

THE FINISH LINE

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2011 PROJECTS AT RMS

By Glenn Gaddis

Wow! What a Year! RMS shipped over 110 contracts this year and about 85% of them were booked AND shipped this year.

It has been a very interesting year too. We've shipped a large variety of equipment. Everything from Superchargers, Fan Rotors, Generator Rotors, Axial Compressors, Centrifugal Compressors, Steam Turbines, Expander Rotors, Lube Systems, Gas Systems,and the list goes on and on. Where else can you go and see such a diversification of machinery? We have successfully landed and shipped projects that most other shops won't even consider taking on, which has led to a much broader client list.

We have also been seeing a significant increase in what used to be the OEM only client base. Staffing in 2011 has increased over 30% with OEM-experienced help to meet the continuing challenges and demands of our customers. We finished up 2011 with the shipment of a 9.6 MW Vapor Turbine Genset, which included the refurbishment of a 4200 RPM Steam Turbine with new flowpath, new generator, gearbox, couplings, lube system and control panels. It was completed in 46 weeks after receipt of order.

What a great topper to an already awesome year!



RMS POWER SOLUTIONS

By Chot Smith

BREAKING NEWS for RMS Power Solutions ----- The Principals of Rotating Machinery Services Inc. have approved plans for an additional expansion to our service facility. During the first quarter of 2012, we will be breaking ground for a 60' X 150' high-bay assembly shop attached to the north side of our current facility. This addition will increase our capacity to 30,000 square feet. The new configuration will allow us to perform rotor work in one bay, continue to increase our machining capacity and capabilities in the second bay and move all assembly work to the new high bay which will add an additional 10 ft under the hook of a 30



ton crane. We will also be creating space for an abrasive cleaning facility and a dedicated area for non destructive testing.



As an update to our last newsletter, we have commissioned our new 52" X 240" engine lathe with the successful manufacture of an integral steam turbine rotor for a high profile project with an expedited delivery.

At RMS Power Solutions we are continually making an effort to improve our capabilities, capacity, and response times to better serve our customers.

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TURBOMACHINERY RULES OF THUMB

By Neal Wikert



Sealants

Permatex "Ultra Blue" Oil resistant RTV. Not high temperature.

Permatex Aviation Form-A-Gasket Sealant Liquid 3H – gasket sealant, non-hardening, on metal-to-metal joints

Dow Corning 3120RTV. – Red. Joint sealant for centrifugal compressors. Need to check temperature capability.

GE RTV60 – uses a catalyst. High temp RTV. Axial Compressor horizontal splits. Can be used on LP steam turbine joints. Highly recommended. Can be used with GE SS4004 Primer for improved adhesion.

Turbo R - Joint sealant for steam turbines horizontal joint.

Turbo 50 - Joint sealant for steam turbines horizontal joint.

Tite-Seal – Joint sealant for steam turbines.

"Silver Seal" – Some (limited experience) success on horizontal joints. Good for 950 deg. F/750 psi.

Cure time 2 hrs at 400 deg. F. 4-6 hrs @ 225 deg. F.

HYDROSTATIC TESTING OF STEAM TURBINE CASING

By Timothy Coull

When refurbishing a steam turbine, it is good industry practice to perform a hydrostatic test, or "hydro-test", of the casing when any changes bring into question its structural integrity or sealing capabilities. For example, turbine casings are generally hydro-tested when rerating to higher operating conditions, if any part of the casing is stress-relieved, or when the casing is weld repaired and/or machined.

Hydro-testing is designed to ensure that the casing can withstand the turbine operating pressures, is free of leaks and has adequate contact at the joints for sealing. A casing is isolated, blanked off, and pumped with liquid to a pressure designed to simulate operating conditions. This pressure is maintained for 30 minutes while the casing is inspected for leaks. Water is the most common working fluid because it is cheap and easy to obtain, dispose of and remove from the turbine. Hydro-tests are desired over air-tests because of the essentially incompressible nature of liquid. Since air is compressible, decompression requires the loss of a large volume of gas. High-pressure gas in a casing tends to want to rapidly expand, and if a crack were to initiate it would provide a path to do so and could potentially explosively rupture the casing. In a hydro-test, loss of a miniscule amount of water could result in total decompression, essentially eliminating the chance of explosion. Not to mention, it is also much easier to identify a leak with weeping liquid than it is with an invisible gas.

When designing for hydro-test pressure, API 612 calls for a 1.5X design factor, as well as a correction factor for deterioration of at-temperature casing mechanical properties listed in ASME Boiler and Pressure Vessel Code, Section 2. Let's take as an example a turbine casing made from cast ASTM A216 WCB that is operating at 550 psig and 725 °F. At ambient temperature, the allowable working stress of the material is 24.0 ksi, whereas the same at operating-temperature is 16.0 ksi. To calculate the minimum required hydrotest pressure, one would use the following formula:

$$(550 \text{ psig}) \cdot (1.5) \cdot \left(\frac{24.0 \text{ ksi}}{16.0 \text{ ksi}} \right) = 1237.5 \text{ psig}$$

Con't HYDROSTATIC TESTING OF STEAM TURBINE CASING By Timothy Coull

Hence, the minimum required test pressure per API 612 and the ASME Code is 1237.5 psig. Since the unit is to be tested independently of the process in which it is to run, blank plates must be designed to seal off any open flanges, including inlet, exhaust, extraction, or admission flanges, as well as leak-offs, drains, exposed joints, and seal bores. In multi-segmented machines experiencing different pressures, casings can be partitioned or tested as separate pieces. Each segment of casing should be tested to the worst-case combination of temperature and pressure experienced in that portion of casing. Blanks and partitions must be of adequate thickness to contain the pressurized fluid without failing. Where practical, tie-bolts may be used to mitigate excessive stress in a plate.

The test setup must also be designed to allow for filling and draining of the fluid and venting of air while filling. When filling a casing or portion of a casing with water or any other fluid, as much air as possible should be removed. Trapped air results in unreliable pressure readings. Also, in the event of springing a leak, excessive compressed air can hinder rapid decompression and can even rapidly propagate a crack, thus marginalizing the advantage of using an incompressible test fluid as previously outlined. Though the point of the test is to examine the integrity of the machine and highlight any potential flaws, it is desirable to find and repair them before they become even more of a problem.

CASE STUDY: SOLVING A CHRONIC E-520 NITRIC ACID EXPANDER VIBRATION PROBLEM

By Robert J Klova, PE

One of our customers has been experiencing chronic vibration on the thrust bearing (inlet) end of their Ingersoll-Rand E-520 tail gas expander. Inspection of the bearing housing area during a recent shutdown revealed severe coking of the bearing housing end seal, as shown in the Figure 1. It is not unusual for this area to run extremely hot, as it is adjacent to the high pressure (HP) casing seal, which can be prone to wear and excessive leakage. The HP seal is a long stepped honeycomb style with extremely tight design clearances, and tends to rub and wear over time. As the seal wears, 1200 degF inlet gas will leak past the seal and impinge directly on the end of the thrust bearing housing. The honeycomb seal can be seen in the figure.

It was suspected that the heavy coke deposits, while not causing significant damage, were acting as a third bearing, inducing unwanted forces into the rotor. To combat this problem, RMS recommended that a purge be added to the bearing housing seal, a modification reasonably performed in the field during the shutdown. As with many modifications, success depends upon properly designed and executed details:

- Add a sufficient quantity of purge air feed holes through the seal (a minimum of six per half), and make them as large as seal tooth spacing allows.
- Use a large enough purge air feed line to the bearing housing to avoid unwanted pressure drops.
- Key: Drill a pressure tap directly into the annulus around the seal to insure proper purge pressure at the seal location.

The modification was a success and reduced rotor vibration to a level suitable for long-term operation. However, the flow of purge air into the bearing housing resulted in an unwanted increase in misting from the lube oil console at higher purge pressures. After some trial and error it was found that operating the seal at 1.0 to 1.5 psig was effective in limiting vibration with only a minor increase in misting.

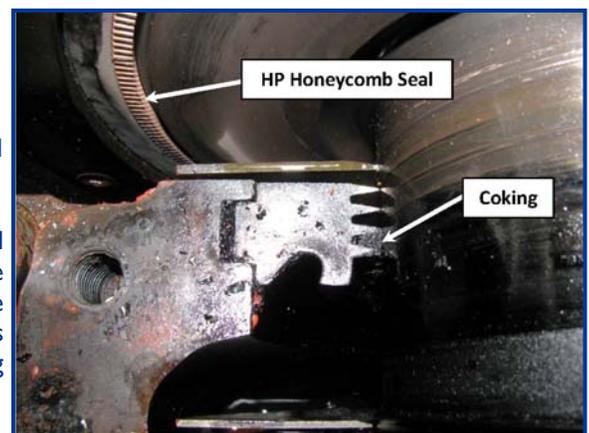


FIGURE 1

RMS OFFERS CUSTOMER'S PART KIT BOXES

By Robert Huffman

RMS is now offering to our customer's part kit boxes. These kit boxes are for the storage of consumable spares used during machinery overhauls. The kits are customizable as required by the customer and typically include the compressor's impeller eye seals, interstage shaft seals, shaft end labyrinth seals and bearing case oil wiper seals. Some users have elected to include the journal bearings, thrust bearings, soft gaskets and small hardware.



The kits can be taken to the machinery deck or to the overhaul shop to support the machinery overhaul. Then either inventory the kit and order replacement parts to replenish or send the kit box back to RMS for us to inventory and replenish for you.

Each part is preserved for long term storage within the kit box. The individual parts are labeled with the part number. The storage location within the kit box is labeled with the part number, item number and assembly number. A laminated assembly drawing showing the location of the part is included within the kit box.

Part kit boxes can be supplied for your compressors, steam turbines, expanders, power turbines and gas turbines.



RMS - SUPPLIER APPRECIATION GOLF OUTING

By Kevin Murphy

On Tuesday, September 27, 2011, RMS held their first Supplier Appreciation Golf Outing at the Green Pond Country Club. This event was to honor and thank RMS strategic suppliers who have helped deliver quality parts, in a timely fashion, enabling RMS meet our customer expectations.

This event was attended by 53 golfers and included 18 holes of golf followed by a buffet meal, awards and prizes. The dinner was attended by over 75 people including RMS employees and suppliers. The weather held up, the food was delicious and fun was had by all who attended.



RMS recognizes our strong supply base is an integral part of our business and being able to pay tribute to our joint successes just strengthens our commitment and continuing relationships.



RMS GIVES BACK !

By Kathy Ehasz

Not only do we put our customers, suppliers, and safety as our Number #1 priority, we also feel it is our duty to put our Community in the Number #1 ranking.

We at RMS have been blessed with a strong leadership team, experienced personnel, loyal customers, dedicated suppliers, another year at 0 accident-free, so the RMS Team enjoys giving back!

This year RMS was very active in participating in the Community, donating to charities, donating blood and establishing both a food and toy drive.

RMS graciously donated to the following charities in 2012:

American Cancer Society, American Heart Association, Movember, Nazareth Baseball Association, BEWBC – Nazareth Wrestling Association, United German Hungarian Oktoberfest, and Action for Animals.

Throughout 2012, staff members again donated blood 2 – 3 times for the Miller Blood Bank.

In September, Sydney Gross, Tony Rubino, Robert Klova and John Rubino entered the Lehigh Valley Marathon / Relay, which is a charity event hosted by VIA of the Lehigh Valley. Via of the Lehigh Valley is a non-profit human service agency that provides services for children and adults with disabilities like Autism, Cerebral Palsy, and Down Syndrome. Serving the community since 1954, Via's staff help individuals and families from birth through retirement focusing in Children's Services, Community Connections and Employment.

In November, the RMS team collected 123 lbs of food to supply to the Second Harvest Food Bank. The food was distributed to less fortunate families for the Thanksgiving holiday.

Robert Klova, VP – Engineering / Chief Engineer and his daughter Elyse ran the Turkey Trot held in Bethlehem, PA. The proceeds benefited the Historic Bethlehem Partnership: 19 Historic sites and 3 centuries of history.

In December, the RMS team hosted a "Toys for Tots" drive, to provide gifts for the Holiday to children ranging from newborn to 12 years old. Each employee brought in, not just 1 new toy, but at least 2 or more! What a heartfelt team we have here at RMS!

Each one of us recognizes the importance of giving back. We are blessed to work for an expanding company, work along side of team-oriented professionals, who work hard but remain humble, compassionate and enjoy volunteering themselves to help others. Thank you to the Management and RMS Employees for your continuing dedication to others!



RMS HOLIDAY PARTY

By Kathy Ehasz

The RMS Principals hosted a Holiday Party for the Staff on Friday evening, December 16th at the Green Pond Country Club in Bethlehem, PA. Fun was had by all! The night started off socializing and reacquainting with each others spouses and meeting the new ones. Jerry Hallman, President, Neal Wikert, VP and Bob Klova, Chief Engineer made speeches thanking the staff for a great year, recognizing the new hires for 2011, and introducing the plans for 2012.



Sydney Gross, Director— Steam Turbine Engineers, expressed appreciation on behalf of the staff to the Principals for their strong leadership, commitment and dedication to RMS.

The night went on with smiles, laughs and a lot of dancing! Thank you to the RMS Principals and employees for a great time!



STRUCTURAL ANALYSIS UPDATE—2012

By William Sullivan

As we enter into the new year, the structural analysis group at RMS is completing plans to increase our capabilities and decrease our turn-around times. To meet both of these ends we are replacing current 32-bit workstation with a larger and faster 64-bit workstation. This alone should dramatically increase our computational capabilities.

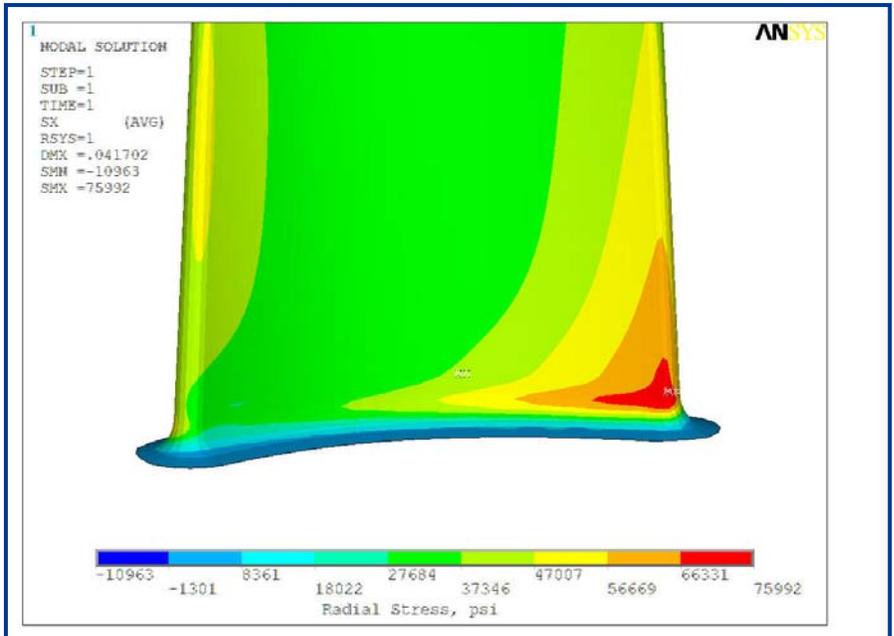
We also are continuing our strategy of continual improvement in the areas of computer program and macro development to further decrease turn-around time and to reduce sources of error inherent in the transferring data between the various programs and systems used to build, analyze and evaluate the various structures encountered in turbomachines.

In addition, we will be adding additional data on existing materials to our library of material properties and adding new materials as our range of turbomachinery applications continues to expand.

Finally, along with our current collection of analytical techniques, we will be using our enhanced analytical tools, both hardware and software, to continue our investigations into new techniques, particularly in the areas of shock loads and blade vibration.

I couldn't write an article without at least one plot! These are radial stress contours in an airfoil from an airfoil stacking analysis.

Best wishes for a happy and "reliable" New Year!



RMS WELCOMES

By Kathy Ehasz



TAMMY KACHURAK, CPA CONTROLLER

Tammy has joined Rotating Machinery Services, Inc. as our Controller. She has twelve years of experience in public accounting where she specialized in corporate taxes and managing small business accounts. She previously held management positions at Parente Randolph, KPMG and Beard Miller Company.



JAMES VANHORN DRAFTING / 3D DESIGN

Thirty Eight years of Turbo machinery design and drafting experience, with hot gas expanders, steam turbines, axial compressors and centrifugal compressors for the refining and petrochemical industry.

Previously help positions at Dresser-Rand, General Electric Oil & Gas, Conmec, Damper Design, and Ingersoll Rand.

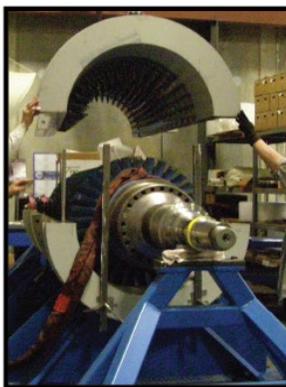
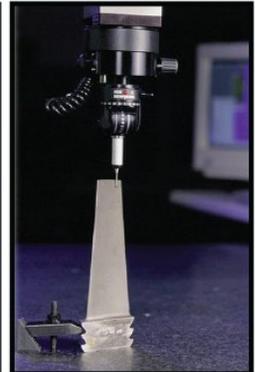
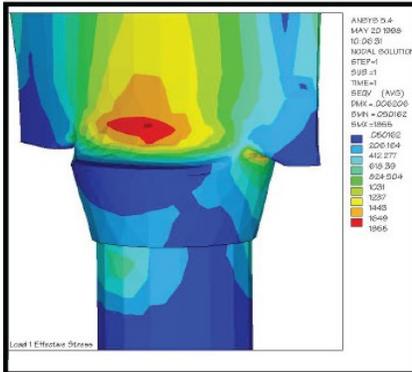
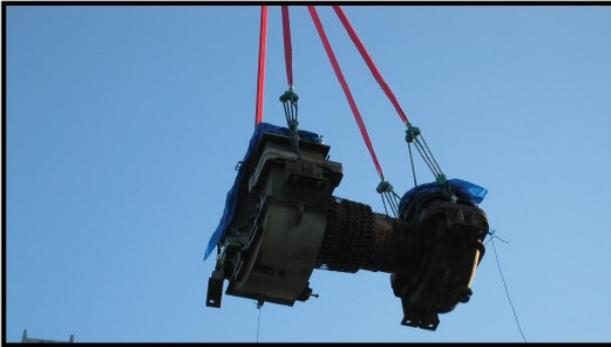


Axial Compressors



Rotating Machinery Services is backed by decades of experience in Axial Compressor design, analysis, manufacture and service. Our Key staff averages over 25 years experience.

Rotating Machinery Services is available to our customers 24 hours, 7 days a week. Visit our web site at www.RotatingMachinery.com to view all our capabilities.



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RMS EMPLOYEE HIGHLIGHTED

By Carol Hamm

How often does a mother get to bond with her son? Not too often since most mothers leave that up to dad. My son & I share a love for the outdoors that most mothers don't have with their sons and it is through the sport of hunting.

This year, I was fortunate enough to hunt with my son DJ for two successful trips. Our family treated our son to go on a Montana Elk Hunting trip with his Grandfather and myself. Three (3) generations of hunters traveling out west on a traditional horse back & horse drawn wagon hunt for elk & mule deer.

Does it get any better than this? We didn't get the elk but my son shot his first mule deer. He had bragging rights since he shot his 1st before I shot mine. His grand-father actually was with him when he shot it, he was so proud of the clean shot he made to take down this 8 point. How much prouder could we be? I finally shot this nice buck on the last day which was bigger than his 8 point. We came home to PA for the 2011 rifle season and once again I was able to take my son in the field with me for an all day Saturday hunt. We were blessed to both take a buck and share the day's events sitting on a stand.

Teaching your son about nature, sharing tips on how to stay focused on game and how nature reacts to man in their environment are keys to teaching our kids how to respect what God and nature gives us. It's not always about the trophies you take away, but the moments you share that create the memories to last a lifetime. This year, I was truly blessed and will always be grateful for the special time I was able to spend with my son & father. I will forever be grateful for the stars aligning that produced this spectacular hunting season & the game we harvested. Life is not about the breaths we take but the moments that take our breath away.

