

FUME AND GAS EMISSION RATES ASSOCIATED WITH FCA WELDING AND FLAME CUTTING OF PLATES COATED WITH HEMPEL ZS 15890 SHOP PRIMER (copy)

At the request of Hempel's Skibsfarvefabrik A/S the FORCE Institute has measured the fume and gas emission rates associated with FCA welding and flame cutting of plates coated with Hempel ZS 15890 in order to evaluate whether the decomposition products from the primer constitute a health risk compared to welding and cutting in shot blasted plates.

The tests were part of the investigations within the Nordic project NI-P92035 "Welding of shop primed plates" (ref. 1). The results for ZS 15890 shop primer have furthermore been reported in two separate reports for welding and cutting respectively (ref. 2 and 3).

The investigation was based on comparative tests in shot blasted plates and primed plates respectively. The technique used to measure the fume and gas emission rates was the fume box method in accordance with the draft for CEN standard for emission rate measurements in welding and allied processes.

Primer film thickness on the test plates was measured to approx. $21 \pm 5 \mu\text{m}$

Summary of test results

a. Welding

Welding was performed as horizontal-vertical fillet welding using FCA welding with 1.2 mm diameter metal cored wire at 285 amps and shielding gas 82 Ar/18 CO₂.

The test results showed that welding on Hempel ZS 15890 shop primer increases the fume emission rate and the zinc content in the fume compared to welding on shot blasted plate. The emission rates of gases were very low and without hygienic significance.

The increase in fume emission rate and zinc content in the fume due to ZS 15890 correspond to an increase in NHL-value of approx. 4800 m³/h compared to welding on non-coated material.

This increase in NHL-value is of the same magnitude as normally found for shop primers. Furthermore, the increase is within the range of variations in NHL-value due to the welding process itself and, consequently, the normal ventilation requirements for the welding process can be considered as sufficient for welding on the primer in the recommended coating thickness.

b. Flame cutting

Flame cutting tests were performed in 10 mm shot blasted mild steel plates as well as plates coated on both sides with ZS 15890 using acetylene-oxygen cutting.

The measurements showed that cutting in plate material coated with Hempel ZS 15890 shop primer resulted in a reduction of the total fume emission rate compared to flame cutting in shot blasted plate but at the same time the zinc content

in the fume was higher than for shot blasted plate. The emission rates of gases during cutting in the primer were of the same magnitude as for shot blasted material.

The combined effect of the reduction in fume emission rate and the increase in zinc content was a reduction in the NHL-value of approx. 2400 m³/h for cutting in primed material compared to shot blasted material.

This result is in agreement with the experiences from previous preliminary investigations of the effects of shop primers on the fume and gas emission rates in flame cutting (ref. 4). The total results show that the ZS 15890 shop primer decomposes during flame cutting and contributes to the fume and gas emission rates, including an increase in the zinc content in the fume, but at the same time the cutting process itself is influenced by the primer in such a way that the fume emission rate from the process in general is reduced compared to cutting in shot blasted material.

The test results are described in details in ref. 1, 2 and 3.

References

- (1) Welding of shop primed plates. NI-project P92035.
Report 94.53, FORCE Institute 1994.
- (2) Investigation of the fume and gas emission rate associated with FCA welding on plates coated with Hempel ZS 15890 shop primer.
FORCE Institute report, July 1997, at the request by Hempel's Skibsfarvefabrik A/S.
- (3) Investigation of the fume and gas emission rate associated with flame cutting in plates coated with Hempel ZS 15890 shop primer.
FORCE Institute report, July 1997, at the request by Hempel's Skibsfarvefabrik A/S.
- (4) Flammeskæring med naturgas, propan og acetylen, arbejdshygiejniske målinger.
Report 87.51, FORCE Institute.