

## Type 444 Stainless Steel for Flue Duct

TB20-1013

January 20<sup>th</sup>, 2020

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### Background:

Gas-burning appliances like boilers and generators create corrosive byproducts from the flue gases expelled from the combustion process. As the efficiency of the gas-burning appliance increases, the flue gases approach their dew point temperature and start to condense in the vent which amplifies the corrosive conditions. These environments require the use of properly tested and listed venting systems to ensure the robustness of the material being used.

### Details:

Underwriters Laboratories (UL) 1738 – Standard for Venting Systems for Gas-Burning Appliances, Categories II, III, and IV is the standard that tests materials to verify they can withstand the harsh environments of gas appliance venting. A few of the tests performed are temperature, wind load, impact, puncture, and joint tests. UL 1738 also dictates the metal that can be used based on the requirements in Section 39 of the UL 1738 Standard, “Resistance to Condensate - Exposure Corrosion Test for Metals”. Both Type 444 stainless steel and AL29-4C are high grade stainless steel and comply with this section.

Stainless steels perform well in corrosive environments due to the addition of chromium in their chemical composition. The chromium helps create an oxide layer on the surface of the metal that helps protect it from the environment. If this layer were to be disrupted by a scratch, a new layer would form upon interaction between the chromium in the metal and oxygen in the air. This oxide layer formation is what makes stainless steels “stainless”.

A common concern in corrosive environments with elevated temperatures is stress corrosion cracking (SCC). Though both Type AL29-4C and Type 444 stainless steel resist corrosion, Type 444 stainless steel has a near immunity to SCC [1]. To simulate an environment for SCC to appear, stainless steel manufacturers have subjected both materials to extensive testing at elevated temperatures in the presence of salts and acids (like magnesium chloride, lithium chloride, acetic acid and nitric acid) and no cracking was observed on the material in any of these tests [1, 2]. Additionally, Type 444 stainless steel has the equivalent corrosion resistance as Type AL29-4C, but at lower cost [3].

Finally, Type 444 stainless steel is commonly desired due to an increased temperature limit of 650 °F, over the 600 °F limit of Type AL29-4C [1, 2]. This increased temperature limit provides an added benefit and safety factor for Type 444 stainless steel.

CaptiveAire's BH Special Gas Vent, utilizes Type 444 stainless steel on the inner wall, and is fully listed to UL 1738 with flue temperatures up to 550 degrees [4]. This product is also backed by a 20-year warranty to ensure the longevity of the system. Based on the information above, it is the opinion of CaptiveAire that using Type 444 stainless steel is an effective and sustainable solution for venting combustion flues.

**Citations:**

[1] "ATI Technical Data Sheet: ATI 444 Stainless Steel: Ferritic." Allegheny Technologies Incorporated.

[https://www.atimetals.com/Products/Documents/datasheets/stainless-specialty-steel/ferritic/ati\\_444\\_tds\\_en\\_v1.pdf](https://www.atimetals.com/Products/Documents/datasheets/stainless-specialty-steel/ferritic/ati_444_tds_en_v1.pdf)

[2] "ATI Technical Data Sheet: ATI AL29-4C Alloy for Heating and Ventilating." Allegheny Technologies Incorporated.

[https://www.atimetals.com/Products/Documents/datasheets/stainless-specialty-steel/superferritic/al\\_29-4c\\_hvac\\_tds\\_en.pdf](https://www.atimetals.com/Products/Documents/datasheets/stainless-specialty-steel/superferritic/al_29-4c_hvac_tds_en.pdf)

[3] "Catalog Addendum to L820 – FasNSeal 444 & FasNSeal W2 444." Duravent.

[http://www.duravent.com/docs/product/fns\\_444\\_addendum\\_2011\\_web.pdf](http://www.duravent.com/docs/product/fns_444_addendum_2011_web.pdf)

[4] "Double Wall Special Gas Vent 2V Type BH Specification." CaptiveAire Systems.

<https://www.captiveaire.com/CATALOGCONTENT/DUCTWORK/UL1738/doc/Double%20Wall%20Special%20Gas%20Vent%202V%20Type%20BH%20Specification.pdf?v=1702020>