

RESEARCH IN WELDED SIEVE QUALITIES DEPENDANCE ON ASPECTS OF PRODUCTION TECHNOLOGY

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Abstract. Mechanical, technological, operating characteristics of welded sieves, manufactured by different companies are researched in. Technologies of pretreatment and welding of wire, as well as the effect of the coat covering technology on the strength of the final product, value of corrosion resistance and processes of transportation, storage, assembling, as well as stability of the shape under the conditions of exploitation are evaluated.

Key words: welded sieve, wire, technology, mechanical characteristics, quality.

Introduction

Welded sieve, manufactured from wire, is applied for keeping of domestic birds and animals, for restriction of the territory, for shaping of metallic frames in ferroconcrete products as well as in other fields of natural economy. The demands for mechanical, technological operation characteristics of welded sieve from wires change depending on the application. Mechanical characteristics of welded sieve depend on the mechanical characteristics, chemical composition, manufacturing technology, geometrical dimensions, after- treatment technology as well as on technologies of assembling, welding and manufacturing of sieve, on technologies of surface treatment and formation of coating as well as on characteristics of the covering material.

Wires are manufactured from non-alloy low-carbon steel, non-alloy steel with high carbon content as well as stainless steel.

Materials and methods

Manufacturing processes of sieve production are compared as well as geometrical dimensions, mechanical characteristics, strength of welded joints, stability of coating and reaction on acid influence of sieves, manufactured by different companies are researched. There are chose sieves with approximately similar geometrical dimensions of eyes as well similar diameters and materials of wire.

Schematic manufacturing lines mostly often used for production of welded sieves are summarized in Table 1.

Table 1

Schematic manufacturing lines for manufacturing of welded sieves

Manufacturing processes of sieves production			
Cutting of wire	Hot drawing	Low-temperature drawing	Low-temperature drawing
Composition	Cutting of wire	Cutting of wire	Calibration
Welding of sieve	Composition	Composition	Surface fining
Surface fining	Welding of sieve	Welding of sieve	Zinc plating
Covering by PVC	Surface fining	Surface fining	Cutting of wire
Control	Covering by PVC	Zinc plating	Composition
Rolling up	Control	Covering by PVC	Welding of sieve
Labeling	Rolling up	Control	Covering by PVC
-	Labeling	Rolling up	Control
-	-	Labeling	Rolling up
-	-	-	Labeling

After wire sieve is covered by polyvinylchloride (PVC) there is a problem for the customer to appreciate the quality of sieve; manufacturers usually do not inform customers about the materials and the manufacturing technology of sieve, especially in cases, when for reduction of production costs simplified technology is chosen.

There are fragments of wire sieves produced by companies Frigerio (Italy); Arcelor Mittal (Luxemburg); He Bei and Be Young (China); two different consignments of sieves from Betaface (Belgium) used in the research with the eye size 60x100 mm.

Measuring of the metallic part of wire as well as the total diameter was done by vernier caliper with the reading value 0.01 mm.

The quality of coating was appreciated in dependence on the reaction of the coating to the presence in 20 % hydrochloric acid as well as how easy it is to make mechanical disconnection of polymer from wire.

The tensile strength is defined for wires with coating by using 90 mm long samples. The tensile strength, elastic limit as well as unit elongation are defined according to the standard LVS EN 10002-1 „Metals. Tensile test. Part 1: Test method on surrounded environment temperature”. Mechanical characteristics are defined by making use diagrams of elasticity; the diagrams were obtained by the test machine Zwick-2.5

The hardness of wire was estimated by using the Rockwell's press with a specially transformed indenter, the reason of transformation was: it turned out that the original indenter (boll or conic shape) was not suitable for hardness checking of thin wires. The work-piece of the indenter is made in a shape of a ring. The external diameter of the ring is 3.0 mm, the internal diameter of ring is 2.5 mm, the applied load – 1471 N. The procedure of hardness definition is in accordance with the standard LVS EN ISO 6508-1 „The metallic material Rockwell's hardness test Part 1: Test method”.

The tensile strength of welding seam is defined for samples, which are cut from sieve in those ways, that the welding seam is located in the middle of the loaded sample as well as the length of vacant endings of welded wires would be at least 55 mm.

The technological and operating characteristics of welded sieve were evaluated on the basis of the data from testing of physical-mechanical and chemical characteristics.

Results and discussion

The examination results of physical-mechanical characteristics of sieves wires are summarized in Table 2.

Table 2

Physical-mechanical characteristics of wires and joints

Parameter/Producer	Betaface	He Bei	Frigerio	Be Young	Arcelor Mittal
Made in	Belgium	China	Italy	China	Luxemburg
Total wire diameter, mm	2.65±0.05	2.25±0.10	2.45±0.10	2.40±0.03	2.60±0.05
Wire metallic part diameter, mm	2.00±0.03	1.85±0.07	2.00±0.15	1.91±0.02	1.92±0.02
Wire tensile strength, R_m , MPa	940±40	520±35	620±40	483±42	930±40
Elastic limit, R_e , MPa	910±35	490±30	610±40	440±30	905±35
Unit elongation, A , %	26±6.5	29±9.3	24±7.5	31±11.0	22±4.5
Seam tensile strength, N	592±74	355±97	549±65	439±82	584±43
Seam unit elongation, %	23±6.3	13.3±4.3	18±5.3	12±2.1	22±3.7
Wire hardness, HR	56 ± 3	12±2	37±5	17±3	5±3

Holding of wires in watered hydrochloric acid showed that wires, manufactured by all researched producers, are zinc plated before covering by PVC.

The spark method test of the materials for manufacturing of wires gives evidence that all producers have used low-carbon steel with the carbon content 0.15±0.04 %. Measuring of the diameter of wires gives evidences that calibration of wires in the process of manufacturing is made only by producers from the companies Betaface, Be Young and Arcelor Mittal.

The strength tests of seams as well as metallographic researches give evidence that calibration of wires enables greatly to improve the quality of welding due to decreased dispersion of the diameter dimensions of welded wires as well as provides equivalent contact – stress in the welding process.

The products of Arcelor Mittal have the best strength and elasticity of welded seams .

The results of the research demonstrate that the elastic limit of Betafence and Arcelor Mittal wires is approximately twice higher than of Be Young and He Bei wires as well as 1.5 times higher than Frigerio wires.

The wires manufactured by Betafence and Arcelor Mittal have the best hardness. Hardness of wires, manufactured by China companies is approximately four times less. This fact demonstrates that wires, manufactured by China producers, are not deformed plastically due to what the mechanical characteristics of them are greatly lower.

Arcelor Mittal wires have the best tieback between the coating and metal wire, the worst – wires, manufactured by He Bei and Be Young. The wires manufactured by Betafence and Arcelor Mittal have the biggest total diameter of wire as well as the thickness of the coating, The products of Betafence and Frigerio have the largest diameter of the wire metallic part.

The wires manufactured by Arcelor Mittal have the best tieback between PVC coating and wire. The coating of wires manufactured by Bei and Be Young is disconnected more easily.

The wires wickerwork manufactured by Betafence and Arcelor Mittal have greatly better characteristics of the technology and operating than He Bei and Be Young wickerwork due to the possibility for more qualitative fixation in the process of shaping of the fence, they do not need additional strong fixation elements for shape supporting as well as it is easier to provide the quality of transformation and transportation.

The wires wickerwork manufactured by Arcelor Mittal has higher corrosion resistance, good stability of the shape as well as resistance in cases of impact of casual load, producer guarantees for 15 years guarantee period. The wires wickerwork manufactured by Betafence has a little bit less corrosion resistance, good stability of the shape and resistance in cases of impact of casual load as well as producer guarantees for 10 years guarantee period. The wires wickerwork manufactured by He Bei, Be Young and Frigerio does not have any producer guarantee period.

The operating characteristics of Betafence and Arcelor Mittal products – corrosion resistance, shape stability on time as well as ability to hold out deformations in cases of casual loads impact are greatly better. Good corrosion resistance of Arcelor Mittal and Betafence products is guaranteed due to good adhesion between PVC coating and metal wire, the last one after all is treated by the method of low-temperature drawing plastic deformation as well as by calibration and zinc plating.

Conclusions

1. Low-carbon steel with carbon content 0.15 ± 0.04 % is used for manufacturing of all researched types of welded sieves.
2. Mechanical, technological, operating characteristics of welded sieves greatly depend on characteristics of wire material, on technologies of treatment of wires as well as technology of manufacturing of sieves.
3. Plastic deformation of wires, obtained by low-temperature drawing and calibration, increases the rate of hardness, tensile strength, elastic limit as well as provides stability of the wire diameter.
4. Stability of wire diameter provides a stable and qualitative process of welding. The seam tensile strength of Betafence and Frigerio company wires is accordingly 592 and 549 N in comparison with He Bei wires – 439 N.
5. Best adhesion between the coating and metal wire is observed for wires manufactured by the companies Arcelor Mittal and Betafence.
6. The wire sieves manufactured by the companies Betafence and Arcelor Mittal have greatly better characteristics of operating and technology: a possibility for more qualitative fixation in the process of shaping of the fence, they do not need additional strong fixation elements for shape supporting as well as it is easier to provide the quality of transformation and transportation. These companies can presume to guarantee 15 years guarantee period.

References

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