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Marketing communications plan for L.E. Jones company Menominee, Michigan

John H. Cantwell

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A MARKETING COMMUNICATIONS PLAN
FOR L. E. JONES COMPANY
MENOMINEE, MICHIGAN

BY
JOHN H. CANTWELL
GREEN BAY, WISCONSIN

AN APPLIED MANAGEMENT DECISION REPORT
PRESENTED TO THE FACULTY OF CARDINAL STRITCH COLLEGE
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
MASTER OF BUSINESS ADMINISTRATION
JANUARY/FEBRUARY/MARCH/APRIL 1992
A MARKETING COMMUNICATIONS PLAN
FOR L. E. JONES COMPANY
MENOMINEE, MICHIGAN

by
John H. Cantwell
MBA 2-09

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Presented to the Faculty of Cardinal Stritch College
in partial fulfillment of the requirements
for the degree of
Master of Business Administration
January/February/March/April 1992
This committee has approved the Applied Management Decision Report of John H. Cantwell

Paul Michaels, Case Study Advisor

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ABSTRACT

The author researched the feasibility of improving marketing communications for L. E. Jones Company of Menominee, Michigan. Based on career experience and scholarship gained through the Cardinal Stritch Master of Business Administration program, the author was able to identify the problems facing the firm, analyze the marketing communications needs, recommend various alternatives, assist in the selection of alternatives, and create the actual advertising and sales support materials. These improvements in marketing communications will permit the firm to more confidently pursue new business in an increasingly competitive market.
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ACKNOWLEDGMENTS

The author would like to thank the following individuals for contributing their time, effort, and consideration toward this report:

Carol Cantwell, wife
Cindy Cerro, Cardinal Stritch College student representative
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James De Lorme, business partner
Doug Dooley, L. E. Jones Company engineer
Tera Johnson, Cardinal Stritch College P.M.A. representative
Joe Kane, vice president of Diesel and Gas Turbine Publications, Inc.
Paul Michaels, Cardinal Stritch College case advisor
Don Mick, L. E. Jones Company sales manager
INTRODUCTION

In April of 1990 the author was creative director of the Green Bay, Wisconsin firm, Gladstone Communication Services which will hereafter be referred to as Gladstone. Gladstone was contacted by Jack Bennett, president and chief executive officer of L. E. Jones Company of Menominee, Michigan. Gladstone had, for several years, provided L. E. Jones with a variety of services including the creation of product video programs, public relations press releases, and the writing of promotion letters to prospective customers.

Bennett said that the firm experienced a turn-around within the past few years, although he would not release financial statements. Since he had been put in charge on September 1, 1987, the firm increased its market share from 40% to about 45% of the North American market, and decreased its defect and scrap rate from 10% to less than 2% in two years.

Bennett was satisfied that the firm was headed in the right direction in terms of its financial management and with its quality programs, but was concerned about the increasing competition in his industry and wished to study improved marketing communications as a way to strengthen his firm's position. He stated that he was also uncomfortable with the image of his firm. Bennett stated that current printed pieces including stationery, envelopes, cards, mailing labels, forms, product labels, and brochures had a "disconnected" look and he was
concerned about how his firm was perceived. He thought that the public might be getting a mixed or confused message due to the haphazard use of the logo and logo typography, and the "jumble" of printed pieces that the firm was using.

Bennett also expressed concern that there was no control over how the firm's logo was being used. He said too many people in the firm were buying printing and "everything looked different." With the steady growth of the firm, there was an increase in the number and complexity of items being printed. He knew his firm was too small to have a full time staff devoted to creating these pieces, but felt that improving his firm's corporate identity was important.

Mr. Bennett was unsure if his firm should attempt any trade advertising or if he needed sales promotion materials and what form they might take. He said he was not a believer in advertising for engine parts manufacturers and was even less sure of the usefulness of sales promotion literature as a tool in generating new business.

As a result of this and other meetings, Bennett contracted with Gladstone to determine the feasibility of enhancing corporate marketing communications, corporate identity and for the creation of sales support materials for L. E. Jones Company.

The author selected this case as the subject for his Applied Management Decision Report because it involves
comprehensive issues of an organization requiring problem analysis, identification and resolution.
CURRENT SITUATION

The Product

L. E. Jones Company manufactures engine valve seat inserts. Valve seat inserts are used in a reciprocating engine's combustion chamber. The function of an insert is to act as a seal for the intake and exhaust valves during the compression cycle and, thus, are subject to intense heat and wear. Inserts can be made of a variety of alloys depending on the engine requirements but are usually very hard and can withstand temperatures from 900°F to 1300°F. The primary consideration of the purchaser is that the insert be the best quality to prevent engine problems.

Valve seat inserts require special alloys, perhaps more than any other engine part, because the operating environment is the most hostile. Metallurgical engineers of the L. E. Jones Company work with engine builders throughout the world and assist them in developing the proper alloy and valve seat design for their particular engine.

The company produces cast and wrought valve seat inserts in a wide variety of alloys from stellites to iron base materials and will specially formulate alloys for particular manufacturer applications where the metal alloy specifications have been developed by the engine builder.

Valve seat inserts begin in the L. E. Jones Company foundry. The exceptions are wrought valve seat inserts which are machined from bar material. The process begins with the molding operation. Heat forming machines produce
pancake-shaped molds from resin bonded sand. Each mold contains from four to dozens of cavities. Several molds are stacked on top of one another and pressed together to insure flatness. The stacks are transported by special conveyer to the furnace area where they are compressed to receive the poured metal.

A wide variety of nickel, cobalt and exotic corrosion resistant alloys are cast by the L. E. Jones Company. The product is produced by melting selected raw materials in electric induction furnaces. Chemistry control of insert alloys is provided by a vacuum emissions spectrometer. This instrument possesses both the speed and the flexibility necessary to permit heat analysis to be made prior to pouring. Shortly after each pour, sample castings are tested (radiographed) with a 250 kV X-ray unit to detect and correct any internal problems, such as gas porosity.

The Market

There are only about 30 potential customers in the U.S. and 65 worldwide. Valve seat inserts fall under the commodity product definition of an engine part. That is, they are ordered in large quantities under long term contractual agreements. These contracts usually contain price ceilings from year to year prohibiting the supplier from increasing prices.
Industry Attitudes

According to Bennett, the L. E. Jones Company enjoys a good reputation in the industry and is ranked as the largest North American producer of valve seat inserts. This is a very price sensitive business so costs must be kept in check. With the advent of just-in-time inventory systems, strict delivery schedules are also a major consideration.

The barriers to entry into this market are high. The shell molding techniques used by L. E. Jones were developed by the firm (Gwartney and Stroup 1987). Although there are no patents protecting the process, much of what is known about valve seat insert manufacturing is known only by a few engineers at the firm and at their main competitor, Winsert, Inc. of Marinette, Wisconsin. Winsert was started by a number of former L. E. Jones engineers in 1981.

The Customer

The customer for engine parts is usually a buyer in the corporate purchasing department who, working closely with the engineers who designed the engines, decide on their outside suppliers. The purchase of this type of product is a decision so important that it may take two to three years of regular contact by the supplier for any substantive talks or negotiations to evolve. The customer is not only greatly interested in the quality of the
product, but also in the supplier's ability to meet delivery deadlines.

L. E. Jones has, in the past, relied on its long history of innovation to keep and acquire customers. But with the new global market emerging, the characteristics and needs of the customer are changing.
IDENTIFICATION OF THE PROBLEM

Jack Bennett, president of L. E. Jones Company, contacted the author, a marketing communications consultant, to analyze his firm’s market identity in the marketplace and make recommendations to improve it. Bennett took this step because he was concerned with increasing competition and the perception that the firm could lose market identity in the automotive parts business. This concern was based on observations made by employees of the firm and through contact with engineers and buyers from current customers and prospects. There was also a threat from foreign parts manufacturers who were attempting to enter the North American market.

Bennett stated in the initial meeting that, "Every manufacturer of engines knows about the L. E. Jones Company" (personal conversation). It is this type of statement from a company executive that makes the job of a marketing communications consultant very difficult. It has been the author's experience that a manager's perception of the customer attitudes is rarely realistic.

The author analyzed the current corporate identity, and the advertising and promotion strategies and addressed the following:

1. What was the firm currently doing in advertising and promotion and how was the firm perceived in the marketplace?

2. What were the alternatives available in terms of marketing mix and method?
3. Would improved public relations efforts benefit the firm?
4. Recommend a budget for any advertising or promotion projects.

Definition of Terms

Several terms should be defined to aid the reader in following this report.

Advertising - those display advertisements created for and placed in industry trade publications and technical journals.

Advertising Specialties - gift items such as pen and pencil sets on which the company identification is printed or engraved.

Corporate Identity - the business appearance which includes the firm's logo, slogans, and graphic standard which is used constantly in its advertising, its ad specialty items, and its sales promotion items.

Sales Promotion - brochures and catalogs (also called collateral materials) that are either mailed or hand delivered to prospective customers.

Market Identity - how the buyers of a particular product perceive the seller.

Marketing Communications - brings all these areas together and, for the purpose of this report, will be the umbrella term to cover all the tools used by L. E. Jones to promote its products.
Background Of The L. E Jones Company

Founded in 1941, the L. E. Jones Company is located in Menominee, Michigan, U.S.A. Its plant and office complex exceeds 60,000 square feet and contains a modern shell mold casting foundry, complete machining and heat treating facilities, a fully equipped metallurgical laboratory, and a sophisticated inspection and control capability. At one time it manufactured a variety of cast products for the engine industry. Now it has one primary product: engine valve seat inserts.

Pierce and Robinson (1991) would describe the firm as one that pursued a concentrated growth strategy by focusing on a specific product and market combination. Concentrated growth is the strategy L. E Jones successfully used to direct its resources to the profitable growth of a single product, in a single market, with a single dominant technology. The main rationale for this approach, sometimes called a market penetration or concentration strategy, is that the firm thoroughly develops and exploits its expertise in a delimited competitive arena like the engine parts industry.

L. E. Jones Company is a privately held corporation. At the time Bennett contracted with Gladstone, the firm was preparing to celebrate its 50th anniversary in 1991.
ANALYSIS OF THE PROBLEM

L. E. Jones Company Positioning

The company considers itself the leading North American manufacturer of valve seat inserts and wishes to protect that lead. None of the firms that manufacture valve seat inserts make available their financial statements. L. E. Jones bases its leadership claim on feedback from customers and on its own market share estimates. The firm's founder, L. E. Jones, actually developed the valve seat insert in the early 1940's and this fact has helped the firm in its marketing efforts over the years.

Current Advertising And Sales Promotion

The firm is not currently placing advertising nor is it involved in any sales promotion efforts. No marketing plan had ever been devised or implemented by the firm. Mr. Bennett has long felt that since the firm developed the valve seat insert, customers should be aware of the existence of the firm and that should be all the marketing that is needed. It has become clear to Mr. Bennett that this theory could result in serious problems in the long term.

Corporate Identity

The existing L. E. Jones logo is a circle symbol with lines crossing vertically and horizontally at the center. It is an adaptation of the engineering representation for the engine valve. This symbol has a certain recognition
value to persons familiar with engine engineering
drawings. For this reason, it is considered a meaningful
icon. The trademark is not registered with the United
States Patent and Trademark office nor is it registered
with any state agency.

The accepted opinion of marketing communication experts
is that a firm's logo is a very important symbol (Carter,
1982). With continued use over time, the logo comes to
symbolize the firm. To change a logo or modify it can
have good or bad results depending on the care and
planning that go into any change. Over the years, several
variations of the logo had been used on printed pieces,
signs, and on stationery. Several pieces of artwork were
being used for printing reproduction. Much detail and
consistency had been lost and it was not clear if any
original artwork even exists.

**Sales Promotion Materials**

In the early 1980's, L. E. Jones Company had a
corporate capabilities brochure developed by a marketing
communications firm. This eight page, four color brochure
highlighted the design and manufacturing skills of the
firm. In terms of design, the brochure was laid out in a
fashion that presented the manufacturing process from
design through pouring, casting, heat treating, machining
inspection and shipping. The brochure included various
color photographs of these steps.
The author noted three areas that made the brochure obsolete.

First, the clothing and hair styles worn by those pictured were out of fashion and dated the piece. While appearing to be a minor problem, dated promotional pieces can have a negative impact on readers because they give the impression that the advertiser is either out of touch with the times or is handing out old literature. Neither of these impressions is acceptable.

Second, several of the individuals in the photographs were no longer with the firm. While, at first glance, this might seem to be an insignificant factor, it was mentioned many times by those individuals who use the brochure in sales calls. They simply did not feel comfortable handing out a brochure that was nearly ten years old.

Third, the strengths of the firm noted in the brochure's copy were of questionable relevance (even at the time of publication) and certainly were of minor importance in the 1990's. Accomplishments like the firm's commitment to Statistical Process Control, Quality Programs, and adherence to their customers' Just-In-Time delivery requirements are now very important issues. These issues were not known or considered important when this existing brochure was created.
Technical Support Materials

In the area of technical information, the firm has not recently prepared any materials which could be sent to customers or prospects. These materials might include descriptions of the various alloys offered by the firm, examples of the applications in which the different alloy compounds might be used, technical bulletins that would describe a valve seat insert and the role it played in the engine and in the engine design process, and characteristics of the metallurgical compounds.
POTENTIAL SOLUTIONS

Before any attempt is made to solve an industrial marketing problem, one must understand the nature and scope of what is to be accomplished. The challenge for the author as marketing communications consultant is not to determine if the current approach is adequate. Mr. Bennett has made that decision. He stated he was ready to embark on a plan to improve the firm's identity and to attract new customers through advertising and promotion.

The issue at hand is researching alternatives available to management for solving marketing communications problems, and assisting them in their decision making process.

Marketing Research Study

A proven method of ascertaining industry attitudes and opinions is through a marketing research study. Marketing research is the controlled collection and analysis of information and data relevant to a particular marketing situation facing a firm. It is not uncommon for a firm to conduct marketing research on a regular basis. This enables managers to keep track of opinions and trends in the hopes of making better planning decisions (Kotler, 1988).
Logo, Slogan And Corporate Identity

(Graphic Standard)
The purpose of the new logo, identity and sales support materials is to present a consistent image which works together. A new graphic standard would involve redesigning the letterhead, envelopes, mailing labels, packaging and many other items. Research conducted by the author and personal experience with industrial marketing pointed toward the creation of a graphic standard for L.E. Jones (Murphy and Rowe, 1988). A designer could incorporate graphic elements into a treatment that would assure the consistent use of the logo, slogan, and typography (Carter, 1978).

Sales Promotion Literature

Two of the more common tools used by firms involved in business-to-business commerce are product catalogs and corporate capabilities brochures (Oglivy, 1983). Product catalogs are more specific in nature because they concentrate on describing the product(s) that the firm is selling. These catalogs would typically include product descriptions, photographs, drawings, performance charts and graphs and technical information. These catalogs are the type most likely to be retained by the potential customer as they contain useful product data that can be referred to as the buying decision progresses.

Corporate capabilities brochures are intended to present an overview of the firm and are more general in
nature than the product catalog. Capabilities brochures usually include pertinent facts about the founding and history of the firm and the philosophy of the firm, among other elements.

This type of brochure is less specific than the product catalog. If photographs or illustrations are included, they would concentrate on plant and people.

Trade Advertising

Another marketing communications option for the firm is advertising in trade publications. The list of potential publications is quite small since the market is limited. Although this would seem to be an ideal tool in reaching potential buyers, L. E. Jones has historically done little trade advertising. Their reason was there was, "not much to tell potential customers" (personal conversation). The product line was limited to one item and that did not provide much substance for a media ad campaign. However, other firms in the same engine parts business had, from time to time, used trade magazines and product directories to tell their stories.

Business Marketing (1987) reported that the average advertising budget for firms producing automotive parts is 1.1% of sales. Financial information about the firm is confidential, but the author estimated annual sales to be about $35 million. Using the 1.1% average noted above, a budget of $38,500 would be appropriate.
Reprint Of Full Color Trade Advertisement

One of the services offered by trade publishers is the reprinting of articles and advertisements which appeared in their issues. This is important in this case because of the low cost. It would be appropriate that any ad be designed and written in such a way that, if reprinted, it could be used as a handout brochure. This low cost piece could serve many purposes, including distribution to employees, customers, local media, and at trade shows.

Technical Specifications Binder

When one launches a marketing communications improvement project, the primary step is to identify the audience - the customer. What does the person making the purchase decision want? In order to answer these questions, one must delve deeply into the business to find answers about the customer. In the case of L. E. Jones Company, their customers first want information. But the question is, what kind of information?

A common method of compiling and presenting complicated technical information is a three-ring binder system of tabbed sections. A three ring binder system could be developed that would present the firm's products and services in four sections: Alloy Specifications, Manufacturing Facilities, Quality Programs, and Technical Information. A description of the section's contents follows.
Alloy Specifications Sheets

The firm has developed more than thirty valve seat insert alloy compounds. Because there are many uses to which engines are put there are different levels of heat build-up and wear. For this reason various compounds have been developed. Over the years, twelve have become the most popular and are considered by industry to be the standards. These compounds possess various characteristics including their application, nominal chemistry, hot hardness temperature measurements, and thermal expansion coefficients. The problem is, how does L. E. Jones Company tell potential customers about these alloy compounds in a concise, easy to read and easy to file manner?

After researching methods of arranging and presenting technical information (Berry, 1981), the author presented the option of creating individual sheets that would include all the pertinent information as well as microscopically enhanced photographs of alloy grain structures.

Technical Information

Most engine manufacturers do not manufacture their own inserts nor are they familiar with the design, alloy compounds, of specifications of inserts. This section would be intended to familiarize engineers with the valve seat insert and the terminology. It would include information on the four basic compounds (iron base, cobalt
base, nickel base, and wrought), a page on insert design nomenclature, a page on nominal tolerances, a page on application notes, and information of the installation of inserts.

Quality Programs

With today's penchant for establishing quality programs, it would be natural to include some information about the firm's success at reducing scrap and defective parts. Since the firm's customer base is diverse and includes automotive, heavy duty diesel, and aircraft industry, the quality systems is designed to meet the most stringent of industry standards. This section of the technical binder might describe those quality programs.

Manufacturing Facilities

Many customers ask potential suppliers for a list of their machining equipment and a description of their manufacturing facilities. This information is helpful in determining if the manufacturing, quality, and delivery claims a supplier makes can be backed up. While this information is often considered confidential, in many cases it must be divulged in order to be considered. It was recommended by members of the L. E. Jones sales department that this would be a helpful section to be included in the binder system.
Jack Bennett expressed an interest in creating a brochure that would center around a photograph of all the employees and retirees. Mr. Bennett thought that this would be a good public relations piece that could be given to each employee and retiree as a, "thank you for a job well done." The brochure could also be used as a handout given to visitors to promote the goodwill that Mr. Bennett knew was felt by all his employees.

The fiftieth anniversary of a business is an important event. The author presented the option of creating a memento or gift item be designed and produced as a goodwill gesture and thank you. These could be given to employees and guests, and mailed to current and potential customers.
RESOLUTION OF THE PROBLEMS

After lengthy discussions with Jack Bennett and others from L. E. Jones Company, and based on the alternatives outlined above, it was decided that the firm would pursue several major improvements in its marketing communications. A budget was developed and presented to the firm in order to assist officials of L. E. Jones with their selections (Table 1). The actual choices were made by Mr. Jack Bennett. He deliberated for several days before contacting the author with his selections. As an outsider, the author was not a party to this final decision process.

Table 1
L. E. Jones Company
Marketing Communications Budget
April, 1990

1. Marketing research study $ 6,000.00
2. Logo, slogan and corporate identity 5,000.00
3. Corporate capabilities brochure 21,000.00
4. Trade advertising 7,500.00
5. Reprint of trade advertisement 1,200.00
6. Technical specifications binder 2,500.00
7. 50th anniversary brochure 4,500.00
8. 50th anniversary gift item 6,000.00

Total $53,700.00
After review of the recommendations and the budget, Mr. Bennett chose $50,000 as the amount he was willing to spend during the first year. No budget was established for subsequent years.

**Marketing Research**

It was recommended by the author that a marketing research study be conducted to determine industry attitudes and expected trends. To support the merit of the study, the author prepared a sample questionnaire which was presented to L. E. Jones Company officials (See Appendix A). At this presentation, the author attempted to explain how much valuable information could be gained from this type of study, particularly since we knew we could reach the entire population.

This study would be developed, written, printed and tested by Gladstone. It would be sent out under the name of Center for Strategic Marketing, the marketing research division of Gladstone. However, after much encouragement by the author and dispute by Jack Bennett, it was decided that the marketing research study would not be performed. No amount of cajoling by the author would convince Mr. Bennett. He said he could not understand how a marketing research project could cost that much. When the author explained that a quality research project had to be built from the ground up, and the small size of the sample made it an ideal candidate for a study, he seemed to understand. He was, however, firm in his decision. He
contended that, "several phone calls could accomplish the same results as your $6,000 study."

As a footnote to this discussion, the author believes that dropping the marketing research project permitted the project to fall within the $50,000 ceiling and doubts that any phone calls were ever made. All subsequent mentioning of marketing research meet with resistance from Mr. Bennett.

**Logo, Slogan And Corporate Identity**

No purpose would be served in the creation of a new logo. To take advantage of the existing graphic identity, the logo would be re-illustrated and an appropriate logo type was selected to compliment the logo.

A slogan would be developed for use with the logo and name to bring the elements together and give the reader a clear understanding of what the firm manufactured and how the firm felt about its products and commitment to quality and customer.

The color red (Pantone Matching System [PMS] 185) that had been used for the logo would be standardized and used on all printed communication pieces. New stationery, envelopes, and cards would be developed to carry the new theme forward. Product labels as well as mailing labels were created.

Packaging labels, business forms and many other new printed pieces were designed as needed and incorporated the new logo illustration and typography.
Corporate Capabilities Brochure

The current brochure was outdated and should not be used. A new brochure was developed and printed within the year. This was the most expensive and time consuming of all the projects. The budget (table 2) was considered to be adequate to prepare a brochure that would represent the firm well. The $23,000 appropriated for this project is detailed below.

Table 2
Corporate Capabilities Brochure Project Estimate

<table>
<thead>
<tr>
<th>Concept</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concept</td>
<td>3,000</td>
</tr>
<tr>
<td>Design, layout and paste-up</td>
<td>6,000</td>
</tr>
<tr>
<td>Writing</td>
<td>3,500</td>
</tr>
<tr>
<td>Photography</td>
<td>1,500</td>
</tr>
<tr>
<td>Pre-press production</td>
<td>2,400</td>
</tr>
<tr>
<td>Printing</td>
<td>6,600</td>
</tr>
<tr>
<td>Total</td>
<td>$23,000</td>
</tr>
</tbody>
</table>

Trade Advertising

Trade advertising can have enormous impact on sales provided it is well conceived, targeted and consistent (Berry, 1981). The author recommended that L. E. Jones begin to advertise in trade magazines beginning with a full color display ad to announce the celebration of their 50th anniversary during 1991. This type of advertising has a reassuring effect on readers and there was plenty of
resource material to choose from since anniversary ads are usually historical in nature.

In May of 1990, the author contacted Joe Kane, vice president of Diesel and Gas Turbine Publications. The purpose was to get his views as to the current advertising and promotion methods being used by engine parts manufacturers. During the conversation, the author mentioned the 50th anniversary of L. E. Jones.

One week after the discussion, the author received an offer from the editor of one of its magazines to prepare a story about the 50th anniversary of L. E. Jones. The editor thought it might be newsworthy to feature the firm in light of its recent growth and quality improvements. Based on this offer, and upon the author's recommendations, it was decided to prepare a four page advertisement in the Diesel Worldwide Annual Directory. The directory is a listing of all manufacturers of engines and the parts manufacturers that supply them.

The 50th anniversary trade article would be published about the same time as the worldwide directory, one reinforcing the other.

Reprint of the Trade Advertisement

Once a directory ad is created and produced, many publishers offer re-printing of the ads, in this case a four page brochure. The cost of these brochures is about one fifth the normal cost of creating and printing a stand-alone piece since the pre-press labor is already
paid for. Based on the low cost of these reprints, it was
decided to design the trade advertisement so that it could
be reprinted in a four page brochure format. One thousand
reprints were ordered.

Technical Specifications Binder

This project was originally conceived as simple printed
pages listing particular alloy compositions and describing
their applications. However, discussions with Mr. Doug
Dooley, chief metallurgist, and others who deal regularly
with the customers, prompted the author to develop these
pages into a much more useful marketing tool. Dooley had
dealt with many customers over the years and always
regretted the lack of a detailed guide to valve seat
insert alloys and insert design. He contended that by
giving customers adequate information, the company would
be helping them with the buying decision.

It is interesting to note that while this project was
not one originally included as part of the plan, it turned
out to be the most complex and time consuming to produce.
Many drafts of the various sections passed between Dooley
and the author before all were comfortable that the
material being presented was correct, relevant and
understandable. The cost of the expanded project was
about $4,500. This was $2,000 over the budgeted estimate
but was considered well worth the money by all who now use
it.
50th Anniversary Brochure

This brochure was considered a public relations exercise. The relatively small promotional value derived from this piece compared to its cost (about $4,500), made it expendable. In addition, the piece had little use once the anniversary year passed. Mr. Bennett decided that he would set up a committee of employees to prepare a 50th anniversary brochure in-house on photocopiers thus avoiding the higher cost.

50th Anniversary Gift Item

It is a difficult decision for a firm to choose a gift item. How does one decide between a $1.50 pen and $25 desk set?

From 1973 through 1976, the author was responsible for selecting and purchasing gifts for Snap-on Tools Corporation in Kenosha, Wisconsin. The dealer force of over 3,000 had a large appetite for give-away items. Unpublished research conducted by the Snap-on sales promotion department discovered that low cost items given now and then received much better reaction from customers than larger, more expensive items given at traditional times such as Christmas. Also, low cost items given to customers carried little negative connotations sometimes associated with more expensive gifts.

Additional survey research by the department at Snap-on Tools revealed that most of the business community felt that a gift of below $10 in retail value is considered
acceptable if it is intended for office use or business use by the recipient. This might include a pen or pen and pencil set, a note pad, pen caddy or similar gift.

It is also noteworthy to point out that a gift that has been imprinted with the giver's company logo will influence the value of the gift since it cannot be used by the recipient as a gift to another person. This factor reduced the value of the gift.

A gift of a more personal nature such as a bottle of liquor, a package of expensive imported cheese or similar item should be given more scrutiny. In the case of the L. E. Jones Company, engineers and purchasing managers are the individuals who most often face the problem of whether to accept gifts.

Many firms have in place a policy that prohibits buyers from receiving gifts from vendors. In the author's experience, many have a dollar limit on the value of gifts. This practice is difficult to police since value is rather arbitrary and subject to interpretation.

The harm in receiving a gift is that it might tend to induce the recipient to give preference to the giver in subsequent dealings (Frascona, et al 1991).

Many choices of executive gifts are available. They range in price from a few dollars to fifty or one hundred dollars. It is, however, an ethical issue as to what constitutes a simple gift and, frankly speaking, what constitutes a bribe.
After several items were suggested, a coffee mug was selected as a practical gift item. It could be handed out to employees and visitors to the plant as well and mailed to current customers and prospects.

Design of the 50th anniversary logo was directly influenced by the knowledge that it would be used on this mug. The author recommended that a high quality mug be chosen since L. E. Jones Company wanted recipients to be impressed with the gift. Mr. Bennett eventually settled on a black mug with metallic gold and red as the colors.
CONCLUSION

For Jack Bennett and the managers of L. E. Jones Company to agree on the need for improved marketing communications would have been a major accomplishment. Each manager had his or her own agenda and priorities. Those individuals in the sales department wanted a new brochure and gift items. They knew this would help them in their sales efforts. Those individuals who had only phone contact with customers could not see any value in sales promotion literature but understood the need for advertising. Customer service staff saw no value in advertising or promotion literature, but liked the new stationery and business forms. The financial accountant did not want to spend any money on something as speculative and abstract as marketing.

In the end, it was not the collective opinions of L. E. Jones managers that influenced the choice of improvements that were made, for these were somewhat contradictory. Nor was it the carte blanche acceptance of the recommendations and suggestions made by the author. It was Mr. Bennett's assessment of the relative value and expected effectiveness of the suggested marketing methods and whether it fit into the budget established for these projects.
REFERENCES


L.E. Jones Company produces valve seat inserts in a wide range of alloys from steels to iron base materials. These inserts are used in a variety of engines including small air cooled gas and diesel, aircraft, and commercial heavy duty gas and diesel. This has been our specialty since 1941 and we do it better than anyone in the world.

A valve seat insert is an important component of an engine. It must withstand seating heat and relentless physical pounding. It is crucial in maintaining proper cylinder compression - a key factor in engine efficiency. A faulty insert means costly downtime. This is why we insist on such rigorous standards at the L. E. Jones Company.

In a time when everyone is trying to do everything, we have chosen to excel at producing a single product: a product we actually developed 50 years ago.

Working closely with our customers we have instituted an attitude and a philosophy that we call "A Partnership in Quality."

This year, we celebrate fifty years of doing what we do best.

L. E. Jones Company

Precision Valve Seat Inserts
Fax 906-863-4867 - Phone 906-863-4411
1200 36th Avenue
P.O. Box 250
Menominee, MI 49858-0250 U.S.A.
## Valve Seat Insert

### Alloy Specifications

#### Shell Cast Iron Base Alloys

<table>
<thead>
<tr>
<th>EJ Alloy</th>
<th>Similar To</th>
<th>C</th>
<th>Cr</th>
<th>Ni</th>
<th>Si</th>
<th>Fe</th>
<th>Mn</th>
<th>Mo</th>
<th>W</th>
<th>Co</th>
<th>Cu</th>
<th>Hardness</th>
<th>Characteristics and Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>101Ni</td>
<td>Ni RESIST #1 SAE J610b Item #4</td>
<td>2.0</td>
<td>2.5</td>
<td>14.5</td>
<td>1.5</td>
<td>bal</td>
<td>1.25</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>5.5</td>
<td>Rs. 37</td>
</tr>
<tr>
<td>120</td>
<td></td>
<td>1.3</td>
<td>4.0</td>
<td>-</td>
<td>.45</td>
<td>bal</td>
<td>.45</td>
<td>6.5</td>
<td>5.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Rs. 45</td>
</tr>
<tr>
<td>122</td>
<td>SAE J610b Item #1</td>
<td>2.7</td>
<td>3.0</td>
<td>-</td>
<td>2.0</td>
<td>bal</td>
<td>.70</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Rs. 50</td>
</tr>
<tr>
<td>125</td>
<td>Cast XI</td>
<td>1.45</td>
<td>20.0</td>
<td>1.3</td>
<td>2.1</td>
<td>bal</td>
<td>.40</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Rs. 40</td>
</tr>
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</table>

#### Wrought Iron Base Alloy

<table>
<thead>
<tr>
<th>EJ Alloy</th>
<th>C</th>
<th>Cr</th>
<th>Ni</th>
<th>Si</th>
<th>Fe</th>
<th>Mn</th>
<th>Mo</th>
<th>W</th>
<th>Co</th>
<th>Cu</th>
<th>Hardness</th>
<th>Characteristics and Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS5700</td>
<td>.45</td>
<td>14.0</td>
<td>14.0</td>
<td>.50</td>
<td>bal</td>
<td>.50</td>
<td>.40</td>
<td>2.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Rs. 50</td>
</tr>
<tr>
<td>MS5710</td>
<td>.80</td>
<td>20.0</td>
<td>1.3</td>
<td>2.2</td>
<td>bal</td>
<td>.40</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Rs. 35</td>
</tr>
</tbody>
</table>

---

**L. E. Jones Company**

Precision Valve Seat Inserts

Fax 906-863-4867 - Phone 906-863-4411

1200 34th Avenue

P.O. Box 250

Menominee, MI 49858-0250 U.S.A.
A Partnership in Quality

L. E. Jones Company
Precision Valve Seal Inserts
### Cobalt Base Alloys

<table>
<thead>
<tr>
<th>LEJ No</th>
<th>Similar To</th>
<th>C</th>
<th>Cr</th>
<th>Ni</th>
<th>Si</th>
<th>Fe</th>
<th>Mn</th>
<th>Mo</th>
<th>W</th>
<th>Co</th>
<th>Cu</th>
<th>Other</th>
<th>Hardness</th>
<th>Characteristics and Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>J3</td>
<td>Stellite 3</td>
<td>2.45</td>
<td>20.0</td>
<td>3.0%</td>
<td>1.5%</td>
<td>3.0%</td>
<td>1.0%</td>
<td>-</td>
<td>12.5</td>
<td>bal</td>
<td>-</td>
<td>-</td>
<td>Re 53</td>
<td>Excellent resistance to oxidation, abrasion and wear. High hardness at elevated temperatures. Ideal for heavy-duty intake and exhaust inserts.</td>
</tr>
<tr>
<td>J6</td>
<td>Stellite 6</td>
<td>1.10</td>
<td>20.0</td>
<td>3.0%</td>
<td>1.5%</td>
<td>3.0%</td>
<td>1.0%</td>
<td>-</td>
<td>4.5</td>
<td>bal</td>
<td>-</td>
<td>-</td>
<td>Re 45</td>
<td>Excellent resistance to oxidation, abrasion and wear. High hardness at elevated temperatures. Ideal for heavy-duty intake inserts.</td>
</tr>
<tr>
<td>J10</td>
<td>Triboloy</td>
<td>0.0%</td>
<td>8.0</td>
<td>1.0%</td>
<td>2.5</td>
<td>1.0%</td>
<td>-</td>
<td>28.0</td>
<td>-</td>
<td>bal</td>
<td>-</td>
<td>-</td>
<td>Re 54</td>
<td>Excellent abrasion resistance. Ideal for heavy-duty intake valve seat inserts.</td>
</tr>
</tbody>
</table>

### Nickel Base Alloys

<table>
<thead>
<tr>
<th>LEJ No</th>
<th>Similar To</th>
<th>C</th>
<th>Cr</th>
<th>Ni</th>
<th>Si</th>
<th>Fe</th>
<th>Mn</th>
<th>Mo</th>
<th>W</th>
<th>Co</th>
<th>Cu</th>
<th>Other</th>
<th>Hardness</th>
<th>Characteristics and Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>J70</td>
<td>SAE J610b</td>
<td>2.40</td>
<td>20.0</td>
<td>bal</td>
<td>1.25%</td>
<td>9.0%</td>
<td>-</td>
<td>2.0</td>
<td>-</td>
<td>17.0</td>
<td>-</td>
<td>2.0 V</td>
<td>Re 38</td>
<td>Good hot hardness and hot corrosion resistance for heavy-duty exhaust inserts.</td>
</tr>
<tr>
<td>J96</td>
<td></td>
<td>2.40</td>
<td>20.0</td>
<td>bal</td>
<td>1.0%</td>
<td>8.0%</td>
<td>-</td>
<td>-</td>
<td>15.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Re 44</td>
<td>Cobalt-free version of J100. Good hot hardness and hot corrosion resistance. Ideal for heavy-duty exhaust inserts.</td>
</tr>
<tr>
<td>J100</td>
<td>SAE J610b</td>
<td>2.40</td>
<td>20.0</td>
<td>bal</td>
<td>1.0%</td>
<td>8.0%</td>
<td>-</td>
<td>-</td>
<td>15.0</td>
<td>10.0</td>
<td>-</td>
<td>-</td>
<td>Re 44</td>
<td>Good hot hardness and hot corrosion resistance for heavy-duty exhaust inserts.</td>
</tr>
</tbody>
</table>

The L.F. Jones Company is a complete research, design and production firm geared to meet your needs by providing total service from conception to the finished product. Our engineering department is always available to assist you with alloy and design recommendations. We produce millions of inserts annually but are small enough to care about the success of your business.

We adhere to a simple philosophy. Give customers what they want, produce it with care and attention to quality, and meet the shipment deadline.

If you agree with our philosophy, why not give us an opportunity to serve you too.
August 30, 1990

Good Morning,

The Center for Strategic Marketing is conducting a survey to determine the level of satisfaction of engine designers for engine parts and components.

Your contribution to this base of knowledge can help your suppliers provide you with better products, delivery, and service.

As a thank you for conscientiously completing this survey by September 30, 1990, we will send you a free pocket knife. Your name will not be added to any mailing list and you will not receive any other mailings based on your response to this survey.

You may return the survey in the attached postage free envelope.

Cordially,

J. Hall Cantwell
Director

Enc.

JC/gg
ENGINE MANUFACTURING
INDUSTRY SURVEY
-QUESTIONNAIRE-

Please complete & return by September 30, 1990

1. My responsibilities include the following: (Check all that apply)
   1. Engine design
   2. Engine & component testing
   3. Purchasing engine components
   4. Specifying engine components
   5.
   6.
   7.
   8.
   9.
   10.

2. I am familiar with the following suppliers of valves and valve seat inserts: (Check all that apply)
   1. Plueco
   2. Winset
   3. Eaton
   4. L.E. Jones Company
   5. Sealed Power
   6. Haynes Corp.
   7. Nippon Piston Ring
   8.
   9.
   10.

3. I have purchased valves or valve seats from one or more of these suppliers. (Check all that apply)
   1. Plueco
   2. Winset
   3. Eaton
   4. L.E. Jones Company
   5. Sealed Power
   6. Haynes Corp.
   7. Nippon Piston Ring
   8.
   9.
   10.
   11.
4. I plan on going out for bids on valves or valve seat inserts within the next 6 months.

   Yes ______  No ______

5. I consider the following to be quality suppliers of valve and valve seat inserts:

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Strongly Agree</th>
<th>Strongly Disagree</th>
<th>Don't Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. L.E. Jones Company</td>
<td>5 4 3 2 1 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Plueco</td>
<td>5 4 3 2 1 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Winset</td>
<td>5 4 3 2 1 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Eaton</td>
<td>5 4 3 2 1 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Sealed Power</td>
<td>5 4 3 2 1 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Haynes Corp.</td>
<td>5 4 3 2 1 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Nippon Piston Ring</td>
<td>5 4 3 2 1 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Eaton</td>
<td>5 4 3 2 1 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Eaton</td>
<td>5 4 3 2 1 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Eaton</td>
<td>5 4 3 2 1 0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. I consider customer service to be an important quality of my suppliers

   Strongly Agree | Strongly Disagree | Don't Know |
   5 4 3 2 1 0    |

7. My current supplier offers metalurgical analysis as part of the job at no additional cost.

   □ Yes □ No

8. My current supplier would agree to visit our plant to assist in meeting our needs.

   Strongly Agree | Strongly Disagree | Don't Know |
   5 4 3 2 1 0    |

9. I would consider changing to a new supplier of valves or valve seat inserts if they promised:

   ______ Improved quality  ______ Other  ______ Other
   ______ Improved delivery  ______ New material  ______ Other

10. I would rank the following in order of importance: (#1 being highest, #6 being lowest)

     ______ Quality  ______ Reputation  ______ Other
     ______ Delivery  ______ Design assistance  ______ Other
Alloy Specifications

Shell Cast Valve Seat Inserts

Material
Cobalt base alloy

Similar to
Stellite 3
SAE J610c item #14

Applications
Excellent hot hardness ideal for heavy duty intake and exhaust applications

Nominal Chemistry

<table>
<thead>
<tr>
<th>Element</th>
<th>Nominal Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>2.45</td>
</tr>
<tr>
<td>Mn</td>
<td>1.0max</td>
</tr>
<tr>
<td>Cr</td>
<td>29.0</td>
</tr>
<tr>
<td>W</td>
<td>12.5</td>
</tr>
<tr>
<td>Ni</td>
<td>3.0max</td>
</tr>
<tr>
<td>Fe</td>
<td>3.0max</td>
</tr>
<tr>
<td>Si</td>
<td>1.5max</td>
</tr>
<tr>
<td>Co</td>
<td>bal</td>
</tr>
</tbody>
</table>

Typical Room Temperature Hardness
Rc 53

Thermal Expansion Coefficient

13.3 x 10^-6/°C

Etched 100x
Etched 500x

Phone 906-863-4411 • FAX 906-863-4867 • 1200 34th Ave • Menominee, MI 49858-0250
### Alloy Specifications

<table>
<thead>
<tr>
<th>Material</th>
<th>Shell Cast Valve Seat Inserts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similar to</td>
<td>Cobalt base alloy</td>
</tr>
<tr>
<td>Applications</td>
<td>Stellite 6</td>
</tr>
<tr>
<td>Nominal Chemistry</td>
<td>Excellent hot hardness. Ideal for heavy duty applications</td>
</tr>
<tr>
<td>C</td>
<td>1.10</td>
</tr>
<tr>
<td>Mn</td>
<td>1.0mx</td>
</tr>
<tr>
<td>Cr</td>
<td>29.0</td>
</tr>
<tr>
<td>W</td>
<td>4.5</td>
</tr>
<tr>
<td>Ni</td>
<td>3.0mx</td>
</tr>
<tr>
<td>Fe</td>
<td>3.0mx</td>
</tr>
<tr>
<td>Si</td>
<td>1.5mx</td>
</tr>
<tr>
<td>Co</td>
<td>bal</td>
</tr>
</tbody>
</table>

### Hot Hardness

![Hot Hardness Graph](image)

### Typical Room Temperature Hardness

Rc 45

### Thermal Expansion Coefficient (20 - 600°C)

14.9 x 10^-6/°C
Alloy Specifications

Shell Cast Valve Seat Inserts

Material: Cobalt base alloy

Similar to: Tribaloy T-400

Applications: Excellent abrasion resistance. Ideal for heavy duty intake applications.

Nominal Chemistry:
- C = 0.8\%  
- Cr = 8.0  
- Si = 2.5

Ni & Fe = 3.0\%  
Mo = 28.0  
Co = bal

Typical Room Temperature Hardness: Rc 54

Thermal Expansion Coefficient (20 to 800°C):
- 13.4 x 10^-6/°C

Etched 100x Etched 500x

Phone 106-863-4411 • FAX 106-863-4867 • 1200 34th Ave. • Menominee, MI 49858-0250
Alloy Specifications

Material: Nickel base alloy

Similar to: SAE J610b Item #13

Applications: Excellent hot hardness and high temperature corrosion resistance. Normally used for heavy duty exhaust applications.

Nominal Chemistry

- C = 2.40
- Cr = 29.0
- Ni = bal
- Si = 1.25%
- Mo = 2.0
- V = 2.0
- Fe = 9.0%
- Co = 17.0
- Si = 1.25%

Hot Hardness

Typical Room Temperature Hardness: Rc 38

Thermal Expansion Coefficient (20 - 600°C): 11.1 x 10^-6/°C
Alloy Specifications

Shell Cast Valve Seat Inserts

Material: Nickel base alloy

Applications: Excellent hot hardness and high temperature corrosion resistance. Normally used for heavy duty exhaust applications.

Nominal Chemistry:
- C = 2.43
- Cr = 29.0
- Si = 1.0mx
- Fe = 8.0mx
- W = 15.0
- Ni = bal

Hot Hardness

Typical Room Temperature Hardness: Rc 44

Thermal Expansion Coefficient (20 - 600°C): 14.8 x 10^9/°C

Etched 100x

Etched 500x

Phone 906-863-4411 • FAX 906-863-4867 • 1200 34th Ave • Menominee, MI 49858-0250
Alloy Specifications

Shell Cast Valve Seat Inserts

Material
Nickel base alloy

Similar to
SAE J610b item #12, Eatonite

Applications
Excellent hot hardness and high temperature corrosion resistance. Normally used for heavy duty exhaust applications.

Nominal Chemistry

<table>
<thead>
<tr>
<th>Element</th>
<th>Nominal</th>
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</thead>
<tbody>
<tr>
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<tr>
<td>Fe</td>
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<tr>
<td>Cr</td>
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<tr>
<td>W</td>
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<tr>
<td>Co</td>
<td>10.0</td>
</tr>
<tr>
<td>Si</td>
<td>1.0mx</td>
</tr>
</tbody>
</table>

Hot Hardness

![Graph showing hot hardness vs. temperature]

Typical Room Temperature Hardness

Rc 44

Thermal Expansion Coefficient (20 - 600°C)

12.6x 10^-6/°C

Etched 100x

Etched 500x
Alloy Specifications

Shell Cast Valve Seat Inserts

Material
Iron base alloy

Similar to
Ni-RESIST #1, SAE-J610b Item #4

Applications
Aluminum head applications requiring high thermal expansion coefficient.

Nominal Chemistry

<table>
<thead>
<tr>
<th>Element</th>
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</thead>
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<td>Mn</td>
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<td>Cu</td>
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Typical Room Temperature Hardness
Rc 37

Thermal Expansion Coefficient (20 - 600°C)
15.7 x 10^-6/°C
Alloy Specifications

Material: Iron base alloy
Similar to: Modified molybdenum high speed steel.
Applications: Heavy duty intake and moderate duty exhaust

Nominal Chemistry
C = 1.3 W = 5.5
Cr = 4.0 Mn = .45
Mo = 6.5 Fe = bai
Si = .45

Hot Hardness

Typical Room Temperature Hardness: Rc 45
Thermal Expansion Coefficient (20 - 600°C): 10.9 x 10^-6/°C

Etched 100x
Etched 500x

Phone 906-863-4411 • FAX 906-863-4867 • 1200 34th Ave. • Menominee, MI 49858-0250
**Alloy Specifications**

**Shell Cast Valve Seat Inserts**

**Material**
Iron base alloy

**Similar to**
SAE J610b item #1

**Applications**
Intake seats

**Nominal Chemistry**

<table>
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<th>Element</th>
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<tr>
<td>Si</td>
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**Hot Hardness**

![Hot Hardness Graph]

**Typical Room Temperature Hardness**

Rc 53

![Etched 100x](Etched 100x)

![Etched 500x](Etched 500x)
Alloy Specifications  

Shell Cast Valve Seat Inserts

Material  
Iron base alloy

Similar to  
Cast Silchrome XB

Applications  
Heavy duty intake and moderate duty exhaust

Nominal Chemistry

- C = 1.45  
- Fe = bal  
- Cr = 20.0  
- Mn = 4.0  
- Si = 2.1  
- Ni = 1.3

Hot Hardness

Typical Room Temperature Hardness  
Rc 40

Thermal Expansion Coefficient (20 - 600°C)  
$10.3 \times 10^{-6}/°C$

Etched 100x  
Etched 500x
<table>
<thead>
<tr>
<th>Alloy Specifications</th>
<th>Wrought Alloy</th>
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<tbody>
<tr>
<td>Material</td>
<td>Iron Base alloy</td>
</tr>
<tr>
<td>Similar to</td>
<td>Wear resistant austenitic stainless steel</td>
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<tr>
<td>Applications</td>
<td>Primarily used for aircraft inserts where a high thermal expansion coefficient is required</td>
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<td>Mo</td>
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<td>Mn</td>
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<table>
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<tr>
<th>Typical Room Temperature Hardness</th>
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<tr>
<td>Rc</td>
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</table>

<table>
<thead>
<tr>
<th>Thermal Expansion Coefficient (20 - 600°C)</th>
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<td>18.3 X 10^-6/°C</td>
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</table>

Etched 100x  Etched 500x
Alloy Specifications

Wrought Alloy

Material: Iron Base Alloy

Similar to: Silchrome XB

Applications: Primarily used for aircraft inserts. AMS5710 is heat treatable and is similar to a martensitic stainless steel.

Nominal Chemistry

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<td>Mn</td>
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</table>

Hot Hardness

Typical Room Temperature Hardness: Rc 35

Thermal Expansion Coefficient (20 - 600°C): 12.4 x 10^-6/°C
Introduction
Valve seat inserts are the primary product of the L. E. Jones Company. We supply inserts for:
• Heavy duty diesel engines
• Air-cooled engines, both gasoline and diesel
• Piston-driven aircraft engines

Some of our major accounts include:
• Textron Lycoming
• Caterpillar, Inc.
• Mack Truck
• Cummins
• Onan
• Teledyne Continental

This guide will review valve seat insert alloys, some of the design aspects of the valve seat insert itself, and recommended installation and application procedures.

Background
Valve seat inserts are installed in the cylinder block of internal combustion engines for the following reasons:
1. to improve engine durability by providing a material for the valve to seal against which is better suited than the cylinder head for this hostile environment. Inserts generally possess greater hot hardness and high temperature corrosion resistance than does the head material.
2. to provide for simpler engine field repair.
3. to allow for the reconditioning of engine heads which originally had integral seats.
Valve Seat Insert Alloys
Valve seat inserts are either cast, made from bar stock, or produced by powder metallurgy. Most heavy-duty inserts are made by casting. Bar stock is primarily used for aircraft valve seat inserts. The major markets for powder metallurgy are automotive and small air-cooled engines.

L. E. Jones Company produces individually cast insert blanks using the shell mold process. Cast alloys are grouped into three major families based upon the primary alloy element: iron, nickel, or cobalt.

Iron Base Alloys
Iron base alloys offer the lowest cost of the three families. They are almost universally used for intake valve seat inserts. They are also employed for automotive and a number of heavy-duty exhaust applications. Usually, 1000°F (538°C) is their maximum temperature limit. Listed below are L. E. Jones' major iron base alloys:

- J120 - modified molybdenum high-speed steel
- J125 - cast silchrome XB
- J122 - alloy white cast iron
- J101H - Ni-resist #1 - high thermal expansion coefficient
Technical Information

Valve Seat Insert Alloys

**Nickel Base Alloys**
Nickel base alloys are normally rich in carbon, chromium, and carbide forming elements such as molybdenum or tungsten. Their structure consists of wear resistant alloy carbides surrounded by a tough nickel rich matrix. Nickel base alloys possess excellent hot hardness (retaining hardness up to 1400°F [750°C]) and high temperature corrosion resistance and are normally used for heavy duty exhaust applications. They are more expensive than the iron base alloys. The three most common L. E. Jones nickel base alloys are:

- J70
- J96
- J100

**Cobalt Base Alloys**
Cobalt base alloys are also used for heavy duty inserts as they also possess good hot hardness. L. E. Jones cobalt base alloys include:

- J3
- J6
- J10

**Wrought Bar Stock**
As stated previously, wrought bar stock is primarily used for aircraft inserts. Two grades are used: AMS5700 and AMS5710. Both are supplied in the form of bar or extruded tube. AMS5700 is akin to an austenitic stainless steel except that it has a dispersion of tungsten rich carbides throughout its microstructure to provide for wear resistance. AMS5710 is a heat treatable grade similar to a martensitic stainless steel.
Valve Seat Insert Design

Typical Nomenclature

Standard Valve Seat Insert

- Seat
- Taper or Relief
- Top or Combustion Face
- Width or Thickness
- Bottom or Back Face

Lead Chamfer/Radius

I.D., O.D.

Flexible or Skirted Insert

- Flange
- Skirt
## Technical Information

### L. E. Jones Company
Precision Valve Seat Inserts

#### NOMINAL TOLERANCES

<table>
<thead>
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<th>Feature</th>
<th>Outside Diameter (O.D.)</th>
<th>Inside Diameter (I.D.) As-cast I.D.</th>
<th>Inside Diameter (I.D.) Machined I.D.</th>
<th>Seat (non pre-finished)</th>
<th>Lead Chamfer</th>
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<tbody>
<tr>
<td>Size</td>
<td>+/- .0005in. (.013mm)</td>
<td>+/- .010in. (.25mm)</td>
<td>+/- .005in. (.13mm)</td>
<td>+/- 1°</td>
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<td>+/- .0005in. (.013mm)</td>
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<td>+/- 2°</td>
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<td>Finish (Max.)</td>
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<td>Runout (I.D. to O.D.) 0.020in. (0.5mm)</td>
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<tr>
<td>As-cast Size</td>
<td>+/- .005 in. (.13mm)</td>
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<td>Width Size</td>
<td>+/- .010 in. (.25mm)</td>
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</tr>
<tr>
<td>Parallelism</td>
<td>.005in. (.06mm)</td>
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</table>

---

5
DESIGN GUIDELINES

Seat Measurement
There are a number of methods used to determine seat size. Some specify the seat diameter on the top face of the insert. Others measure the actual width of the seat. The most common and the preferred procedure is to use the gage or seat height method where the distance from the bottom face of the insert to a specified gage diameter is utilized. This gage height technique is more consistent and avoids tolerance stack-up problems which affect the other two methods.

Inside Diameter
The inside diameter of an insert may be completely machined or it may remain as-cast (un-machined). The benefit of specifying an as-cast I.D. is simply lower cost as the boring operation (which is relatively slow) is eliminated. Machined I.D.'s are used to obtain better concentricity with the O.D., to control the seat width more closely, or to obtain tighter I.D. tolerances.

Seat Angle
The two most common angles specified are 30 and 45 degrees. With a 45° seat angle, the seating pressure is high and will tend to crush any combustion deposits which otherwise would prevent valve sealing. In certain applications, however, this heavier seating pressure can also cause increased valve and insert wear, and a shallower angle such as 30° or even 15° may be required.

Interference Angle
The seat angle of the insert is sometimes deliberately made slightly smaller than the corresponding face angle of the valve by approximately 1/2° to 1°. This causes the valve to seat on the combustion chamber side of the insert. The benefit is similar to that of a steep seat angle - high localized seating pressures and more efficient sealing.
Pre-finished Valve Seat Inserts

In normal practice, inserts are installed in the counterbore and then the final seat configuration is either turned or ground by piloting off the valve guide. A number of OEMs have or are attempting to eliminate this secondary machining step by using a precision (pre-finished) machined insert. These precision inserts are installed and used either as-is or, at most, with a small amount of touch-up grinding. The key to success with pre-finished inserts is control of the entire valve assembly: valve guide tolerances, cylinder head machining tolerances-guide hole and counterbore, valve tolerance, and valve seat tolerances. On the insert side, pre-finished inserts are controlled as to: seat to O.D. runout, flatness, seat angle (normally an interference angle is specified), seat profile (i.e. roundness of seat), and seat finish.

Lead Chamfer Radius

The purpose of the chamfer or radius is to guide the insert into the counterbore upon insertion. For cast iron heads, a simple 45° chamfer is usually sufficient. On aluminum heads, however, more care is required to prevent the hard insert from scraping or shaving the softer aluminum counterbore. If a radius is used, the blend of the radius on the O.D. must be smooth with no sharp edges or steps. If a chamfer is employed, it is advisable that it be a shallow one to better blend with the O.D. This is illustrated below:

Width

When installed, the outer diameter of the insert is in intimate contact with the head counterbore. This contact is important for two reasons. One it provides a means of heat conduction away from the insert (which itself is conducting some of the heat from the valve). Secondly, the frictional force generated between the O.D. and the counterbore keeps the insert in place. For both of these reasons, it is better to make the insert width on the larger side. SAE recommends that the width be 1.7 to 2.5 times the wall or radial thickness. This will allow for a sufficient amount of surface area contact between the insert and the counterbore.
INSTALLATION PRACTICE

Interference Fit

The interference or press fit between the insert and the counterbore is critical. A good fit allows both proper heat transfer from the insert to the head and retention of the insert in place. Normal recommended interference fit range would be .003 to .006 in. (.076 to .15mm).

Since inserts (particularly the nonferrous alloys) may compressively deform upon installation and reduce the effective remaining interference fit, one should use an initial interference on the higher end of the above range when possible.

Counterbore

Proper preparation of the counterbore is also essential. The counterbore must first be made both concentric with the guide hole, and perpendicular to the guide centerline. SAE recommends a .003 inch TIR (.08) counterbore-to-guide runout and a perpendicularity of the bottom of the counterbore-to-guide centerline of .002 inch (.05mm). Surface finish of the counterbore is recommended at 80 microinch (2 micron) maximum. In rebuilding, we recommend machining an oversize counterbore rather than reusing the existing one due to the possible damage and distortion which the original counterbore may have suffered.

Installation

Many different methods of installing valve seat inserts are used. Many engine builders install with both the seat and the head at room temperature. Others cool inserts in a refrigerator or dry ice prior to insertion. This, of course, causes the insert to contract and allow for easier installation. It also causes condensation to occur on the cold insert which may assist installation by acting as a lubricant. With aluminum heads, many times the head itself is heated to allow the counterbore to expand.

Actual installation is usually accomplished with a pneumatic hammer equipped with a pilot tool which matches the insert. Some high production lines use specially designed presses which install a number of inserts as one time. In any case, it is important that the insert be started squarely and pressed or hammered until it bottoms-out on the counterbore.
APPLICATION NOTES

Unleaded Fuel
Combustion of leaded gasoline will deposit lead compounds on the exhaust valve and seat. These compounds provide a degree of lubrication between the valve and seat. With unleaded gasoline, the lubricating deposits are absent and greater valve/seat wear may occur. Many automotive OEM's locally harden the seat area of cast iron heads to avoid excessive wear. Aluminum heads require the use of a valve seat insert. For the most part, hardened iron base inserts have been satisfactory for unleaded applications. Our J125 alloy is the most popular choice for the combination of durability and economy.

Dry Fuel
Engines which burn clean fuels having little combustion deposits such as natural gas or LPG are notorious for rapid exhaust valve and seat wear. Recommendations include:

a) using a shallower seat angle (e.g. 30° instead of 45°).
b) use a tool steel insert (J120) or a nickel base alloy (J96).

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Introduction
As indicated in other sections of this document, the L.E. Jones Company is a completely integrated manufacturer of cast valve seat inserts including alloy and insert designs to meet virtually all engine applications. Since our customer base is diverse and includes automotive, heavy duty diesel, and the reciprocating aircraft engine industries, the quality systems in place must meet the most stringent of industry standards. Our success is reflected in the quality awards listed at the end of this section. The system itself is rigidly controlled yet flexible enough to satisfy all customer requirements. Virtually all products enjoy ship-to-use status.

The intent of this section is to highlight the quality programs in place and used on a day to day bases at the L.E. Jones Company.

Quality Manual
The L.E. Jones Company has documented its quality program in a complete Quality and Operational Procedures Manual. This manual provides detail for all standard operating procedures and addresses all critical aspects of the process. The manual is updated periodically to provide the most accurate information possible, and is available for review upon request.

Quality Organization
The Quality Organization at L.E. Jones Company is a unique blend of quality, product and process engineering. In essence, we define the process to meet the needs of the product. This is not a typical approach but is ideal for our company because of its size. It is a natural process for the people doing the planning to be part of the quality group. Some of the important functions carried out by this group include quality planning, process planning, quality auditing, and customer interaction. Its members strive to achieve excellence in all areas. These personal achievements include individuals with Certified Quality Engineer and Certified Quality Technician status.

Statistical Process Control
L.E. Jones Company is committed to the use of statistical tools (techniques) to optimize quality and minimize variation. Those tools are used on a variety of machining operations to aid the
operator in problem solving and machine control. Whenever possible, gaging is interfaced with electronic data collection systems to provide the immediate feedback of statistical information. In addition, the information gathered can be provided to the customer to assure that all products meet customer specifications. This information also provides a record for ongoing improvement. Some of the statistical tools used on a regular basis include: X bar and R charts, individuals moving range charts, median charts, run charts and target charts. All production equipment generating finished machined surfaces have at least one statistical tool applied to that operation.

Training employees in the use of statistical tools and the application of new techniques is an ongoing process. Virtually all employees have had from a few hours to several days training in the use of SPC. That time continues to grow as employees take advantage of in-house and technical school courses.

Other statistical methods used on a regular basis include: Pareto analysis, cause and effect diagrams, scatter diagrams and designed experiments.

All gages, gaging fixtures, gage blocks and masters as well as test equipment are identified and are calibrated/verified at specified time intervals by either an outside laboratory or by our gage room technician. All records are maintained on file and can be traced to the National Institute of Standards and Technology (NIST). This system is designed to meet all requirements of military standard MIL-C-45662 as well as specific customer requirements.

Gages are stored and distributed through a central gage area which supplies both production and support group gaging, i.e. no employee-owned gages are used in the facility. Gage capability (R&R) studies are also conducted on a regular basis with frequencies depending on the nature of the gage and past demonstrated capability. Detailed information concerning our gage and test equipment program is provided in the L.E. Jones Quality Manual.
Quality Programs

Preventive Maintenance

To assure continuous machine uptime and consistent quality, the L.E. Jones Company's maintenance department follows a time based preventive maintenance program on all machines, furnaces and equipment. Each piece of equipment has an individual file folder which specifies the preventive maintenance time interval and details the necessary work to be performed. This folder also contains records of any work done on the machine during the interim between scheduled preventive maintenance. Rebuilt machines also follow a qualification process to determine machine capability.

Quality Improvement

The objectives of quality improvement at the L.E. Jones Company are to identify and correct any chronic internal problems and subsequently reduce manufacturing costs and process variation. This is addressed by targeting goals and objectives for specific improvement. Past examples include reduction in grinder variation, improved data collection systems, reductions in specific alloy defect rates and improvements to our supplier selection system.

Upper management, production, and Engineering/Q.C. personnel establish these yearly goals and projects. Each project identified is assigned to a member of the production or Engineering/Q.C. team who monitors the progress and determines the magnitude of the eventual improvements.

Engineering
Print/Specification Control Program

An effective program for the receipt, routing, and distribution of engineering information is in place. This program insures that information is disseminated to the appropriate individuals and areas, and that modification to affected gaging and fixtures and existing inventories is addressed properly.

Materials Testing Program

The L.E. Jones Company has the following in-house metallurgical facilities: spectrochemical analysis, mechanical and physical properties testing, and metallographic analysis. Various NDT capabilities include: fluorescent penetrant inspection, hardness testing, and the facilities for radiographic interpretation. Other specialized testing is performed on a contract basis by outside laboratories as required.
Employee Involvement  The key to the success of the L.E. Jones quality program lies in its employees. The company has the benefit of a mature and experienced work force which is encouraged to participate in the decision making process. All suggestions are heard and given equal consideration at regular employee involvement meetings. Evidence of our success was the recent recognition by the Michigan Governors Conference, and an invitation to present the framework for our model employee involvement program.

Quality Awards

Avco Lycoming
Williamsport Division

TEXTRON

Partners and Progress
Supplier of the Year
L. E. Jones Company
1990

Avco Lycoming
Williamsport Division

TEXTRON

QUALITY SUPPLIER AWARD
This is to acknowledge
L. E. Jones Company
1989
As Exemplified By Your Incoming Quality Level
"Pride - Quality - Service"
Quality Programs

L. E. Jones Company

Quality Awards

This certifies
L. E. Jones Company

Comau Corporation

Date: August 1, 1991

Q1
PREFERRED QUALITY AWARD

L. E. Jones Co.

Ford Motor Company

1991
Quality Awards

CATERPILLAR CERTIFIED SUPPLIER
L. E. JONES COMPANY
Menominee, Michigan
is recognized as a supplier of quality material

CATERPILLAR CERTIFIED SUPPLIER
L. E. JONES COMPANY
Menominee, Michigan
is recognized as a supplier of quality material
### EQUIPMENT LIST

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<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
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<td></td>
<td>2</td>
<td>Model CB-8-SB Gas Fired Beardsley &amp; Piper Shell Molding Machines- manual load and strike off</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Custom built Isocure Molding Machine</td>
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<td>250KW 9-Line Inductotherm with (1) 550# Furnace Cabinet</td>
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<td>1</td>
<td>150KW Motor Generator - Inductotherm with (1) 200# Furnace Cabinet</td>
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<td>1</td>
<td>50KW Motor Generator - Inductotherm with (1) 60# Hand Furnace</td>
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## EQUIPMENT LIST

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</tr>
<tr>
<td>1</td>
<td>Oscillating Auto Snagger</td>
</tr>
<tr>
<td>3</td>
<td>Model #2 Cincinnati Centerless Grinders - modified as parts snaggers</td>
</tr>
<tr>
<td>1</td>
<td>Gardner #125 22&quot; Double Disk Grinder</td>
</tr>
<tr>
<td>2</td>
<td>Gardner #125 26&quot; Double Disk Grinder (One machine is equipped with automatic gaging and a data collection system)</td>
</tr>
<tr>
<td>4</td>
<td>Model #2 Cincinnati Centerless grinders (one is equipped with automatic gaging and all are equipped with data collection systems)</td>
</tr>
<tr>
<td>4</td>
<td>Model #3 Cincinnati Centerless Grinders</td>
</tr>
<tr>
<td>1</td>
<td>Landis Type C No. 8 Cylindrical Grinder</td>
</tr>
<tr>
<td>1</td>
<td>Model #2 Cincinnati Centerless In-feed Grinder</td>
</tr>
<tr>
<td>1</td>
<td>Gardner #2H30 30&quot; Double Disk Grinder</td>
</tr>
<tr>
<td><strong>Lathes &amp; Turning Machines</strong></td>
<td>28</td>
</tr>
<tr>
<td>2</td>
<td>SL25B/500 (1990) Mori Seiki CNC Lathes</td>
</tr>
<tr>
<td>2</td>
<td>SL2B Mori-Seiki CNC Lathes</td>
</tr>
<tr>
<td>1</td>
<td>Conomatic 8-Spindle Bar Machine</td>
</tr>
<tr>
<td>1</td>
<td>#3 Warner Swasey Turret Lathe</td>
</tr>
<tr>
<td>1</td>
<td>#5TL Morey Turret Lathe</td>
</tr>
</tbody>
</table>
# Manufacturing Facilities

## L. E. Jones Company

### Precision Valve Seat Inserts

## EQUIPMENT LIST

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Other Equipment</strong></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>K-18 New Holland Spin Dryers</td>
</tr>
<tr>
<td>1</td>
<td>K-12 New Holland Spin Dryers</td>
</tr>
<tr>
<td>2</td>
<td>Monode Multiple Part Marking Machines</td>
</tr>
<tr>
<td>1</td>
<td>Monode Face Marking Machine</td>
</tr>
<tr>
<td>3</td>
<td>Coolant Filtration Systems</td>
</tr>
<tr>
<td>1</td>
<td>Quincy #490 100 hp Air Compressor</td>
</tr>
<tr>
<td>1</td>
<td>Quincy 50 hp Air Compressor</td>
</tr>
<tr>
<td>1</td>
<td>Federal Pneumo-Centric Roundness Machine</td>
</tr>
<tr>
<td>1</td>
<td>PT-350 Mitutoyo Profile Projector</td>
</tr>
<tr>
<td>1</td>
<td>Mitutoyo Indicator Calibration Tester</td>
</tr>
<tr>
<td>2</td>
<td>Bendix Profilometers</td>
</tr>
<tr>
<td>2</td>
<td>Roto-Finish Vibratory Finishing Machines</td>
</tr>
<tr>
<td>1</td>
<td>Hi-Production &quot;Zyglo&quot; Line</td>
</tr>
<tr>
<td>2</td>
<td>Wilson &quot;JR&quot; Rockwell Hardness Testers</td>
</tr>
<tr>
<td>1</td>
<td>NewAge Versitron AT 130-R Hardness Tester &amp; AT 130-N Bench Stand</td>
</tr>
<tr>
<td><strong>Laboratory</strong></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Data Collection Systems</td>
</tr>
<tr>
<td>1</td>
<td>Hurco BMC-20 Machining Center with Ultimax II Control</td>
</tr>
<tr>
<td>1</td>
<td>Model 750 Jarrell Ash Spectrometer</td>
</tr>
<tr>
<td>1</td>
<td>B&amp;L Metallograph &amp; Assoc. Grinding &amp; Polishing Equipment</td>
</tr>
</tbody>
</table>
SCRAP

SUPPLIERS

SAND RECLAMATION

METALS RECLAMATION

MOLDING

CHARGE PREPARATION

MOLD ASSEMBLY

MELTING

POURING

SPECTROMETER

SHAKE-OUT

BLAST

SORT, DEBURR

HEAT TREAT

TO MACHINE SHOP

FOUNDRY SNAG

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