

**SAFETY CONSIDERATIONS
IN FLUID POWER PRODUCTS—
PART 1: MOTIVATIONAL ASPECTS**

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ABSTRACT: With manufacturers expecting over 1,000,000 product-liability suits annually by 1980, more and more emphasis must be placed on safety and failure prevention. Companies with a poor track record, and which deal with "accident prone" equipment, have little choice if they plan to survive the onslaught of an aroused, safety-minded and suit-conscious public.

This paper is the first of a two-part series dealing with safety considerations in fluid-power systems. In this part, a panorama view is presented of the factors that should motivate the fluid-power industry to take immediate action to ensure that safety is designed into their products. Time is of the essence, and we must get our house in order now.

KEY WORDS: fluid power, product safety, product liability, liability insurance, safety litigation, safe design

INTRODUCTION

It is time that the fluid-power industry look at itself as the consumer might. Clues as to the view are present everywhere. Is the industry being lauded for its efforts toward ensuring product safety and reliability? Or, could it be true that ample warning has been given, and action is needed to stem off a rash of product-liability claims.

The nation and the world are developing new and earthshaking attitudes toward safety and the reliability of products. The fluid-power industry must become aware of these changing attitudes and prepare itself to meet these changes head-on with compliance and conformity. We have entered an era in which we must stand up and defend the integrity of our products, be prepared to explain the theory behind our designs and to justify the amount and type of verification testing performed to prove the service worthiness and safety features of our products.

This paper highlights the factors that should motivate us to action. In this part, the product-liability question including insurance is addressed. In addition, the influence of governmental agencies on product standards is discussed.

An Exposition

PRODUCT LIABILITY QUESTION

Reasons for Concern

Product-liability suits hang like a noose over the heads of every major producer of consumer or industrial products. The chances that a company will become involved in legal action over the quality of their product is extremely high. It was uncovered by A. T. Kearney, Inc. [1], that of the 280 leading companies, 51% either have been, or are currently involved in legal action over product safety and quality problems. A figure of this magnitude cannot, and certainly should not, be ignored.

Suits on the Rise

According to Jury Verdict Research of Cleveland, Ohio [1], there were 50,000 product suits in litigation in 1963, and in 1970 there were 500,000. They contend that this trend will continue, and that by 1980 there will be one million suits in litigation involving as much as \$100 billion in product-liability claims [1]. Some of the individual cases being settled today are multi-million dollar settlements, such as a Florida case where \$1,950,000 was awarded to the operator of a front-end loader that allegedly contained a defectively-designed steering axle assembly [2].

Today's legal systems no longer uphold the doctrine of "caveat emptor" (buyer beware) but seem to sanction one at the other end of the spectrum; that is, "caveat vendor" (seller beware). Certainly, products must be designed with the human being in mind, and foremost consideration must be given to the safety and reliability of our products. Without a company resolution to this effect, an undisputed reputation and a record as a manufacturer of quality products cannot be garnered, and a fruitless struggle will continue for survival among highly motivated international competitors.

Fluid Power on the Block

The fluid power industry is by no means immuned or unaffected by the current rise in product-liability suits.

In fact, any industry that is concerned with power transmission and control are almost "setting ducks" when questions of safety and failure arise and "fingers are pointed." Even the adjective, *high*, has haunted us in the courtroom—high performance, high horsepower, high noise level, high temperature, high pressure. Such words might help to distinguish one condition or system from another, but they serve as subtle warnings to the public and only amplify the need of having *special* safety features incorporated in the designs.

Words can also be misused, misinterpreted, or "conjure up" wrong images that can create a host of unjust allegations.

For example, the lubrication film on cylinder rods, when dubbed *external leakage*, leads to cylinders being called *leakers* and associated cylinder rods or mechanically-connected elements called *drifters*. Extreme caution must be particularly exercised in describing fluid-power systems, performance features, and maintenance admonitions in service manuals. One company, in 1977, lost a million plus dollar suit simply because they emphasized the importance of cleaning a fuel filter in their operator's service manual by stating: "Numerous reports of gradual fuel pressure loss have been traced to this finger strainer becoming plugged with dirt and a varnish-like substance that is almost invisible to the naked eye." Perhaps we are being forced into saying "what to do," but not explaining "why" [3].

To appreciate the reality of our involvement in product liability, a few facts and figures might be worth reviewing. Rollin D. Schnieder [4] of the University of Nebraska collected some very significant data on fluid power-related deaths and injuries. He found that in the state of Nebraska alone, from the years 1961-1975, approximately one death occurred per year with slightly more in reported injuries per year. These figures are a sobering reminder that fluid power-related accidents are indeed occurring. And, when accidents occur, fatalities and injuries are likely, and product-liability claims and suits are inevitable.

Liability Claims

Product liability claims tend to fall into three major categories: negligence, warranty, and strict liability in tort. Any party involved in the design, manufacture, or commerce of a product can be held negligent. Only sound engineering design principles, rigid product-integrity assessment standards, and effective quality-assurance practices can truly give the necessary degree of protection against a claim of negligence. Warranty claims should be studied carefully before they lead to serious involvement and trouble for a manufacturer. Admittedly, not all producers are required to provide expressed warranties (oral or written). However, by means of the uniform commercial code, all products are covered by implied warranties. Implied warranties simply guarantee that the product is safe to use.

Since 1965, when the American Law Institute recommended that manufacturers be held strictly liable for

their products, over 40 states have adopted the doctrine of strict liability [1,5]. The strict-liability doctrine comes into play in the case of an accident where the injured party can show [6]: 1. The accident was a result of a condition of the product. 2. The condition was unreasonably hazardous. 3. The condition existed at the time the product left the control of the manufacturer. From the strict-liability doctrine, corporate employees and officers can no longer be held immuned from being found liable in claims resulting from accidents [6].

A detailed study made in 1973 involving 525 product-liability cases between July, 1970, and March, 1972, showed how the categories of the cases were distributed [1]. The results are given in Fig. 1. Of these 525 product liability lawsuits, the plaintiff won 62% of the negligence cases and 55% of the warranty and strict liability in tort cases. Even more startling is the fact that nearly 50% of all the cases were comprised of design defects and implied warranties.

Negligence	Manufacturing Negligence	(48 cases)	18% of total
	Continuous Process Negligence	(21 cases)	
	Assembly Negligence	(20 cases)	
	Transportation & Distribution	(3 cases)	
Warranty	Implied Warranties	(157 cases)	40% of total
	Expressed Warranties	(54 cases)	
Strict Liability In Tort	Design Defects	(103 cases)	42% of total
	Inadequate Warning	(48 cases)	
	Material Defects	(29 cases)	
	Inadequate Test & Inspection	(17 cases)	
	Packaging Defects	(15 cases)	
	Incomplete Instructions	(7 cases)	
	Label Misrepresentation	(3 cases)	

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Fig. 1. Distribution of Types of Liability Cases.

The Who Did It Defense

Once a company has been arraigned, a sound defense is essential. According to Paul C. Nelson [2] of International Harvester Co., a company's defense can be based only on three arguments: "I didn't do it," "The plaintiff did it to himself," or "Someone else did it."

If the company pleads, "I didn't do it," then it must prove that there was no defect in the product at the time it was sold or manufactured.

However, if a company pleads, "The plaintiff did it to himself," the company must present proof that it was

the plaintiff's bad judgement, his failure to properly maintain the product, or his improper use of the product that caused the accident.

If the company claims, "Someone else did it," proof must be presented showing that there was a change or alterations to the product after it left the hands of the manufacturer.

A strong defense, based on the proper plea together with documentation proving the integrity and quality of the product, is the only way of winning court decisions and avoiding claim costs and public embarrassment by losing an important court decision.

LIABILITY INSURANCE

Role of Insurance Company

The role of insurance companies concerning product liability is as important as ever. Major casualty insurance companies have experienced losses in the millions of dollars through product-liability underwriting [6]. For some manufacturing companies producing particularly hazardous products, rates have doubled and even quadrupled over the years [6]. What can be done?

The insurance companies are not technically expert in determining the safety and the risk associated with consumer products [7, 8]. Certainly, they are not experts when it comes to fluid-power components and systems. The manufacturer must either possess or retain the necessary expertise needed in the development, certification, and promotion of his products. Therefore, the company that produces and sells must assume the responsibility of assessing the safety and reliability of its products.

Evaluating the hazardous nature and characteristics of any product is not easy, but neither can it be circumvented or ignored. Successful court cases attest to the value of evaluations and tests conducted by third-party sources, including independent laboratory tests and those conducted by technical experts [8]. The cost of obtaining such third-party documentation for a trial defense is reflected in the insurance company's rates.

Like "fixing the roof when it is not raining," management hates to waste good time and money to develop a sound, defensible product safety and integrity position when no suits have been filed. However, reduced insurance rates may help compensate for such suit preventive action. The cost of *crash programs* for developing a good technical defense is exorbitant when compared to the cost of a sane and orderly program before the fact. Such a program should include good design methodology, application of accepted or good voluntary standards, and stringent manufacturing and quality-assurance requirements.

Reacting to Customer Complaints

When products are already in the hands of the user or consumer, the manufacturer should respond promptly and responsibly to any and all field complaints concern-

ing safety-related incidents. The number of warranty claims and distributor inputs is often ample indication that action should be taken to demonstrate the manufacturer's sensitivity and concern for the safety of their product users. Such inputs may also indicate overlooked errors that might taint the *unquestionable* reputation of the manufacturer's name and products. Many times, a manufacturer facing legal action concerning a product is placed in a poor defensive position simply because he was slow in reacting to a potential or existing hazard that was brought to his attention [8].

ROLE OF OSHA

More than seven years have elapsed since President Nixon signed the Occupational Safety and Health Act of 1970 creating "OSHA." This act was enacted with the hope that it would help provide safe and healthful working conditions throughout industry. OSHA was organized to cover all companies involved in interstate commerce, except where other federal agencies have authority. As a result of OSHA's influence on safety, supporters are claiming reductions in workmen's compensation cost by as much as 25% each year. Marked reductions in lost time due to accidents are also claimed—as high as 50% [9]. Predictably, top management has reacted to OSHA by giving much more attention to safety and health aspects when selecting and buying capital equipment and machinery.

One of the most frequent violations cited by OSHA concerns hazardous power-transmission equipment [9]. Fluid-power systems certainly fall under this category. With more and more safety requirements becoming mandatory, no company producing power-transmission products or machinery can possibly survive unless they comply and incorporate rigid safety and quality control features into its product designs.

False Security

Just because a product meets OSHA regulations, or other federal safety standards does not necessarily give assurance that liability is relieved in all market areas of the United States and the world. Individual states and even municipalities have their own standards. Hence, to avoid all product-liability uncertainties, the manufacturer should seek legal assistance in determining whether a product complies with safety standards throughout a given marketing area.

If a product is to be marketed outside the United States, a completely new set of product safety and quality requirements likely exist. Advanced countries invariably have their own idea of what constitutes a safe and reliable product. Therefore, the designer must either know the requirements in advance or be prepared to adapt, redesign, or otherwise comply with codes pertinent to his product throughout the world.

If adequate standards have not been developed to govern the safety aspects of a product (particularly new products), compliance with all safety regulations in a marketing area does not relieve the manufacturer from liability. Also, in cases where it can be proved that the

manufacturer was aware of possible hazards in the application of the product, liability is definitely not relieved.

CONSUMER PRODUCT SAFETY COMMISSION

Another federal agency designed to ensure safe products is the Consumer Product Safety Commission. Here, consumer products are regulated rather than industrial products, as in the case of OSHA [10]. The purpose of the consumer product safety act lies in four categories of concern as described in Section 2(b):

- To protect the public against unreasonable risks of injury associated with consumer products.
- To assist consumers in evaluating the comparative safety of consumer products.
- To develop uniform safety standards for consumer products and to minimize conflicting State and local regulations.
- To promote research and investigation into the causes and prevention of product-related deaths, illnesses, and injuries.

The commission has been granted a wide range of powers to carry out their designated purposes. These powers can range from research through standards-making to actual seizures. In 1975, the commission received 124 formal complaint notifications representing over nine million product units. The causes of these 124 notifications are shown in Table 1.

	Cases	Product Units
Mechanical Defects (design & material strength)	42	6,575,978
Electrical Shock	32	1,055,497
Fires	19	113,681
Human Engineering Defects (including hazards from unclear instructions)	9	69,823
Bottling Defects	8	1,015,118
Manufacturing Defects	8	25,838
Toxicity	3	3,239
Germ Growth	2	60,330
Noncompliance with Standards	1	4,186

Table 1. Ranking of Complaint Notifications.

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CONCLUSIONS

As reflected in this paper, we have been warned in every way possible of the necessity for manufacturing safe products. If we open our eyes, we can see familiar sounding cases already hitting close to home. Accusations of "tub thumping" are becoming less frequent as manufacturers gain an overall awareness of potentially impending problems in their particular area. Like anything else, it takes time to identify a threat, screen proposed solutions, and implement effective measures.

Hopefully, this paper has motivated the reader to investigate carefully the possibility of safety problems existing in his company's products. The sooner such problems are recognized, the sooner corrective action can be initiated. The second part of this report will look at each of the components comprising a fluid power system, and will discuss specific features that could lead to safety problems. Solutions to these problems are offered for the consideration of the fluid-power industry.

ABOUT THE AUTHOR

J. C. Fitch is a senior in Industrial and Systems Engineering at Georgia Tech. Over the past four years, Jim has made numerous contributions to the published works of the BFPR Program at the Fluid Power Research Center. His growing interest in product safety and reliability considerations is reflected in the contents of this paper and the major literature study that preceded it.

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