAULIC SYSTEM - COMPONENT LOCATION

5. Distribution system protection

   Protection is provided by a pressure relief valve (14) for the flight controls and by a pressure relief valve (13) for the lift dumpers. These valves open when the system pressure reaches 250 bar (3550 psi).

6. Ground testing (See figure 1)

   The hydraulic system is tested on the ground by means of a hydraulic power unit connected to a suction connection (16) and a delivery connection (17).

   After incorporation of S.B. No. 537

   The check valve between No. 1 system and electro-pump system is suppressed. This modification allows the electro- pump to be used on the ground for maintenance purposes, i.e. to check the operation of airbrakes, droop leading edges, wing flaps, L/G, brakes and nosewheel steering system through No. 1 system as for servo-controls.

   NOTE: To avoid jerky operation of the wing flap motor/reduction gear unit during the ground tests with the electro-pump, it is recommended to apply the S.B. No. 590, as this will permit to reduce the release pressure of the motor/reduction gear unit brake to 50 bar (725 psi).

Perform crosscheck visual inspection (by team of 2 students) on a mock up with defaults on the hydraulic system

Objectives: At the end of this exercise you shall be able to
- **perform crosscheck visual inspection**

Job Sequence

Following the specific job card to:

- Perform crosscheck visual inspection on a mock up.
- Routing according to the diagram
- Cleanliness
- Grounding, bounding standards
- Marking and lockage
- Marking of systems
- Check tightening torques
- Check the assembly compliance of the system according to the requirements defined in the documentation.

NOTE

Depending on the available material in the ITI, the work cards will correspond to the existing real element available.

Perform Hydraulic system leak tests

Objectives: At the end of this exercise you shall be able to
- **using compressed air, perform Hydraulic system leak tests**

Job Sequence

Following the specific job card to:

- Using compressed air, perform Hydraulic system leak tests on the available system in ITI.

NOTE

Depending on the available material in the ITI, the work cards will correspond to the existing real element available.

Perform assembly on the Pneumatic system

Objectives: At the end of this exercise you shall be able to
- **perform assembly on the Pneumatic system**

Job Sequence

Following the specific job card to:

- Assembly the pneumatic system components: compressor, pressure gauge, filter, regulator, etc.
- Position parts relative to each other.
- Tightening according to the standard torque aluminium mentioned in work card.
- Bonding/grounding: screw the ground termination, apply varnish on different pipes.
- Checking functionality according to the technical documentation.
- Checking leakages.

NOTE

The following pages give an example of a work card for this chapter.

The Aircraft Maintenance Manual used for this example is that for the Falcon 20.

Depending on the available material in the ITI, the work cards will correspond to the existing real element available.

If available, the material mentioned is only given as an example. Procurement will be based on the real specific exercise set up.

AVIONS MARCEL DASSAULT

FAN JET FALCON

MAINTENANCE MANUAL

COMPRESSED AIR

1. General (Figures 1 and 2)

The compressed air bled from each of the two engines through four compressor bleeds is used to ensure the following:

- **cabin air conditioning and pressurization**
- **fuel tank and hydraulic reservoir pressurization**
- **wing, nacelle and engine de-icing (see description in chapter 30).**

As regards air conditioning, two A/C versions are to be considered, depending on whether S.B. No. 558 is incorporated or not.

A. A/C not changed per S.B. No. 558

A single line is provided from the engine compressed air bleed (A3) up to the fuselage, where it divides into two lines: one air conditioning line and one fuel tank and hydraulic reservoir pressurization line (ancillary P2 air system).

(1) Air conditioning line (see also chapter 21)

The air conditioning line includes an electrically-operated valve which permits the corresponding bleed flow to be cut off in the event of fumes coming from the engine for instance.

A flow limiter calibrated at 10 kg/min. (22 lb/min.) limits the maximum flow from each engine.

During flight at very low altitude, the bleed actually is about 10 kg/min. (22 lb/min.) per engine which corresponds to 0,8 % approximately of the engine main air flow.

During flight at high altitude (40 000 feet), the bleed is about 5 kg/min. (11 lb/min.) per engine which corresponds to 1,5 % approximately of the engine main air flow.

Each P3 valve (25D1-25D2) is controlled by means of a two-position switch (24D1-24D2) on the air conditioning control panel.

(2) Fuel tank and hydraulic reservoir pressurization line (ancillary P2 air system) (see also chapters 28 and 29)

The fuel tank and hydraulic reservoir pressurization line is provided with a restrictor (after incorpo- ration of S.B. No. 38) and is protected by a check valve and a filter. It distributes compressed air to the three pressure reducing valves corresponding to the equipment to be pressurized (see chapters 28 and 29) and to the emergency air conditioning valve (see chapter 21).

B. A/C changed per S.B. No. 558 (air conditioning separated from fuel tank and hydraulic reservoir pressu rization)

(1) Air conditioning line

The engine compressed air bleed (A3) is only intended for cabin air conditioning and pressurization. A line is tapped upstream of P3 valve to supply the emergency cabin air conditioning and pressurization valve through a restrictor (see chapter 21). The rest of the line is similar to the previous description (para. 1.A).

(2) Fuel tank and hydraulic reservoir pressurization line (ancillary P2 air system)

The air required for fuel tank and hydraulic reservoir pressurization is bled directly from engine bleed A2 already used for wing and engine de-icing. The line is tapped at the lowest point of bleed A2. Moreover, the lowest point of the line (at engine pylon level) is provided with an automatic drain (see chapter 28).

The ancillary system, which is protected through a check valve and a filter, distributes compressed air to the three wing fuel tank, rear compartment fuel tank and hydraulic reservoir pressurization system pressure reducing valves described in chapters 28 and 29.

C. A/C changed per S.B. No. 567 (complementary to S.B. No. 558)

Suppression of the hydraulic reservoir and fuel tank pressurization through the A.P.U. (see chapter 49-00). (see chapter 49-00).

5. <u>Distribution system protection</u>

Protection is provided by a pressure relief valve (14) for the flight controls and by a pressure relief valve (13) for the lift dumpers. These valves open when the system pressure reaches 250 bar (3550 psi).

6. <u>Ground testing (See figure 1)</u>

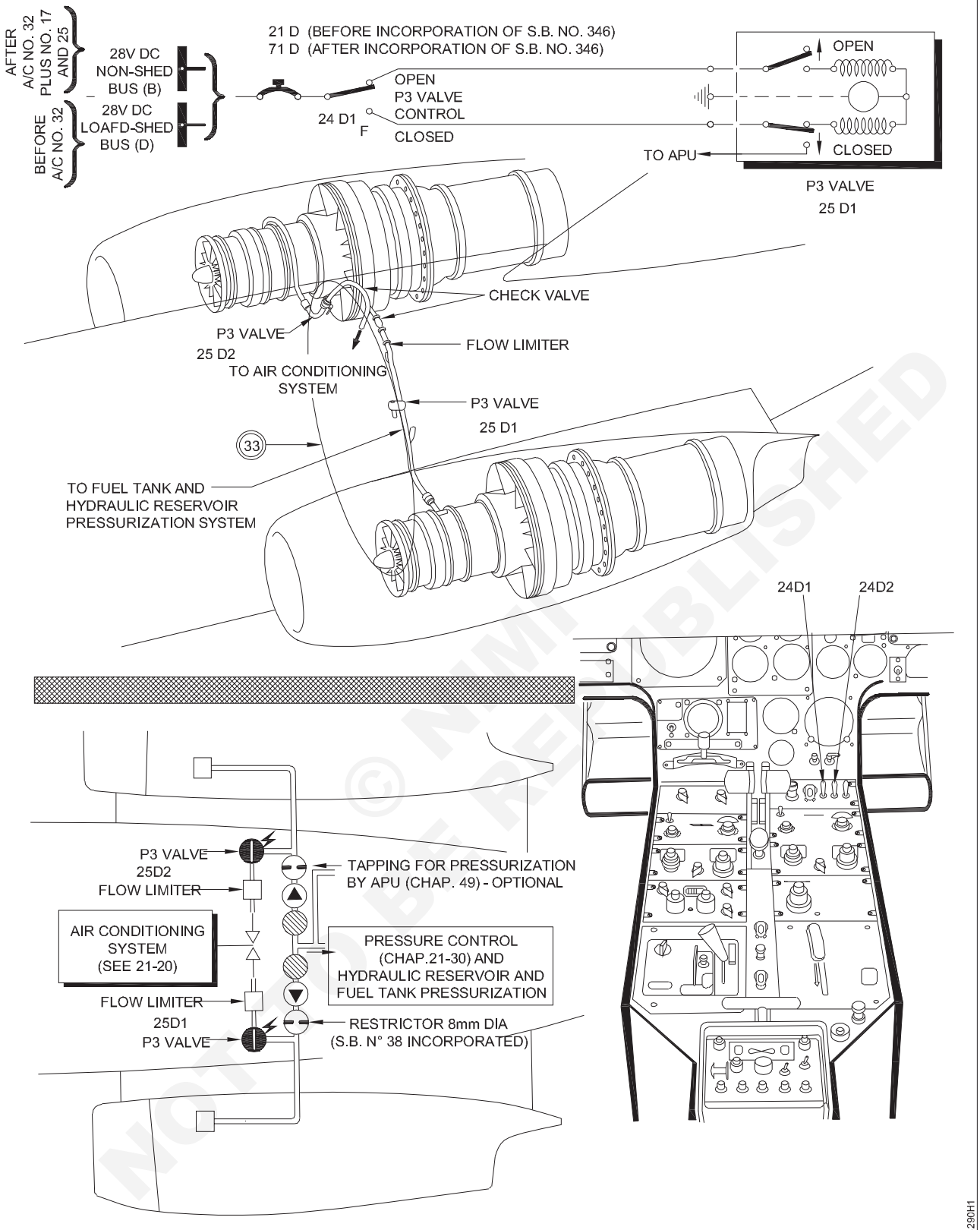
The hydraulic system is tested on the ground by means of a hydraulic power unit connected to a suction connection (16) and a delivery connection (17).

<u>After incorporation of S.B. No. 537</u>

The check valve between No. 1 system and electro-pump system is suppressed. This modification allows the electro- pump to be used on the ground for maintenance purposes, i.e. to check the operation of airbrakes, droop leading edges, wing flaps, L/G, brakes and nosewheel steering system through No. 1 system as for servo-controls.

NOTE: To avoid jerky operation of the wing flap motor/reduction gear unit during the ground tests with the electro-pump, it is recommended to apply the S.B. No. 590, as this will permit to reduce the release pressure of the motor/reduction gear unit brake to 50 bar (725 psi).

Fig 1



COMPRESS AIR SYSTEM A/C NOT CHANGED PER S.B. NO. 558

Perform crosscheck visual inspection (by team of 2 students) on a mock up with defaults on the pneumatic system

Objectives: At the end of this exercise you shall be able to
- **perform crosscheck visual inspection**

Job Sequence

Following the specific job card to:

Following the specific job card to:

- Perform crosscheck visual inspection on a mock up.
- Routing according to the diagram
- Cleanliness
- Grounding, bounding standards
- Marking and lockage
- Marking of systems
- Check tightening torques
- Check the assembly compliance of the system according to the requirements defined in the documentation.

Note: Depending on the available material in the ITI, the work cards will correspond to the existing real element available.

Perform Pneumatic system leak tests.

Objectives: At the end of this exercise you shall be able to
- **using compressed air, perform pneumatic system leak tests**

Job Sequence

Following the specific job card to:

- Using compressed air, perform pneumatic system leak tests on the available system in ITI.

Note: Depending on the available material in the ITI, the work cards will correspond to the existing real element available.

Perform assembly and fitting of Oxygen components

Objectives: At the end of this exercise you shall be able to
- **perform assembly on the Oxygen system**

Job Sequence

Following the specific job card to:

- Position parts relative to each other
- Tightening according to the standard torque aluminium mentioned in work card
- Bonding/grounding: screw the ground termination, apply varnish on different pipes
- Checking functionality according to the technical documentation

Note: The following pages give an example of a work card for this chapter.

The Aircraft Maintenance Manual used for this example is that for the Falcon 20.

Depending on the available material in the ITI, the work cards will correspond to the existing real element available.

If available, the material mentioned is only given as an example. Procurement will be based on the real specific exercise set up.

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FAN JET FALCON

MAINTENANCE MANUAL

COMPRESSED AIR

Passenger oxygen system solenoid valve removal/installation (aircraft not incorporating s.b. no. 589)

1- General

The following procedure provides all information required for removal and installation of the solenoid valve causing the masks to drop out and supplying the passenger oxygen system in case of cabin decompression. A test procedure to be carried out during reinstallation is also provided to check the equipment for perfect installation.

2 Equipment and materials

- 28V DC power supply
- Two-wire cable with SOURIAU connector 851-00-RC-10-6P (01) for connection to solenoid valve and switch on positive wire.

3 Preliminary steps

A - Access

- Remove the lower trim panels of the RH co-pilot's console to gain access to the solenoid valve.

B- Precautions

- Open access door No. 425 (See 12-00-10) and close the oxygen bottle valve.
- Release the pressure in the lines by inserting a tube having a diameter equal to that of the mask
- bayonet coupling end-piece into the pilot's or co-pilot's oxygen mask connection so as to open the internal valve.

C- Turn off all electrical power supplies in the aircraft.

Caution: hands and tools must be free from grease. Ventilate flight compartment (open sliding window and passenger/crew door).
Smoking is prohibited.

4 Removal of solenoid valve

A - Disconnect the electrical connector.

B - Disconnect the solenoid valve from the oxygen system by unscrewing the couplings of the lines:

(1) connecting the solenoid valve to the oxygen supply system (lower coupling)

(2) connecting the solenoid valve to the normal shut-off valve (side coupling)

(3) connecting the solenoid valve to the emergency shut-off valve (upper coupling).

NOTE: Removal and installation instructions for BRIGGS couplings are given in chapter 20-40-2.

C - Remove the solenoid valve from its support by loosening the MINOX attaching clamp.

The removed solenoid valve is fitted with a female tee-coupling with straight adapters on oxygen outlet side and with a straight coupling with an elbow adapter on oxygen inlet side.

D- Remove the outlet female tee-coupling and the inlet straight coupling from the solenoid valve.

5- Installation and testing of solenoid valve

The solenoid valve body with its two threated end-pieces is marked with an arrow showing the oxygen flow direction. This arrow must be directed towards the lines connecting the valve to the normal and emergency shut-off valves,

A- Install the female tee-coupling fitted with its straight adapters at the outlet of the solenoid valve.

B - Install the straight coupling fitted with its straight adapter at the inlet of the solenoid valve. NOTE: Orient these couplings according to position of connecting lines,

C - Install the solenoid valve on its support by means of the MINOX clamp.

D - Connect the line between the solenoid valve and the oxygen supply system (lower coupling).

E - Carry out the installation test

(1) Connect the cable described in para. “Equipment and materials” to the 28V DC power supply.

(2) Check that cable switch is open.

(3) Connect the cable connector to the solenoid valve.

(4) Open the oxygen bottle valve (See instructions in 12-00-21).

(5) Close the cable switch to energize the solenoid valve.

(6) Quickly check that oxygen flows from upper adapter of tee-coupling at solenoid valve outlet and open the switch. The oxygen flow should be interrupted.

NOTE: If oxygen flows when the solenoid valve is de-energized, this indicates that the valve is incorrectly installed (outlet adapter connected to supply system and inlet adapter connected to normal and emergency shut-off valves). In this event, connect the solenoid valve in normal operating direction.

(7) Disconnect the cable from the solenoid valve.

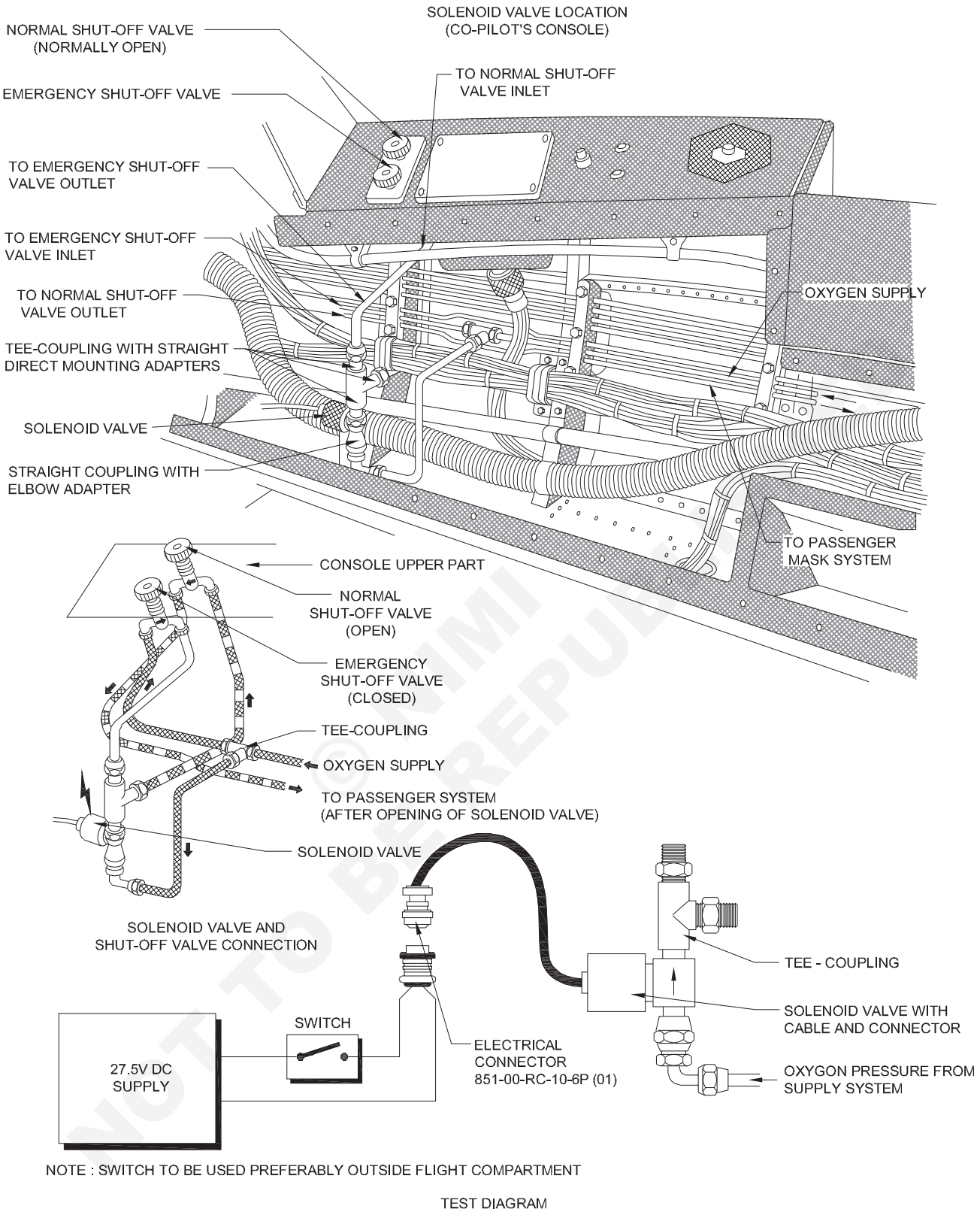
F - Connect the line between the solenoid valve and the normal and emergency shut-off valves to the female tee-coupling.

G - Connect the solenoid valve electrical connector to the corresponding aircraft fixed connector.

6 - **Final steps**

- Reinstall the lower trim panels of the RH co-pilot’s console.

Fig 1



PASSENGER OXYGEN SYSTEM ELECTRO-VALVE REMOVAL/INSTALLATION AND TEST
(AIRCRAFT NOT INCORPORATING S.B. NO: 589)

AFN4293H1

OXYGEN SUPPLY SYSTEM

1- Description (Fig. 1)

The oxygen supply system essentially consists of a bottle, a pressure reducing valve, two HP pressure gauges, a filler valve and a vent.

A - Bottle: The bottle capacity is 2,094 liters (550 US gallons), inflated to 130 bars (1,850 psi). It is located in the passenger compartment, under the bar floor.

The bottle is equipped with a manually-operated shut-off valve (closed on ground-open in flight).

B - Pressure reducing valve: This valve lowers the high pressure from 130 bars (1,850 psi) to an operating pressure of 5. 15+0.7 bars (75+ 10 psi). It is located near the bottle,

C - Pressure gauges: Two HP pressure gauges are used. One for filling check, located near the bottle, the other for in-flight check, installed on the instrument panel or on the altitude sensitive valve on the co-pilot's console if S.B. No. 589 has been incorporated.

D- Vent: The vent, installed outside the fuselage, consists of a union with a puncture disk connected to the bottle.

It prevents any internal overpressure.

2 - Operation

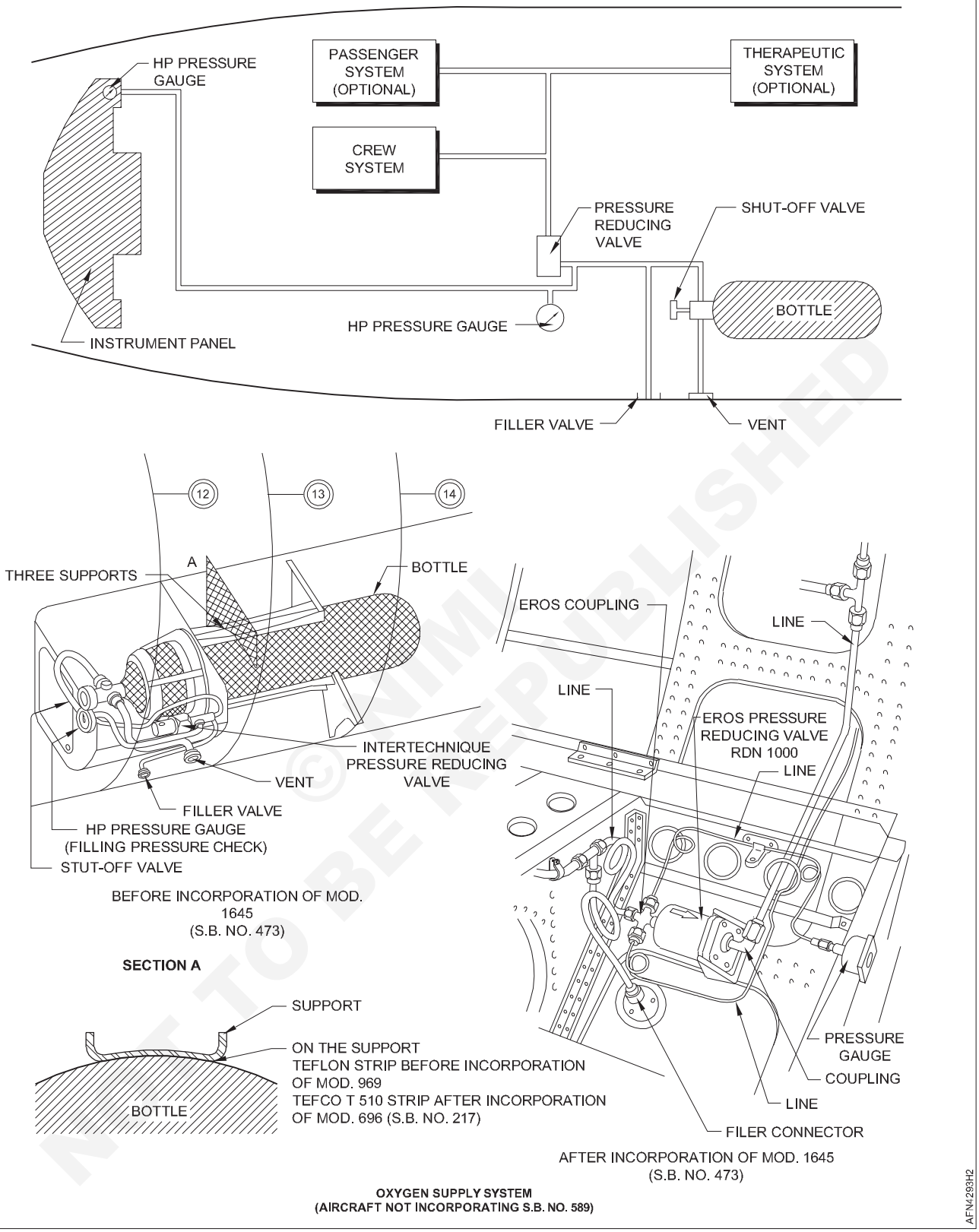
On the ground:

- After opening the bottle valve, filling is carried out through the filler valve.
- After disconnection, the valve ensures sealing of the installation,

In flight:

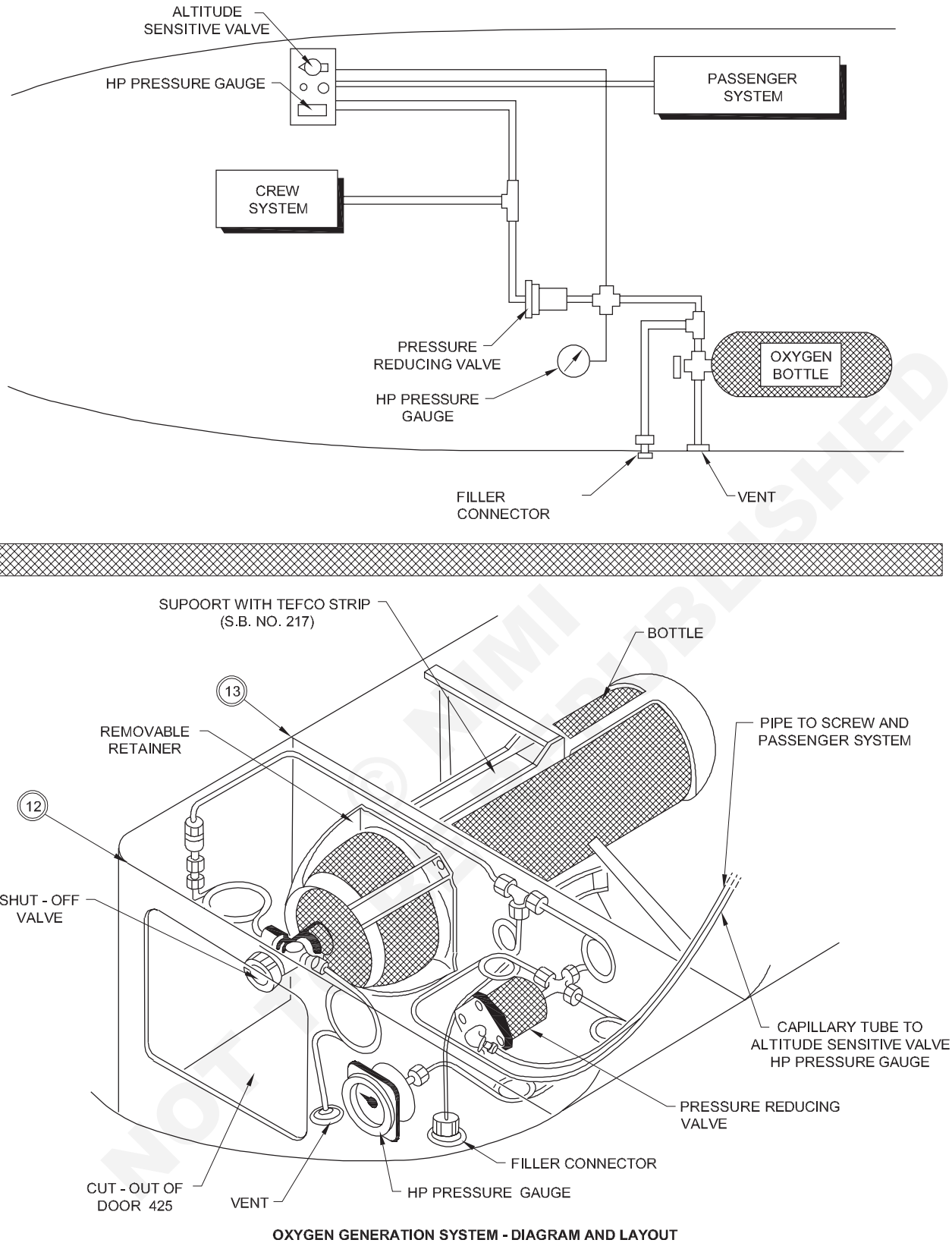
- After opening the bottle, the oxygen reaches the pressure reducing valve which regulates the pressure in the various systems.

Fig 2



OXYGEN SUPPLY SYSTEM
(AIRCRAFT NOT INCORPORATING S.B. NO. 589)

Fig 3



OXYGEN GENERATION SYSTEM - DIAGRAM AND LAYOUT (AIRCRAFT WITH S.B. NO.589 AND 473)

Perform crosscheck visual inspection (by team of 2 students) on a mock up with defaults on the oxygen system.

Objectives: At the end of this exercise you shall be able to
- **perform crosscheck visual inspection**

Job Sequence

Following the specific job card to:

- Routing according to the diagram
- Cleanliness
- Grounding, bounding according to CDCCL standards
- Marking of systems
- Check tightening torques
- Check the assembly compliance of the system according to the requirements defined in the documentation.

Note: Depending on the available material in the ITI, the work cards will correspond to the existing real element available.

Perform Oxygen system leak tests

Objectives: At the end of this exercise you shall be able to
- **using compressed air, perform oxygen system leak tests**

Job Sequence

Following the specific job card to:

- Using compressed air, perform oxygen system leak tests on the available system in ITI.

Note: Depending on the available material in the ITI, the work cards will correspond to the existing real element available

Perform assembly and fitting of fuel components

Objectives: At the end of this exercise you shall be able to
- **perform assembly on the fuel system**

Job Sequence

Following the specific job card to:

- Assembly of Fuel system components: pump, pipes, vent valve, fixed and semi-floating elements, floating fittings, pipe fastening elements, different fitting joints, pipe marking...
- Positioning parts relative to each other
- Tightening according to the standard torque Aluminium mentioned in work card.
- Bonding/grounding: screw the ground termination, apply varnish on different pipes (Fuel Tank Safety standard)
- Checking leakages

Note: The following pages give an example of a work card for this chapter.

The Aircraft Maintenance Manual used for this example is that for the Falcon 20.

Depending on the available material in the ITI, the work cards will correspond to the existing real element available.

If available, the material mentioned is only given as an example. Procurement will be based on the real specific exercise set up

FUEL SYSTEM-INSPECTION/CHECK

1- Inspection/test of rear compartment fuel tank suction relief valve (See figure 601)

A plexiglass plate on the upper doors of the rear compartment fuel tanks permits immediate checking of the suction relief valve. On the central stem of this valve is a readily apparent circular red-luminescent-paint mark; this mark, when flush with the valve body mounting flange, indicates that the valve is closed. Open the small access door located above the valve and apply slight pressure to the valve stem to ascertain that the valve is not stuck on its seat.

NOTE: Air should escape upon actuation of valve stem, provided that such an actuation is performed within 6 hours after aircraft landing and that rear compartment fuel tank pressurization system check valves are normally hermetic. Air will not escape in the case where check valves are not hermetic. It is recommended to replace them. See also chapters 28-10-40 and 28-10-42, pages 101 and 301 and chapter 28-10-42 page 101.

2. Testing the rear compartment tank pressure relief valve (See figure 601)

Access to the pressure relief valve stem is gained by removing a plug on the rear compartment fuel tank upper box section. Ascertain that the tank is fully depressurized.

Remove the plug and collect the seal. Apply slight pressure to the valve stem to check that the valve is not stuck on its seat. If the tank is full, kerosene may flow from the rear compartment tank overpressure drain line (between frames 35 and 36). Reinstall the plug, fitted with its seal.

3- Inspecting the system (see figure 602)

A- Preliminary steps

- Remove fillets No. 202, 203 and 257
- Remove doors No. 163, 264, 256, 432 and 280 See chapter 12
- Open rear compartment door No.254}
- Remove protective fairings attached by CAMLOC fasteners between frames 33 and 34 and between stringers 6 and 8 (access through rear compartment door).

B. Inspection/Check

(1) On upper surface of each wing:

(a) Check security of three tank unit attaching screws.

(b) Remove the wing filler plug, and check condition of chain and retaining pins.

Check plug seal for condition. Check security of plug supporting base, and condition of filter. Reinstall and lock the filler plug (lock lowered in the air flow direction).

(c) Check security of electro-static balancing connection (adjacent to filler plug) and condition of Technyl plug.

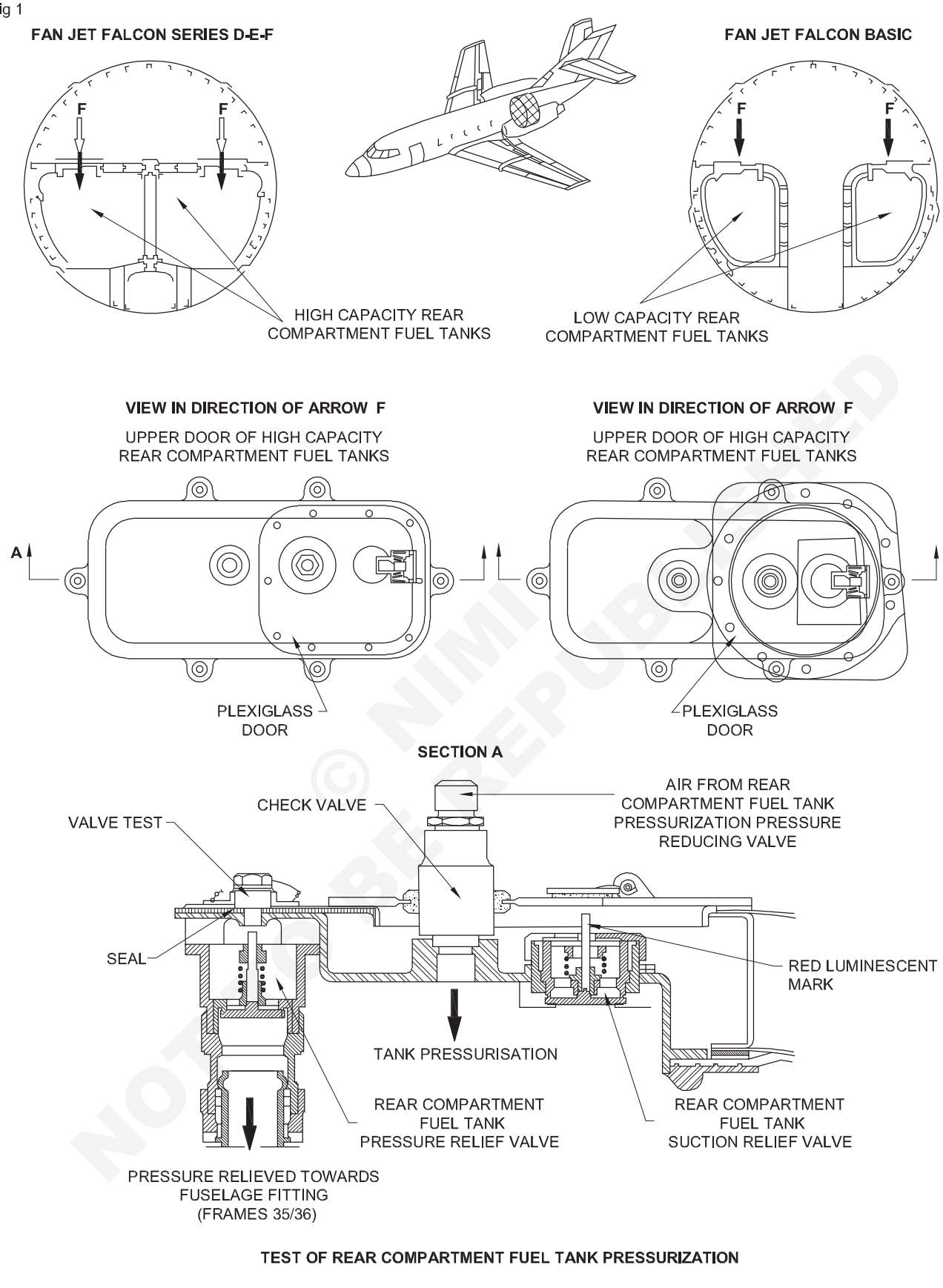
(d) At the wing-to-fuselage joint plate, check safetying of WIGGINS couplings on pressurization line (For servicing, see chapter 20-20-1).

(e) Check security of magnetic gauge door (in line with fence) and security of gauge on this door. Check condition of paint index marks on door and on wing.

NOTE: To check whether the flappers of the valve boxes (located inside wing at rib 9) are stuck on their seats, it is necessary to remove the dip-sticks (see chapter. 28) and proceed as follows:

- through the dip-stick mounting hole, pull the flapper away from the valve box seat (on leading edge side) by means of a srewdriver.
- perform same operation for the valve box (on trailling edge side), but using a metal rod having an approximate length of 600 mm (24 in.) and a bevelled end.

Fig 1



TEST OF REAR COMPARTMENT FUEL TANK PRESSURIZATION

(2) On lower surface of each wing:

(a) Check security of suction valve, (below LH and RH doors 163), safetying of WIGGINS coupling and security of attachment of valve pipe to rib N.16.

(b) Check security of attachment of drain tube at rib N.19.

(c) At wing root, check security of both bleeder valves, and safetying of their adaptors on the wing.

(3) On fuselage underside, between frames 26 and 29:

(a) Check safetying of all WIGGINS couplings, as well as condition and security of the bonding straps.

- Check for absence of kerosene leakage.

(b) Check security of both circular panels on rear vertical face of center wing and security of accessories on these panels

(c) Check security of electrical motor and condition of wing cross-feed valve control linkage (bolt cotter pins and tightening of control-link lock nuts).

(d) Check condition of universal joint on control of fuel isolating valves. Operate the valves to ascertain absence of binding.

NOTE: To operate the valves, remove the two plugs (in passenger cabin) which give access to the valve controls. Before reinstalling the plugs, check condition of stirrup which maintains the valves in the open position. Also check appearance of the bright red circular marks (one mark at end of drive end-fitting and two marks on adaptor rivetted to the floor). Reinstall the two plugs.

(e) Check both transfer pumps for security of attachment.

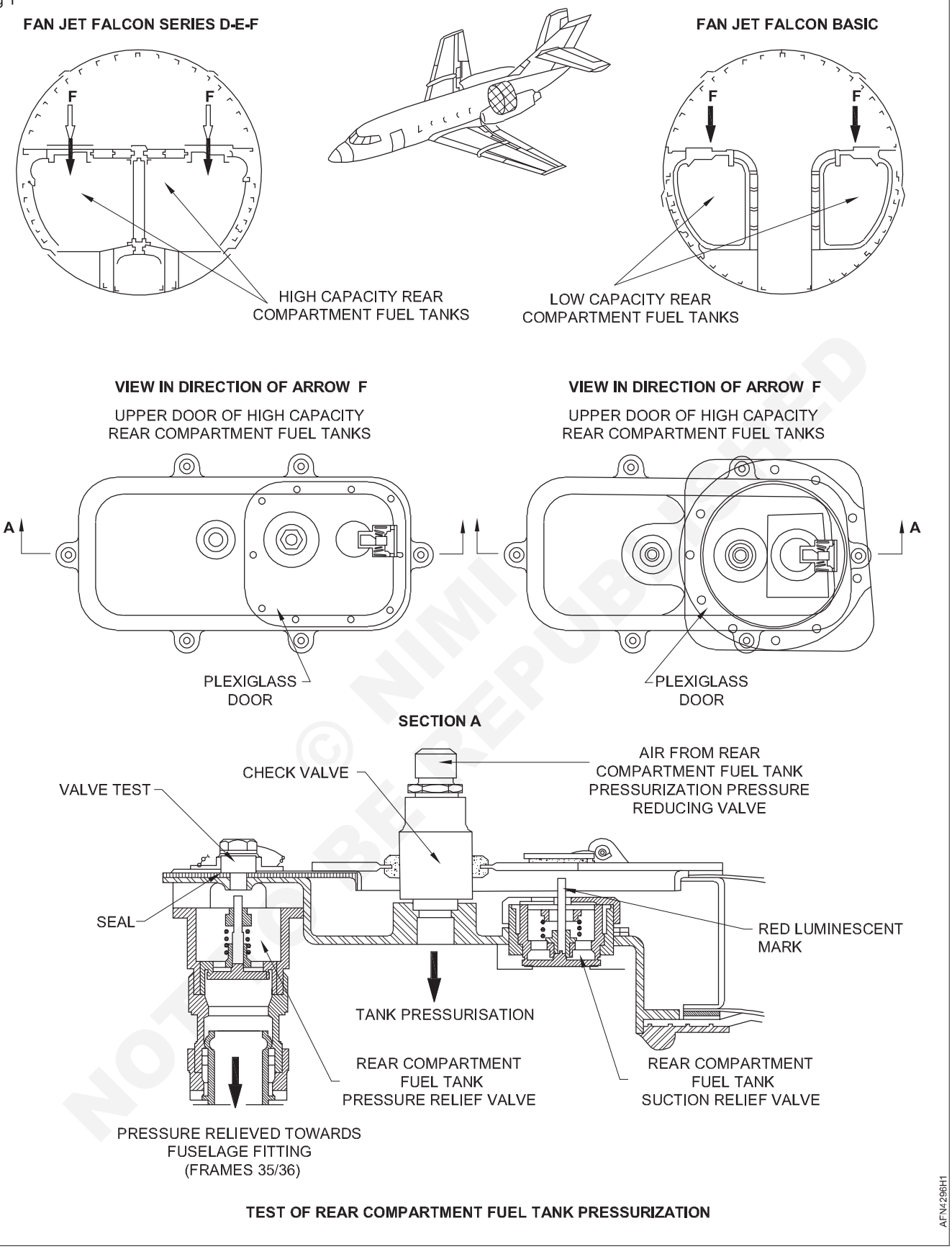
(f) Check safetying of drain plugs, and condition of their retaining chains. Remove plugs to check condition of their internal seal.

CAUTION: CLOSE BOTH FUEL ISOLATION VALVES.

Reinstall the drain plugs, safety, and open both isolating valves.

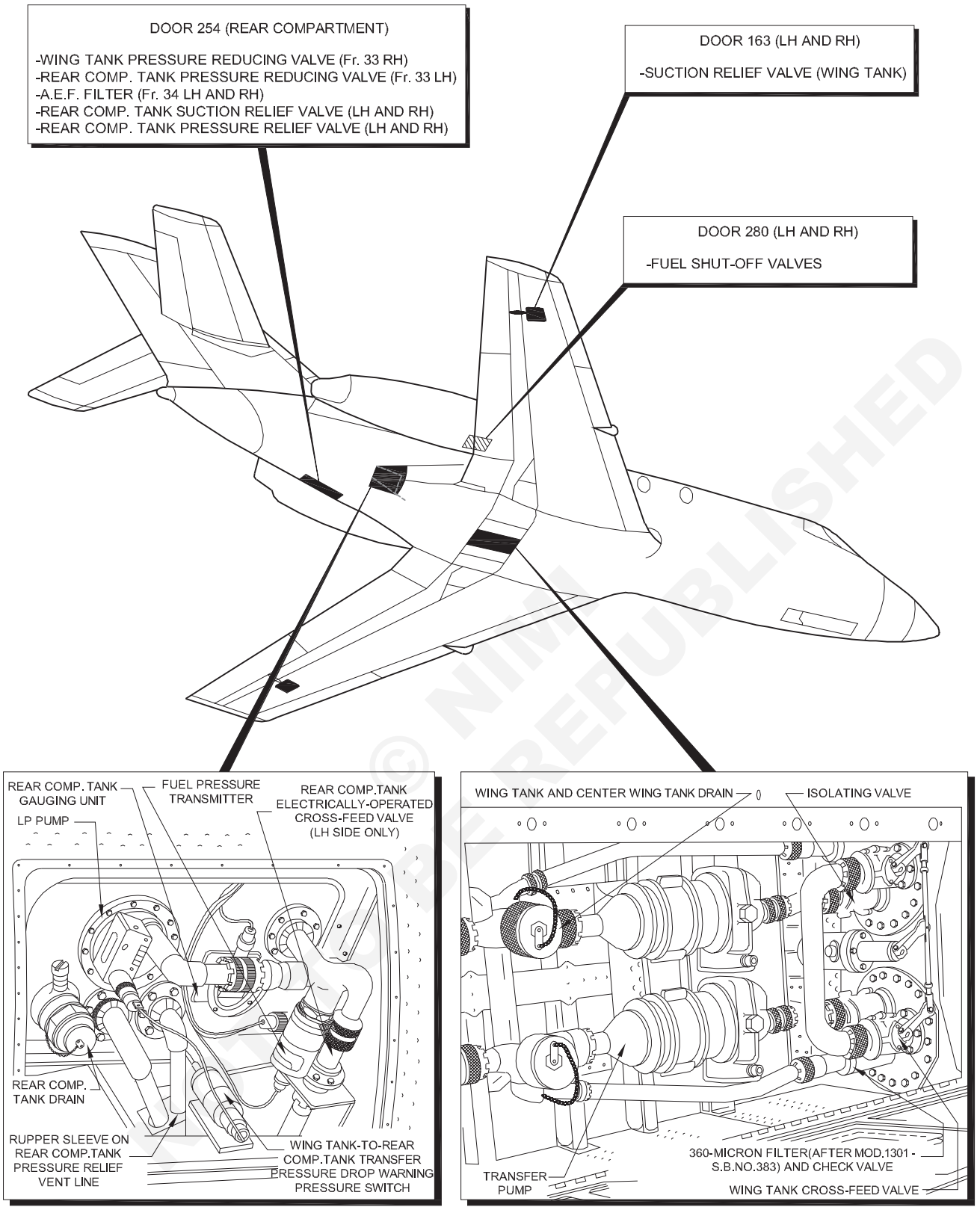
(g) Check electrical connectors for condition and security of attachment.

Fig 1



TEST OF REAR COMPARTMENT FUEL TANK PRESSURIZATION

Fig 2



LOCATION OF FULL SYSTEM SUB-ASSEMBLIES

AFN4296H2

(4) On fuselage underside, at frame 36:

(a) Check security of lower panel on both rear compartment tanks, and security of accessories on this panel.

(b) Check safetying of WIGGINS couplings, and bonding strap condition and security.

- Check for absence of kerosene leakage.

(c) Check safetying of drain plug relative to sleeve, and safetying of sleeve relative to body of drain device.

(d) Check electrical connectors for security and condition.

(e) Check the rubber sleeve making the connection between the rear compartment tank pressure relief vent lines for security and condition, and check its two clamps for tightness.

(5) In the rear compartment:

(a) Behind frame 33:

- Check security of wing and transfer tank pressure reducing valves, and tightness of test connection plugs.
- Check tightness of plug on fuel tank pressurization connection.

(b) Forward of frame 34, at stringers 6 and 7, check security of pressurization system AEF filters.

(c) Remove plexiglas panel at top of rear compartment tanks, and check security and safetying of non-return and suction valves.

Check condition of plexiglas panel, paying special attention to cracks at attaching points, then reinstall the panel.

(d) Check safetying of all WIGGINS coupling.

(6) At lower front end of engine support-struts, check fuel shut-off valves for condition and security.

C. Final operations

Reinstall the protective fairings (aft of frame 33).

Reinstall the fillets 202, 203 and 257, and panels 163, 264, 256, 432 and 280.

Close the rear compartment door.

4 - Replacement of seals on WIGGINS couplings (see also chapter 20-20-1)

The seals on the wing tank pressurization system and pressure relief system are shown in figure 603 which illustrates the variants for Basic, series D or E and series F aircraft.

The seals on the fuel system are shown in figures 604 and 605.

Note : These seals must be replaced upon each removal of a WIGGINS coupling or when working in the wing tanks. The seals of the couplings upstream of the pressure reducing valve can be replaced with BESTOBELL seals.

The part number of these seals is given in the Illustrated Parts Catalog, chapter 28-10-50. In order to replace them (see chapter 12-00-10):

- gain access to the rear compartment (door 254),
- remove fillet 202 and doors 201, 269, 261, 258, 262 and 270,
- lower D.L.E. slats and remove skin flange 414 on Basic and series D and E aircraft,
- open doors 602 and 605 on series F aircraft.

B. Seals on fuel system

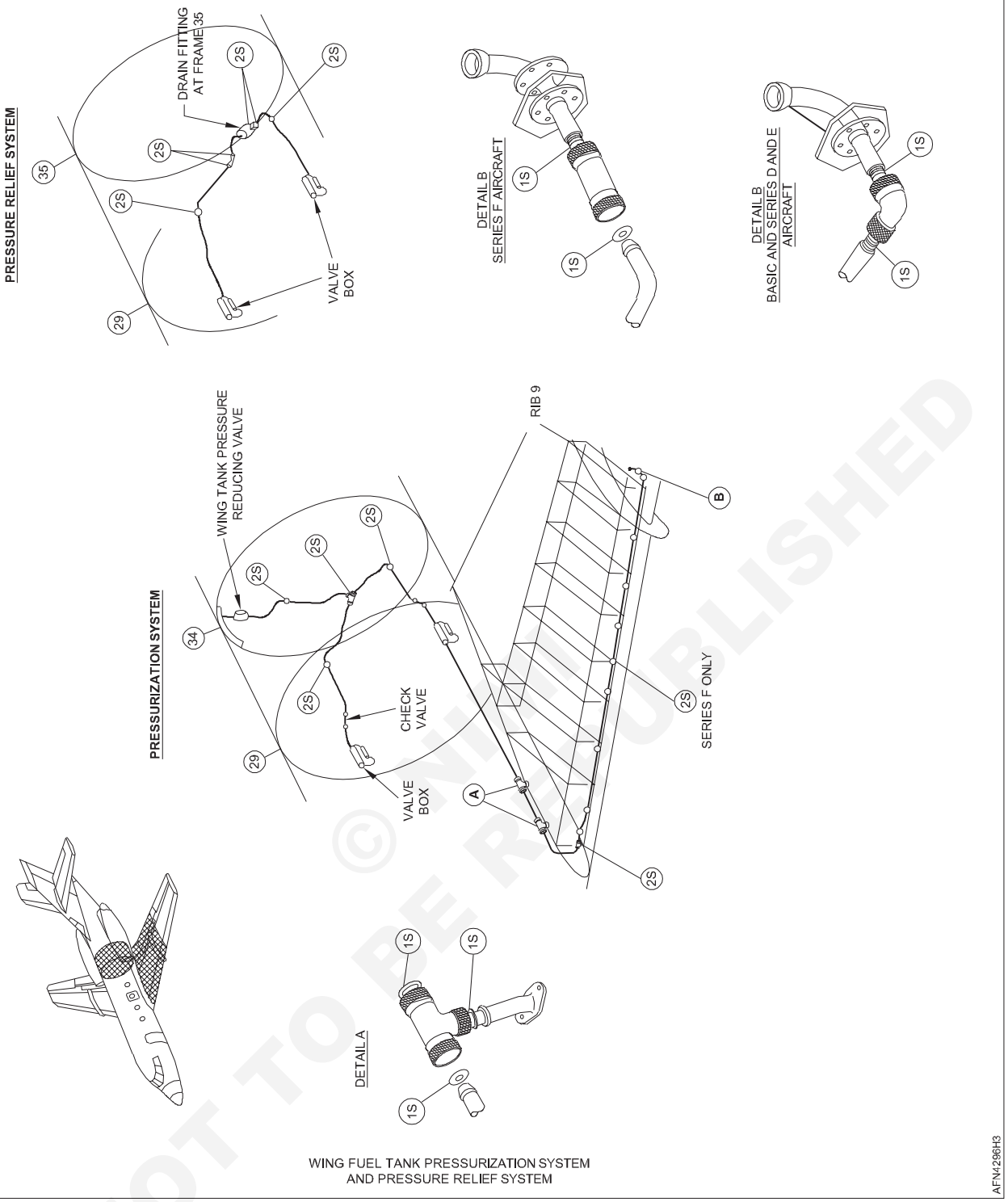
These seals are shown on figures 604 and 605 which illustrate :

- the pressure refuelling system (aircraft changed per SB No. 400),
- the wing/rear compartment fuel tank transfer system (downstream from transfer pumps),
- the engine fuel supply system (downstream from rear compartment tanks),
- the rear compartment fuel tank cross-feed system.

The part number of these seals is given in the Illustrated Parts Catalog, chapters 28-10-30 and 28-20-00. In order to replace them (see chapter 12-00-10):

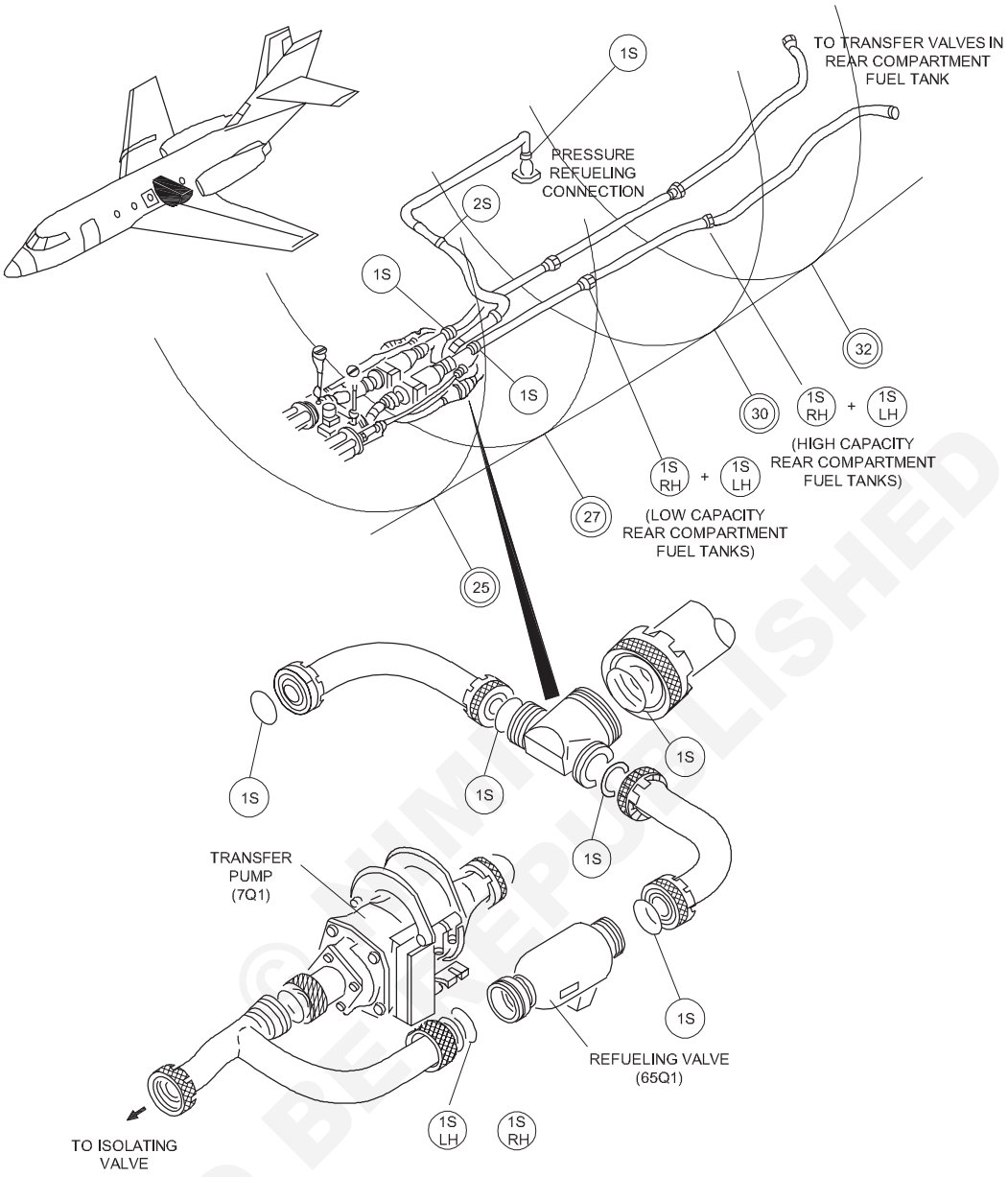
- remove doors 264, 261, 258, 281, 282 and 283.

Fig 3



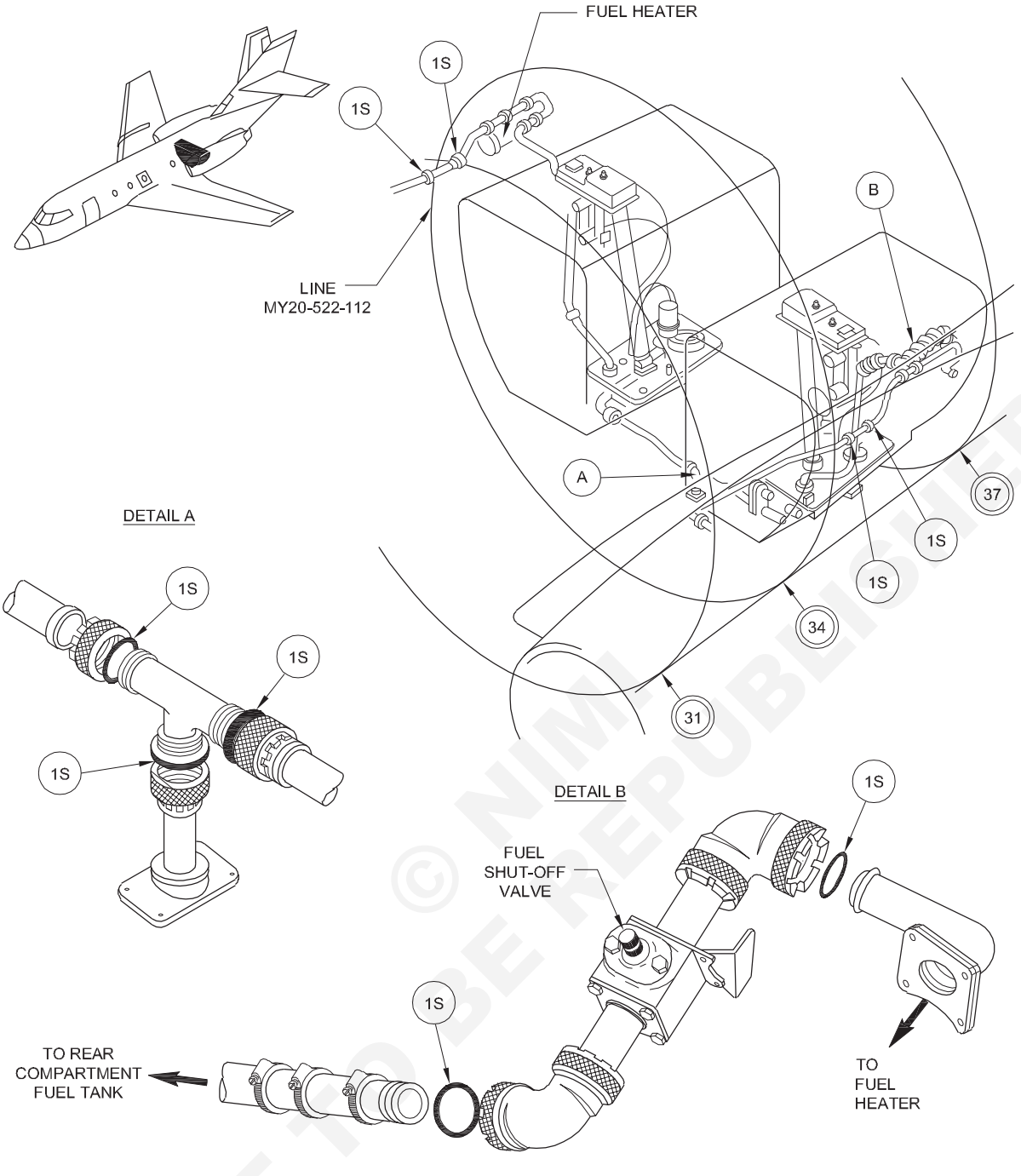
WING FUEL TANK PRESSURIZATION SYSTEM
AND PRESSURE RELIEF SYSTEM

Fig 4



PRESSURE REFUELING SYSTEM (A/C CHANGED PER SB NO. 400) AND WING/REAR COMPARTMENT FUEL TANK TRANSFER SYSTEM

Fig 5



ENGINE FUEL SUPPLY SYSTEM AND REAR COMPARTMENT TANK CROSS-FEED SYSTEM

Perform crosscheck visual inspection (by team of 2 students) on a mock up with defaults on the fuel system

Objectives: At the end of this exercise you shall be able to
- **perform crosscheck visual inspection**

Job Sequence

Following the specific job card to:

- Routing according to the diagram
- Cleanliness
- Grounding, bounding according to CDCCL standards
- Marking of systems
- Check tightening torques
- Check the assembly compliance of the system according to the requirements defined in the documentation.

Note: Depending on the available material in the ITI, the work cards will correspond to the existing real element available.

Perform Fuel system leak tests.

Objectives: At the end of this exercise you shall be able to
- **using compressed air, perform fuel system leak tests**

Job Sequence

Following the specific job card to:

- Using compressed air, perform fuel system leak tests on the available system in ITI.

Note : Depending on the available material in the ITI, the work cards will correspond to the existing real element available.

Shape and tie wires/cables to build a harness

Objectives: At the end of this exercise you shall be able to
- **cut different wires/cables types according to length definitions.**
- **use lacing tape to build a harness.**
- **use tie cable to build a harness**

Job Sequence

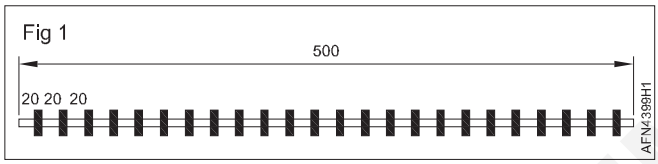
In these exercises, you must:

- Make different knots with the lacing tape following the information given in each task.
- Control the work done.

Terms and conditions:

- The cables must be in bundle strand without crossing.
- The bundle of wires must be braided in such a way that its shape and strength are correct

TASK 1



Using the cables provided by your trainer (Combination of 24-, 22- and 20-gauge wires with a diameter of approx. 10mm.), you will make:

- 24 clove hitches (capstan knots)

Repeat the work until a straight strand is perfectly formed.

Your trainer will validate the acquisition of this skill.

The knots are conform	☐ YES	☐ NO
The pitches are in accordance with	☐ YES	☐ NO
The bundle is rectilinear	☐ YES	☐ NO
The bundle is rigid	☐ YES	☐ NO
The wires do not cross each other	☐ YES	☐ NO

— — — — — —

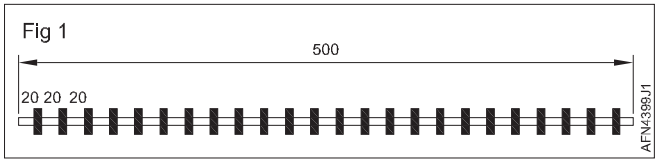
TASK 2

Using the cables provided by your trainer (Combination of 24-, 22- and 20-gauge wires with a diameter of approx. 10mm.), you will make:

- 24 constrictor knots (double capstan knots)

Repeat the work until a straight strand is perfectly formed.

Your trainer will validate the acquisition of this skill.



The knots are conform	☐ YES	☐ NO
The pitches are in accordance with	☐ YES	☐ NO
The bundle is rectilinear	☐ YES	☐ NO
The bundle is rigid	☐ YES	☐ NO
The wires do not cross each other	☐ YES	☐ NO

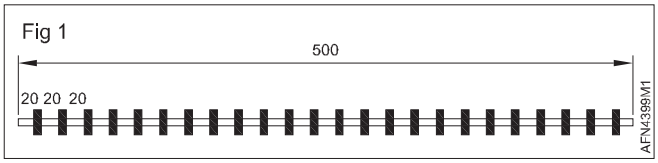
— — — — — —

TASK 3:

Using the cables provided by your trainer (Combination of 24-, 22- and 20-gauge wires with a diameter of approx. 10mm.), you will make:

- 24 Single spot knots (Telephone hitch / American knot)

Repeat the work until a straight strand is perfectly formed.



Your trainer will validate the acquisition of this skill.

The knots are conform	☐ YES	☐ NO
The pitches are in accordance with	☐ YES	☐ NO
The bundle is rectilinear	☐ YES	☐ NO
The bundle is rigid	☐ YES	☐ NO
The wires do not cross each other	☐ YES	☐ NO

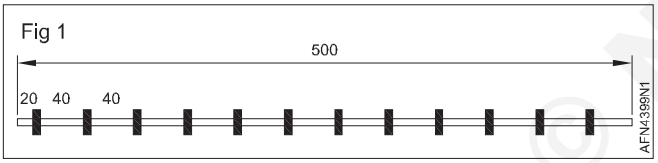
— — — — — —

TASK 4:

Using the cables provided by your trainer (Combination of 24-, 22- and 20-gauge wires with a diameter of approx. 10mm.), you will make:

- 12 Whipping knots (French whipping knot)

Repeat the work until a straight strand is perfectly formed.



Your trainer will validate the acquisition of this skill.

The knots are conform	☐ YES	☐ NO
The pitches are in accordance with	☐ YES	☐ NO
The bundle is rectilinear	☐ YES	☐ NO
The bundle is rigid	☐ YES	☐ NO
The wires do not cross each other	☐ YES	☐ NO

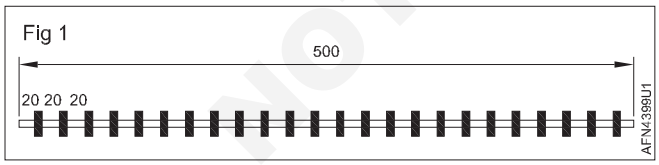
— — — — — —

TASK 5:

Using the cables provided by your trainer (Combination of 24-, 22- and 20-gauge wires with a diameter of approx. 10mm.), you will make:

- 24 Single spots with plastic tie cable

Repeat the work until a straight strand is perfectly formed.



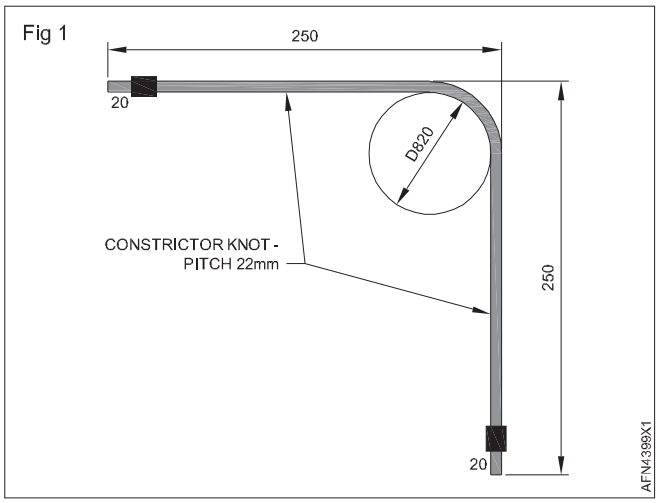
Your trainer will validate the acquisition of this skill.

The knots are conform	☐ YES	☐ NO
The pitches are in accordance with	☐ YES	☐ NO
The bundle is rectilinear	☐ YES	☐ NO
The bundle is rigid	☐ YES	☐ NO
The wires do not cross each other	☐ YES	☐ NO

— — — — — —

TASK 6:

Fig 1



Whipping knots in each end

Using the cables provided by your trainer (Combination of 24-, 22- and 20-gauge wires with a diameter of approx. 10mm.), you will make:

- On A3 sheet, trace the bundle to scale 1. Mark the lacing points on this drawing
- Carry out the bundle stranding.

Repeat the work until a straight strand is perfectly formed.

Your trainer will validate the acquisition of this skill.

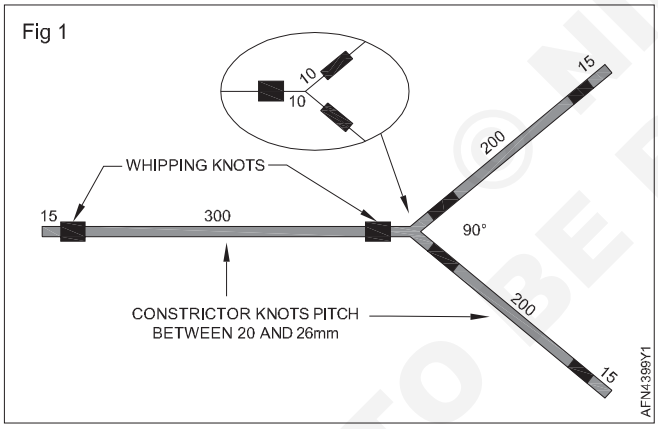
The knots are conform	☐ YES	☐ NO
The pitches are in accordance with	☐ YES	☐ NO
The bundle is rectilinear	☐ YES	☐ NO
The bundle is rigid	☐ YES	☐ NO
The wires do not cross each other	☐ YES	☐ NO

— — — — — —

Task 7

Using the cables provided by your trainer (Combination of 24-, 22- and 20-gauge wires with major diameter of approx. 10mm.), you will make:

Fig 1



- On A3 sheet, trace the bundle to scale 1. Mark the lacing points on this drawing
- Carry out the bundle stranding.

Repeat the work until a straight strand is perfectly formed.

Your trainer will validate the acquisition of this skill.

The knots are conform	☐ YES	☐ NO
The pitches are in accordance with	☐ YES	☐ NO
The bundle is rectilinear	☐ YES	☐ NO
The bundle is rigid	☐ YES	☐ NO
The wires do not cross each other	☐ YES	☐ NO

— — — — — —

Shape and tie wires/cables to build a harness

Objectives: At the end of this exercise you shall be able to
- **cut different wires/cables types according to length definitions**
- **use wiring graph and wiring diagram to prepare wires**
- **build the harness with overlength.**

Job Sequence

For the 2 tasks below, using different types of wires and gauges provided by your trainer:

- Prepare wires/cables: references lengths (notion of tolerances)
- Carry out the wires/cables identification in correlation with the technical instructions
- Set wires/cables according to their destination (layout - wiring diagram)
- Tie wires/cables with plastic ties or lacing tape

Task 1

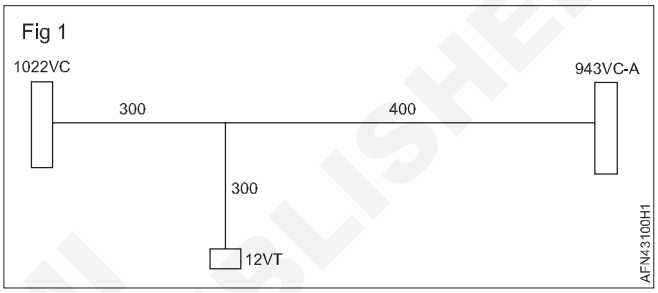
1 From the 2D graph, draw the path diagram to scale on a table. Draw the knots points in 20 to 30 mm pitch.

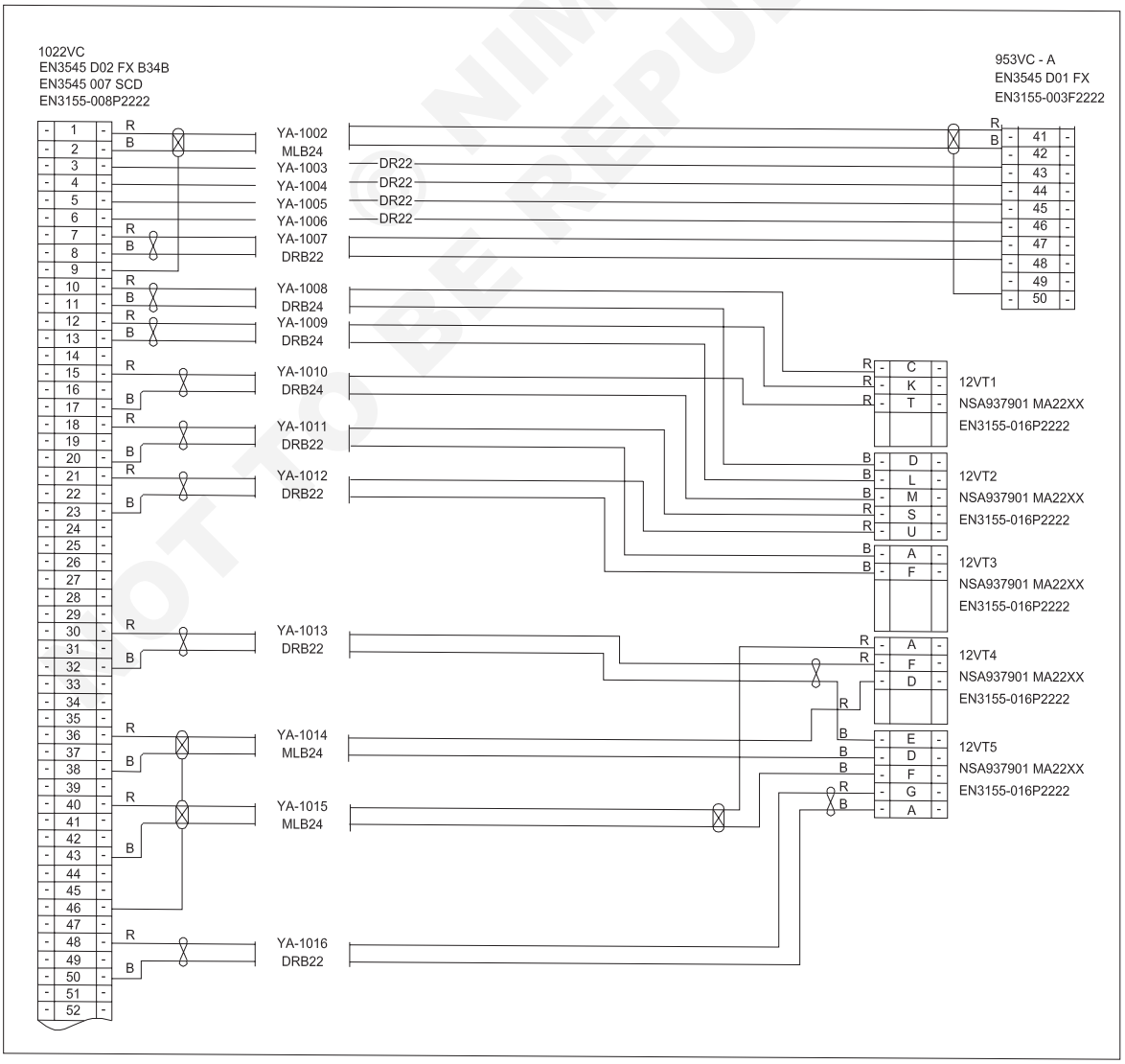
2 Using the wiring diagram, produce the wiring table.

4 Cut and label the cables to their ATA number according to the information in this document.

5 Make the harness leaving 5 cm at each end to connect in a future exercise.

Fig 1





ATA	ITEM 1	CONTACT POSITION	TERMINAL	WIRE	GAUGE	ITEM 1	CONTACT POSITION	TERMINAL

ATA	ITEM 1	CONTACT POSITION	TERMINAL	WIRE	GAUGE	ITEM 1	CONTACT POSITION	TERMINAL

Task 2:

1 From the 2D graph, draw the path diagram to scale on a table. Draw the knots points in 20 to 30 mm pitch.

2 Using the wiring table, produce the wiring diagram.

4 Cut and label the cables to their ATA number according to the information in this document.

5 Make the harness leaving 5 cm at each end to connect in a future exercise.

Fig 1

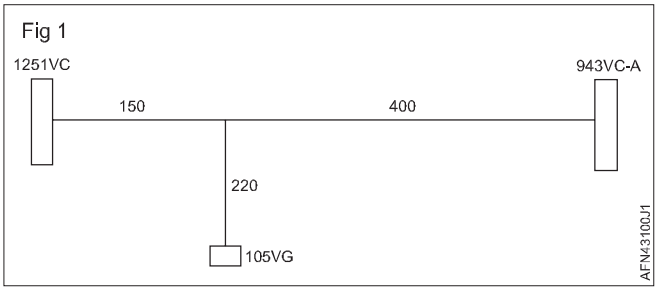
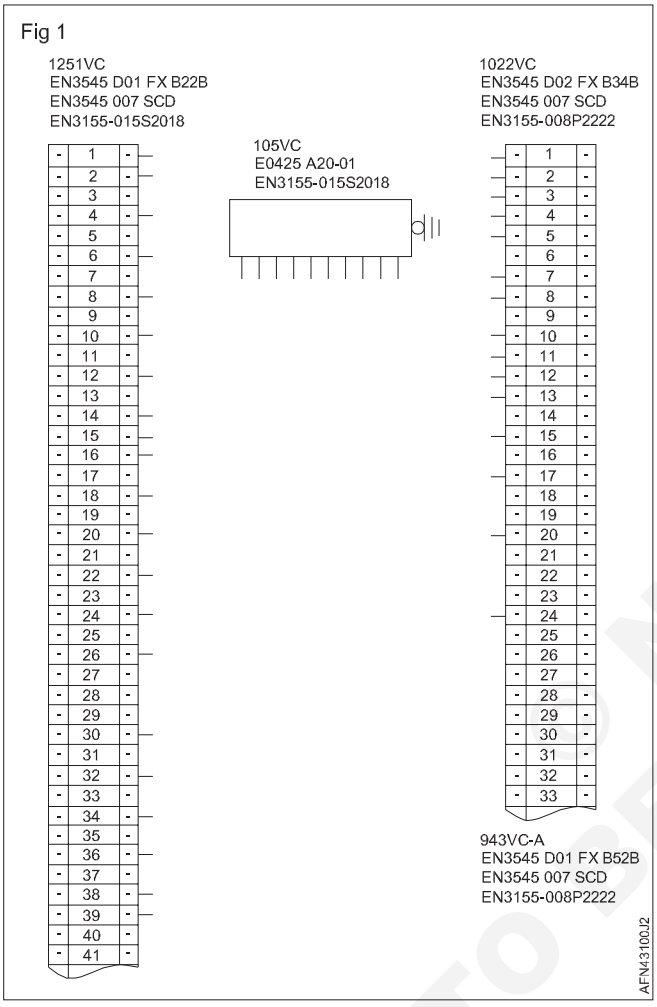


Fig 1



ATA	ITEM 1	CONTACT POSITION	TERMINAL	WIRE	GAUGE	ITEM 2	CONTACT POSITION	TERMINAL
YA-1101	1251VC	2	EN3155-015S2018	DR	22	943VC-A	2	EN3155-003S2222
YA-1102	1251VC	4	EN3155-015S2018	DR	18	105VG	/	EN3155-015S2018
YA-1103R	1251VC	6	EN3155-015S2018	DRB	22	943VC-A	7	EN3155-003S2222
YA-1103B	1251VC	8	EN3155-015S2018	DRB	22	943VC-A	9	EN3155-003S2222
YA-1104	1251VC	10	EN3155-015S2018	DR	18	105VG	/	EN3155-015S2018
YA-1105R	1251VC	12	EN3155-015S2018	MLB	24	943VC-A	13	EN3155-003S2222
YA-1105B	1251VC	14	EN3155-015S2018	MLB	24	943VC-A	14	EN3155-003S2222
YA-G1105	1251VC	BL1	SOLDER SLEEVE	MLB	24	943VC-A	BL1	EN3155-003S2222
YA-1106	1251VC	16	EN3155-015S2018	DR	22	943VC-A	17	EN3155-003S2222
YA-1107	1251VC	18	EN3155-015S2018	DR	22	105VG	/	EN3155-015S2018
YA-1108R	1251VC	20	EN3155-015S2018	DRB	24	943VC-A	21	EN3155-003S2222
YA-1108B	1251VC	22	EN3155-015S2018	DRB	24	943VC-A	23	EN3155-003S2222
YA-1109	1251VC	24	EN3155-015S2018	DR	24	943VC-A	25	EN3155-003S2222
YA-1110	1251VC	26	EN3155-015S2018	DR	18	105VG	/	EN3155-015S2018
YA-1111	1251VC	30	EN3155-015S2018	DR	18	105VG	/	EN3155-015S2018
YA-1112R	1251VC	32	EN3155-015S2018	DRB	22	943VC-A	27	EN3155-003S2222
YA-1112B	1251VC	34	EN3155-015S2018	DRB	22	943VC-A	31	EN3155-003S2222
YA-1113R	1251VC	36	EN3155-015S2018	MLB	24	943VC-A	3	EN3155-003S2222
YA-1113B	1251VC	38	EN3155-015S2018	MLB	24	943VC-A	5	EN3155-003S2222
YA-G1113	1251VC	BL1	SOLDER SLEEVE	MLB	24	943VC-A	BL1	EN3155-003S2222
YA-1114	943VC-A	1	EN3155-003S2222	DR	22	105VG	/	EN3155-015S2018
YA-1115	943VC-A	11	EN3155-003S2222	DR	22	105VG	/	EN3155-015S2018

ATA	ITEM 1	CONTACT POSITION	TERMINAL	WIRE	GAUGE	ITEM 2	CONTACT POSITION	TERMINAL
YA-1116	1251VC	15	EN3155-015S2018	DR	24	1251VC	SH	YA-1105
YA-1117	1251VC	39	EN3155-015S2018	DR	24	1251VC	SH	YA-1113
YA-1118	943VC-A	6	EN3155-003S2222	DR	24	943VC-A	SH	YA-1113
YA-1119	943VC-A	16	EN3155-003S2222	DR	24	943VC-A	SH	YA-1105

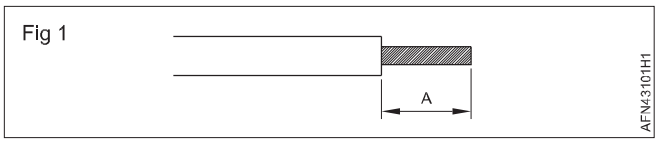
Strip different types of wires/cables.

Objectives: At the end of this exercise you shall be able to
- **strip different types of wire**

TASK 1: **Using different types of wires and gauges provided by your trainer (DR wire 24-, 22- and 20- AWG gauge)**:

- Stripping small gauge wires using the stripping pliers
- Checking for non-conformities

Fig 1



Stripping length A: 4mm

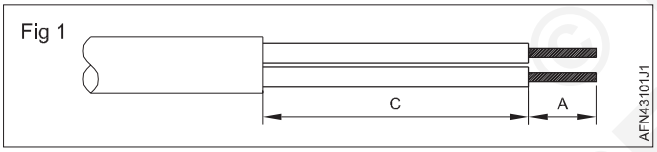
- Cables must be cut at 90°.
- The insulation must not be damaged.
- The pliers used must be in accordance with the type and gauge of the cable.

— — — — — —

TASk 2: **Using different types of shielded wires and gauges provided by your trainer (DRB wire 24-, 22- and 20- AWG gauge):**

- Removal insulation on shielded cables using the scalpel
- Stripping small gauge wires using the stripping pliers
- Checking for non-conformities

Fig 1



Method: Cutting flush the insulator

C length: 25mm

Stripping length: 4mm

- Cables must be cut at 90°.
- The insulation must not be damaged.
- The shield must not be damaged.
- The pliers used must be in accordance with the type and gauge of the cable.

— — — — — —

TASK 3: **Using different types of shielded wires and gauges provided by your trainer (DRB wire 24-, 22- and 20- AWG gauge):**

- Removal insulation on shielded cables using the scalpel
- Stripping small gauge wires using the stripping pliers
- Checking for non-conformities

Method: Wrapping and cutting method

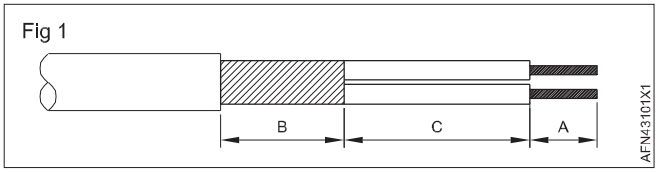
B length: 7mm

C length: 25mm

Stripping length: 4mm

- Cables must be cut at 90°.

Fig 1



- The insulation must not be damaged.
- The shield must not be damaged.
- The pliers used must be in accordance with the type and gauge of the cable.

— — — — — —

TASK 4: **Using different types of shielded wires and gauges provided by your trainer (DRB wire 24-, 22- and 20- AWG gauge):**

- Removal insulation on shielded cables using the scalpel
- Stripping small gauge wires using the stripping pliers
- Checking for non-conformities

Method: sliding method

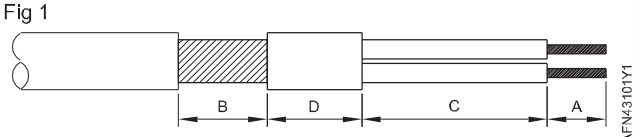
B length: 7mm

C length: 25mm

D length: 20mm

Stripping length: 4mm

Fig 1



- Cables must be cut at 90°.
- The insulation must not be damaged.
- The shield must not be damaged.
- The pliers used must be in accordance with the type and gauge of the cable.

— — — — — —

TASK 5: **Using different types of shielded wires and gauges provided by your trainer (DRB wire 24-, 22- and 20- AWG gauge)**:

- Removal insulation on shielded cables using the scalpel
- Stripping small gauge wires using the stripping pliers
- Checking for non-conformities

Method: cutting method

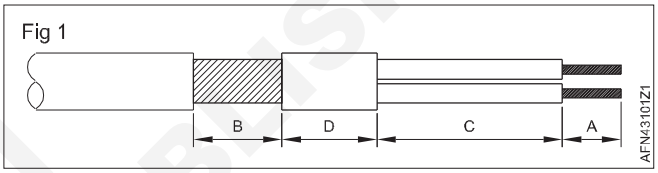
B length: 7mm

C length: 25mm

D length: 20mm

Stripping length: 4mm

Fig 1



- Cables must be cut at 90°.
- The insulation must not be damaged.
- The shield must not be damaged.
- `The pliers used must be in accordance with the type and gauge of the cable.

— — — — — —

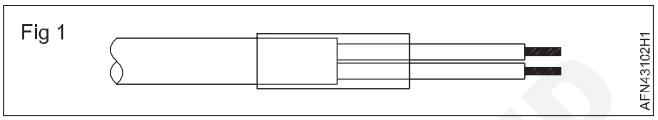
Using infra-red gun or hot air gun

Objectives: At the end of this exercise you shall be able to
- **Shield stop implementation with shrinkable conduit**
- **Shielding by window implementation with solder sleeve**
- **Shielding by end implementation with solder sleeve.**

PROCEDURE

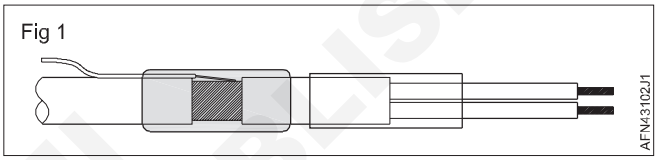
TASK 1: **Using different wire stripped in previous exercises perform operations of:**

- Shield stop implementation using infra-red gun or hot air gun



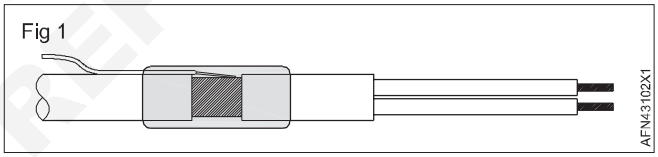
TASK 2: **Using different wire stripped in previous exercises perform operations of:**

- Shielding by sliding window implementation using infra-red gun or hot air gun



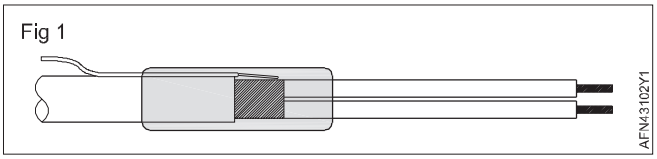
TASK 3: **Using different wire stripped in previous exercises perform operations of:**

- Shielding by cutting window implementation using infra-red gun or hot air gun



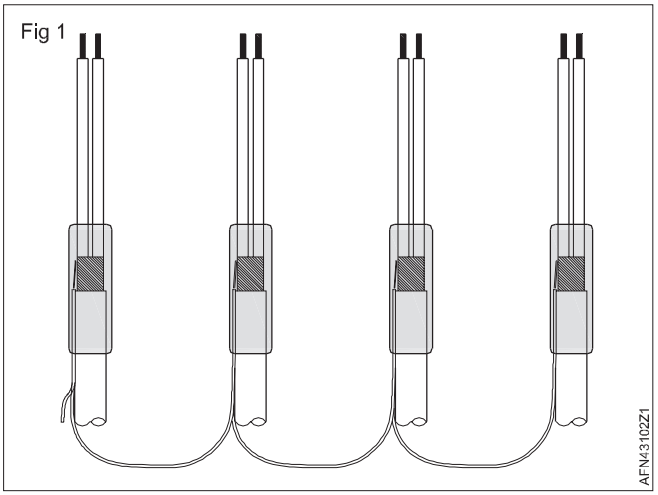
TASK 4: **Using different wire stripped in previous exercises perform operations of:**

- Shielding by end implementation using infra-red gun or hot air gun



TASK 5: **Using different wire stripped in previous exercises perform operations of:**

- Shielding by end implementation multiple wires together using infra-red gun or hot air gun



Perform crimping operations of different terminal components

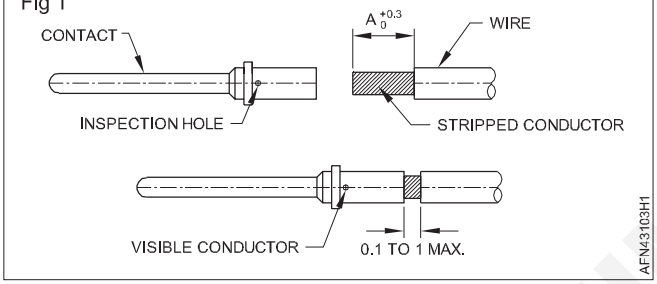
Objectives: At the end of this exercise you shall be able to
- **crimping contacts on small gauge wires**
- **crimping lugs on small gauge wires**
- **crimping splices small gauge wires**
- **ensuring the traceability of crimping operations on the associated technical sheet.**

PROCEDURE

TASK 1: **Using different types of wires and gauges provided by your trainer:**

- Crimping contacts on small gauge wires
- Ensuring the traceability of crimping operations on the associated technical sheet

Fig 1



Use the tables below to select the tooling and its setting.

Special attention is required when stripping the conductor, both in the cut of the strands, which must be perpendicular to the cable, and in the stripped cable length.

A control hole at the bottom of the crimp barrel for each contact allows visual control of the conductor's penetration into the barrel.

CONTACT		STRIPPING LENGTH	TOOL	LOCATOR	SELECTOR POSITION / WIRE GAUGE									INSERTION/EXTRACTION TOOLS	
					26	24	22	20	18	16	14	12	10	INSERTION	EXTRACTION
EN3155-003	F2222	4	M22520/2-01	M22520/2-06	2	3	4	-	-	-	-	-	-	M81969/14-01 GREEN	M81969/14-01 WHITE
			M22520/7-01	M22520/7-06	1	2	3								
EN3155-003	F2022	4	M22520/2-01	M22520/2-10	2	3	4	-	-	-	-	-	-	M81969/14-10 RED	M81969/14-10 ORANGE
			M22520/7-01	M22520/7-08	1	2	3								
EN3155-003	F2020	6	M22520/1-01	M22520/1-04 RED	-	1	2	3	-	-	-	-	-		
			M22520/2-01	M22520/2-10		4	5	6							
			M22520/7-01	M22520/7-08		4	5	6							
EN3155-003	F2018	6	M22520/1-01	M22520/1-04 RED	-	1	2	3	4	-	-	-	-		
			M22520/2-01	M22520/2-10		4	5	6	7						
			M22520/7-01	M22520/7-08		4	5	6	7						

CONTACT		STRIPPING LENGTH	TOOL	LOCATOR	SELECTOR POSITION / WIRE GAUGE									INSERTION/EXTRACTION TOOLS	
					26	24	22	20	18	16	14	12	10	INSERTION	EXTRACTION
EN3155-004	M2020	4.5	M22520/2-01	M22520/2-02		5	6	7						M81969/14-11	M81969/14-11
			M22520/1-01	M22520/1-02	-	2	3	4	-	-	-	-	-		
			M22520/7-01	M22520/7-02		4	5	6							
EN3155-004	M2018	4.5	M22520/1-01	M22520/1-02		2	3	4	5						
			M22520/2-01	M22520/2-02	-	5	6	7	8	-	-	-	-		
			M22520/7-01	M22520/7-02		4	5	6	7						
EN3155-004	M1616	7	M22520/1-01	M22520/1-02				4	5	6				M81969/14-03	M81969/14-03
			M22520/7-01	M22520/7-03	-	-	-	5	6	7	-	-	-		
EN3155-004	M1614	7	M22520/1-01	M22520/1-02					5	6	6				
			M22520/7-01	M22520/7-03	-	-	-	-	6	7	7	-	-		
EN3155-004	M1618	7	M22520/1-01	M22520/1-02		2	3	4	5						
			M22520/7-01	M22520/7-03	-	4	5	6	7	-	-	-	-		
EN3155-004	M1212		M22520/1-01	M22520/1-02	-	-	-	-	-	-	7	8	-	M81969/14-04	M81969/14-04
EN3155-005	F2020	4.5	M22520/2-01	M22520/2-02		5	6	7						M81969/14-11	M81969/14-11
			M22520/1-01	M22520/1-02	-	2	3	4	-	-	-	-	-		
			M22520/7-01	M22520/7-02		4	5	6							
EN3155-005	F2018	4.5	M22520/2-01	M22520/2-02		5	6	7	8						
			M22520/1-01	M22520/1-02	-	2	3	4	5	-	-	-	-		

CONTACT		STRIPPING LENGTH	TOOL	LOCATOR	SELECTOR POSITION / WIRE GAUGE									INSERTION/EXTRACTION TOOLS	
					26	24	22	20	18	16	14	12	10	INSERTION	EXTRACTION
EN3155-008	M2222	4	M22520/2-01	M22520/2-09	2	3	4							M81969/14-01 GREEN	M81969/14-01 WHITE
			M22520/7-01	M22520/7-07	1	2	3	-	-	-	-	-	-		
EN3155-008	M2022	4	M22520/2-01	M22520/2-10	2	3	4								
			M22520/7-01	M22520/7-08	1	2	3	-	-	-	-	-	-		
EN3155-008	M2020	6	M22520/1-01	M22520/1-04 RED		1	2	3						M81969/14-10 RED	M81969/14-10 WHITE
			M22520/2-01	M22520/2-10	-	4	5	6	-	-	-	-	-		
			M22520/7-01	M22520/7-08		4	5	6							
EN3155-008	M2018	6	M22520/2-01	M22520/2-10		4	5	6	7						
			M22520/1-01	M22520/1-04 RED	-	1	2	3	4	-	-	-	-		
			M22520/7-01	M22520/7-08		4	5	6	7						

CONTACT		STRIPPING LENGTH	TOOL	LOCATOR	SELECTOR POSITION / WIRE GAUGE									INSERTION/EXTRACTION TOOLS	
					26	24	22	20	18	16	14	12	10	INSERTION	EXTRACTION
EN3155-009	F2222	4	M22520/2-01	M22520/2-07	2	3	4							M81969/14-01 GREEN	M81969/14-01 YELLOW
			M22520/7-01	M22520/7-05	1	2	3	-	-	-	-	-	-		
EN3155-009	F2022	4	M22520/2-01	M22520/2-10	2	3	4								
			M22520/7-01	M22520/7-08	1	2	3	-	-	-	-	-	-		
EN3155-009	F2020	6	M22520/1-01	M22520/1-04 RED		1	2	3						M81969/14-10 RED	M81969/14-10 ORANGE
			M22520/2-01	M22520/2-10	-	4	5	6	-	-	-	-	-		
			M22520/7-01	M22520/7-08		4	5	6							
EN3155-009	F2018	6	M22520/1-01	M22520/1-04 RED		1	2	3	4						
			M22520/2-01	M22520/2-10	-	4	5	6	7	-	-	-	-		
			M22520/7-01	M22520/7-08		4	5	6	7						

CONTACT		STRIPPING LENGTH	TOOL	LOCATOR	SELECTOR POSITION / WIRE GAUGE									INSERTION/EXTRACTION TOOLS	
					26	24	22	20	18	16	14	12	10	INSERTION	EXTRACTION
EN3155-014	M2022	4	M22520/7-01	EN4008-006	1	2	3	-	-	-	-	-	-	M81969/39-01 GREEN	M81969/39-01 WHITE
			M22520/2-01	M22520/2-08	2	3	4								
EN3155-014	M2020	5	M22520/2-01	M22520/2-08	-	5	6	7	-	-	-	-	-		
			M22520/7-01	EN4008-006		4	5	6							
EN3155-014	M2018	5	M22520/2-01	M22520/2-08	-	5	6	7	7	-	-	-	-		
			M22520/7-01	DMC 86-79 EN4008-006		4	5	6	6						
EN3155-015	F2022	4	M22520/7-01	EN4008-006	1	2	3	-	-	-	-	-	-		
			M22520/2-01	M22520/2-08	2	3	4								
EN3155-015	F2020	5	M22520/2-01	M22520/2-08	-	5	6	7	-	-	-	-	-		
			M22520/7-01	EN4008-006		4	5	6							
EN3155-015	F2018	5	M22520/2-01	M22520/2-08	-	5	6	7	7	-	-	-	-		
			M22520/7-01	DMC 86-79 EN4008-006		4	5	6	6						
EN3155-016	M2222	4	M22520/2-01	DMC K127-2 DMC K673	2	2	3	-	-	-	-	-	-	M81969/14-01 GREEN	M81969/14-01 WHITE
			M22520/7-01	DMC 86-88 EN4008-008	2	3	4								
EN3155-016	M2020	4.5	M22520/1-01	M22520/1-02 RED	-	2	3	4	-	-	-	-	-	M81969/14-11 RED	M81969/14-11 WHITE
			M22520/2-01	M22520/2-02		5	6	7							
			M22520/7-01	M22520/7-02		4	5	6							
EN3155-016	M2018	4.5	M22520/1-01	M22520/1-02 RED	-	2	3	4	5	-	-	-	-		
			M22520/2-01	M22520/2-02		5	6	7	8						
			M22520/7-01	M22520/7-02		4	5	6	7						
EN3155-018	M2022	4.5	M22520/2-01	M22520/2-02	2	3	4	-	-	-	-	-	-	M81969/14-11 RED	M81969/14-11 WHITE
			M22520/7-01	M22520/7-02	1	2	3								
EN3155-018	M2020	4.5	M22520/1-01	M22520/1-02 RED	-	2	3	4	-	-	-	-	-		
			M22520/2-01	M22520/2-02		5	6	7							
			M22520/7-01	M22520/7-02		4	5	6							
EN3155-018	M2018	4.5	M22520/1-01	M22520/1-02 RED	-	2	3	4	5	-	-	-	-		
			M22520/2-01	M22520/2-02		5	6	7	8						
			M22520/7-01	M22520/7-02		4	5	6	7						
EN3155-019	F2022	4.5	M22520/2-01	M22520/2-02	2	3	4	-	-	-	-	-	-	M81969/14-11 RED	M81969/14-11 WHITE
			M22520/7-01	M22520/7-02	1	2	3								
EN3155-019	F2020	4.5	M22520/1-01	M22520/1-02 RED	-	2	3	4	-	-	-	-	-	M81969/14-11 RED	M81969/14-11 WHITE
			M22520/2-01	M22520/2-02		5	6	7							
			M22520/7-01	M22520/7-02		4	5	6							
EN3155-019	F2018	4.5	M22520/1-01	M22520/1-02 RED	-	2	3	4	5	-	-	-	-		
			M22520/2-01	M22520/2-02		5	6	7	8						
			M22520/7-01	M22520/7-02		4	5	6	7						

TASK 2: **Using different types of wires and gauges provided by your trainer:**

- Crimping lugs terminals on small gauge wires
- Ensuring the traceability of crimping operations on the associated technical sheet

Use the tables below to select the tooling and its setting.

Note: There are many types of terminals lugs available. For this exercise we will use PIDG type terminals.

WIRE GAUGE	TERMINAL SIZE	STRIPPING LENGTH
24 to12	22to14	6,0
10	10	9,0
2 x 24	20	6,0
2 x 18	14	6,0
2 x 16	10	8,0
2 x 14	10	9,0

PIDG Ring Tongue Terminals for Thin Wall Cables data and equivalent

Fig 1

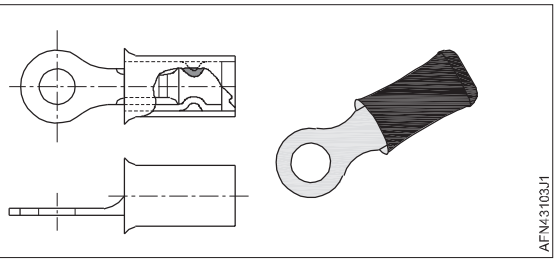
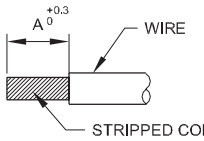


Fig 2



Terminal Type	Wire Size mm2	Single Die		
		AWG	Hand Tool	Dot Code
PIDG Terminals for Thin Wall Cables High and Low Temperature	0.25-0.4	24-22	576778	2 dots
	0.6	20	576779	1 dot
	1.0	18	576780	2 dots
	1.2	16	576781	1 dot
	2.0	14	576782	2 dots
	3.0	12	576783	1 dot
	6.0	10	576784	1 dot

PIDG Ring Tongue Terminals for Thin Wall Cables data and equivalent

Wire Size	Stud Size		Dimensions (Max.)			Color Code	Part Number	NSA936501 (Airbus)
	+/- .03 [+/- 0.8]	Metric	W	L	C			
22-24	.119 3.02	M2.5	.218 5.54	.657 16.68	.166 4.22	Brown	152642	TA 2201
			.281 7.14	.787 19.98	.25 6.35		152644	TA 2203
			.218 5.54	.751 19.08	.25 6.35		152648	
	.145 3.68	M3	.218 5.54	.657 16.68	.166 4.22		152643	TA 2202
			.281 7.14	.787 19.98	.25 6.35		152645	TA 2204
	.171 4.34	M4	.281 7.14	.787 19.98	.25 6.35		152646	TA 2205
	1.97 5.00	—	.281 7.14	.787 20.0	.244 6.20		152647	TA 2206
20	0.93 2.36	M2	.218 5.54	.680 17.27	.166 4.22	Grey	152660	
	.122 3.10	M2.5	.281 7.14	.787 19.98	.26 6.60		152654	TA 2001
			.218 5.54	.680 17.27	.166 4.22		152659	TA 2006
	.148 3.76	M3	.281 7.14	.787 19.98	.25 6.35		152655	
			.218 5.54	.680 17.27	.166 4.22		152658	TA 2005
	.171 4.34	M4	.281 7.14	.787 19.98	.26 6.60		152656	TA 2003
	.199 5.06	—	.281 7.14	.787 19.98	.26 6.60		152657	TA 2004
	.268 6.81	M6	.469 11.91	1.08 27.58	.447 11.35		152661	TA 2008
	.331 8.41	M8	.469 11.91	1.08 27.58	.447 11.35		152662	TA 2009
	.393 9.98	M9.5	.469 11.91	1.08 27.58	.447 11.35		152663	TA 2010
18-16	.122 3.10	M3	.218 5.54	.681 17.30	.166 4.22	Orange	153103	TA 1601
	.145 3.68	M3	.281 7.10	.807 20.50	.26 6.60		153104	TA 1602
	.171 4.34	M4	.312 7.92	.854 21.70	.291 7.39		153105	TA 1603
	.197 5.00	—	.312 7.92	.854 21.70	.291 7.39		153106	TA 1604
	.265 6.73	M6	.469 11.91	1.09 27.70	.447 11.35		153107	TA 1605
	.328 8.33	M8	.469 11.91	1.09 27.70	.447 11.35		153108	TA 1606
	.390 9.90	M9.5	.531 13.48	1.21 30.79	.531 13.48		153109	TA 1607

Insertion and extraction of various contacts on different types of connector

Objectives: At the end of this exercise you shall be able to

- **Insertion/extraction on different connectors type (rectangular, circular, modules) using the appropriate tools**
- **Shielding by window implementation with solder sleeve**
- **Shielding by end implementation with solder sleeve.**

PROCEDURE

TASK 1: **Build the first harness prepared in 4.3.100**

From the graph drawn on the table and the wiring table produced in the 4.3.100 task 1 exercise and the wiring diagram below:

1 Cut and strip the wire.

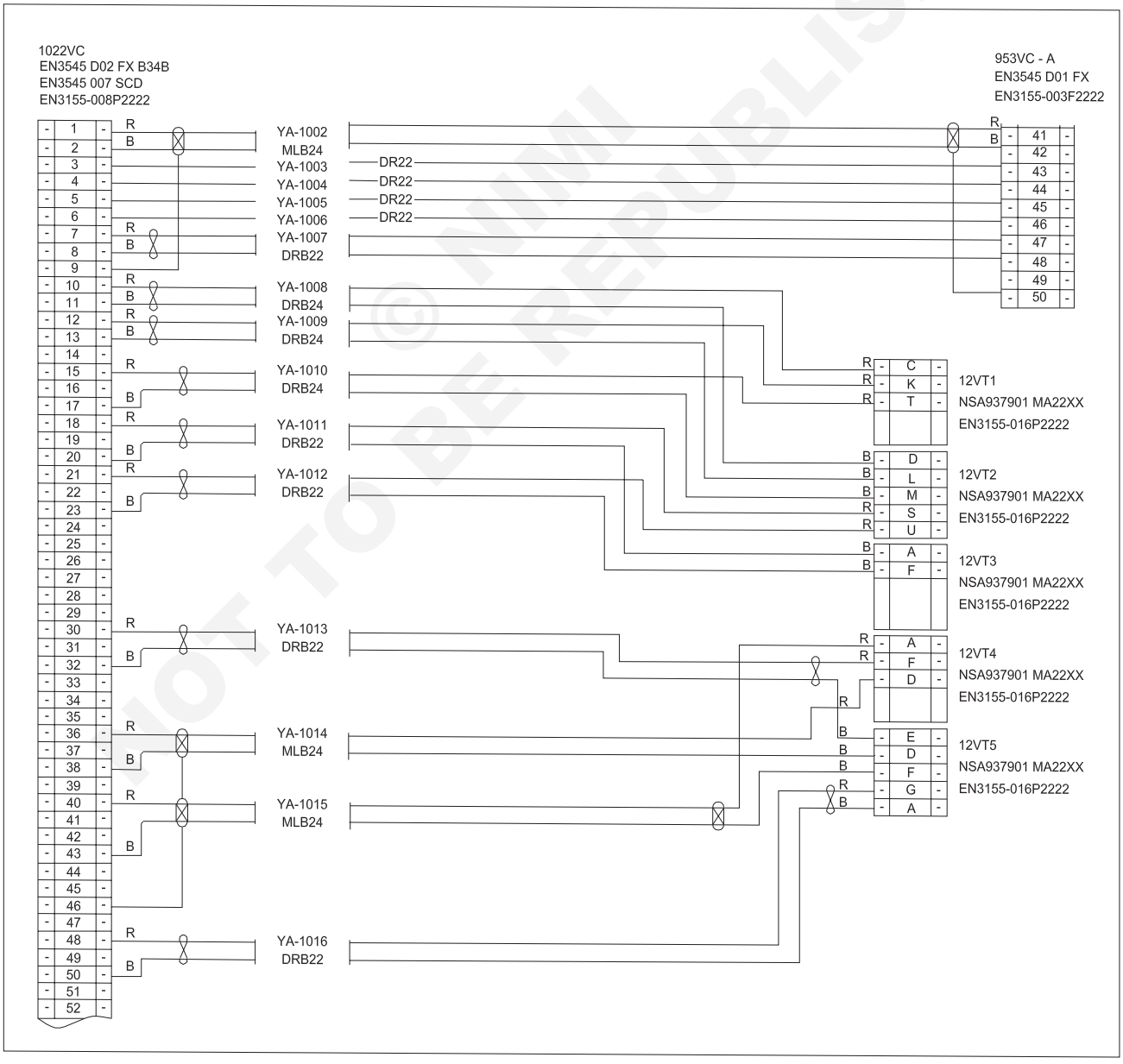
2 Strip and finish the shielded cables.

3 Crimp the contacts (follow the tables chapter 4.3.103)

4 Insert the contact in the connector.

5 Check the harness.

2D graph and Wiring table: see 4.3.100 task 1.



TASK 2: **Build the second harness prepared in 4.3.100**

From the graph drawn on the table and the wiring table produced in the 4.3.100 task 2 exercise and the wiring diagram below:

1 Cut and strip the wire.

2 Strip and finish the shielded cables.

3 Crimp the contacts (follow the tables chapter 4.3.103)

4 Insert the contact in the connector.

5 Check the harness.

2D graph and Wiring diagram: see 4.3.100 task 2.

ATA	ITEM 1	CONTACT POSITION	TERMINAL	WIRE	GAUGE	ITEM 2	CONTACT POSITION	TERMINAL
YA-1101	1251VC	2	EN3155-015S2018	DR	22	943VC-A	2	EN3155-003S2222
YA-1102	1251VC	4	EN3155-015S2018	DR	18	105VG	/	EN3155-015S2018
YA-1103R	1251VC	6	EN3155-015S2018	DRB	22	943VC-A	7	EN3155-003S2222
YA-1103B	1251VC	8	EN3155-015S2018	DRB	22	943VC-A	9	EN3155-003S2222
YA-1104	1251VC	10	EN3155-015S2018	DR	18	105VG	/	EN3155-015S2018
YA-1105R	1251VC	12	EN3155-015S2018	MLB	24	943VC-A	13	EN3155-003S2222
YA-1105B	1251VC	14	EN3155-015S2018	MLB	24	943VC-A	14	EN3155-003S2222
YA-G1105	1251VC	BL1	SOLDER SLEEVE	MLB	24	943VC-A	BL1	EN3155-003S2222
YA-1106	1251VC	16	EN3155-015S2018	DR	22	943VC-A	17	EN3155-003S2222
YA-1107	1251VC	18	EN3155-015S2018	DR	22	105VG	/	EN3155-015S2018
YA-1108R	1251VC	20	EN3155-015S2018	DRB	24	943VC-A	21	EN3155-003S2222
YA-1108B	1251VC	22	EN3155-015S2018	DRB	24	943VC-A	23	EN3155-003S2222
YA-1109	1251VC	24	EN3155-015S2018	DR	24	943VC-A	25	EN3155-003S2222
YA-1110	1251VC	26	EN3155-015S2018	DR	18	105VG	/	EN3155-015S2018
YA-1111	1251VC	30	EN3155-015S2018	DR	18	105VG	/	EN3155-015S2018
YA-1112R	1251VC	32	EN3155-015S2018	DRB	22	943VC-A	27	EN3155-003S2222
YA-1112B	1251VC	34	EN3155-015S2018	DRB	22	943VC-A	31	EN3155-003S2222
YA-1113R	1251VC	36	EN3155-015S2018	MLB	24	943VC-A	3	EN3155-003S2222
YA-1113B	1251VC	38	EN3155-015S2018	MLB	24	943VC-A	5	EN3155-003S2222
YA-G1113	1251VC	BL1	SOLDER SLEEVE	MLB	24	943VC-A	BL1	EN3155-003S2222
YA-1114	943VC-A	1	EN3155-003S2222	DR	22	105VG	/	EN3155-015S2018
YA-1115	943VC-A	11	EN3155-003S2222	DR	22	105VG	/	EN3155-015S2018

ATA	ITEM 1	CONTACT POSITION	TERMINAL	WIRE	GAUGE	ITEM 2	CONTACT POSITION	TERMINAL
YA-1116	1251VC	15	EN3155-015S2018	DR	24	1251VC	SH	YA-1105
YA-1117	1251VC	39	EN3155-015S2018	DR	24	1251VC	SH	YA-1113
YA-1118	943VC-A	6	EN3155-003S2222	DR	24	943VC-A	SH	YA-1113
YA-1119	943VC-A	16	EN3155-003S2222	DR	24	943VC-A	SH	YA-1105

Build a harness

Objectives: At the end of this exercise you shall be able to
- **build a harness.**
- **integrate the harness on electrical box.**

PROCEDURE

TASK 1: **Wiring**

Following the job card below, build the harness.

Note: The coding key of rectangular connectors is given on the 2D graph in the connector part number

Material List

Type	Reference	Quantity	Observation
Contact	EN3155-014P2018	27	or EN3155-014P2020 contacts
Contact	EN3155-015S2018	7	or EN3155-015S2020 contacts
Contact	EN3155-016P2018	20	or EN3155-016P2020 contacts
Contact	EN3155-003S2222	32	
Terminal lug	NSA936501TA2004	1	or PIDG 152657
Solder sleeve	EO160-1-0H	4	
Shrinkable conduit	ASN-E0718-01	4	Length 20 mm
Connector	EN3545D01MXA00A	1	With coding keys
Connector	EN3545D02FXB00A	1	With coding keys
Ground module	EO 425A20-01	1	
Junction module	NSA937908MA2008	4	Other arrangements possibles except 02
Rail		2	62 mm
Rail clamp		4	
Wire	EN2267-010A002S	4 x 15 cm	DR24 – For solder sleeve
Wire	EN2267-010A002S	4 x 55 cm	DR24
		2 x 45 cm	
Wire	EN2267-010A004S	3 x 60 cm	DR22
		5 x 55 cm	
		5 x 45 cm	
		3 x 35 cm	
Wire	EN2267-010A006S	1 x 35 cm	DR20
		3 x 25 cm	
Cable	EN2267-009B004P	3 x 60 cm	DRB22
Cable	EN2267-013B002F	1 x 60 cm	MLB24
		1 x 35 cm	
Cable	EN2267-013B004F	2 x 60 cm	MLB22
Tie cable	NSA935401-04	99	
Tie cable	NSA935401-05	99	
Hexagonal screw	NAS1801 3-()	99	
Washer	NAS1149F0332P	99	
Plastic V bracket	NSA935504-01	3	

Fig 1

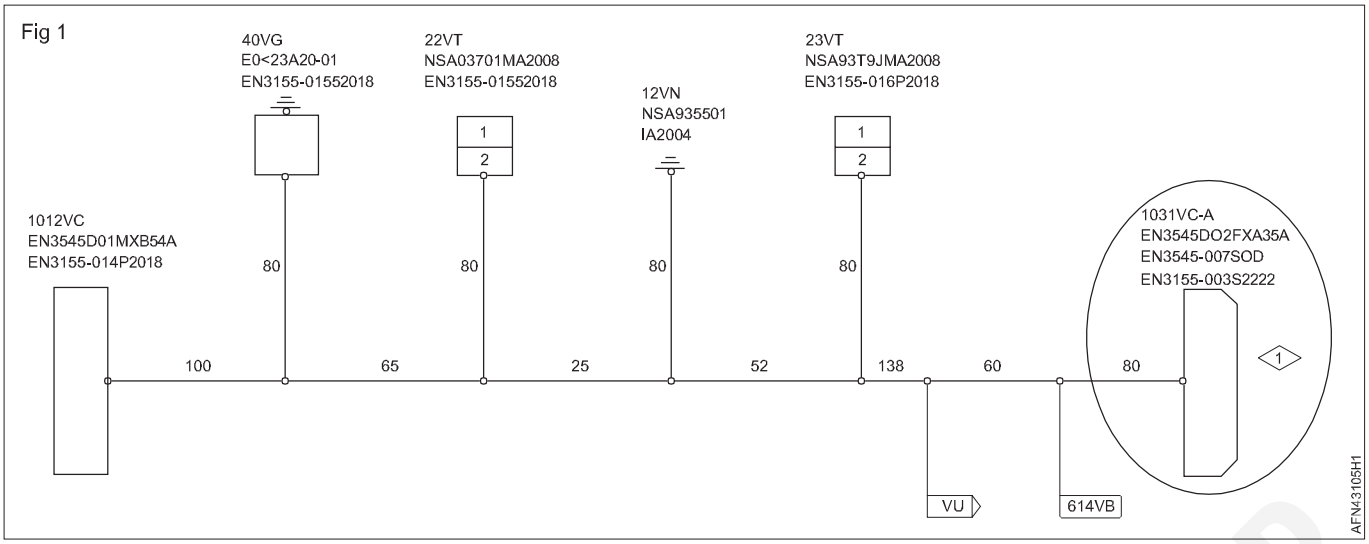
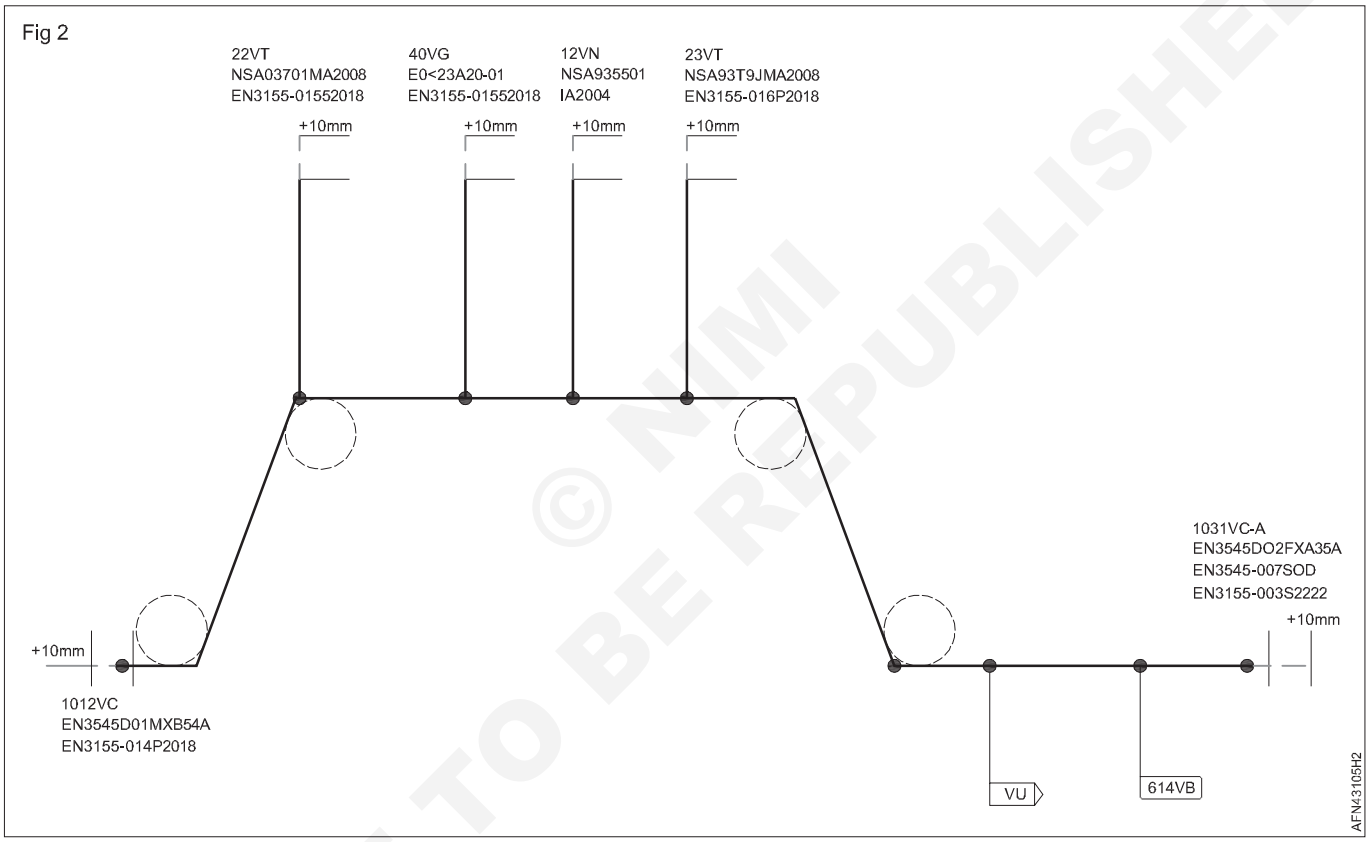
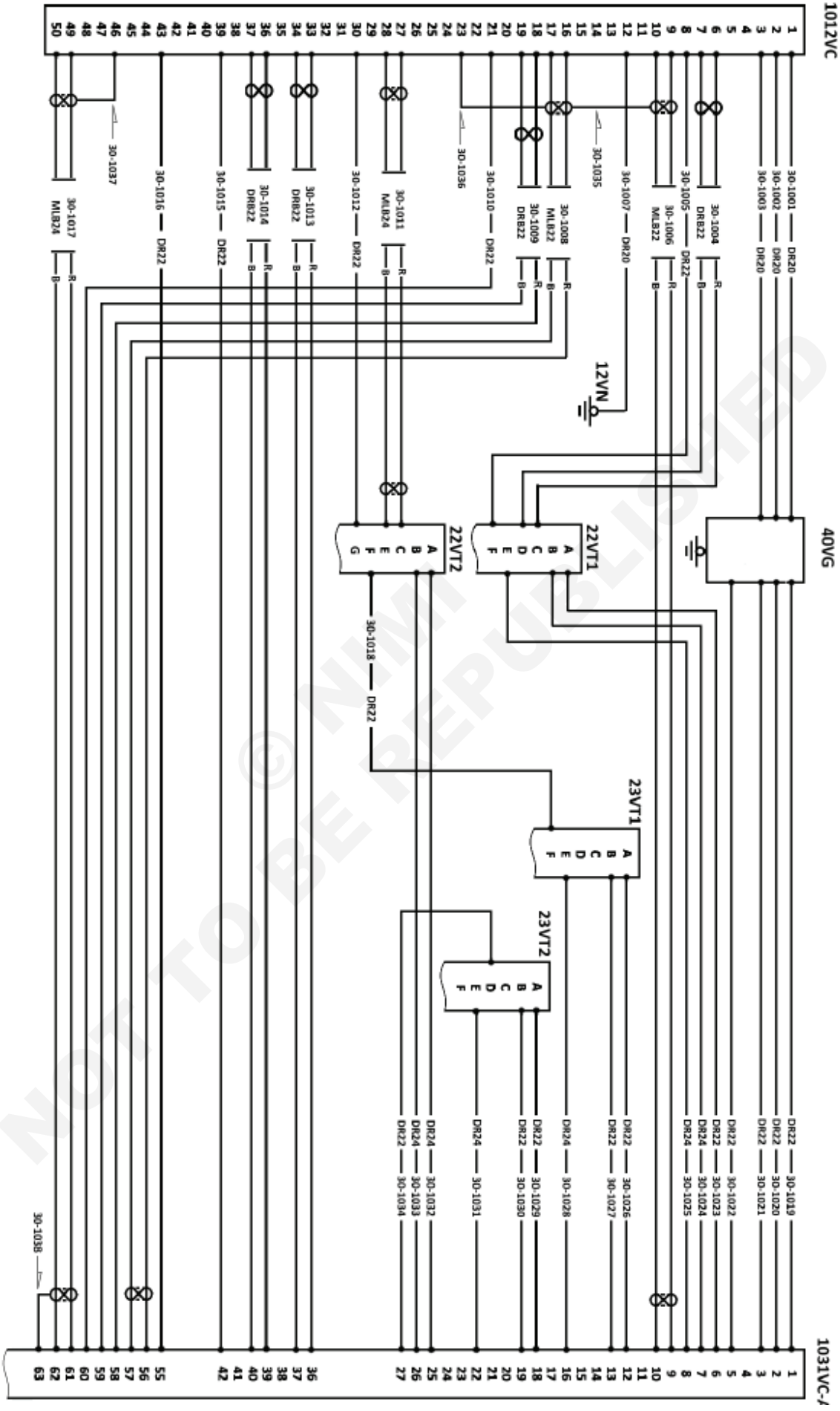


Fig 2





WIRE NUMBER	ITEM 1	CONTACT POSITION	TERMINAL	WIRE	WIRE GAUGE	ITEM 2	CONTACT POSITION	TERMINAL
30-1001	1012 VC	1	EN3155-014P2018	DR	20	40VG	/	EN3155-015S2018
30-1002	1012 VC	2	EN3155-014P2018	DR	20	40VG	/	EN3155-015S2018
30-1003	1012 VC	3	EN3155-014P2018	DR	20	40VG	/	EN3155-015S2018
30-1004 R	1012 VC	6	EN3155-014P2018	DRB	22	22 VT 1	C	EN3155-016P2018
30-1004 B	1012 VC	7	EN3155-014P2018	DRB	22	22 VT 1	D	EN3155-016P2018
30-1005	1012 VC	8	EN3155-014P2018	DR	22	22 VT 1	F	EN3155-016P2018
30-1006 R	1012 VC	9	EN3155-014P2018	MLB	22	1031 VC-A	9	EN3155-003S2222
30-1006 B	1012 VC	10	EN3155-014P2018	MLB	22	1031 VC-A	10	EN3155-003S2222
30G1006	1012 VC	BL1	EO160-1-0H	MLB	22	1031 VC-A	BL0	KYNAR
30-1007	1012 VC	12	EN3155-014P2018	DR	20	10 VN	/	NSA936501TA2004
30-1008 R	1012 VC	16	EN3155-014P2018	MLB	22	1031 VC-A	56	EN3155-003S2222
30-1008 B	1012 VC	17	EN3155-014P2018	MLB	22	1031 VC-A	57	EN3155-003S2222
30G1008	1012 VC	BL2	EO160-1-0H	MLB	22	1031 VC-A	BL0	KYNAR
30-1009 R	1012 VC	18	EN3155-014P2018	DRB	22	1031 VC-A	58	EN3155-003S2222
30-1009 B	1012 VC	19	EN3155-014P2018	DRB	22	1031 VC-A	59	EN3155-003S2222
30-1010	1012 VC	21	EN3155-014P2018	DR	22	1031 VC-A	60	EN3155-003S2222
30-1011 R	1012 VC	27	EN3155-014P2018	MLB	24	22 VT 2	C	EN3155-016P2018
30-1011 B	1012 VC	28	EN3155-014P2018	MLB	24	22 VT 2	E	EN3155-016P2018
30G1011	1012 VC	BL0	KYNAR	MLB	24	22 VT 2	BL0	KYNAR
30-1012	1012 VC	30	EN3155-014P2018	DR	22	22 VT 2	G	EN3155-016P2018
30-1013 R	1012 VC	33	EN3155-014P2018	DRB	22	1031 VC-A	36	EN3155-003S2222
30-1013 B	1012 VC	34	EN3155-014P2018	DRB	22	1031 VC-A	37	EN3155-003S2222
30-1014 R	1012 VC	36	EN3155-014P2018	DRB	22	1031 VC-A	39	EN3155-003S2222
30-1014 B	1012 VC	37	EN3155-014P2018	DRB	22	1031 VC-A	40	EN3155-003S2222
30-1015	1012 VC	39	EN3155-014P2018	DR	22	1031 VC-A	42	EN3155-003S2222
30-1016	1012 VC	43	EN3155-014P2018	DR	22	1031 VC-A	55	EN3155-003S2222
30-1017 R	1012 VC	49	EN3155-014P2018	MLB	24	1031 VC-A	61	EN3155-003S2222
30-1017 B	1012 VC	50	EN3155-014P2018	MLB	24	1031 VC-A	62	EN3155-003S2222
30G1017	1012 VC	BL1	EO160-1-0H	MLB	24	1031 VC-A	BL1	EO160-1-0H
30-1018	22 VT 2	F	EN3155-016P2018	DR	22	23 VT 1	F	EN3155-016P2018
20-1019	1031 VC-A	1	EN3155-003S2222	DR	22	40VG	/	EN3155-015S2018
20-1020	1031 VC-A	2	EN3155-003S2222	DR	22	40VG	/	EN3155-015S2018
20-1021	1031 VC-A	3	EN3155-003S2222	DR	22	40VG	/	EN3155-015S2018
20-1022	1031 VC-A	5	EN3155-003S2222	DR	22	40VG	/	EN3155-015S2018
20-1023	1031 VC-A	6	EN3155-003S2222	DR	22	22 VT 1	A	EN3155-016P2018
20-1024	1031 VC-A	7	EN3155-003S2222	DR	24	22 VT 1	B	EN3155-016P2018
30-1025	1031 VC-A	8	EN3155-003S2222	DR	24	22 VT 1	E	EN3155-016P2018
30-1026	1031 VC-A	12	EN3155-003S2222	DR	22	23 VT 1	A	EN3155-016P2018
30-1027	1031 VC-A	13	EN3155-003S2222	DR	22	23 VT 1	B	EN3155-016P2018
30-1028	1031 VC-A	16	EN3155-003S2222	DR	24	23 VT 1	E	EN3155-016P2018
30-1029	1031 VC-A	18	EN3155-003S2222	DR	22	23 VT 2	A	EN3155-016P2018

Length of wires/cables

Holding	Ending	SIZE (mm)	DR24	DR22	DR20	DRB24	DRB22	MLB24	MLB22
1012VC	1031VC-A	600		3			3	1	2
	40VG	250			3				
	22VT	350		2			1	1	
	12VN	350			1				
	SHIELD	*150*	*3*						
1031VC-A	40VG	600		4					
	22VT	550	4	1					
	23VT	450	2	5					
	SHIELD	*150*	*1*						
22VT	23VT	350		1					

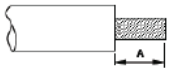
CRIMPING TOOL USED		
Connector/Contact/Terminal lug	Tool/locator	Setting

TECHNICAL INFORMATION

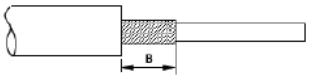
Normal contacts information

Contact	Code	Stripping A	Crimping tool	Locator	Selector setting									Insertion/extraction tools	
					26	24	22	20	18	16	14	12	10	Insertion	Extraction
EN3155-003	S2222	4	M22520/2-01	M22520/2-06	2	3	4	-	-	-	-	-	-	M81969/14-01 GREEN	M81969/14-01 WHITE
			M22520/7-01	M22520/7-06	1	2	3	-	-	-	-	-	-		
	S2022	4	M22520/2-01	M22520/2-10	2	3	4	-	-	-	-	-	-		
			M22520/7-01	M22520/7-08	1	2	3	-	-	-	-	-	-		
	S2020	6	M22520/1-01	M22520/1-04 **RED**	-	1	2	2	-	-	-	-	-	M81969/14-10 RED	M81969/14-10 ORANGE
			M22520/2-01	M22520/2-10	-	4	5	6	-	-	-	-	-		
EN3155-014	P2022	4	M22520/7-01	EN4008-006	1	2	3	-	-	-	-	-	-	M81969/39-01 GREEN	M81969/39-01 WHITE
			M22520/2-01	M22520/2-08	2	3	4	-	-	-	-	-	-		
	P2020	5	M22520/7-01	EN4008-006	-	4	5	6	-	-	-	-	-		
			M22520/2-01	M22520/2-08	-	5	6	7	-	-	-	-	-		
	P2018	5	M22520/7-01	EN4008-006	-	4	5	6	6	-	-	-	-		
			M22520/2-01	M22520/2-08	-	5	6	7	7	-	-	-	-		
EN3155-015	P2022	4	M22520/7-01	EN4008-006	1	2	3	-	-	-	-	-	-	M81969/39-01 GREEN	M81969/39-01 WHITE
			M22520/2-01	M22520/2-08	2	3	4	-	-	-	-	-	-		
	P2020	5	M22520/7-01	EN4008-006	-	4	5	6	-	-	-	-	-		
			M22520/2-01	M22520/2-08	-	5	6	7	-	-	-	-	-		
	P2018	5	M22520/7-01	EN4008-006	-	4	5	6	6	-	-	-	-		
			M22520/2-01	M22520/2-08	-	5	6	7	7	-	-	-	-		
EN3155-016	P2222	4	M22520/2-01	M22520/2-08	2	2	3	-	-	-	-	-	-	M81969/14-01 GREEN	M81969/14-01 WHITE
			M22520/7-01	EN4008-006	2	3	4	-	-	-	-	-	-		
	P2020	4,5	M22520/2-01	M22520/2-08	-	5	6	7	-	-	-	-	-	M81969/14-11 RED	M81969/14-11 WHITE
			M22520/1-01	M22520/1-02 **RED**	-	2	3	4	-	-	-	-	-		
	P2018	4,5	M22520/2-01	M22520/2-08	-	5	6	7	8	-	-	-	-		
			M22520/1-01	M22520/1-02 **RED**	-	2	3	4	5	-	-	-	-		
EN3155-018	P2022	4,5	M22520/7-01	M22520/7-02	1	2	3	-	-	-	-	-	-	M81969/14-11 RED	M81969/14-11 WHITE
			M22520/2-01	M22520/2-02	2	3	4	-	-	-	-	-	-		
	P2020	5	M22520/2-01	M22520/2-02	-	4	5	6	-	-	-	-	-		
			M22520/2-01	M22520/2-08	-	5	6	7	-	-	-	-	-		
			M22520/1-01	M22520/1-02 **RED**		2	3	4							
	P2018	5	M22520/7-01	M22520/7-02	-	4	5	6	7	-	-	-	-		
			M22520/2-01	M22520/2-02	-	5	6	7	8	-	-	-	-		
			M22520/1-01	M22520/1-02 **RED**		2	3	4	5						
EN3155-019	P2022	4,5	M22520/7-01	M22520/7-02	1	2	3	-	-	-	-	-	-	M81969/14-11 RED	M81969/14-11 WHITE
			M22520/2-01	M22520/2-02	2	3	4	-	-	-	-	-	-		
	P2020	5	M22520/2-01	M22520/2-02	-	4	5	6	-	-	-	-	-		
			M22520/2-01	M22520/2-08	-	5	6	7	-	-	-	-	-		
			M22520/1-01	M22520/1-02 **RED**		2	3	4							
	P2018	5	M22520/7-01	M22520/7-02	-	4	5	6	7	-	-	-	-		
			M22520/2-01	M22520/2-02	-	5	6	7	8	-	-	-	-		
			M22520/1-01	M22520/1-02 **RED**		2	3	4	5						

Solder sleeve information

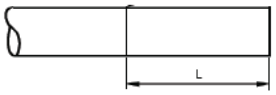


Wire



Shielded cable end stripping

SOLDER SLEEVE	Stripping A ±0,5 mm	Stripping B ±0,5 mm
1-0H	5,5	7
1-1H	5,5	7

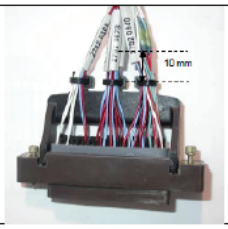


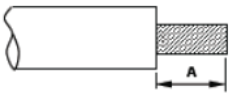
End cut for shielded cable

Length L

60 ±15 mm
In the first cable

NOTE:
Solder sleeves must not touch or enter the backshell.





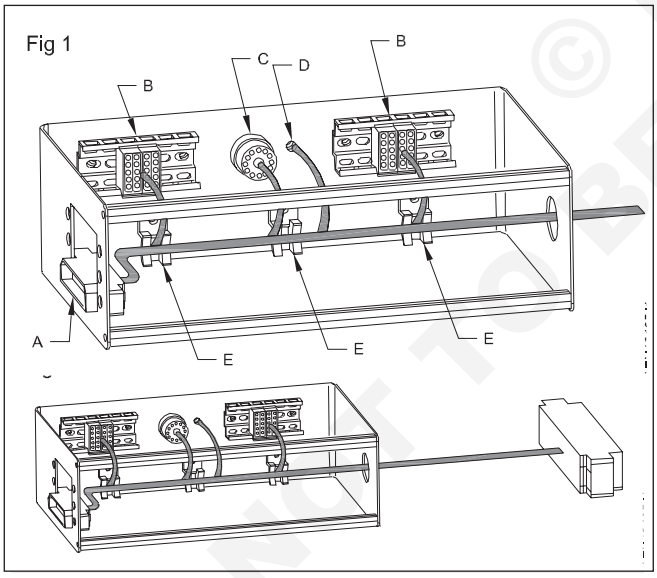
Wire gauge	Terminal lug size	Stripping length A ±0,3 mm
24 to 12	22 to 14	6
10	10	9
2 x 24	20	6
2 x 18	14	6
2 x 16	10	8

Terminal lug NSA936501	Colour	Wire gauge	AMP crimping tool	Tool colour		Dots code
				Code 1	Code 2	
TA22**	Brown	24	576778	Black	Brown	• •
TA22**		22				
TA20**	Grey or white	20	576779	Blue/purple	Grey	•
TA20**		2 x 24				
TA16**	Orange	18	576780	Black	Orange	• •
TA16**		16	576781	Orange	Orange	•

— — — — — —

TASK 2 : **Mounting on the box**

Fig 1



Following the job card below, build the harness.

Use the box prepared in exercise 4.1.82.

A - Install the connector on the VU.

B - Install the module rail, modules and module clamps lock.

C - Install the ground module.

D - Install the terminal lug and protect with varnish.

E - Install the brackets and attach the harness.

Support NSA935504-01
Screws NAS1801 3-()
Washer NAS1149F0332P

TORQUE TIGHTENING

Support clamping: 2 Nm

Tightening of terminals: 1.6 Nm

Tightening castellated nut: 1.4 Nm

Connect the connector according to the information in task 1.

— — — — — —

Perform electrical tests using a multimeter

Objectives: At the end of this exercise you shall be able to
- **carry out a wire continuity check on the harness**

PROCEDURE

TASK 1: **Using multimeter this other student, test continuity wire by wire.**

- Exercise 2.6.91 task 2
- Mark each wire tested

ATA	ITEM 1	CONTACT POSITION	TERMINAL	WIRE	GAUGE	ITEM 2	CONTACT POSITION	TERMINAL
YA-1101	1251VC	2	EN3155-015S2018	DR	22	943VC-A	2	EN3155-003S2222
YA-1102	1251VC	4	EN3155-015S2018	DR	18	105VG	/	EN3155-015S2018
YA-1103R	1251VC	6	EN3155-015S2018	DRB	22	943VC-A	7	EN3155-003S2222
YA-1103B	1251VC	8	EN3155-015S2018	DRB	22	943VC-A	9	EN3155-003S2222
YA-1104	1251VC	10	EN3155-015S2018	DR	18	105VG	/	EN3155-015S2018
YA-1105R	1251VC	12	EN3155-015S2018	MLB	24	943VC-A	13	EN3155-003S2222
YA-1105B	1251VC	14	EN3155-015S2018	MLB	24	943VC-A	14	EN3155-003S2222
YA-G1105	1251VC	BL1	SOLDER SLEEVE	MLB	24	943VC-A	BL1	EN3155-003S2222
YA-1106	1251VC	16	EN3155-015S2018	DR	22	943VC-A	17	EN3155-003S2222
YA-1107	1251VC	18	EN3155-015S2018	DR	22	105VG	/	EN3155-015S2018
YA-1108R	1251VC	20	EN3155-015S2018	DRB	24	943VC-A	21	EN3155-003S2222
YA-1108B	1251VC	22	EN3155-015S2018	DRB	24	943VC-A	23	EN3155-003S2222
YA-1109	1251VC	24	EN3155-015S2018	DR	24	943VC-A	25	EN3155-003S2222
YA-1110	1251VC	26	EN3155-015S2018	DR	18	105VG	/	EN3155-015S2018
YA-1111	1251VC	30	EN3155-015S2018	DR	18	105VG	/	EN3155-015S2018
YA-1112R	1251VC	32	EN3155-015S2018	DRB	22	943VC-A	27	EN3155-003S2222
YA-1112B	1251VC	34	EN3155-015S2018	DRB	22	943VC-A	31	EN3155-003S2222
YA-1113R	1251VC	36	EN3155-015S2018	MLB	24	943VC-A	3	EN3155-003S2222
YA-1113B	1251VC	38	EN3155-015S2018	MLB	24	943VC-A	5	EN3155-003S2222
YA-G1113	1251VC	BL1	SOLDER SLEEVE	MLB	24	943VC-A	BL1	EN3155-003S2222
YA-1114	943VC-A	1	EN3155-003S2222	DR	22	105VG	/	EN3155-015S2018
YA-1115	943VC-A	11	EN3155-003S2222	DR	22	105VG	/	EN3155-015S2018

ATA	ITEM 1	CONTACT POSITION	TERMINAL	WIRE	GAUGE	ITEM 2	CONTACT POSITION	TERMINAL
YA-1116	1251VC	15	EN3155-015S2018	DR	24	1251VC	SH	YA-1105
YA-1117	1251VC	39	EN3155-015S2018	DR	24	1251VC	SH	YA-1113
YA-1118	943VC-A	6	EN3155-003S2222	DR	24	943VC-A	SH	YA-1113
YA-1119	943VC-A	16	EN3155-003S2222	DR	24	943VC-A	SH	YA-1105

Note your observation for the shielded cable:

__ __ __ __ __ __

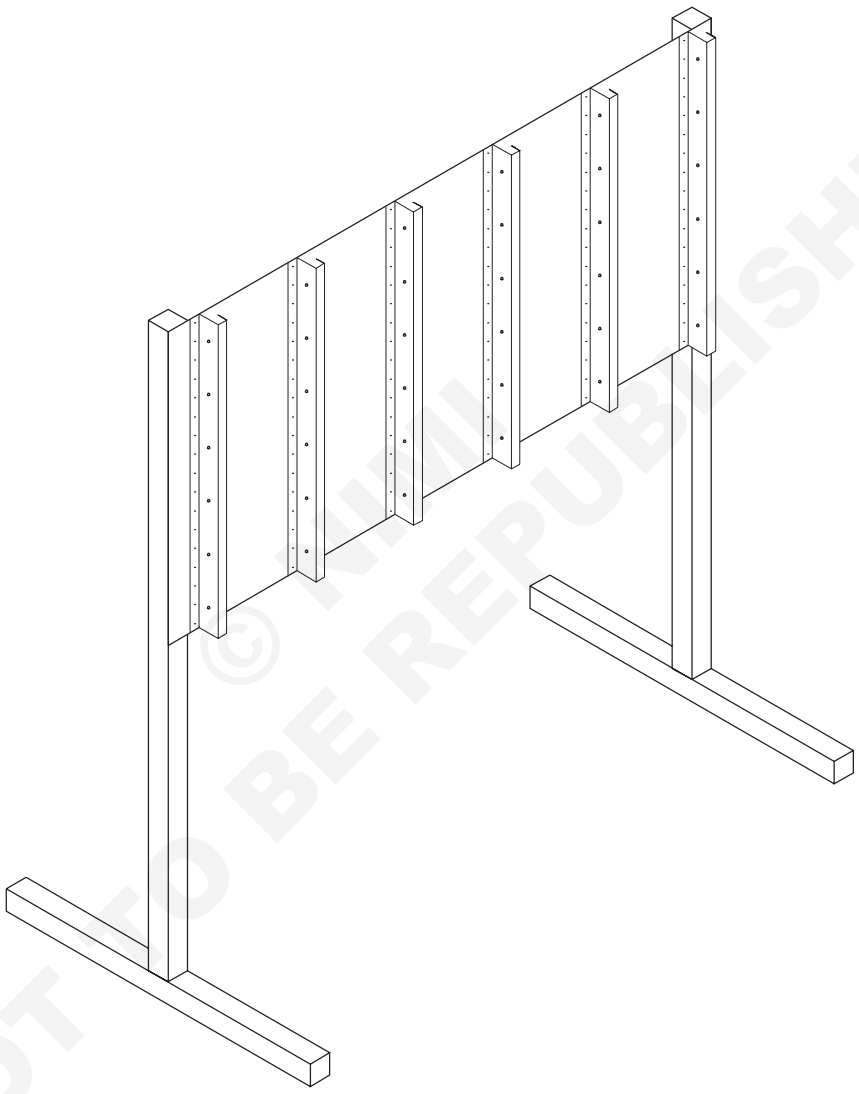
Harness 2: exercise 4.3.100 task 2

Mark each wire tested.

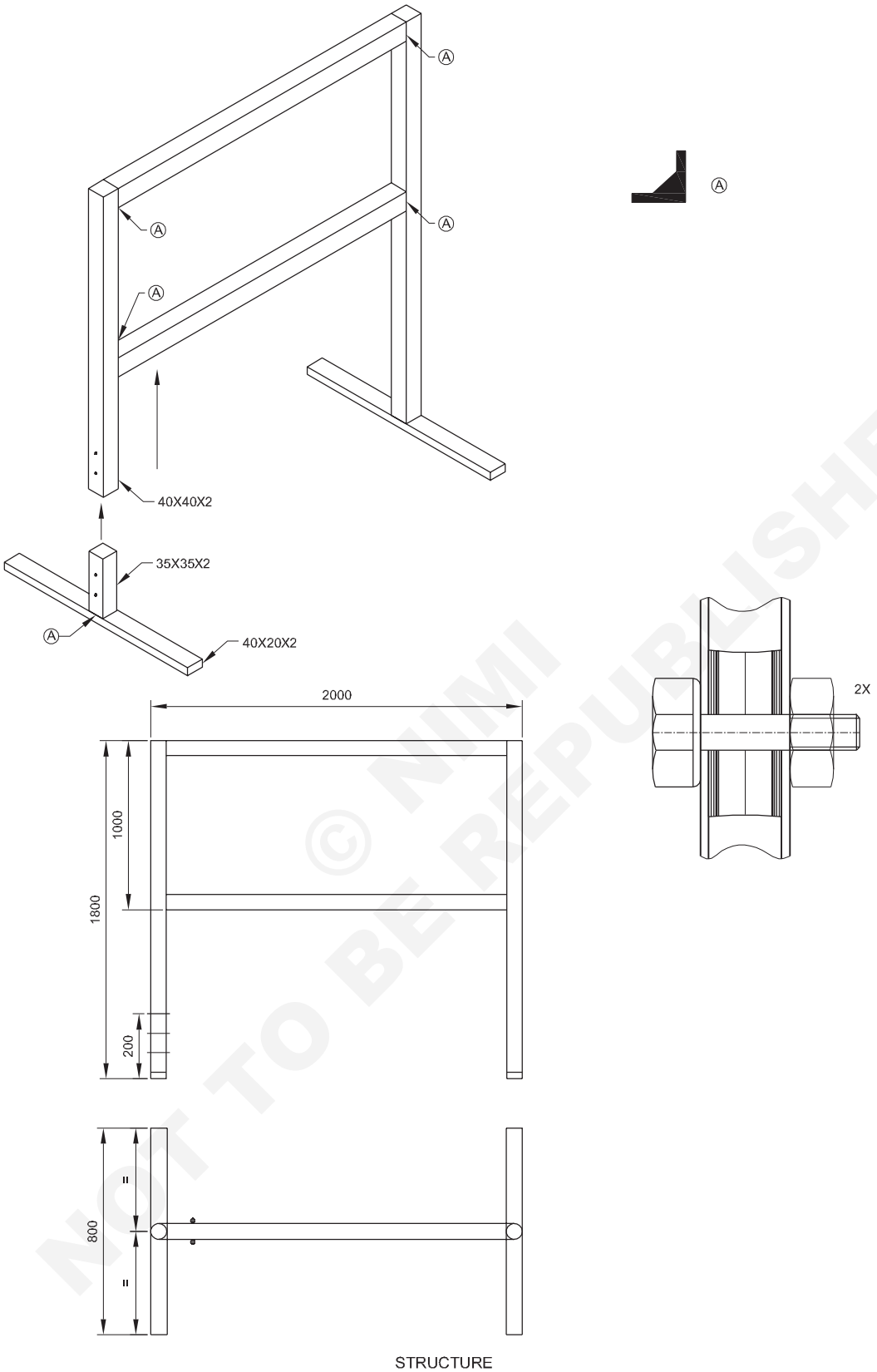
WIRE NUMBER	ITEM 1	CONTACT POSITION	TERMINAL	WIRE	WIRE GAUGE	ITEM 2	CONTACT POSITION	TERMINAL
30-1001	1012 VC	1	EN3155-014P2018	DR	20	40VG	/	EN3155-015S2018
30-1002	1012 VC	2	EN3155-014P2018	DR	20	40VG	/	EN3155-015S2018
30-1003	1012 VC	3	EN3155-014P2018	DR	20	40VG	/	EN3155-015S2018
30-1004 R	1012 VC	6	EN3155-014P2018	DRB	22	22 VT 1	C	EN3155-016P2018
30-1004 B	1012 VC	7	EN3155-014P2018	DRB	22	22 VT 1	D	EN3155-016P2018
30-1005	1012 VC	8	EN3155-014P2018	DR	22	22 VT 1	F	EN3155-016P2018
30-1006 R	1012 VC	9	EN3155-014P2018	MLB	22	1031 VC-A	9	EN3155-003S2222
30-1006 B	1012 VC	10	EN3155-014P2018	MLB	22	1031 VC-A	10	EN3155-003S2222
30G1006	1012 VC	BL1	EO160-1-0H	MLB	22	1031 VC-A	BL0	KYNAR
30-1007	1012 VC	12	EN3155-014P2018	DR	20	10 VN	/	NSA936501TA2004
30-1008 R	1012 VC	16	EN3155-014P2018	MLB	22	1031 VC-A	56	EN3155-003S2222
30-1008 B	1012 VC	17	EN3155-014P2018	MLB	22	1031 VC-A	57	EN3155-003S2222
30G1008	1012 VC	BL2	EO160-1-0H	MLB	22	1031 VC-A	BL0	KYNAR
30-1009 R	1012 VC	18	EN3155-014P2018	DRB	22	1031 VC-A	58	EN3155-003S2222
30-1009 B	1012 VC	19	EN3155-014P2018	DRB	22	1031 VC-A	59	EN3155-003S2222
30-1010	1012 VC	21	EN3155-014P2018	DR	22	1031 VC-A	60	EN3155-003S2222
30-1011 R	1012 VC	27	EN3155-014P2018	MLB	24	22 VT 2	C	EN3155-016P2018
30-1011 B	1012 VC	28	EN3155-014P2018	MLB	24	22 VT 2	E	EN3155-016P2018
30G1011	1012 VC	BL0	KYNAR	MLB	24	22 VT 2	BL0	KYNAR
30-1012	1012 VC	30	EN3155-014P2018	DR	22	22 VT 2	G	EN3155-016P2018
30-1013 R	1012 VC	33	EN3155-014P2018	DRB	22	1031 VC-A	36	EN3155-003S2222
30-1013 B	1012 VC	34	EN3155-014P2018	DRB	22	1031 VC-A	37	EN3155-003S2222
30-1014 R	1012 VC	36	EN3155-014P2018	DRB	22	1031 VC-A	39	EN3155-003S2222
30-1014 B	1012 VC	37	EN3155-014P2018	DRB	22	1031 VC-A	40	EN3155-003S2222
30-1015	1012 VC	39	EN3155-014P2018	DR	22	1031 VC-A	42	EN3155-003S2222
30-1016	1012 VC	43	EN3155-014P2018	DR	22	1031 VC-A	55	EN3155-003S2222
30-1017 R	1012 VC	49	EN3155-014P2018	MLB	24	1031 VC-A	61	EN3155-003S2222
30-1017 B	1012 VC	50	EN3155-014P2018	MLB	24	1031 VC-A	62	EN3155-003S2222
30G1017	1012 VC	BL1	EO160-1-0H	MLB	24	1031 VC-A	BL1	EO160-1-0H
30-1018	22 VT 2	F	EN3155-016P2018	DR	22	23 VT 1	F	EN3155-016P2018
20-1019	1031 VC-A	1	EN3155-003S2222	DR	22	40VG	/	EN3155-015S2018
20-1020	1031 VC-A	2	EN3155-003S2222	DR	22	40VG	/	EN3155-015S2018
20-1021	1031 VC-A	3	EN3155-003S2222	DR	22	40VG	/	EN3155-015S2018
20-1022	1031 VC-A	5	EN3155-003S2222	DR	22	40VG	/	EN3155-015S2018
20-1023	1031 VC-A	6	EN3155-003S2222	DR	22	22 VT 1	A	EN3155-016P2018
20-1024	1031 VC-A	7	EN3155-003S2222	DR	24	22 VT 1	B	EN3155-016P2018
30-1025	1031 VC-A	8	EN3155-003S2222	DR	24	22 VT 1	E	EN3155-016P2018
30-1026	1031 VC-A	12	EN3155-003S2222	DR	22	23 VT 1	A	EN3155-016P2018
30-1027	1031 VC-A	13	EN3155-003S2222	DR	22	23 VT 1	B	EN3155-016P2018
30-1028	1031 VC-A	16	EN3155-003S2222	DR	24	23 VT 1	E	EN3155-016P2018
30-1029	1031 VC-A	18	EN3155-003S2222	DR	22	23 VT 2	A	EN3155-016P2018

Fit and install harness on different types of attaching part

Objectives: At the end of this exercise you shall be able to
- **fit and install harness on different panels**
- **self-check the installation.**



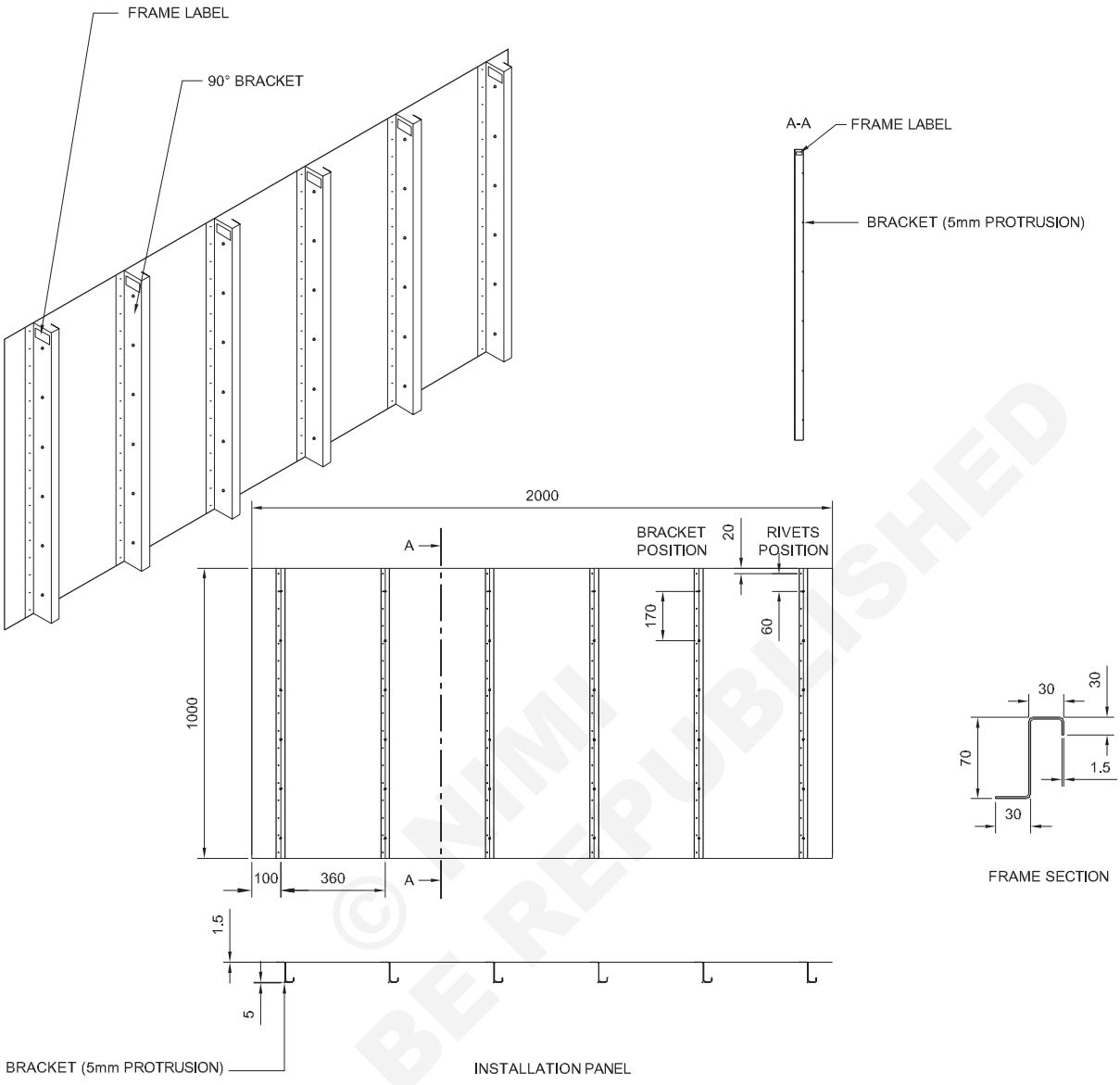
-	-	-	-	-	-	4.3.107
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**EXAMPLE OF TRAINING PANEL MANUFACTURING FOR HARNESSES INSTALLATION**				DEVIATIONS	TIME : 3Hrs
					CODE NO. AFN43107E1	



STRUCTURE

-	-	-	-	-	-	4.3.107
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE : NTS	**EXAMPLE OF TRAINING PANEL MANUFACTURING FOR HARNESSES INSTALLATION**	DEVIATIONS	TIME : 3Hrs
		CODE NO. AFN43107E2	



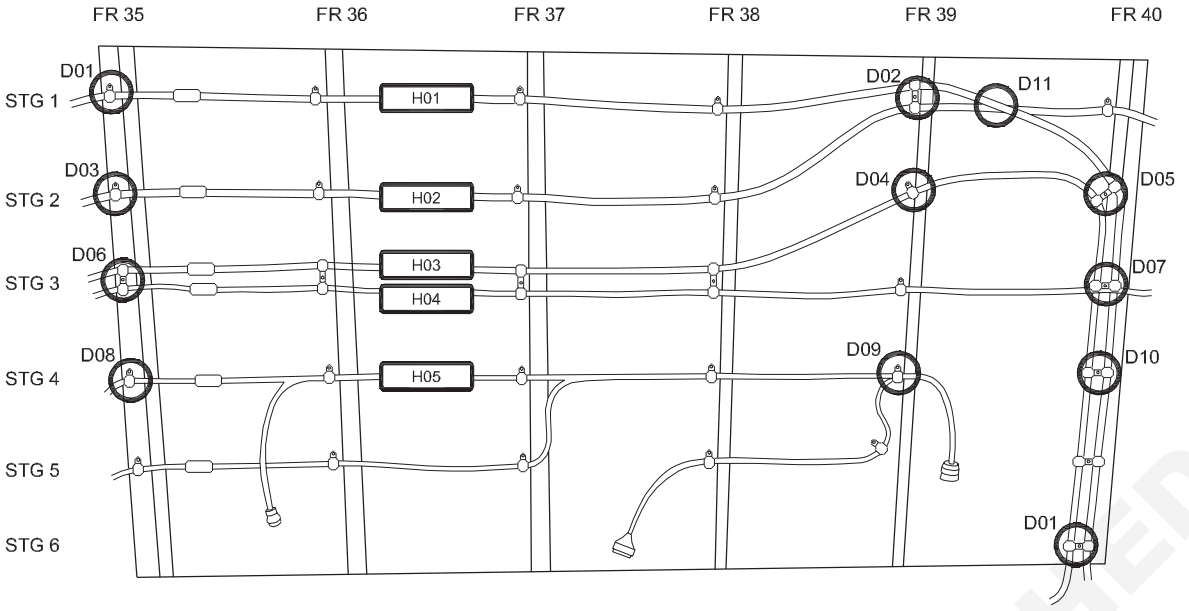
-	-	-	-	-	-	4.3.107
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE : NTS	**EXAMPLE OF TRAINING PANEL MANUFACTURING FOR HARNESSES INSTALLATION**				DEVIATIONS	TIME : 3Hrs
					CODE NO. AFN43107E3	

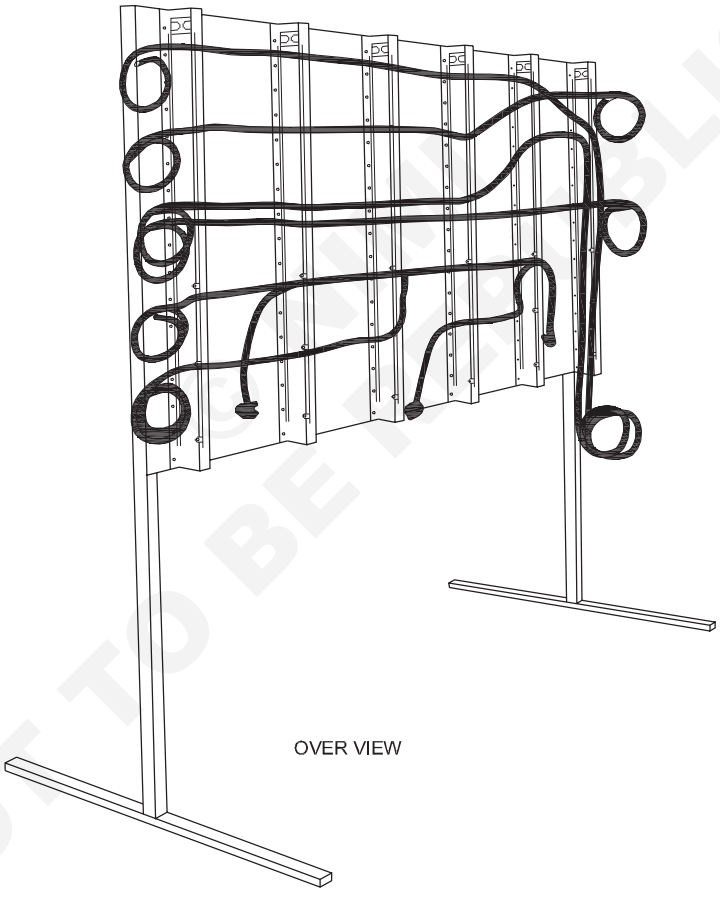
Job Sequence

Follow the specific job cards to:

- Inspecting the integrity of harness before beginning the installation tasks
- Choosing the attaching parts / routing supports (plastic vee supports, metallic or plastic clamps, spacers, screws and washers) to be fastened to the structure panels according to the work card
- Installation of the attaching parts on the panels using ratchet, sockets, screwdrivers and torque wrench
- Installation harness on the different attaching points in accordance with 2D routing drawing
- Bonding/grounding connections: torque the bonding/ grounding terminals, apply protection varnish on the bonding/grounding terminals
- Ensuring the protection of the connection elements with plastic caps or bags
- Self-check

Fig 1





OVER VIEW

JOB CARD EXAMBLE

AFN43107H1

Note: The following pages give an example of a work card for this chapter.

Depending on the available harnesses in the ITI, the work cards will correspond to the existing home-made element.

If available, the material mentioned is only given as an example. Procurement will be based on the real specific exercise set up.

Fig 2

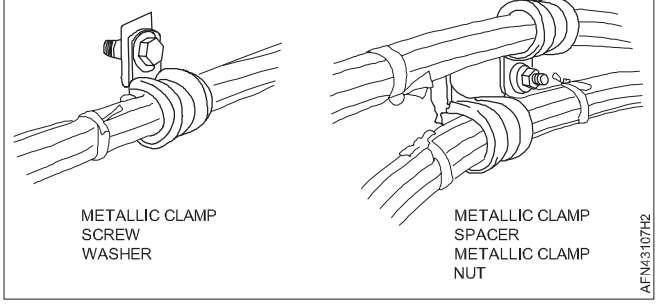


Fig 3

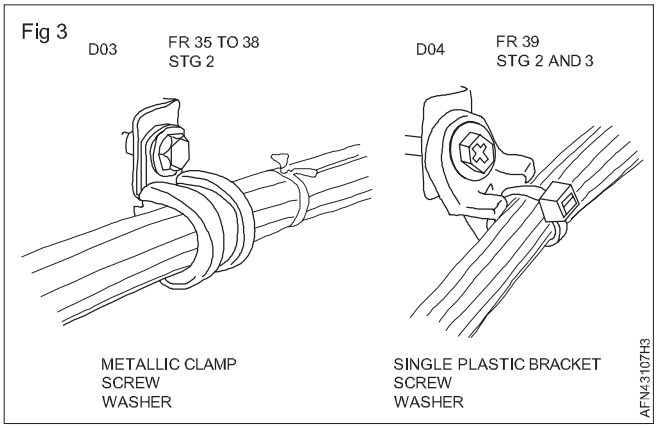


Fig 4

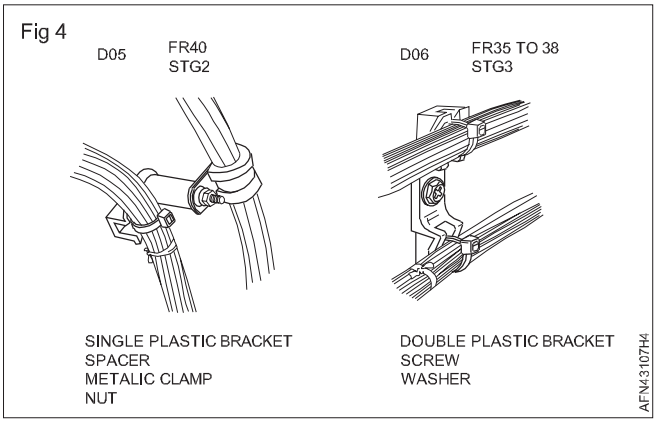


Fig 5