



Tests Report: Measurement of exposure to manganese with SMAW electrodes welding.

Objective: Manganese exposure comparison for SMAW electrodes.

Performance:

Experiments were planned and performed by National Occupational Hygiene Laboratory (Safety and Occupational Health Administration, Ministry of Labor, Social Affairs and Social Services, Israel).

Methodology:

Exposure to manganese fumes produced during the welding process was done by two different ways. In first way, welder's exposure to manganese fume was tested during prolonged welding of plate for examination of mechanical properties according to AWS A5.1 standard. Experiment workplace in welding laboratory was equipped with moveable hood above the bench and with bottom exhaust ventilation under the bench. Welding time was approximately 6 hours.

Second type of experiment was done with specially prepared chamber (Figure 1). From the top, chamber is connected by flexible pipe to the pumping system which takes out all produced fumes. On the narrow entering to the flexible pipe cyclone with the cellulosic filter is located, which is connected by tube to precise lab pump. In such configuration of experiment most of the fume pass through cellulosic filter.

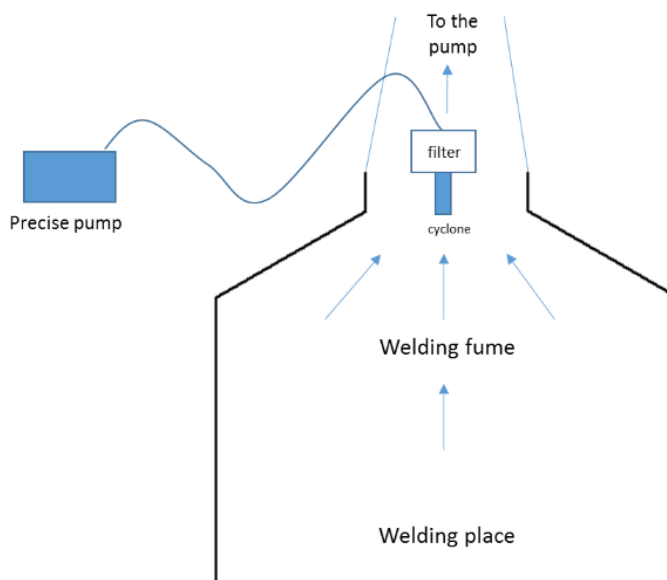


Figure 1 : Schematic view of welding chamber for Mn exposure measurement.



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Results:

Table 1 : Preliminary results of Manganese exposure - rutile coated E6013 – Welding Chamber

| Electrode type | Z-11 E6013 | Zika – 11 E6013 LMn | E 6013 (competitor 1) | E6013 (competitor 2) |
|------------------------------|-------------|---------------------|-----------------------|----------------------|
| Number of test | | | | |
| 1 | 0.99 | 0.31 | 0.51 | 0.48 |
| 2 | 0.67 | 0.32 | 0.72 | 0.52 |
| 3 | 0.62 | 0.26 | 0.47 | 0.47 |
| 4 | 0.82 | 0.31 | 0.54 | 0.61 |
| 5 | 0.77 | 0.32 | 0.55 | 0.54 |
| Mean | 0.77 | 0.30 | 0.56 | 0.52 |
| Variance | 0.02083 | 0.00063 | 0.0092 | 0.0031 |
| Observations | 5 | 5 | 5 | 5 |
| Pearson Correlation | 0.46 | | 0.212 | |
| Hypothesized Mean Difference | 0 | | 0 | |
| df | 4 | | 4 | |
| t Stat | 7.80 | | 0.76 | |
| P(T<=t) one-tail | 0.0007 | | 0.25 | |
| t Critical one-tail | 2.13 | | 2.13 | |
| P(T<=t) two-tail | 0.0015 | | 0.49 | |
| t Critical two-tail | 2.78 | | 2.78 | |

Table 2 : Preliminary results of Manganese exposure - rutile coated E6013

| Electrode type | Exhaust ventilation (mg/m3) |
|-----------------------|-----------------------------|
| Z-11 E6013 | 0.007 |
| E 6013 (competitor 1) | 0.008 |
| E6013 (competitor 2) | - |
| Zika - 11 LMn | 0.003 |



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Table 3 : Preliminary results of Manganese exposure, basic coated E7018 – Welding Chamber

| Electrode type | Z-4 E7018 | Z 7018 | E7018-1 H4R |
|-------------------------------------|-------------|-------------|--------------|
| Number of test | regular | LMn | (competitor) |
| 1 | 1.11 | 1.09 | 1.40 |
| 2 | 1.31 | 1 | 1.09 |
| 3 | 1.08 | 0.64 | 0.91 |
| 4 | 1.2 | 1.04 | 1.37 |
| 5 | 2.1 | 0.85 | 1.31 |
| 6 | 1.05 | 0.9 | |
| 7 | 1.11 | 0.74 | |
| Mean | 1.28 | 0.89 | 1.22 |
| Variance | 0.1384 | 0.027 | 0.21 |
| Observations | 7 | 7 | 5 |
| Pearson Correlation | -0.0063 | | |
| Hypothesized Mean Difference | 0 | | |
| df | 6 | | |
| t Stat | 2.50 | | |
| P(T<=t) one-tail | 0.023 | | |
| t Critical one-tail | 1.94 | | |
| P(T<=t) two-tail | 0.046 | | |
| t Critical two-tail | 2.45 | | |

Table 4 : Preliminary results of Manganese exposure - basic coated E7018

| Electrode type | Exhaust ventilation (mg/m3) |
|--------------------------|-----------------------------|
| Z-4 E7018 regular | - |
| E7018-1 H4R (competitor) | 0.013 |
| Z 7018 LMn | 0.0067 |

Conclusions:

1. Zika-LMn welding electrodes showed low exposure to manganese in comparison with regular electrodes of zika and other competitors.
2. There is a clear correlation between two different exposure methods measurements.

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