BOMBARDIER

de Havilland

Material Specification

TITLE:	**THERMAL SPRAY POWDERS**
SPECIFICATION NUMBER:	**DHMS C 4.19**
ISSUE:	**B**
AMENDMENT:	**--**
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REVISION RECORD

Issue	Page	Description and Reason for Change
A		This is a complete revised issue. Detail changes have not been noted.
B		This is a complete revised issue. General format changed. Updated Table 1, Powder Chemistry characteristics. Added Table 3 , added particle size distribution requirement in % vol for product Metco
	QPL	Added product Metco 5143 from Oerlikon Metco Woka GmbH

1 SCOPE

This specification covers the requirements for powder to be deposited as a thermal spray coating.

1.1 Classification

The powder shall be of the following type:

Type I - Tungsten carbide plus cobalt (WC-Co)

2 APPLICABLE DOCUMENTS

The following documents form part of this specification, to the extent defined herein. In the event of conflicting requirements between this specification and those listed below, the requirements of this specification shall govern. Where a specific issue of a document is not stated, the current issue shall be used.

2.1 de Havilland Production Process Standard

PPS 24.04 Thermal Spray Deposition Coatings

3 REQUIREMENTS

3.1 Coatings Properties

When the powder is applied, the coating shall comply with the requirements of PPS 24.04.

3.2 Powder Quality

The powder shall be uniform in quality, condition and colour, dry, free flowing, and free from foreign materials.

3.3 TYPE I - Tungsten Carbide Plus Cobalt

3.3.1 Physical Characteristics

When examined at 500x magnification using a scanning electron microscope, the powder shall consist of mainly spherical agglomerated and sintered particles.

3.3.2 Chemical Characteristics

The chemistry of the powder shall be as given in Table 1 (mass fraction):

Table 1: Powder Chemistry

Element	Mass Fraction
Tungsten (W)	Balance.
Cobalt (Co)	15-18%
Carbon (C)	4-6%
Iron (Fe)	2% max.
Others	1.0% max.

3.3.3 Particle Size Distribution

A particle size analysis of a representative sample from each lot of powder shall show the weight percentages in Table 2 or volume percentage given in Table 3 when measured using the MICROTRAC wet laser light scattering method:

Table 2: Particle Size Distribution by % Weight

Diamalloy 2005NS			Praxair WC-559 (CS 11-78)			Amperit 526.062		
Particle size[μm]	**Minimum [% wt]**	**Maximum [% wt]**	**Particle size [μm]**	**Minimum [% wt]**	**Maximum [% wt]**	**Particle size [μm]**	**Minimum [% wt]**	**Maximum [% wt]**
+88	-	0.4	**+88**	-	8	**+88**	-	0
+62	-	10	**+62**	-	20	**+62**	4	12
+44	18	35	**+44**	18	55	**+44**	23	35
+31	35	75	**+31**	35	75	**+31**	55	65
+22	60	95	**+22**	60	95	**+22**	83	90
+11	93	100	**+11**	85	100	**+11**	98	100
+5.5	98	100	**+10**	95	100	**+5.5**	99.5	100

Table 3: Particle Size Distribution By % Volume

Particle size [μm]	Metco 7143	
	Minimum [% Vol]	**Maximum [% Vol]**
-62	90	100
-44	70	82
-31	20	65
-22	0	30
-20	0	15
-15.5	0	10
-11	0	3

4 PREPARATION OF TEST SPECIMENS

Not applicable

5 TEST METHODS

Not applicable

6 MATERIAL QUALIFICATION REQUIREMENTS

6.1 Request For Qualification

All requests for qualification to this specification shall be addressed to Bombardier Aerospace Materials Technology Engineering department for approval.

All material qualification shall be site specific.

An audit of the manufacturers and/or test facilities by Materials Technology Engineering may be necessary prior to approval.

6.2 Qualification testing

Potential suppliers shall submit a written qualification test report based on 3 batches/lots of materials showing compliance with the requirements contained in section 3. The test report shall contain actual numerical test values, average test results.

6.2.1 A sample shall be submitted for testing at the discretion of Bombardier Aerospace Materials Technology for evaluation.

6.3 Qualification by Similarity

Where a product has been qualified to another similar specification, the supplier may submit the qualification data applicable to this specification for consideration. The similar specification may be a government, company, or other aerospace specifications where the requirements are similar to this specification.

6.4 Qualification Approval

6.4.1 Upon review of supplier's data, and de Havilland tests, the supplier will be advised either of product qualification or reasons for not qualifying the product.

6.4.2 Products that are qualified will be listed in the Qualified Products List of this specification.

6.4.3 No changes in the method of manufacture and/or formulation, shall be made without notification and prior written approval of Materials Technology Department.

Re-qualification of the product may be requested by the Bombardier Materials Technology if there are any changes in the method of manufacture and/or formulation

7 QUALITY ASSURANCE REQUIREMENTS

7.1 Supplier Batch/Lot Acceptance Tests

7.1.1 The manufacturer/supplier is responsible for the performance of all sampling, inspection and testing of each batch/lot as specified in **Table 4.**

7.1.2 The manufacturer/supplier shall issue with each batch of product one copy of an Acceptance Test report showing actual test data conformance to the acceptance tests specified in **Table 4** The report shall include the supplier's batch identification, materials specification and date of testing.

7.1.3 Bombardier Aerospace Materials Technology Engineering reserves the right to perform any or all of the tests set forth in this specification to ensure that the product continues to meet specification requirements. Any product not meeting the requirements of this specification will be returned to the supplier at the supplier's expense.

7.1.4 The manufacturer/supplier shall certify with a Certificate Conformance that each batch of each shipment meets the requirements of this specification.

7.2 Purchaser Batch/Lot acceptance tests

7.2.1 N/R

7.3 Batch Lot Definitions

7.3.1 Batch is defined as the end product of all the raw materials mixed and/or manufactured at the same time and place. The weight or volume may vary, depending upon the capacity of the manufacturer's facilities.

7.3.2 Lot is defined as the total quantity of product in a shipment taken from the same batch

TABLE 4. Qualification and Batch Acceptance Tests

Test	Paragraph	Qualification (Supplier)	Acceptance (Supplier)
Coating properties	3.1	X	-
Powder Quality	3.2	X	X
Physical characteristics (description)	3.3.1	X	X
Chemical characteristics	3.3.2	X	X
Particle size distribution	3.3.3	X	X

8 ORDERING DATA

8.1 Prerequisite

Products furnished under this specification for production use shall be qualified and listed on the Qualified Products List prior to issuing of a Purchase Order.

8.2 Procurement Document

Procurement documents should specify the following:

- Title, Number, Issue and Amendment Number of this specification
- Manufacturer's Name and Product Identification (trade name or code number)
- Type and size of containers (Imperial, U.S. or metric measure)
- Total Quantity (Imperial, U.S., or metric measure)
- Powder Type
- Acceptance Test Report

9 PREPARATION FOR DELIVERY

9.1 Preservation and Packing

The powder shall be packed in such a manner as to ensure that, during shipment and storage, the product will be protected against damage from exposure to hazards which would affect adversely the property conformance to Section 3 of this specification.

9.2 Marking

Each container shall be legibly marked with the following information:

- Title, Number, Issue and Amendment Number of this specification
- Manufacturer's Name and Product Identification (trade name or code number)
- Date of manufacture
- Batch Number
- Net Quantity (Imperial, U.S., or Metric Measure)

9.3 Shipping Documentation

Shipping document shall show:

- Purchase order number
- de Havilland specification number. (e.g. DHMS C4.19 Type I)
- Number of containers

- Batch number
- Total quantity (Imperial, U.S. or metric measure)
- Acceptance Test Report

10 HEALTH AND SAFETY DATA

When supplying samples for qualification per Para. 6, the supplier shall submit a Material Safety Data Sheet (MSDS) complying with the "Controlled Products Regulations" of the Hazardous Products Act (also known as W.H.M.I.S. Regulations). The document must state all hazardous ingredients, safe-handling procedures, first-aid measures, fire and explosion data, re-activity data, physical properties, preparation information and procedures for storage and disposal.

This MSDS must then be supplied with a completed DH 4339 form, "Application To Introduce A New Material", to the Material Safety Committee.

Upon receipt of DH 4340 form, “Recommendation”, that approves the use of the material, it can then be included on the Qualified Products List.

NOTE: Any changes in the formulation of the material require a re-submission of the MSDS.

QUALIFIED PRODUCTS LIST

Manufacturer's Name and Address	Manufacturer's Product Identification No.	MSDS No.	de Havilland Qualification Sheet No .	Date of Product Approval
	TYPE I			
Sulzer Metco (US) Inc. 220 Miller Place Hicksville, NY 11801 phone: (516) 338-2120 fax: (516) 822-8006	Diamalloy 2005NS	N/A	PQS #1	Aug. 1, 1997
Praxair Surface Technologies Inc. 1500 Polco Street Indianapolis, IN 46224 phone: (317) 240-2500 fax: (317) 240-2426	WC-559 (CS 11-78)	N/A	PQS #2	Aug. 1, 1997
H.C. Starck Inc. 45 Industrial Place Newton, MA 02161-1951 phone: (617) 630-5800 fax: (617) 630-5919	Amperit 526.062	N/A	PQS #3	Aug. 1, 1997
Oerlikon Metco WOKA GmbH Im Vorwerk 25 D-36450 Barchfeld-Immelborn phone: 03 69 61/861-0 fax: 03 69 61/861-30	Metco 5143	N/A	PQS#4	June 1, 2016