J. Walter Miller Company Makes a Smooth Technological Transition with QuikCAST

J. WALTER MILLER COMPANY

THE CHALLENGE

To fully reconfigure J. Walter Miller Company's (JWMC) complex castings during a profound technological evolution.

THE STORY

JWMC recently completed its transition from manual green sand squeeze molding to fully automated molding machines. Each squeezer pattern needed to be converted to run on the new equipment. JWMC decided to explore the use of QuikCAST solidification software to reduce the number of iterations required to reconfigure patterns, reduce porosity in finished castings and explore opportunities for yield improvement.

THE BENEFITS

"This problem would have taken about 12 weeks and $6,000 in pattern changes plus countless hours of machine time to solve using conventional trial and error methods. With QuikCAST, we can easily solve similar problems in 2 weeks and produce a good pattern the first time. We have used simulation on about 20 parts to date and the simulation results are similar to what we see in the shop."

Dan Rudolph
Quality Engineer
J. Walter Miller Company

J. Walter Miller Company (JWMC) produces brass and bronze castings for the fire protection, pumping and valve industries. Both leaded and non-leaded alloys are poured on a daily basis and give JWMC a unique mix of capabilities. Historically, JWMC has specialized in small castings but is growing into larger sizes with the recent acquisition of the DISA Match 130.

JWMC recently completed its transition from manual green sand squeeze molding to fully automated molding machines. Each squeezer pattern needed to be converted to run on the Sinto FBO or the DISA Match 130. In most cases, the rigging and risers were changed to accommodate the machines' fixed sprue locations.

Additionally, some jobs used molding techniques applicable only to squeeze molding such as open risers, pop off sprues and vent wires. In particular, the use of open risers is difficult to replicate on the automated molding machines as they use fixed sprue locations with contact diameters of 1 inch maximum. The results of replacing large open risers with closed risers or sprues of 1 inch diameter were unpredictable and increased the rate of shrink porosity in some castings.

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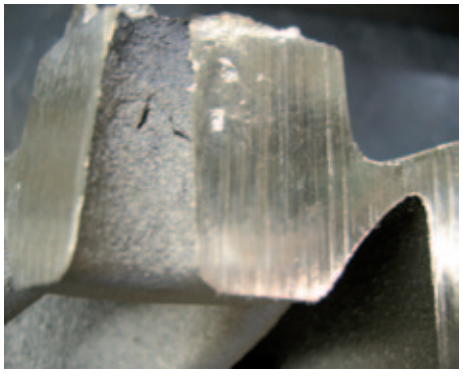
A TOUGH CHALLENGE

For a foundry producing non-leaded pump components, impellers are a main challenge because of the heavy and thin sections of the casting. The highest volume impeller was problematic as it was transitioned from a squeezer mold with an open riser to the automated machines. The original squeezer mold used an open riser feeding a solid triangular hub.

This configuration was not possible on the DISA Match 130. The impeller castings exhibited shrink porosity and voids in the hub when machined at the customer's facility. The riser at the hub area required redesign.

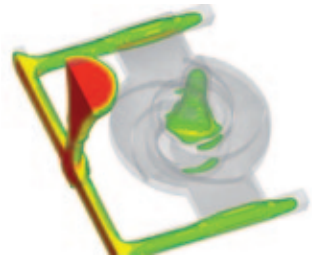


Original shrink defect found in the heavy hub section of the casting

INITIAL DESIGN

Conventional thinking, prior to the use of QuikCAST software, lead to the addition of a core in the hub, to reduce the amount of liquid metal required to feed the hub during solidification. Also, the open riser would have been replaced with a tall closed riser of similar contact area.

Following casting and machining, the hub of the impeller exhibited no defects after boring. However, a new defect began to appear in the wear ring section of the casting, which is a heavy circular rib about an inch around the hub. At this time, JWMC turned to QuikCAST software to determine the cause of this frustrating new defect.



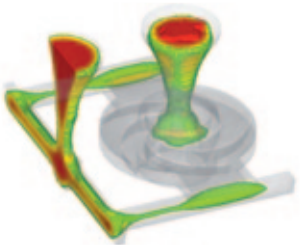
Closed riser and cored hub design. Shrink pocket shown in wear ring.

After analyzing the simulation results, the new defect was determined to be a shrink caused by the reduced feeding from the hub section which was now cored and solidifying much more quickly. This left the wear ring section to solidify later and result in a shrink pocket which was exposed during the machining process.

REVISED DESIGN

The lack of feed metal from the hub was creating a shrink that was nearly impossible to feed from any other location. It was then suggested that the core in the hub be removed to allow a feed path to the wear ring. This change also required the use of a 1 inch sprue as an open riser to provide more feed metal than the existing closed riser could provide.

The design changes were applied to the CAD model of the casting and input into QuikCAST for evaluation. After the model was finished, the original problem of shrink porosity in the hub was evident, but shrink in the wear ring was not present. The shrink in the hub appeared to be contained only in the center most region and would be removed during the machining process, leaving a clean, smooth bore.



Open riser, solid hub design. No shrink pocket in wear ring.

REAL WORLD OUTCOME

The changes modeled in QuikCAST were applied to the impeller during the next production run. As predicted, some centerline shrink was evident in the hub, but was easily removed during machining. There was no shrink found in the wear ring with the new configuration. JWMC's customer witnessed a dramatic reduction of scrap in the machining process, which contributed to large cost savings for both the customer and JWMC.

Hub with no shrink cracks present.

"We selected QuikCAST because it has the most comprehensive capabilities for simulating brass and bronze alloys. QuikCAST is a very powerful simulation tool."

Dan Rudolph,
Quality Engineer, J. Walter Miller Company

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info@esigroup.com

EUROPE

CZECH REPUBLIC & EASTERN EUROPEAN COUNTRIES
MECAS ESI s.r.o.
Brojova 2113/16
326 00 Pilsen
Czech Republic
T. +420 377 432 931
F. +420 377 432 930

FRANCE
ESI France
Parc d'Affaires Silic
99, rue des Solets - BP 80112
94513 Rungis cedex
France
T. +33 (0)1 49 78 28 00
F. +33 (0)1 46 87 72 02

GERMANY
ESI GmbH
Sales & Technical Headquarters
Mergenthalerallee 15-21
D-65760 Eschborn
Germany
T. +49 (0)6196 9583 0
F. +49 (0)6196 9583 111

ITALY
ESI Italia srl
Via San Donato 191
40127 Bologna
Italy
T. +39 0516335577
T. +39 0516335578
F. +39 0516335601

SPAIN
ESI GROUP HISPANIA, S.L.
Parque Empresarial Arroyo de la Vega
C/ Francisca Delgado, 11 – planta 2ª
28108 Alcobendas (Madrid)
Spain
T. +34 91 484 02 56
F. +34 91 484 02 55

SWITZERLAND
Calcom ESI SA
Parc Scientifique
EPFL / PSE-A
1015 Lausanne-EPFL
Switzerland
T. +41 21 693 2918
F. +41 21 693 4740

UNITED KINGDOM
ESI-UK Ltd.
1 Robert Robinson Av.
The Magdalen Centre
Oxford Science Park
Oxford OX 4 4GA
United Kingdom
T. +44 (0) 1865 784 829
F. +44 (0) 1865 784 004

SOUTH AMERICA

SOUTH AMERICA
ESI South America.
Av. Pedroso de Morais, 1619 cj.312
São Paulo
SP CEP 05419-001
Brazil
T./F.+55 (011) 3031-6221

ESI Group Headquarters
ESI Group
100-102 Avenue de Suffren
75015 Paris
FRANCE
T. +33 (0)1 53 65 14 14
F. +33 (0)1 53 65 14 12

NORTH AMERICA

USA
ESI North America
32605 W 12 Mile Road
Suite 350
Farmington Hills, MI
48334-3379
USA
T. +1 (248) 381-8040
F. +1 (248) 381-8998

USA
ESI North America
6767 Old Madison Pike
Suite 600
Huntsville, AL 35806
USA
T. +1 (256) 713-4700
F. +1 (256) 713-4799

ASIA

CHINA
ESI-ATE Holdings Limited
Room 16A,
Base F Fu Hua Mansion
No. 8 Chaoyangmen North Avenue
Beijing 100027
China
T. +86 (10) 6554 4907
F. +86 (10) 6554 4911

CHINA
ZHONG GUO ESI CO., LTD
Unit 401-404, bldg G,
Guangzhou Soft-Park No. 11, Caipin Road, Guangzhou Science City (GSC)
Guangzhou 510663
China
T. +86 (020) 3206 8272
F. +86 (020) 3206 8107

INDIA
ESI India
Indrakrupa #17, 100 feet ring road
3rd phase, 6th block,
Banashankari 3rd stage
Bangalore 560 085
India
T. +91 98809 26926
F. +91 80401 74705

JAPAN
Nihon ESI K.K.
Headquarters and Sales Division
5F and 16F Shinjuku Green Tower Bldg, 6-14-1,
Nishi-Shinjuku
Shinjuku-ku, Tokyo 160-0023
Japan
T. +81 3 6381 8490
F. +81 3 6381 8488

KOREA
Hankook ESI
157-033, 5F MISUNG bldg., 660-6,
Deungchon-3Dong,
Gangseo-ku,
Seoul
South Korea
T. +82 2 3660 4500
F. +82 2 3662 0084

SOUTH-EAST ASIA
ESI Group South-East-Asia
12, Jalan Dato Haji Harun,
Taman Tayntton, Cheras
56000 Kuala Lumpur
Malaysia
T. +60 (12) 6181014