



GNB Bugle

Vacuum Excellence Defined

September
2010

GNB is Involved in New Scientific Discovery By Mel Sattler, Quality/Shipping Manager

Overview:

In 1916, Albert Einstein predicted the existence of gravitational waves in his general theory of relativity, but until now no one has ever been able to detect these waves. Only since the 1990s has technology become powerful enough to permit detecting them and harnessing them for science. Currently, the National Science Foundation is funding a program to develop a system that will detect gravitational waves. The GNB Corporation built gate valves for this system in 1998 and now is helping to upgrade the system by contributing a set of chambers and accessories. This "Advanced Ligo" upgrade will increase the sensitivity used to detect gravitational waves. The new equipment will allow observation of inspiraling binaries made up of two 1.4 M neutron stars to a distance of 300 Mpc, and Neutron star - black hole (BH) binaries will be visible to 650 Mpc (one Mpc is 3.09×10^{22} meters). Direct detection of gravitational waves will confirm Einstein's vision of the waves, and allow a fascinating and unique view of cataclysms in the cosmos. In principal, the gravitational field of our universe is completely different from the magnetic field from which we now understand our universe.

Process:

The vacuum chambers built by GNB will house the laser from the interferometer. This laser is cleaned, split and travels 4 kilometers in each direction before it contacts a mirror and returns with the same frequency. When each laser returns, the deviations in the waves are then measured and the results are used to calculate gravita-

tional movement of the earth resulting from other celestial bodies. The sensitivity of the measurements is in the range of 1×10^{-20} of a meter. At this range, even the smallest foreign particle can cause interference; therefore each chamber has the strictest of contamination control requirements.

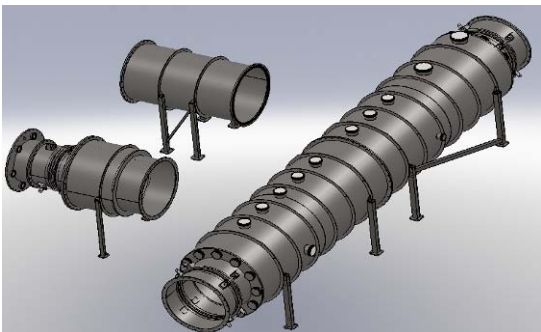
Today at GNB:

In the last few months, GNB has diligently prepared equipment and resources to fabricate these ultra clean vacuum chambers. GNB has leased 12,500 additional square feet where a class 8 clean room has been installed. Currently, a class 5 clean room is being installed inside the class 8. Additionally, GNB has purchased new vacuum testing equipment: mass spectrometer, vacuum ion pump, UV and violet light detection system, etc. The new equipment and clean room will allow GNB to assemble, weld and test all systems in a controlled environment which will nearly eliminate all contamination potential. Additionally, GNB has completed all designs for the vacuum chambers and these designs have been verified and approved by an outside Engineering



GNB's New Clean Room

firm. The challenges facing GNB to procure, fabricate and deliver such detailed components are extensive. However, they are also exciting, and allow GNB to have a small hand in scientific discoveries that may one day change how we view our world.



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New Vacuum Units Conversion Calculator

Have you ever wondered how to convert a leak rate of Torr x L/s to SCCM? Perhaps you have even tried to convert an outgassing rate of W/m² to mbar x L/(cm²/s). Vacuum unit conversions can be complex, and it is not easy to find good reference tables. However with the GNB Web-site, these conversions are fast and easy. We now have a vacuum unit conversion button right on our homepage. For vacuum conversions made easy just visit www.gnbvalves.com and look for this button.





Annual GNB BBQ By Amy Long, HR Specialist

2010 has brought many new faces to GNB. What an exciting time! It was great to have around 100 people at the annual summer BBQ. The kids are getting so big. It's fun to watch them grow up over the years. Some were just babies 10 years ago when I came to GNB. Chris Long, our Controller, was working and sweating hard at the BBQ flipping all the yummy burgers and hotdogs. The best food though was brought by the employees. We had egg rolls, lasagna, rice, incredible desserts, croissant sandwiches, salads, fruit, chocolate covered strawberries and much more. (Oh, did I mention extra delicious chocolate covered strawberries...?) You name it...it was there! The air was filled with laughter, hellos and screeches from the kids. Some were on the softball field, and others were playing soccer, volleyball, and badminton, or just relaxing under a tree in the shade. The classic events this year were the tug-o-war and the raw egg toss. Man! Eric Raymond, Engineering Supervisor and Pavol Lo-

jan, Assembler, are quite the team egg throwers. They must have been 100 feet apart before their egg finally cracked all over them. It was funny though to watch the little kids just throw their egg at a bystander. Well, they say egg is really good for your hair...lol! Tug-o-war is always fun and exhausting. It is like doing a 40 minute workout in 10 seconds. The weld shop really rocked this year. The girls would have won but Colleen lost a sandal and went down...I'm still cracking up about that one. It was an extremely awesome time to share with the employees and their families.



SEMICON West 2010

By
Tim Gates, International Inside Sales Manager

The GNB President, Ken Harrison, myself, and some GNB Sales and Marketing Partners (US Technologies West, J.F. Hurlbut Co., and JS Kim from Korea Multitec Corp.) were joined by several hundred exhibitors participating at SEMICON West 2010. The event was held July 13th – 15th at the Moscone Center in San Francisco, CA. SEMICON West is the flagship annual event for the global microelectronics industry.

This year's event featured a Photovoltaic/Solar segment where over 100 exhibitors displayed both traditional as well as new and emerging technologies for PV manufacturing. Alongside GNB's showcased valve and chamber expertise were companies with offerings from materials, cells, modules, subsystems and components for the solar energy industry worldwide.

As GNB continues to look to broaden its reach into ever ex-

panding global markets, this year's participation at SEMICON West was an outstanding and successful occasion to spread our *Customer Partnership Philosophy*.

GNB doesn't take the typical view that customers are just customers. We view our customers as long term partners. We see ourselves as an extension of our customers' own engineering and manufacturing floor.

The people at GNB work each and every day to act as an extended customer team member to meet the quality, on-time, and budgetary objectives of the project.

This year's SEMICON West was a fantastic event. We look forward to our participation next year.



GNB'S Newest Addition By Amy Long, HR Specialist

Reese Anne Hyland
Born August 14th, 2010
7 pounds, 5 ounces, 19 inches
Born to Alexis and Greg Hyland
Arrived 10:04 am



Vacuum Trivia By Bruce Powell, Retired

Diffusion Pumps are still widely used for many rough and high vacuum based processes due to their high throughput. They use hot oil vapor sprayed downward through water cooled walls to trap gas molecules. The gas particles are pumped out of the system by a mechanical pump.

The mechanical backing pump must be able to move the gas load the diffusion pump is compressing into its foreline. Therefore, the gas load of the mechanical pump must match the gas load of the diffusion pump. In equation form, Q (mechanical pump) = Q (diffusion pump). It is important to size the backing pump so that it operates below the critical forepressure. Exceeding the critical forepressure allows fluid vapors to move into the chamber and high vacuum valve.

As an example, let's look at a diffusion pump with a 95,000 liters/second pumping speed in air. The operating speed is 1×10^{-6} Torr. The critical forepressure stated by the pump manufacturer is 360×10^{-6} Torr.

As stated above: Q (mp) = Q (dp).

We know that Q (gas load) = S (pump speed) \times P (Pressure).

Therefore, SP (mp) = SP (dp)

$$S$$
 (mp) = SP (dp) / P (mp) = (95,000 L/S) \times (1×10^{-6} Torr) / (360×10^{-6} Torr) = 263.8 L/sec.

Mechanical pump speeds are generally specified in cubic feet per minute (CFM) and not L/S. So, S (mp) = (263.8 L/sec) \times (60 sec/minute) / (28.4 L/Ft³) = 557.5 CFM. Note that there are 28.4 Liters in a cubic foot. The diffusion pump manufacturer usually states the minimum size backing pump needed. In this case, the manufacturer stated that the recommended minimum backing pump size is 500 CFM. So, our calculation agrees with it. However, in practice the minimum backing pump size doesn't leave any margin, so designers often reduce the forepressure tolerance. If we reduce the critical forepressure tolerance to 200×10^{-6} T, the above formula will result in a minimum backing pump size of 1003.5 CFM. Designers would specify a 1000 CFM mechanical backing pump in this case.

Look at GNB's Newest Machine By Chris Long, Controller

In August, GNB Corporation added another CNC Horizontal Boring Mill to our machine shop. The machine is a new Fermat WFT 13 with a Fanuc control. The travel on the machine is 118 inches x 79 inches. This machine coupled with our TOS WQA 13 and our Hyundai KBT 13 will increase our large machining capacity by 50%. Feel free to come in sometime to see our new baby in action!



Vacuum System Surface Finishes

By
Ken Harrison, President

When building vacuum chambers, valves and other vacuum components, one of the questions that we always ask is, "What is the surface finish?" There are many possible options for material surface treatment, and the right finish can have a significant impact on the cost, appearance and functionality of the end product. In this article, I will describe the types of finishes that are available.

The first consideration is the edge surface condition, which is determined by how the material is cut. Some of the possible cutting methods are:

1. Oxy acetylene cutting
2. Plasma cutting
3. Laser cutting
4. Waterjet cutting
5. Abrasive cutting
6. Saw cutting
7. Machined edges
8. Ground edges



Waterjet Edge Quality Designations

I have listed these in the approximate order from the roughest and least visually appealing finish to the most precise and costly processes. The type of cutting process selected is a trade-off between aesthetics, tolerances and price. A common finish for us is waterjet cutting. For many applications, this is acceptable without further processing. The slower the cut, the better the finish that can be achieved with waterjet cutting. The edge quality can be specified by Q numbers as the above picture demonstrates.

In addition to the edge surfaces, the flat plate surfaces can vary greatly. Some of the options are as follows:

1. Number 0 finish is hot rolled annealed (also known as HRA or a mill-scale finish).
2. Number 1 finish is hot rolled, pickled and passivated.
3. Number 2D finish is cold rolled, annealed, pickled and passivated.
4. Number 2B finish, this is 2D plus a cold rolled bright finish between polished rollers. The finish is smooth and highly reflective. This finish is available only on material that is less than 1/4 inch thick.
5. Number 2BA is bright annealed finish, nearly a mirror like finish.
6. Number 3 grained finish is plate that has been sanded in a uniform direction with 80-100 grit.
7. Number 4 grained finish is plate that has been sanded in a uniform direction with 150 grit. It is not highly reflective, but a good general finish for vacuum components.
8. Number 6 finish is plate sanded with a rotating abrasive cloth. "Satin Blend" is an example and the finish is non-directional.
9. Number 7 finish is buffed and highly reflective, but it has some fine buffing scratches.
10. Number 8 finish is a true blemish-free mirror finish.
11. Bead blast finish is plate that has had the scale and imperfections removed by grit blasting. It is a common and inexpensive way to obtain a uniform finish.



Bead Blasted Vacuum Chamber

**Vacuum System Surface Finishes
By
Ken Harrison, President**

- 12. Blanchard ground finish is used to make the material flat. It will have swirled grinding marks in a uniform pattern.
- 13. Machined all over is a finish that is produced by machining operations such as milling and turning. The pattern of the machining marks is determined by the type of machining process and also the types of cutters that are used. Generally this is a uniform, attractive finish, but not highly reflective. The roughness of the finish can be specified by an Ra number which is the arithmetic average of the peaks and valleys of the surface. One Ra equates to one millionth of an inch (for metric units the finish is called out in micro-meters which equates to 40 micro-inches). The Ra designation has replaced the older callout of RMS (meaning root-mean-squared). A conversion between RMS and Ra values along with sanding grits is as follows:

Ra (μ inch)	RMS (μ inch)	Ra (μ meter)	RMS (μ meter)	Grit Finish
4	4.5	0.10	0.11	Mirror
8	9.0	0.20	0.23	400
16	18	0.41	0.46	240
32	36	0.81	0.91	180
63	71	1.60	1.80	120
125	141	3.18	3.57	36
250	281	6.35	7.14	NA
500	560	12.7	14.3	NA
1000	1125	25.4	28.6	NA
2000	2250	50.8	57.2	NA

- 14. An electro-polished finish is a shiny finish that is obtained by electro-polishing. It will still show the marks of the other surface preparation. Electro-polishing commonly is done after fine grit blasting, #4 graining or on a 2B finish.
- 15. A lapped finish is a process to create a flat part with a finish of Ra 8 or better.

A summary of typical surface finishes by manufacturing methods is:

Process	Roughness Height Ra (μ inch)									
	2000	1000	500	250	125	63	32	16	8	4
Flame Cutting	-----XXXX-----									
Waterjet	-----XXXX-----									
Sawing	-----XXXXXX-----									
EDM	-----XXXXXXXXXXXX-----									
Milling	-----XXXXX-----									
Turning	-----XXXXX-----									
Laser	-----XXXXXXXXXXXX-----									
Grinding	-----XXXXXXXXXXXXXXXXXXXXXXXX-----									
#4 Grained	----XXX---									
Electro-Polish	-----XXXXXXXX-----									
Lapping	-----XXXXXXXXXXXXXXXX									

Introducing Vaccum One By Scott Dix, Sales Representative

Vacuum One is pleased to be a new sales representative for the GNB Corporation. We are a manufacturers' representative group headquartered in Chicago, IL. The company was founded in 1998 by Scott Dix, and our territory includes Illinois, Wisconsin, Minnesota, Michigan, Indiana, Missouri, Kansas, Iowa, North Dakota, South Dakota, and Nebraska.



Vacuum One has over 35 years experience in the field, and it represents vacuum industry leaders that offer the highest quality products and solutions, as well as superior customer service. We take pride in taking care of our customers and offer products which include turbopumps, vane pumps, dry pumps, vacuum gauging, cryopumps, closed-loop cryogenic refrigeration, standard and custom vacuum

hardware, valves, baffles, getter pumps, surface metrology equipment, ion pumps, ion sources, power supplies, mass flow controllers, and complete deposition systems.

Vacuum One feels fortunate to partner with GNB, and we are excited about the opportunities we see in the Midwest for GNB products and solutions. We have a very diverse customer base that includes large national research labs, solar, industrial, vacuum furnace, glass coating, thin film and many others.

We anticipate that we will enjoy many years of success with GNB, and we look forward to meeting everyone! Our new Web site will be up soon, so please take a look at www.vacuumone.com to learn more about our company. Again, we look forward to working with all of you!



Safety Is Everyone's Business By Russ Hedman, Plant Manager

Safety First! Yes at GNB this is a way of life. There are many hazards associated with metal fabrication and general manufacturing. Our safety awareness and prevention practice's involves everyone. This safety program centers on a daily safety meeting

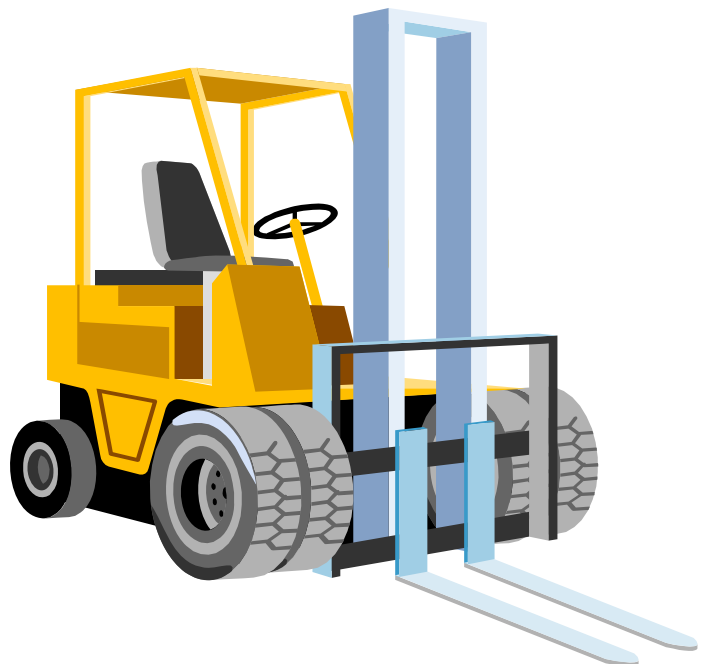


for all shop employees. We discuss projects going on throughout the shop and specifically the safety issues that surround those projects. This includes material handling, forklift operation, crane use and rigging safety practices. We have safety training for

our machining, welding and other fabrication operators. We also have regularly scheduled safety committee meetings and plant safety inspections. Our processes have now been re-written to incorporate safety elements as part of our effort to elevate the safety awareness company wide. We believe that safety in the work place has the highest priority. The more we talk about safety the fewer safety related incidents will occur. Below are two Web sites that pro-

vide excellent information about safety not just for the workplace but in everyday life.

<http://osha.gov> <http://www.cdc.gov>



Meet Don Lenkiewicz, Buyer
By,
Amy Long, HR Specialist

1. What city were you born in? **New Haven, Connecticut at Yale University Hospital. I consider myself a Yale alumni.**
2. Where did you grow up and what was it like there? **Connecticut (beautiful state, lots of American history), upstate New York (long cold winters with lots of snow), and San Jose, California (like the Sacramento area, just cooler summer temperatures and more traffic).**
3. As a child, did you have pets? **I did not have any pets as a child, but I now have 2 Golden Retrievers**
4. What did you enjoy doing as a child? **Playing with friends, going on family vacations, and camping in upstate New York.**
5. What is your favorite outdoor activity? **Anything with my family, going on long drives either in the car or on the Harley, exploring new areas, and barbequing.**
6. What were some of your first jobs? **Part time jobs included working in specialty auto parts stores which fed my addiction to tinkering on and restoring old cars.**
7. Are you married? Any children? **Married for 19 ½ years to my wife Trish; and I have an eleven year old daughter, Larissa.**
8. What are some favorites? (color, food, ice cream, book, movie, song, sport, etc) **Color - blue, Food - pizza and Mexican food, Ice cream - chocolate, Book - ???, Movie - any good action movie, Song - all classic rock and roll, Sport - Professional Hockey and all the school sports my daughter competes in: volleyball, basketball and track.**
9. What things do you find yourself doing that you said you'd "never" do. **I said I would never change a baby diaper, but that changed very quickly when my daughter was born.**
10. Tell me about a memorable moment in your life; a time you will never forget. **The day my daughter was born.**
11. What great historical events you have experienced in your lifetime? **Man landing on the moon (watched it on TV in elementary school), Bay area 1989 earthquake (I was there), 1980 USA Olympic Hockey Team beating Russia for the Gold Medal, Gasoline shortages in the 70's (worked part time at a gas station in the late 70's, 1st job, so I would not have to wait in line to buy gas) and the Gulf War.**



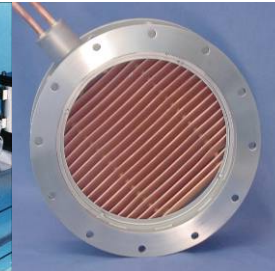
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