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G.H.F.
20/12

6th, December 1961

Reference P 257 HAK/SG

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MISSION AUSTRALIENNE
S.N.E.C.M.A.
70, bld Kellermann

PARIS 13e
France

COMMONWEALTH AIRCRAFT CORPORATION PTY. LTD.
BOX 779 H P.O.
Elizabeth Street

MELBOURNE
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A/F MANAGER	SUPT. INSPECTION

Attention : the MANAGER

Subject : Engine factory processing Data.
Turbine blade Production.

Dear Sir,

Enclosed herewith please find three copies of "Interim report on Turbine Blade Production for ATAR Engine " with one copy of creep test piece drawing 55 and Turbine Blade Material sheet document N° YLK II985 attached.

Yours faithfully,

G.H. Foster

G.H. FOSTER

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HAK/SG

6th, december 1961

HAK/SG

INTERIM REPORT ON TURBINE BLADE

PRODUCTION FOR ATAR ENGINE.

This report will be written under three main headings, namely 1-Material, 2-Forging, and 3-Machining and Processing at SNECMA.

MATERIAL

The materials currently being used, and specified for ATAR 9C and ATAR 9K engines, are as follows.

Material for Turbine Blades ATAR 9C.

L.P. Turbine Blade 2nd Stage :

Nimonic 93 - NKCD 20 T A u or v, Spec. DTM 107-74.

H.P. Turbine Blade 1st Stage :

Little udimet 500-NKCD 20 AT u, Spec. DTM 107-95.

Material for Turbine Blades ATAR 9K.

L.P. Turbine Blade 2nd Stage :

Udimet 500 - NKCD 20 AT w, Spec. DTM 107-99.

H.P. Turbine Blade 1st stage :

Udimet 700 - NKCD 20 AT x, Spec. DTM 107-93.

N.B. See SNECMA document n° YLK II985, attached to this report, in confirmation of the above detail.

Nimonic 100 was used in the early stages of ATAR 9C High Pressure 1st Stage Turbine Blade production, but has since been replaced by little Udimet 500. Confusion could have arisen, on this subject, in that both Nimonic 100 and little Udimet 500 are known by the same material code designation, namely NKCD 20 AT u. Specification DTM 107-95 and the attached document n° YLK 11985 is quite clear on what material is currently being used and required for this forging.

FORGING

The following is a brief summary of turbine blade forging production for ATAR 9C and ATAR 9K engines, as carried out by the various forgers.

AUBERT & DUVAL (France)

-Turbine blade forgings, in production quantities, have been supplied for both stage 1 and stage 2 ATAR 9C engine.

-Turbine blade forgings have been supplied for both stages of ATAR 9K engine, but it is not known if these were in production quantities. They were not supplied as precision forged blades.

S.N.E.C.M.A. Forge at Gennevilliers.

-the only turbine blades that have been produced for ATAR 8 or ATAR 9 engines, at SNECMA Gennevilliers plant, are a small production quantity of 2nd Stage ATAR 9C blades for type testing and approval. Technique approval has just been granted.

-SNECMA have recently completed a licence agreement with UTICA in America for forgings techniques for production of turbine blades. Equipment arrangements are at present in progress at SNECMA prior to commencement of forging using techniques resulting from this licence agreement.

It is proposed to produce both L.P. and H.P. turbine blade forgings at the Gennevilliers plant for ATAR 9C and ATAR 9K engine.

UTICA in America.

H.P. turbine blade forgings have been produced in Udimet 700 by UTICA as a precision (close to form size on the aerofoil) forging. Udimet 700 is reported to be a difficult material, to machine.

MACHINING AND PROCESSING AT SNECMA.

All machining and processing of turbine blades is carried out at the SNECMA Kellermann Factory.

Acceptance Testing.

All turbine blade forgings are subjected to a routine acceptance testing procedure prior to being accepted into store. The forgings are received in the solution heat treated condition.

Acceptance testing details would appear to be well documented in the form of DTM specifications (not yet translated into english). A grain size examination is carried out, but only on a low percentage bases. A grain size standard is specified, but it is not a difficult one to comply with. There is an elongation requirement on the creep test, and this is considered an important property to be complied with. While it is not known for certain at this stage, but this elongation requirement could be the reason for the particular care SNECMA take in preparing the creep test piece. The blade is first sectioned and then fully aged. It is then machined in a lathe to finished size plus grinding allowance. The gauge length is then ground with strict control on the following conditions - amount of metal removed, speed of wheel RPM, lubricant, and wheel condition. From what is understood at this stage, three test pieces are machined and ground from each test blade. Two are used for creep test. If there is any doubt as to test piece preparation, the third prepared test piece is given a heat treatment of 16 hrs. at 850°C., and then etched all over in fry's reagent. The gauge length is then carefully inspected for surface cracks. If any are present, the results of the other two tests are discarded.

A copy of the test piece drawing (55), as used for ATAR 9C and ATAR 9K turbine blade forgings, is attached for information.

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SHOP OPERATION SEQUENCE.

The following is a very condensed summary of manufacturing operations for 1st Stage H.P. Turbine Blades.

Mill
V
1st Age 8 hrs. at 850°C.
V
Mill
V
2nd Age 8 hrs. at 850°C.
V
Mill
V
Grind
v
Electrolytic etch.
V
Inspect
V
Zyglo
V
Inspect
V
3rd Age 8 hrs. at 850°C.
16 hrs. at 760°C.
V
Acid clean
V
Vapour blast
V
Shoot peen root.
V
Inspect
V
Store.

N.B. There is no electropolishing, High temperature skin annealing, or grain-size evaluation carried out on any turbine blades during production, at present being produced by SNECMA.

The operational sequence for the 2nd stage L.P. turbine blade is very similar to the H.P. The 1st and 2nd ageing treatments are carried out at a lower temperature, and the 3rd age is dispensed with altogether.

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This document received from M Brunetaud
 - Chief Material Office Kellerman Works

34 Bureau
 16/11/61

10.11.61. R.D.

ALLIAGES DE FORGE POUR AUBES MOBILES DE TURBINE ATAR 9C - 9K

Désignation normalisée	Appellation type	Fournisseur de l'alliage	Marque	Utilisation	Composition chimique						Fluage CREEP	
					C	Ti	Al	Cr	Co	Mo	Ni	Conditions de réception
DTM 107-74 NCK20TA U ou V	Nimonic 93	Aubert et Duval	PER2U	2 ^{ème} étage ATAR 9C	<0,12	18/30	07/18	18/21	15/21	—	base	815°C - 30 kgf/mm ² : t _R ≥ 30h - A% ≥ 35 950°C - 8 kgf/mm ² : Classement u: si t _R ≥ 5h 15 ≤ t _{2%} ≤ 15h Classement v: si t _{2%} > 15h
DTM 107-95 NKCD20ATu	petit Udimet 500	Aubert et Duval	PER2S	1 ^{er} étage ATAR 9C	<0,12	25/35	20/30	16/19	15/20	35/50	base	815°C - 33 kgf/mm ² : t _R ≥ 30h - A% ≥ 35 950°C - 10 kgf/mm ² : t _{2%} > 15h
DTM 107-74 lots 1200 et N190-66.		Imphy	ATGS4S									
DTM 107-94 NKCD20ATw	Udimet 500	Aubert et Duval	PER5	2 ^{ème} étage ATAR 9K	<0,12	2,75/3,25	2,75/3,25	18/20	15/20	30/50	base	815°C - 36 kgf/mm ² : t _R ≥ 30h - A% ≥ 35 950°C - 12 kgf/mm ² : t _{2%} > 15h
DTM 107-93 NKCD20ATx	Udimet 700	Spécial Métales Inco	Udimet 700	1 ^{er} étage ATAR 9K	<0,10	2,75/3,75	3,75/4,75	14/16	17/20	4,5/5,5	base	815°C - 40 kgf/mm ² : t _R ≥ 30h - A% ≥ 40 980°C - 125 kgf/mm ² : t _R ≥ 23h - A% ≥ 8

S.N.E.C.M.A. 09.03.50.410 (10)

S.N.E.C.M.A.

DOCUMENT N° YLK 11935

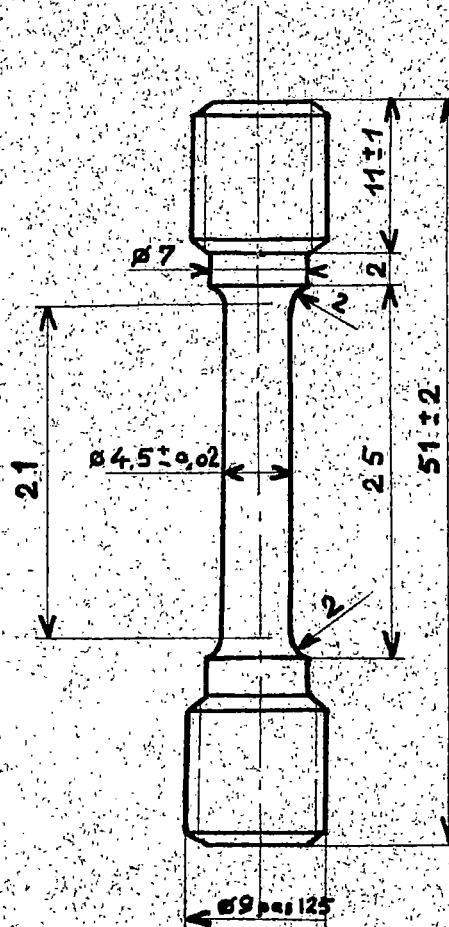
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ÉPROUVETTE Ø4,5 DE FLUAGE - RUPTURE

55

Longueur réduite



Longueur de référence : $23 = \sqrt{33.335}$

Longueur calibrée : 21

Tolérances générales: ±0.1

Échelle 2/1

DIRECTION TECHNIQUE
S.N.E.C.M.A

le 18-10-57

Dessiné par : Mittler