Data / date :	**03 agosto 2020**
Richiedente / Applicant:	**GLOBAL di Fardelli Ottorino & C. s.r.l.**
Indirizzo / Address:	**GLOBAL di Fardelli Ottorino & C. s.r.l.** **via Rondinera n.51** **24060 - Rogno (BG)**
Marchio di fabbrica / Manufacturer trademark:	**GLOBAL**
Gamma / Type:	**STYLE PLUS** **Modello STYLE PLUS 600 (10 elementi)** *Campione rappresentativo della gamma.*
Materiale / Material:	**Alluminio + camera acqua in ferro**
Verniciatura / Painting :	**BIANCO** *Superficie liscia.*

Il Responsabile delle Prove — Operator

F.to: P.I. Samuele Maggioni

Il Responsabile del Laboratorio — Laboratory Manager

F.to: Prof. Ing. Fabio Rinaldi

Firmato digitalmente ai sensi del CAD - D. Lgs 82/2005 e s. m. e i., art. 21 c. 1-2

NORMA/ REFERENCE/ REFERENCE/ REFERENZ / REFERENCIA:
EN 442-1:2014 § 5.9

"For painted radiators and convectors only, the resistance to minor impact damage shall be tested according EN ISO 2409. Test result shall be within the fist three clss (0-1-2) of EN ISO 2409:2013 – Table 1"

1. Prova di resistenza a piccoli urti dimostrato da prova di quadrettatura secondo ISO 2409:2013
Paints: Cross-cut test

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"***The protection against corrosion in normal storage and installation conditions shall be demonstrated by absence of surface corrosion after 100 h humidity test according to EN442-2:2014, Annex K***"

2. Prova di resistenza alla corrosione secondo BS 3900 -F2
Determination of resistance to humidity (cyclic condensation)

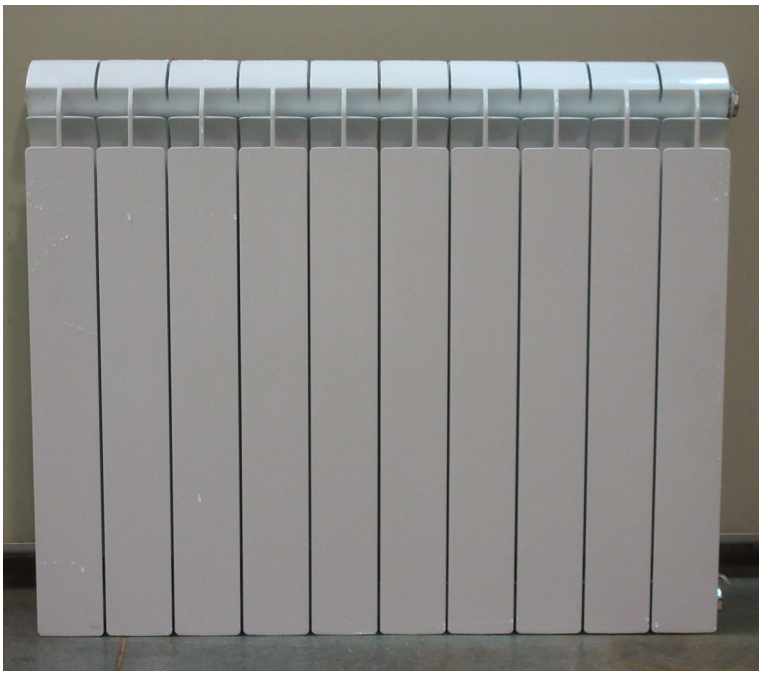


Fig.1 – Sample under test

CYCLIC CONDENSATION TEST

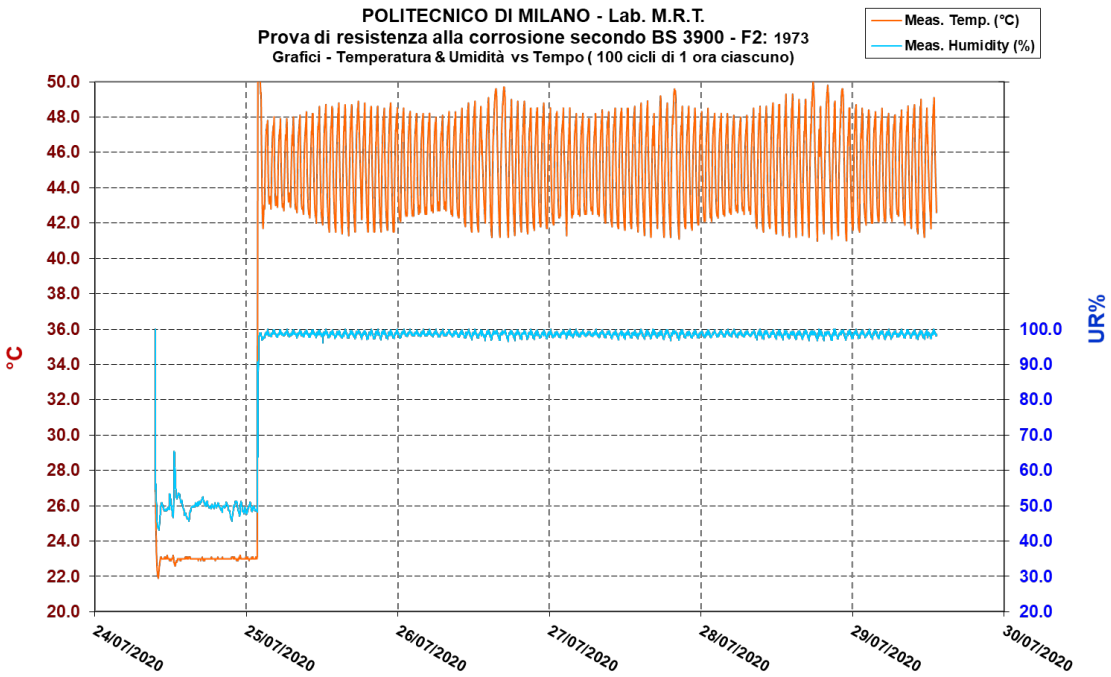


Figure 2: Graphics of Temperature and Humidity - 100 hours condensing cycles

MISURA SPESSORE VERNICIATURA

Measure of coating thickness

Metodo di misurazione utilizzato: *Method of measurement used:*		**Metallo ferromagnetico (Fe): sensore a induzione magnetica (ISO 2178)** *Ferromagnetic metal (Fe): Magnetic-induction gauge (ISO 2178)*
	√	**Metallo non ferromagnetico (NFe): sensore a correnti indotte (ISO 2360)** *Non-ferromagnetic metal (NFe): Eddy-current gauge (ISO 2360)*

Tipo di verniciatura: **Verniciatura monostrato**
Coating system: *Single coating system*

Strumento utilizzato: **Spessimetro per rivestimenti digitale**
Instrument used: *Digital coating thickness gauge*

Modello: **SAUTER TE 1250-0.1 FN**
Model:

S/N: **N554440**

Certificato di taratura: **D014079 – 25/06/2014**
Calibration certificate:

CROSS-CUT TEST

Tipo di utensile da taglio: **Utensile da taglio multilama manuale**
Type of cutting tool: *Hand-held multi blade cutting tool*

Metodo di incisione: **Manuale**
Method of cutting: *Manual*

I campioni sono stati condizionati prima del test per 16 ore ad una temperatura di (23 ± 2) °C ed a una umidità relativa di (50 ± 5) %. (ISO 2409:2013 §6.1.2)
Condition the test panels immediately prior to the test at a temperature of (23 ± 2) °C and a relative humidity of (50 ± 5) % for a minimum of 16 h. (ISO 2409:2013 §6.1.2)

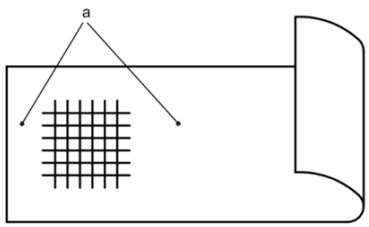
Il "cross-cut" test è stato eseguito ad una temperatura di (23 ± 2) °C ed a una umidità relativa di (50 ± 5)%. (ISO 2409:2013 §6.1.1)
Carry out the test at a temperature of (23 ± 2) °C and a relative humidity of (50 ± 5) %. (ISO 2409:2013 §6.1.1)

Lame utilizzate:
Blades choose:

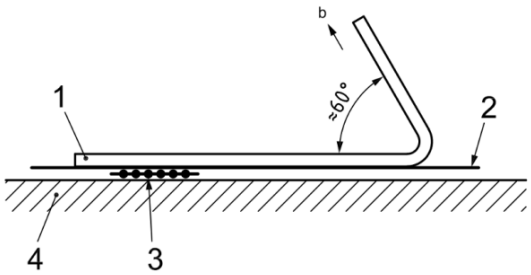
	Fino a 60 µm *up to 60 µm*	**Passo lame 1 mm, per substrati "duri" (es. metallo e plastica)** *1 mm spacing, for hard (e.g. metal and plastics) substrates*
	Fino a 60 µm *up to 60 µm*	**Passo lame 2 mm, per substrati "morbidi" (es. legno e gesso)** *2 mm spacing, for soft (e.g. wood and plaster) substrates;*
	Da 61 µm a 120 µm *61 µm to 120 µm*	**Passo lame 2 mm, per substrati "duri" e "morbidi"** *2 mm spacing, for both hard and soft substrates;*
√	**Da 121 µm a 250 µm** *121 µm to 250 µm*	**Passo lame 3 mm, per substrati "duri" e "morbidi"** *3 mm spacing, for both hard and soft substrates.*

Procedure per la rimozione di vernice staccata: **Nastro adesivo sensibile alla pressione (ISO 2409:2013 §A.2)**
Procedures for removing loose paint: *Pressure-sensitive adhesive tape (ISO 2409:2013 §A.2)*

Cross-cut test procedure: steps to be done during controls



a) Position of adhesive tape with respect to grid



b) Position immediately prior to removal from grid

Key

1 tape
2 coating
3 cuts
4 substrate

a Smoothed down.
b Direction of removal.

Fig.3

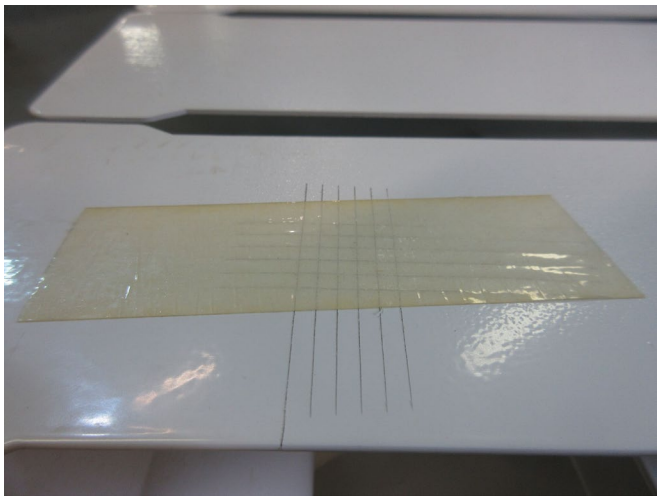


Fig.4

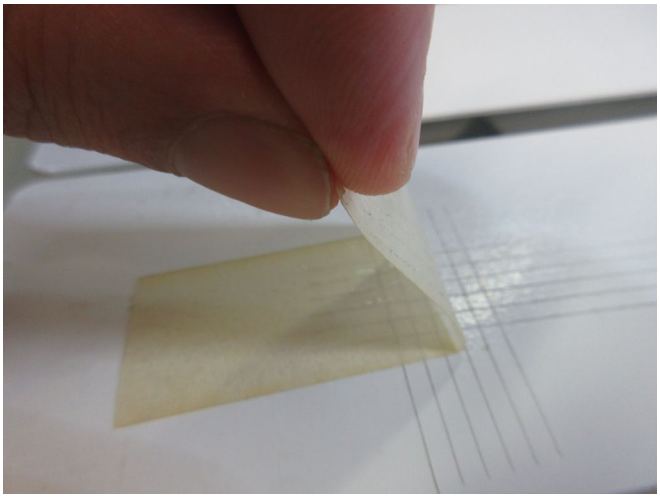


Fig.5

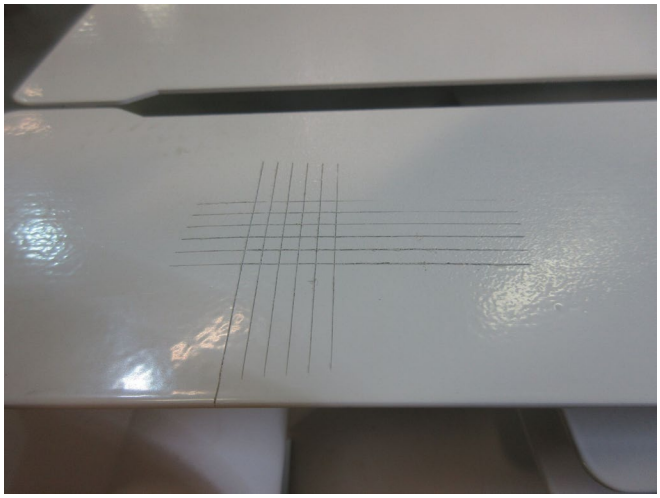


Fig.6

Prova 1 – Classificazione dei risultati secondo ISO 2409:2013

Peintures: Essai de hachurage/ Paints: Cross-cut test classification / Farben: Kreuz-schneiden Sie Test

Table 1 – Classification of test results

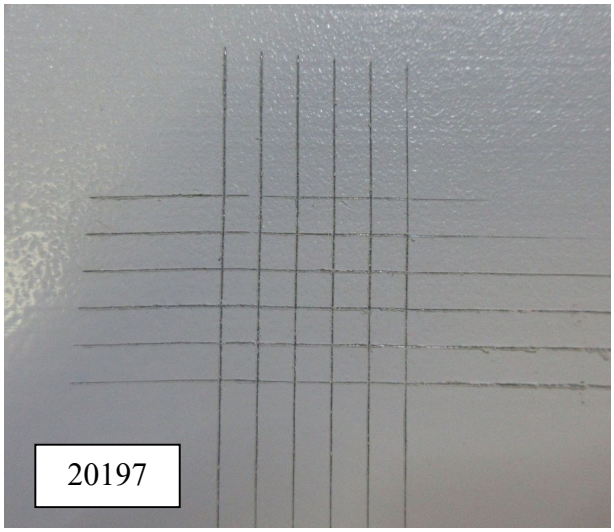
Classification	Description	Appearance of surface of cross-cut area from which flaking has occurred [a] (Example for six parallel cuts)
0	The edge of the cuts are completely smooth; none of the squares of the lattice is detached.	
1	Detachment of small flakes of the coating at the intersections of the cut. A cross-cut area not greater than 5 % is affected	
2	The coating has flaked along the edges and/or at the intersections of the cuts. A cross-cut area greater than 5 %, but not greater than 15 % is affected.	
3	The coating has flaked along the edges of the cuts partly or wholly in large ribbons, and/or it has flaked partly or wholly on different parts of the squares. A cross-cut area greater than 15 %, but not greater than 35 % is affected.	
4	The coating has flaked along the edges of the cuts in large ribbons and/or some squares have detached partly or wholly. A cross-cut area greater than 35 %, but not greater than 65 % is affected.	
5	Any degree of flaking than cannot even be classified by classification 4	---

a The figures are examples for a cross-cut within each step of the classification. The percentages stated are based on the visual impression given by the pictures and the same percentages will not necessarily be reproduced with digital imaging.

Type: STYLE PLUS

- **RISULTATO Prova 1 - Classificazione secondo ISO 2409:2013**

Paints: Cross-cut test classification



Dry coating thickness: 209 µm

Average value of thickness measured in 4 different locations around the cross hatching area.

In conformità alla tabella 1, e come visualizzato nella foto, la verniciatura provata risulta appartenente alla classe:

In conformity to table 1, the tested paint complies with the class:

0
(Zero)

The edge of the cuts are completely smooth; none of the squares of the lattice is detached.

- **RISULTATO Prova 2 – Prova di resistenza alla corrosione secondo BS 3900 -F2**

Determination of resistance to humidity (cyclic condensation)

Il campione in oggetto è stato posto in cella climatica chiusa e sottoposte a **100** cicli di 1 ora ciascuno per verificarne la resistenza alla corrosione in presenza di condensa superficiale.
I valori di temperatura ed umidità registrati durante la prova sono riportati nella Figura 2.
Dopo l'esecuzione della prova, ad un esame visivo **non si evidenziano danni al rivestimento superficiale** quali vescicamento, macchie, rammollimento e/o raggrinzimento.

The above sample has been placed in a climatic test-room and subordinate to 100 cycles of 1 hour each, in order to verify the resistance to corrosion in presence of superficial condensation.
Values of temperature and humidity recorded during test are shown in Figure 2.
*After test, to a visual examination, **no damages to the superficial covering are evidenced**, like blistering, spots, rust staining and change of colour.*

POLITECNICO DI MILANO - DIPARTIMENTO DI ENERGIA

Laboratorio Misure Ricerche Termotecniche M.R.T. - ***Notified body number: 1695***

Laboratorio notificato ai sensi del "Regolamento (UE) n. 305/2011" dal Ministero dello Sviluppo Economico.
Notified Laboratory according "Construction Products Regulation n. 305/2011/EU" by Italian Ministry in charge.
Laboratorio di Riferimento secondo la Norma EN 442:2014 - Annex I e conforme a ISO 9001 e ISO 17025.
Reference Laboratory according EN 442:2014 - Annex I, in conformity to ISO 9001 and ISO 17025.

POLITECNICO MILANO 1863

Indirizzo/ Address: Via Raffaele Lambruschini , 4A (Zona Bovisa) – 20156 Milano – ITALY

Phone: ++39 02 2399 3825; e_mail: mrt@polimi.it ; http://www.mrt.polimi.it

NORMA/ REFERENCE/ REFERENCE/ REFERENZ: EN 442-1:2014 & EN 442-2:2014

RAPPORTI DI PROVA/ RAPPORTS D'ESSAI/ TESTS REPORT / PRÜFBERICHT/ INFORME DE PRUEBAS

Sommario/ Sommaire/ Summary/ Inhalt/ Resumen

1) ENE/MRT.RAP.20197
Determinazione della potenza termica di un corpo scaldante/
Détermination de la puissance thermique d'un corp de chauffe/
Determination of the heat output of a heating emitter/
Bestimmung der Wärmeleistung eines Heizkörper/
Determinación de la salida de calor de un emisor de la calefacción.

2) ENE/MRT.RAP.20197/P
Prove di tenuta a pressione/ Epreuve de tenue a la pression/
Pressure testing/ DruckPrüfung/ Prueba de presión.

3) ENE/MRT.RAP.20197/ΔP
Prova perdita di carico/ Epreuve de chute de pression/
Drop pressure test/ TropfenDruckPrüfung/ Prueba de presión de la gota.

Il Responsabile delle Prove Operator	Il Responsabile del Laboratorio Laboratory Manager
F.to: P.I. Samuele Maggioni	**F.to: Prof. Ing. Fabio Rinaldi**

Firmato digitalmente ai sensi del CAD - D. Lgs 82/2005 e s. m. e i., art. 21 c. 1-2

NORMA/ REFERENCE/ REFERENCE/ REFERENZ: EN 442-1:2014 & EN 442-2:2014

Determinazione della potenza termica di un corpo scaldante/ Détermination de la puissance thermique d'un corp de chauffe / Determination of the heat output of a heating emitter / Bestimmung der Wärmeleistung eines Heizkörper/ Prueba termica de un aparato de calefaccion.

Data/ date/ date/ datum/ fecha :	03/08/2020
Documento di prova/ Rapport d'essai/Test report/ Prüfbericht/Expediente n°:	ENE/MRT.RAP.20197
Richiedente/Demandeur/Applicant/ Antragsteller/Peticionario:	**GLOBAL di Fardelli Ottorino & C. s.r.l.**
Indirizzo/Adresse/Address/Anschrift/Direccion :	via Rondinera n.51 24060 - Rogno (BG)

Corpo scaldante/Appareil de chauffage/Heating appliance/HeizKörper/Aparato de Calefaccion

Marca/Appelation Commerciale du constructeur/ Manufacturer's trademark/ Handelsbezeichnung des herstellers/ Marca		:	GLOBAL
Gamma/ Gamme/ Type/ Typereihe/Gama		:	STYLE PLUS
Modello/ Modèle/ Model/ Modell/Modelo		:	STYLE PLUS 600 (10 elementi)
Tipo di corpo scaldante/Construction/Construction/Bauart/Tipo		:	Radiatore
Materiale/ Matériel/ Material/ Werkstoff/Material		:	Bimetallico (Alluminio + camera acqua in ferro)
Altezza/ Hauteur/ Height/ Höhe/ Altura	mm	:	675
Lunghezza/ Longueur/ Length/ Länge/ Longitud	mm	:	800
Profondità/ Profondeur/ Depth/ Tiefe/ Anchura	mm	:	95
N° elementi/ No éléments/ Elements n°/ Anzahl der Glieder		:	10 (4 alette laterali)
Contenuto d'acqua/ Contenance en eau/Water content	kg	:	1.9
Massa/ Masse/ Mass/ Masse/Masa en vacio	kg	:	23.1
Disegno/ Dessin / Drawing / Zeichnungs/ Planos	n° / data:		E06195075A (STYLE-PLUS 600)

Risultati della prova/ Resultats de l'essai/ Test results/ Ergebnisse/ Resultados de la prueba

Equazione caratteristica/ Equation caractéristique/ Characteristic equation/ Kennlinie/ Ecuacion caracteristica :

$$\Phi = K_m \ \Delta T^{\,n} \ q_m^{\,c}$$

K_m = 7.15578	n = 1.33678	c = 0

Potenza Nominale (ΔT=50 K) del modello provato: Standard Rated Thermal Output	**1336 W**	**(133.6 W/elem.)**
Potenza (ΔT=30 K): EN442-2:2014 Standard Low Temperature Thermal Output	**675 W**	

Documento di prova/ Rapport d'essai/ Test report/ Prüfbericht/ Expediente n°: ENE/MRT.RAP.20197

Ambiente di prova/ Description de l'installation d'essai/ Description of the test installation/ Beschreibung des prüfstandes/ Caracteristicas de la camara

Camera di prova chiusa raffreddata dall'acqua circolante nelle pareti. (EN 442-2:2014 / § 5.2.2)
Essai en chambre fermée à refroidissement par eau/ Test in closed water cooling booth/ Prüfung in abgeschlossener wassergekühlten Prüfkabine/ Camara de prueba cerrada, Paneles de acero refrigerados por agua.

Dimensione della camera/ Dimensions de la cellule/ Dimensions of test booth/ Abmessungen der Prüfkabine/ Dimensiones de la cabina de la prueba : 4 x 4 x 3 m

Misura della potenza termica : metodo per pesata
Mesure de la puissance thermique : méthode par pesée/ Measure of heat output : weighing method
Messung des Wärmeleistung : Wägeverfahren/ Metodo: de pesada

NOTE:
Connessioni idrauliche al radiatore nella condizione di prova: - Ingresso acqua, in alto a sinistra; - Uscita acqua, in basso a sinistra. Hydraulic connections to the radiator : - Inlet water, on the top of the left radiator's side; - Outlet water, on the bottom of the left radiator's side.

Data e luogo del prelievo **21/07/2020 - Rogno (BG)**
Date and place of the model withdrawal :

Responsabile del prelievo **Responsabile Sistema Qualità: Ing. Sandro Panteghini**
Responsible of the model withdrawal :

Identificazione del modello a cura del responsabile del prelievo **---**
Identification of the model made by Responsible :

Data di arrivo al Lab. M.R.T. - Date of the model arrival at Lab. M.R.T.: **22/07/2020**

Data di esecuzione della prova - Testing date : **23/07/2020**

Numero di connessioni - Number of connections : **4**

Interasse - Hub spacing (mm): **600**

Verniciatura - Painting **:** **Bianco RAL**

Documento di prova/ Rapport d'essai/ Test report/ Prüfbericht/ Expediente n°: ENE/MRT.RAP.20197

Valori medi misurati e risultati/ Moyenne des valeurs mesurées et résultats/ Average measured value and results/ Mittelwerte aus Meßgröben und Ergebnissen/ Valores medios caracteristicos y resultados

	Simbolo/ Symbol	**Unità/ Unité/ Unit/ Einheit**		**Punto/ Point/ Point/ Meßstellen**	
			I	**II**	**III**
Pressione atmosferica/ Pression atmosphèrique/ Air pressure/ Lufdruck/ Presion atmosferica	p	kPa	99.466	99.485	99.457
Temperatura di riferimento dell'aria/ Tempèrature de référence de l'air/Reference air temperature/ Bezugs -Lufttemperatur/ Temperatura de enfriamiento de aire	tr	°C	20.20	20.37	19.85
Temperatura dell'acqua in ingresso/ Température d'entrée de l'eau/ Inlet water temperature/ Vorlauftemperatur/ T. entrada agua	t1	°C	87.27	75.33	52.92
Temperatura dell'acqua in uscita/ Température de sortie de l'eau / Outlet water temperature/ Rücklauftemperatur/ T. salida agua	t2	°C	74.25	65.36	47.81
Differenza di temperatura/ Différence de température/ Temperature difference/ Temperaturunterschied/ Diferencia	t1-t2	K	13.02	9.97	5.11
Entalpia dell'acqua in ingresso/ Enthalpie d'entrée de l'eau / Inlet water enthalpy/ Enthalpie im vorlauf/ Entalpia entrada	h1	kJ/kg	365.392	315.277	221.492
Entalpia dell'acqua in uscita/ Enthalpie de sortie de l'eau / Outlet water enthalpy/ Enthalpie im Rücklauf/ Entalpia salida	h2	kJ/kg	310.751	273.520	200.134
Differenza di entalpia/ Différence d'enthalpie/ Entalpy difference/ Enthalpiedifferenz/ Diferencia de entalpias	Δh	kJ/kg	54.641	41.757	21.358

Documento di prova/ Rapport d'essai/ Test report/ Prüfbericht/ Expediente n°: ENE/MRT.RAP.20197

			I	II	III
Temperatura media dell'acqua/ Température moyenne de l'eau / Mean water temperature/ Mittlere wassertemperatur/ T. media del agua	tm	°C	80.76	70.35	50.37
Differenza temperatura acqua-aria (tm-tr) Difference de température eau-air/Excess temperature/ Übertemperatur/ Diferencia	ΔT	K	60.56	49.98	30.52
Metodo ponderale -Portata d'acqua/ Méthode par pesée - débit d'eau/ Weighing method - water flow rate/ Wägeverfahren - wässersestrom/ Metodo de pesada- caudal masico	q_m	10^{-3} kg/s	31.271	31.739	32.029
Potenza termica misurata/ Puissance thermique mesurée/ Thermal output measured/ Wärmeleistung (gemessen)/ Potencia de prueba	Φ_{me}	W	1708.7	1325.3	684.1
Potenza termica riportata alla pressione atmosferica di 101.325 kPa/ Puissance thermique ramenée a la pression atmosphérique normale/ Thermal output corrected for barometric pressure influence/ Wärmeleistung mit Luftdruck-Korrektur/ Potencia corregida	Φ	W	1724.2	1337.2	690.3
Coefficienti utilizzati per la correzione/ Coefficients utilisée/ Used coefficients/ Luftdruck Korrektur/ Coeficientes utilizados en la correcion	S_k	0.25			
	n_p	0.65			

NORMA/ REFERENCE/ REFERENCE/ REFERENZ / REFERENCIA: (EN 442-1&2):2014

Test di tenuta a pressione n°/ *Epreuve de tenue à pression No/ Testing pressure n°/ DruckPrüfung N°/ Prueba de presiòn*

n°: ENE/MRT.RAP.20197/P

Massima pressione d'esercizio dichiarata dal Costruttore / *Pression de service maximale indiquée par le Constructeur/ Maximum working pressure stated by the Manufacturer/ Max Betriebsdruck vom Hersteller angegebenen/ Presión máxima de servicio indicada por el fabricante.*	**3500**	**kPa**
❑ **EN 442-1:2014 / § 5.4 / Prova di tenuta /** *Essai d'étanchéité/ Tightness test/ Dichtheitprüfung/ Prueba de escape*		
Pressione di prova / *Pression d'èpreuve/ Pressure value applied during the test/ Druck bei der Prüfung angewendet / Valor de presión aplicada durante el ensayo.*	**4550**	**kPa**
- ***Tenuta***/ *Etanchéité/ Tightness/ Dichtheit/ Resultado*	(Pass or Fail)	**PASS**
❑ **EN 442-1:2014 / § 5.6 / Prova di resistenza /** *Epreuve de résistance/ Test of resistance to pressure / Prüfung der druckfestigkeit/ Pruebe de resistencia*		
Pressione di prova / *Pression d'èpreuve/ Pressure value applied during the test/ Druck bei der Prüfung angewendet / Valor de presión aplicada durante el ensayo.*	**5000**	**kPa**
- ***Resistenza alla pressione***/ *Tenue à la pression/ Behavior to pressure/ Druckfestigkeit/ Comportamiento a la presión*	(Pass or Fail)	**PASS**
❑ **Pressione di scoppio** (*) / *Point de rupture mécanique/Mechanical breaking point/ Mechanischer Schnittpunkt/ Punto de desempate mecánico* (*) Prova eseguita solo se richiesta / seulement si demandée/ only if demanded/ nur wenn demended *Nota: 5000 kPa limite massimo della strumentazione / the maximum advanced limit of the instrumentation*	**Test not required**	
❑ **EN 442-2:2014 / § 4.3.1 , § 4.3.3 / Controlli dimensionali** / *Contrôles dimensionels/ Dimensional controls/ Masshaltigkeitsprüfung/ Controles dimensionales*		
Conformità dell'apparecchio alle quote del disegno *Conformité de l'appareil testé par rapport aux plans/ Conformity of test sample with regard to drawings/ Konformität des Heizkörpers in Bezug auf die Zeichnungen/ Conformidad respecto a gráficos*	(Pass or Fail) **PASS**	
Conformità dei disegni alle tolleranze di tabella 3 della Norma EN442-2 :2014 *Conformité des plans par rapport aux tolérances du tableau 3 de EN 442-2 :2014/ Conformity of drawings with regard to table 3 of EN 442-2:2014/ Konformität des Zeichnungen in Bezug auf die Toleranzen der Tabelle 2 auf EN 442-2:2014/ Conformidad de gráficos con respecto al vector 3 - EN 442-2:2014*	(Pass or Fail) **PASS**	

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NORMA/ REFERENCE/ REFERENCE/ REFERENZ / REFERENCIA:
EN 442-2:2014 § Annex B.2.2

Prove di perdita di carico e calcolo dell'equazione caratteristica del modello provato

Essai de chute de pression et détermination de l'équation caractéristique du modèle testé / Test of pressure drop and determination of the characteristic equation of the tested model / Test des Druckabfalls und der Ermittlung der charakteristischen Gleichung des geprüften Modell / Prueba de la gota de presión y de la determinación de la ecuación característica del modelo probado n°:

ENE/MRT.RAP.20197/ΔP

Valori Misurati e Risultati / *Valeurs mesurées et resultats/ Measured values and results/ Messgrössen und ergebnisse/ Medidos valores y resultados*			
	FLOW RATE	**FLOW RATE**	**DROP PRESSURE**
	q_m (l/h)	**q_m ($10^{-3}m^3/s$)**	**Δp (Pascal)**
0.50 x q_{ms}	57.7	**0.01603**	**19**
0.75 x q_{ms}	85.8	**0.02383**	**38**
q_{ms} : Portata d'acqua / *Débit d'eau / Water flow rate / Caudal del Agua/ Wässerströmungsgeschwindkeit*	114.4	**0.03178**	**64**
1.50 x q_{ms}	172.0	**0.04778**	**140**
2.00 x q_{ms}	227.3	**0.06314**	**241**
Equazione caratteristica del modello provato / *Equation caractéristique du modèle essayé / Characteristic equation of the tested model / Kennlinien des Prüflings / Ecuación característica del modelo probado*		**$\Delta p = K * q_m^d$**	
		K =	**41445**
		d =	**1.870**
Temperatura dell'acqua / *Température de l'eau/ Water temperature/ Wassertemperatur/ Temperatura del agua*		**25 °C**	