



Transportation of Dangerous Goods Directorate
L'Esplanade Laurier
300 Laurier Avenue West
Ottawa, Ontario
K1A 0N5

Direction générale du transport des marchandises dangereuses
L'Esplanade Laurier
300, avenue Laurier Ouest
Ottawa (Ontario)
K1A 0N5



Equivalency Certificate (Approval issued by the competent authority of Canada)

Certificate No.: SU 7694 (Ren. 5)

Certificate Type: N/A

Certificate Holder: FABER INDUSTRIE SpA

Mode of Transport: Road, Railway, Air, Marine

Effective Date: September 28, 2020

Expiry Date: November 30, 2025

LEGEND

For the purposes of this equivalency certificate, documents referred to by an abbreviation have the following meaning:

TDG Act: *Transportation of Dangerous Goods Act, 1992*

TDG Regulations: *Transportation of Dangerous Goods Regulations*

CSA B339-18: CSA Standard B339-18, “Cylinders, spheres, and tubes for the transportation of dangerous goods”, June 2018, published by the Canadian Standards Association (CSA)

CSA B340-18: CSA Standard B340-18, “Selection and use of cylinders, spheres, tubes, and other containers for the transportation of dangerous goods, Class 2”, June 2018, published by the Canadian Standards Association (CSA)

CSA B341: CSA Standard B341, “UN pressure receptacles and multiple-element gas containers for the transport of dangerous goods”, published by the Canadian Standards Association (CSA), as amended from time to time

NOTES

Note 1: Subsection 31(4) of the *TDG Act* stipulates that any non-compliance with the conditions of this equivalency certificate will result in the provisions of the *TDG Act* and *TDG Regulations* to apply as though this equivalency certificate did not exist.

Note 2: This equivalency certificate provides no regulatory relief other than specifically stated herein. Therefore, all other requirements of the *TDG Act* and the *TDG Regulations* apply.

PURPOSE

This equivalency certificate authorizes the manufacture and use of cylinders based on the TC-3AAM specification of *CSA B339-18*. The applicant has demonstrated that by augmenting testing at manufacture, restricting certain design parameters as well as the types of gases that are to be contained, a cylinder with reduced wall thickness may be used with equivalent safety. Cylinders similar in design to the ones specified herein have previously been manufactured under a certificate granted under the *Regulations for the Transportation of Dangerous Commodities by Rail*.

CONDITIONS

This equivalency certificate authorizes **FABER INDUSTRIE SpA**, to sell, offer for sale, distribute, or deliver in Canada, and authorizes any person to handle, offer for transport, transport, or import into Canada, by road or railway vehicle, by aircraft or by vessel, cylinders, in a manner that does not comply with:

- subsections 5.1.1(1) and 5.1.1(2) of the *TDG Regulations*,
- section 5.2 of the *TDG Regulations*,
- subparagraphs 5.10(1)(a)(ii), 5.10(1)(b)(iii), 5.10(1)(c)(ii), and 5.10(1)(d)(iii) of the *TDG Regulations*,, and
- subsection 5.10(2) of the *TDG Regulations*,

if the following conditions are met:

Selection and Use

- (a) Subject to condition (b) of this equivalency certificate, the requirements with respect to specification TC-3AAM cylinders in *CSA B340-18*, are complied with;
- (b) The cylinders do not contain:
- (i) HYDROGEN, COMPRESSED,
 - (ii) HYDROGEN SULPHIDE,

 - (iii) NATURAL GAS, COMPRESSED, with high methane content,
 - (iv) CARBON MONOXIDE, COMPRESSED,
 - (v) gas mixtures containing:
 - (A) HYDROGEN SULPHIDE or other free sulphide,
 - (B) HYDROGEN or NATURAL GAS,
 - (C) more than 10 percent CARBON MONOXIDE, or
 - (D) CARBON MONOXIDE and having a dew point of -47°C or higher at atmospheric pressure,
 - (vi) any liquefied gas, or
 - (vii) any gas or gas mixture that could cause corrosion, stress corrosion cracking, enhanced fatigue crack growth, or hydrogen embrittlement of the cylinder steel;

Manufacture

- (c) The cylinders are manufactured at Via dell'Industria, 23, 1- 33043 Cividale del Friuli, Udine, Italy, in accordance with the specific procedures and the drawings listed in Table 1 of Appendix A of this certificate, filed by Faber INDUSTRIE SpA on January 9, 2004, November 10, 2005, April 13, 2006, and December 9, 2010, with the Transport Dangerous Goods Directorate;
- (d) Subject to conditions (e) to (t) of this equivalency certificate, the cylinders are in compliance with the requirements applicable for specification TC-3AAM set out in *CSA B339-18*;
- (e) The chemical composition of the steel is as follows:

<u>Element</u>	<u>Mass Percent</u>	<u>Product Analysis Tolerances</u>	
		<u>Under Minimum Limit</u>	<u>Over Maximum Limit</u>
Carbon	0.32 to 0.37	0.01	0.01
Manganese	0.60 to 0.90	0.03	0.03
Phosphorus	0.015 maximum	--	0.01
Sulphur	0.010 maximum	--	0.00
Sulphur and Phosphorus	0.025 maximum	--	0.00
Silicon	0.15 to 0.35	0.02	0.03
Chromium	0.90 to 1.15	0.03	0.03
Molybdenum	0.15 to 0.25	0.01	0.01
Aluminium	0.015 to 0.050	--	0.00
Copper	0.25 maximum	--	0.00
Nickel	0.25 maximum	--	0.00

- (f) The steel is treated with calcium to provide the following J-K microcleanliness rating in accordance with ASTM E45-18a, *Standard Test Methods for Determining the Inclusion Content of Steel*, published in 2018:

<u>A (Sulphides)</u>		<u>B (Alumina)</u>		<u>C (Silicates)</u>		<u>D (Oxides)</u>	
Thin	Heavy	Thin	Heavy	Thin	Heavy	Thin	Heavy
2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0

and the material manufacturer certifies that the material was calcium treated and indicates the J-K microcleanliness rating for each heat of steel;

- (g) The steel is aluminium killed and made by a fine grain de-oxidation practice;
- (h) The cylinders are manufactured by the cold drawing process and have bottoms with a thickness not less than the minimum design wall thickness and have a surface finish which does not exceed a roughness of 250 root mean square;

Equivalency Certificate SU 7694 (Ren. 5)
(Approval issued by the competent authority of Canada)

- (i) For cylinders with a service pressure of 6.9 MPa or more, the wall stress in Equation 1, Clause 4.2.1 of *CSA B339-18* does not exceed 67 percent of the minimum tensile strength as determined by the tensile test or 624 MPa, whichever is the lesser;
- (j) The cylinders are held at the austenitising temperature for at least 2.4 minutes per millimetre of maximum cylinder thickness and are then quenched in a liquid medium which provides a cooling rate not greater than 80 percent of that of water, and
 - (i) the steel temperature on quenching does not exceed 927°C,
 - (ii) the tempering temperature is not less than 540°C, and the cylinders are held at that tempering temperature for at least 2.4 minutes per millimetre of maximum cylinder thickness,
 - (iii) the concentration of the quenching medium is measured by refractometer reading and recorded, at least once per day, to ensure that the quenching rate is within specifications, and
 - (iv) a sample of the quenching medium is analysed by its original manufacturer, at least once every three months, to ensure that its properties are maintained within the original specifications;
- (k) The flattening test requirement, in Clause 6.10.4 of *CSA B339-18*, is flattening to 8 times the wall thickness without cracking, and the Independent Inspector records the actual degree of flattening attained without cracking in the Certificate of Compliance and Test Report;
- (l) Three (3) Charpy impact specimens, taken from one heat treated cylinder for each lot of 200 cylinders or less, are tested as follows:
 - (i) each specimen is a V-notch type, size 10 x 4 mm or the largest obtainable, taken in accordance with ASTM standard E 23-16b, *Standard Test Methods for Notched Bar Impact Testing and Metallic Materials*, published in 2016,
 - (ii) each specimen is taken from the sidewall of the cylinder at approximately evenly spaced (120°) intervals,
 - (iii) the axis of the specimen is parallel to the longitudinal axis of the cylinder, and the axis of the notch is perpendicular to the surface of the cylinder,

Equivalency Certificate SU 7694 (Ren. 5)
(Approval issued by the competent authority of Canada)

(iv) the specimens are tested at -50°C in accordance with ASTM Standard E23 and the impact properties achieved are not less than the following values:

<u>Average Value for 3 specimens, minimum, Joules/cm²</u>	<u>Minimum Value for single specimen, Joules/cm²</u>	<u>Lateral Expansion, minimum, mm</u>	<u>Fibrous Fracture, minimum %</u>
<u>53</u>	<u>44</u>	<u>0.305</u>	<u>50</u>

(v) the Independent Inspector records the results in the Certificate of Compliance and Test Report,

and if the test requirements are not met, the lot is rejected;

(m) A flawed cylinder test is performed on one heat treated cylinder taken from each lot of 200 cylinders or less. Three flaws are introduced into the test cylinder by a means that will not affect the mechanical or metallurgical properties, and

- (i) each flaw is at least 6 times the wall thickness in length and at least 0.1 times the wall thickness in depth and located at 120 degree intervals around the cylinder circumference,
- (ii) cycling is carried out as described in Clause 4.14.4 of *CSA B339-18* except that the pressure is cycled between 0 kPa and 1.25 times the service pressure, and cycling is continued to cylinder failure,
- (iii) failure is by leakage before burst with evidence of crack propagation by fatigue prior to leakage, and

(iv) if the test requirements are not met, the lot is rejected;

(n) Tensile strength, as determined by the tensile test, is not more than 1096 MPa, and elongation is at least 14 percent in Type E specimens;

(o) Each cylinder is non-destructively inspected for flaws after heat treatment to detect the presence of quench cracks or other discontinuities by one of the following methods:

- (i) the wet magnetic particle method in accordance with ASTM Standard E 709-15, *Standard Guide for Magnetic Particle Testing*, published in 2015. Any cylinder that has a quenching crack is condemned,

- (ii) the ultrasonic inspection method in accordance with ASTM E213-14e1, *Standard Practice for Ultrasonic Testing of Metal Pipe and Tubing*, published in 2014. Ultrasonic Inspectors are qualified to National Standard of Canada CAN/CGSB-48.9712, *Non-Destructive Testing – Qualification and Certification of Personnel*, published in 2014, American National Standards Institute/ American Society for Non-Destructive Testing Standard AISI/ASNT CP-189, *Qualification and Certification of Nondestructive Testing Personnel*, published in 2016, or International Standard ISO 9712:2012, *Non-Destructive Testing – Qualification and Certification of NDT Personnel*, published in 2012. Any imperfection giving a response greater than that produced by a notch equal to 5% of the minimum design wall thickness is rejected;
- (p) There is only one reheat treatment permitted for rejected cylinders. The reheat treatment is in accordance with the requirements for the initial heat treatment, and all reheat treated cylinders pass the specified tests and are identified in the Certificate of Compliance and Test Report;
- (q) After the final heat treatment, each cylinder is hardness tested on the cylindrical section, and
 - (i) the hardness does not exceed HRC 34,
 - (ii) when the result of the initial hardness test exceeds the maximum permitted, two or more retests may be made, but the hardness number obtained in each retest does not exceed the maximum permitted, and
 - (iii) cylinders failing to pass the test are rejected;
- (r) The Transport Canada mark, the specification designation, and the service pressure marked on each cylinder are as follows:

TC - SU 7694 -

followed by the service pressure expressed in bar;

New Design Qualification

- (s) In addition to the requirements of Clause 4.14 of *CSA B339-18*, a flattening test is performed in accordance with Clause 4.11 of *CSA B339-18* on 3 cylinders of each new design. Flattening to 8 times the wall thickness without cracking is required;

Requalification

- (t) The requalification period for the cylinders is five years;
- (u) The Transport Dangerous Goods Directorate is advised prior to the cylinders being returned to service, where cylinders are requalified after having been subjected to fire;

Equivalency Certificate SU 7694 (Ren. 5)
(Approval issued by the competent authority of Canada)

- (v) The documents referred to in Clause 4.20 of *CSA B339-18* are retained by the manufacturer and by the Independent Inspector, as defined in that standard, for the service life of the cylinder; and
- (w) The certificate holder reports any incident involving loss of contents or failure of the cylinders to the Executive Director, Regulatory Frameworks and International Engagement, Regulatory Affairs Branch, Transportation of Dangerous Goods Directorate, Transport Canada.

This equivalency certificate serves as the registration of FABER INDUSTRIE SpA, pursuant to Clause 25.2 of *CSA B339-18*, to manufacture cylinders of the designs specified herein. FABER INDUSTRIE SpA's registered mark, pursuant to *CSA B339-18*, is:

M8303

Signature of Issuing Authority



David Lamarche, P. Eng., ing.
Chief, Approvals and Special Regulatory Projects

Contact Person:	Viviano Ongaro FABER INDUSTRIE SpA Via dell'Industria, 23 1-33043 Cividale del Friuli Udine ITALY
Telephone:	+39 0432 706711
E-mail:	viviano.ongaro@faber-italy.com
<u>Legend for Certificate Number</u>	
SH - Road, SR - Rail, SA - Air, SM - Marine SU - More than one Mode of Transport Ren - Renewal	

NOTE

Under Canadian Law, a foreign manufacturer of non-specification cylinders cannot be charged with an offence under the *Transportation of Dangerous Goods Act, 1992* for failure to comply with the conditions of an equivalency certificate. However, certain remedies under the Act are available to Transport Canada in this eventuality.

These include:

1. detention of dangerous goods and consequently the means of containment containing them (subsection 17(1));
2. detention of the means of containment whether full or empty (subsection 17(1));
3. directions not to import the means of containment or to return them to origin (subsection 17(3));
4. inspectors' directions (section 19);
5. directions to importers of the means of containment to issue notices of defective construction or recall (subsection 9(2)); and
6. revocation of the certificate, thereby making any use of the means of containment an offence (subsection 31(6)).

If none of the foregoing are adequate, Protective Directions may be issued to prohibit or to control the use of the means of containment (section 32).

APPENDIX A

TABLE 1: Cylinder Data

Drawing nº	Re v	Outside Diameter (mm)	Service Pressure (MPa)	Test Pressure (MPa)	Water Capacity (L)	Minimum Design Wall Thicknes s (mm)	Minimum Design Base Thicknes s (mm)
TCUS-100-273-840/2	0	100	18.2	27.3	2	2.3	2.3
TCUS-100-273-840/3	0	100	18.2	27.3	3	2.3	2.3
TCUS-140-273-840/7	0	140	18.2	27.3	7	2.7	2.7
TCUS-184-273-840/11.9	0	184	18.2	27.3	11.9	3.5	3.5
TCUS-203-273-840/17	0	203.6	18.2	27.3	17	3.9	3.9
TCUS-183-311-840/11.1	0	184	20.7	31.1	11.1	4.0	4.0
TCUS-171-342-840/9	0	173.8	22.8	34.2	9	4.1	4.1
TCUS-100-363-840/2	0	100	24.2	36.3	2	2.6	2.6
TCUS-100-363-840/3	0	100	24.2	36.3	3	2.6	2.6
TCUS-184-363-840/7.8	0	184	24.2	36.3	7.8	4.7	4.7
TCUS-184-363-840/11.9	0	184	24.2	36.3	11.9	4.7	4.7
TCUS-203-363-840/17	0	203.6	24.2	36.3	17	5.1	5.1
TCUS-171-363-840/9	0	171	24.2	36.3	9	4.3	4.3
TCUS-184-273-840/12.9	0	184	18.2	27.3	12.9	3.5	3.5
TCUS-203-363-840/19	0	203.6	24.2	36.3	19	5.1	5.1
TCUS-203-363-840/15	0	203.6	24.2	36.3	15	5.1	5.1
TCUS-184-363-840/15.3	0	184	24.2	36.3	15.3	4.7	4.7
TCUS-184-363-840/12.9	0	184	24.2	36.3	12.9	4.7	4.7
TCUS-184-363-840/10.2	0	184	24.2	36.3	10.2	4.7	4.7
TCUS-140-363-840/5	0	140	24.2	36.3	5	3.6	3.6