

50R

HAK/SG P 252

FR 8/22
ACCT COPY SENT
TO ENGINE SUPT

29th, November 1961

Mngr.....	Eng. Supt.....	
Sec.....	Lia. Mngr.....	
Asst. Sec.....	Ch. Eng. A/D.....	
	Pers. Supt.....	
Ch. Acct.	11 DEC 1961	Supply Sales
Stores.....		
Ansd.....	Init.....	

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
Australia

CIRCULATION / COPIES 14/12/61	
E.F. MNGR ✓	FCT. ADM. SUPT.
DSGN. ENGR	MC. SHOP. SUPT.
DEV. ENGR	PRODCN. SUPT.
SERV. ENGR	ASSM. SUPT.
QUAL. ENGR	FOUNDRY SUPT.
PROD. ENGR	METCAL. SUPT. ✓
MATL. ENGR	PROCESS SUPT. ✓
CH. TL. DSGR	TOOL. PROD. SUPT.
CH. INSP. E. F.	TOOL. ROOM. SUPT.
A/F MANAGER	SUPT. INSPECTION

Attention : the MANAGER

Subject : Shaw Process Castings Reports.

Dear Sir,

Enclosed herewith please find three copies of following reports :

- Report No 1 The Shaw Process at SNECMA Gennevilliers Plant.
- Report No 2 Shaw Process castings ATAR 9C engine (set of drawings included)
- Report No 3 Material requirements for Production of Shaw Process castings for ATAR 9C engine.

Yours faithfully,

C. Bellward

C. BELLWARD

HAK/SG

[Handwritten signature]

REPORT No ITHE SHAW PROCESS AT S.N.E.C.M.A. Gennevilliers Plant.Contacts

Mr. SALLADARE Manager Foundry Section
Mr. KESSLER Steel Foundry - Shaw process

Introduction

The shaw process at the S.N.E.C.M.A. Gennevilliers plant has been employed for the production of low alloy steels, high alloy steels, and cobalt base alloy castings, in production quantities, since 1957. The licence for the shaw process was taken out in 1956.

At present the output from the shaw process foundry include, in addition to the aeroengine part requirement to satisfy the 15 engine per month requirement, a small percentage of commercial parts. The labour strength is approximately 30.

This report will cover a survey of the equipment used, the general aspects of the process, and comments on equipment required and plant layout. The official S.N.E.C.M.A. documentation covering a complete set of up to date operation sheets and drawings is as present being prepared, and is expected to be available to us by mid of Dec. or sometime during January 1962.

Equipment

The following are the main items of equipment used at S.N.E.C.M.A. for the production of castings by the shaw process.

1. A hooded area approximately 30' X 6' with fan extraction and expanded metal racks for placement of moulds during burn off.

2. A mould firing furnace, as recommended for the shaw process, and satisfactory for firing of all ATAR 9C shaw process produced castings. The basic details are :

- Temperature : up to 1050° C (Normal operating temperature is 900° C)
- Extraction : forced extraction from the furnace chamber is provided, but this was not considered essential.
- Working dimensions : 80 cm wide X 80 cm high X 100 cm deep.
- Heating : electric element.

NB. In addition, 2 other furnaces ex. the SNECMA heat treat dept, have been installed in the area and are available for mould firing. One of these furnaces is similar to the above recommended furnace, while the other is a circular rotating hearth type. The latter furnace is the one in regular use and the one preferred by the operators. All furnaces are electrically heated.

...

- 3. the dry mixing equipment was of a very simple design. It was in fact old equipment ex SNECMA aluminium foundry. There were no special requirements here that could not be adequately provided for by our Roto Cube mixers in the Investment Casting Dept. at C.A.C. There is no reclamation of used mould refractory materials.

- 4. For wet mixing, a concrete mixer of the commercial type was recommended. The mixer that was in use was one ex the aluminium foundry, but was a very old design and has given considerable trouble at various times due to difficulties in ^{not} being able to clean out properly. It is used for mixing the mould backing material.

- 5. For heating ladles etc, two gas fired furnace pits are provided. These consisted of a gas burner located at the bottom of a fire brick pit approximately 18" deep by 6"-9" diameter. The ladels are heated by placing up side down on the top of the pit.

- 6. The melting furnace, as recommended for the Shaw Process, is a induction furnace,

40 kgs capacity
4000 periods
three furnace bodies.

and in this case is manufactured by Bauknecht (Dutch). Two additional 15 lb indirect arc austenite type furnaces are installed. Both types of furnaces are used and recommended for the production of castings for the ATAR 9C engine.

- 7. Knock out equipment consisted of two hand type pneumatic hammers. The majority of the mould is broken away with ordinary hammers blows and then the remainder is gouged out on a bench with pneumatic hammers and chisel.

- 8. Cut off equipment for runners and risers consisted of :

Two universal horizontal type band saws.
One "radiac" type cut off wheel with special table for holding bulky castings.

- 9. Finishing equipment was of standard type and consistent with the equipment and techniques employed for investment castings at C.A.C.

Moulding techniques, binder solutions, and mould burn off.

The details of moulding techniques and binder solution details will not be dealt with until the licence arrangement details for the Shaw Process are finalised.

The moulding and burn off section is located in a completely enclosed area separate from the remainder of the process. No air conditioning or room temperature control is employed for control of mould production, nor was it considered necessary.

Mould firing.

All moulds are fired at 900°C after complete burn off of volatile binder constituents under the "hooded" area specially provided. The moulds are charged cold into the furnace at temperature, and fired for a period, up to 12 hours, depending on the size of the mould.

As the end of the firing period the moulds are removed from the furnace, placed in a convenient position on their side, and compressed air blown into the cavity through the runner and risers to blow out any foreign matter that may have lodged there.

After the "blowing out" process the moulds are placed in position ready for casting. It could be five to ten minutes before the moulds are cast after removal from the furnace.

Casting Technique.

As a general rule :-

- the low alloy steels are melted in the 40 kgs induction furnace using an acid lining.
- the high alloy steels and cobalt base alloy are melted in the 15 lb indirect austenite type furnaces.
- the low alloy steel charges for the induction furnace consist of 3" to 4" length slugs of feed stock or scrap castings. A quantity of old feeder heads ex castings of the same alloy as the one being melted, is also always added to provide a carbon enrichment to the melt to compensate for the carbon loss that takes place during melting. The quantity of high carbon feeder heads that are added was stated to be dependent on the analysis of the feed stock, but no explanation at this stage has been given for the calculation of this addition.

Neither the feed stock or scrap used for the charge is shot blasted as it is considered there is sufficient fluxing action during melting and deoxidation, and cleaning during the skimming process prior to pouring the castings, as to warrant this unnecessary. Once the 30 kg charge of metal is molten, the following deoxidants are added to the melt.

99 % manganese - 170 gms.

Silicone metal - 50 gms.

These additions are allowed to react for a few minutes. The following weight of pure aluminium is then put into the bottom of the ladle.

Aluminium - 20 gms.

before entry of the molten metal.

...

The ladle of molten metal is tilted and skimmed with a wooden skimmer prior to pouring into the moulds.

A crushed wood charcoal cover is used on top of all runners and risers as soon as pouring a mould is finished.

The high alloy steel and cobalt alloy charges for the indirect arc furnaces are always shot or sand blasted beforehand. No deoxidants or other additions are made. In the majority of cases the charge is poured direct from the furnace through a refractory lined extension spout attached to the throat of the furnace. The mould, or a number of small moulds are held on a tray in front of the furnace by two operators. A third operator tilts the furnace and pours the charge.

Moulds are also poured by emptying the charge from the furnace into a ladle and then pouring into the mould. There are very few parts that are cast by clamping the mould to the top of the furnace then inverting the mould and furnace together.

Kalmex n^o I, as supplied by FORSECO is used as a cover for feeder and riser heads. Being a very reactive substance it is applied only when the runner head has just become solid, and not when molten. While crushed wood carbon is preferred, Kalmex n^o I is used as an alternative and to prevent carbon contamination of the runners and risers. These runners and risers could subsequently be used as feed stock for production of castings against commercial orders when high carbon contents could be very undesirable.

Temperature measurement is not a routine practice during production of any of the ATAR 9C shaw process castings. The only time temperature measurements are carried out is for experimental work and for alloys not previously cast. For production castings it is left to the furnaceman to determine, by visual means and experience the right time to pour the charge to produce satisfactory castings.

Recommendation for Shaw Process equipment for C.A.C.

Reference is here made to engine Factory precessing dept. Drawing N^o 434-C-00 for plant layout of Shaw Process that was prepared before leaving Australia. For convenience this drawing should now be referred to in conjunction with the following comments.

No major changes to plant layout are recommended as a result of discussions on the process in general with S.N.E.C.M.A.

- the 100 lb indirect arc furnace will not be required.
- the position for the vacuum furnace (not required for the shaw process) could now be brought over to the position that was occupied by the 100 lb arc furnace.
- Two gas or oil fired blast furnace pits for ladle heating etc.. could be placed in the position that was occupied by the vacuum furnace. These

...

are additional pieces of equipment that were not originally provided for.

- the radiac type cut off wheel and a universal horizontal metal band saw could be installed in the new cut off section for Shaw Process casting in lieu of the existing cut off wheel indicated.

The following new equipment is recommended for the Shaw Process installations at C.A.C. which would be in addition to certain items at present installed that will become common to both Shaw and Investment Processes.

I. Concrete mixer (commercial type)

II. Burn off hooded area with forced fume extraction

III. Induction melting furnace.

Re install the existing 2 cwt M/F 2000 cycle BROWN BOVERI furnace in the position indicated.

or

purchase an additional furnace
40 kg capacity
4,000 periods.

IV. Two gas or oil fired pits for heating ladels etc... These need only be of simple design and could be manufactured at C.A.C.

V. Mould firing furnace

Hearth 80 cm W x 100 cm deep

Height of opening 80 cm

Temp 800 - 1050° C.

VI. Two hand pneumatic hammers, one large and one small.

VII. Radiac type cut off wheel with special mill type table for clamping castings with runners during cut off.

VIII. Universal horizontal metal band saw.

IX. Shot blast machine.

This equipment recommendation does provide for the production of Shaw Process castings in excess (both in size and quantity) of that at present proposed for the ATAR 9C engine. However it is all considered necessary if it is desired that the process be developed on more than a limited pilot production basis and to provide a reasonable production capacity coverage for the potential of the Process. No comments can here be offered of what potential exists for this process in Australia for producing castings on an economic basis for commercial customers or D.O.S.

As regard to the present requirements of ATAR 9C castings that are listed for production by the shaw process, it would be a proposition as a temporary measure and from the equipment view point to produce all castings with

...

REPORT No II.

SHAW PROCESS CASTINGS ATAR 9C ENGINE

- The following is a complete list of castings on the ATAR 9C engine, as advised by SNECMA, that are produced by the Shaw Process.

Casting Part No	Finished Part No	No off per engine	Part Name	To be cast at C.A.C.
50I-150-090-9	50I-150-090-0	I	Chape	7
50I-410-054-9 §	50I-410-054-0	I	Embout (hard core)	-
50I-415-001-9 §	50I-420-016-0	I	Boitier air Av.	-
50I-484-013-9	50I-484-013-0	I	(hard core) Carter Purgeur	-
50I-486-038-9	50I- 486-038-0	2	(hard core) Bossage supérieur	-
50I-486-039-9	50I-486-039-0	2	(hard core) Bossage inférieur	-
50I-451-001-9 §	50I-456-006-0	I	(hard core) Support de palier	-
50I-703-016-9 *	50I-703-016-0	I	(hard core) Cône	I2
50I-703-123-9 *	50I-703-123-0	I	Bride	I2
50I-700-134-9 *	50I-700-134-0	I	Couronne	I2
6I3-508-003-9	6I3-508-003-0	I	Rotor centrifug	7
50I-351-022-9	50I-351-030-0	I	Boitier	7
502-500-340-9	502-500-340-0	3	Anneau hissage	55
502-705-014-9	502-705-014-0	2	Support	35
502-705-009-9	502-705-009-0	6	Patin	II5
502-705-013-9	502-705-013-0	I	Piece accroch	I5
502-705-042-9	502-705-042-0	I2	Rail	235
502-705-017-9	502-705-017-0	I8	Volet assefvi	355
502-705-197-9	502-705-197-0	2	Support de galet	35
502-553-355-9	502-553 -355-0	I	Anneau de levage	I5
502-705-084-9	502-705-084-0	9	Chape double (hard core)	-

§ for 9C engine only

* doubtful at present if common parts for 9C and 9K engine

All other parts are common.

HAK/AQ

MATERIAL REQUIREMENTS FOR PRODUCTION OF SHAW PROCESS CASTINGS FOR ATAR 9C ENGINE.

This report will cover the raw material requirements and initial ordering data for establishing production of Shaw Process Castings at C.A.C. This information and data was obtained from discussions with personnel at the S.N.E.C.M.A. Gennevilliers Shaw Process foundry.

I Metal Alloy for Castings.

- (a) 25 CD 4.
Ordered as "Acier 25 CD 4 S - coupes ϕ 30 X 70"
I.E. 25 CD 4 S Steel approx. 30mm diam X 70mm long.
from "AUBERT & DUVAL"
41, rue de Villers
Neuilly-sur-Seine

- (b) 35 CD 4.
Ordered as "Acier 35 CD 4 S - coupes ϕ 30 X 70"
i.e. 35 CD 4 S Steel approx. 30mm diam X 70mm long.
from "AUBERT & DUVAL".

- (c) 28 CD V 5.
Ordered as "Acier 28 CD V 5" - coupes ϕ 30 X 70"
from "AUBERT & DUVAL".

- (d) Z 15 CN S 20.
Ordered as "Z 12 CN S 20" 12mm sq. X 70mm long.
from "AUBERT & DUVAL".

- (e) Z 20 CN W 22.
Ordered as "Z 15 CN W 22" 12mm sq. X 70 mm long.
from "AUBERT & DUVAL"

- (f) Z 10 CN Nb I8.
Ordered as "Z 10 CN Nb I8" 9mm diam X 70 mm long.
from "AUBERT & DUVAL".

- (g) KC 25 NW.
ordered as "KC 25 NW" granuals.
from "AUBERT & DUVAL"
or as AMS 5382 granuals
from AUSTENAL in America.

BASIS FOR ARRIVING AT METAL REQUIREMENTS FOR INITIAL ORDER SHAW PROCESS CASTINGS

PART No	Approx. Wt Kgs cast + runners	Qty castings required	Qty castings allowed for	35 CD4	WEIGHT OF ALLOYS IN KGS						
					25CD4	Z20CNW22	Z10CNNb18	ZI5CNS20	28CDV5	KC25NW	
50I-I50-090-9	2	7	2I		42						
50I-703-016-9	0 - 6	I2	36				22				
50I-703-I23-9	I - 6	I2	36				58				
50I-700-I34-9	0 - 4	I2	36		I5						
6I3-508-003-9	3 - 6	7	2I		76						
50I-35I-022-9	3 - 0	7	2I		63						
502-500-340-9	I - 0	55	I65			I65					
502-705-0I4-9	0 - 6	35	I05			63					
502-705-009-9	3 - 4	II5	230		782						
502-705-0I3-9	3 - 0	I5	45		I35						
502-705-042-9	0 - 8	235	470		376						
502-705-0I7-9	I - 3	355	7I0								923
502-705-I97-9	I - 4	35	I05		I47						
502-553-355-9	0 - 8	I5	45			36					
TOTALS		9I7	2046	-	I636	264 Kg	80Kg	-	-		923 Kg

NB :- The excess castings allowed with provide metal for development of techniques, any discrepancy that may exist between approx and actual wt of casting and runner, and a scrap loss allowance for initial production quantities. I00 % excess is allowed for quantities over I00 and 200 % excess quantities under I00.

HAK/AQ

SUGGESTED INITIAL ORDERING ACTION FOR RAW MATERIALS SHAW PROCESS.

<u>ITEM</u>	<u>QUANTITY</u>	<u>TO BE ORDERED IN FRANCE</u>	<u>TO BE ORDERED THROUGH AUST.</u>	<u>TO BE PURCHASED LOCATLY IN AUST.</u>
1 (a) 25 CD 4S	1650kg	Yes	-	-
1 (b) 35 CD 4S	NIL	Yes	-	-
1 (c) 28 CD V5	NIL	Yes	-	-
1 (d) Z 12 CNS 20	NIL	Yes	-	-
1 (e) Z 15 CNW 22	270kg	Yes	-	-
1 (f) Z 10 CNNbI8	80kg	Yes	-	-
1 (g) KC 25 NW	950kg	Yes	-	-
(a) ferro- manganèse	I Cwt	-	-	Yes
2 (b) Silicon Metal	I Cwt	-	-	Yes
2 (c) Aluminium	Ex Al foundry	-	-	Yes
3 (a) Wood charcoal	I Cwt	-	-	Yes
3 (b) Kalmex n° I	I Cwt	-	-	Yes
4 (a) Zircon flour 200 mesh	$\frac{1}{2}$ ton	-	-	Yes
4 (a) Zircon flour 150-200 mesh	$\frac{1}{2}$ ton	-	-	Yes
4 (b) Molochite NO 9	$\frac{1}{2}$ ton	-	Yes	-
4 (b) Molochite NO IO	$\frac{1}{2}$ ton	-	Yes	-

HAYSG