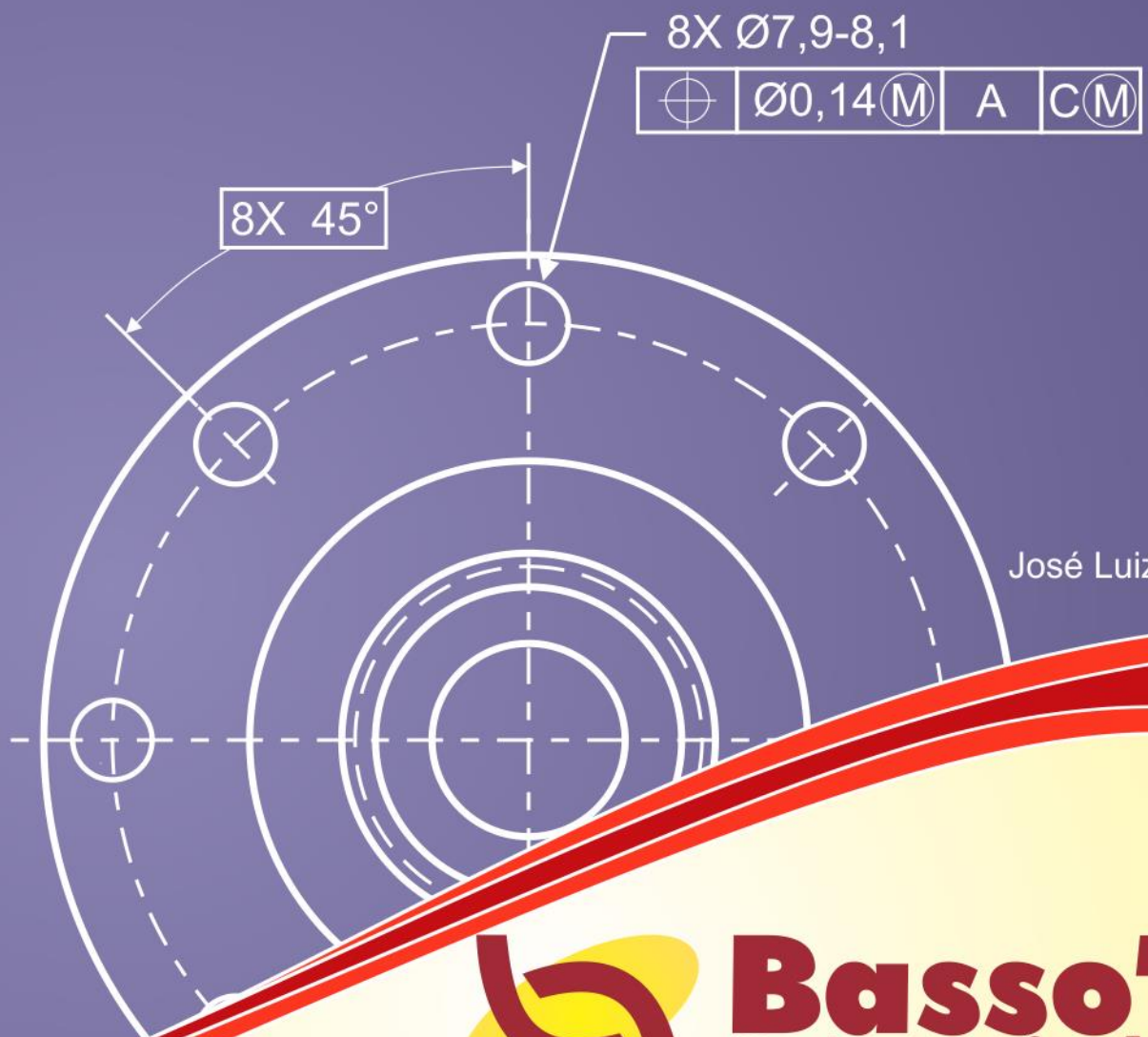


# THE 40 MYTHS OF GD&T

Practice Responsible  
Application of GD&T



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Quality and Productivity

 **Basso's**  
& Associados  
Consultoria e Treinamento

# The 40 Myths of GD&T

The Geometric Dimensioning and tolerancing (GD&T) reduces the direct cost of products because it uses larger fields of tolerance eliminates the scraping of good parts and guarantees the zero-dimensional defect in the manufacture of components

**José Luiz Basso**

**A**wareness of the need and application of GD&T has increased in recent years mainly by companies in the automotive industry and, more specifically, by corporate America. If this is the good news, on the other hand, we have many deficiencies in the application, interpretation and control of GD&T. My involvement with the subject took place in 1977, at that time GD&T was virtually unknown, they knew not the slightest thought. Thus the prevailing Cartesian system, ie, tolerances of plus and minus, for whatever the error part. However, I remember some companies in which I dealt with GD&T, called at the time of Geometric tolerances or tolerance Form and Position, where the concept has been applied.

I made reference to the article by Alex Krulikowski Nine Myths of Geometric Dimensioning and tolerancing and adapt and extend, within the current reality of Brazilian and foreign companies operating in Brazil, reaching 40 myths, divided into five groups: Management, Training, Specification, Manufacturing and Control. Many of the myths cited make companies apply GD&T improperly and some not even apply in full. GD&T is, in fact, the means by which engineers, technicians and designers can create quality drawings and, by extension, quality products. However to get the benefits of GD&T companies must understand and eliminate common myths about it.

## MYTHS

MANAGEMENT	1. Our company does not need GD&T	SPECIFICATION	20. Standards of GD & T are ambiguous and confusing	
	2. GD&T is synonymous of preciousness		21. Drawings using GD&T is time consuming	
	3. GD&T is applied because the client asks for		22. Cartesian system is easier than Geometric System	
	4. GD&T is a matter of product engineering		23. GD&T should be used only in critical elements	
	5. GD&T should be applied in a specific area		24. Preparation of design and GD&T are distinct	
	6. Vendors will strive to apply GD&T		25. GD&T requires review of all the old drawings	
	7. GD&T Increases the cost of the product		26. Standards of GD&T are all equal	
	8. GD&T makes it difficult to find suppliers		27. GD&T is synonymous of accuracy	
	9. GD&T is only one set of standards		28. The Application of GD&T requires use of software	
	10. GD&T is just another tool		29. GD&T does not require dimensional analysis	
TRAINING	11. I know GD&T	MANUFACTURING	30. GD&T applies in informal discussions	
	12. You can learn GD&T in two days		31. The use of GD&T generates different specifications	
	13. GD&T is learned in college		32. Only the definition of reference is sufficient in GD&T	
	14. GD&T is learned in open courses		CONTROL	33. The tools do not need GD&T
	15. Few people need to know GD&T			34. The construction of the tooling with GD&T is complicated
	16. The management does not need to know about GD&T			35. GD&T hinders productivity
	17. We adopt a simple solution for training in GD&T		36. Dimensional control and GD&T are synonymous	
	18. GD&T is learned by intranet/internet		37. GD&T allows the sum bonus of references	
	19. We can't realize the GD&T training cost-benefit		38. GD&T increases the number of control devices	
	39. GD&T increases the number of rejected parts			
	40. GD&T does not require control by CEP			

# The 40 Myths of GD&T

## Myths related MANAGEMENT

### Myth 1: Our company does not need GD&T

This myth is perpetuated by a preference to use the coordinated system tolerances, which most engineers, technicians and designers have used since the technical course, and had greater adherence to understand it better than the GD&T. But the system of tolerances coordinates has existed for about 150 years and has no rules as clear, nor has a philosophy of design for quality. GD&T is used by half of all companies of products with features electromechanical in the world. This allows clear communication at all levels and functions within the company, as well as with its customers and suppliers. Its philosophy is pro-billing and pro-growth.

### Myth 2: GD&T is synonymous of preciousness

This myth stems from the idea that GD&T tolerances prescribed. The myth of tolerance is just essentially a misunderstanding of the use of basic dimensions in GD&T, which has no tolerance, and lack of knowledge of the tables Control Element which has tolerances. In fact, the philosophy of GD&T uses the greater tolerance possible, considering the scaling function. The tolerance bands of GD&T allows 57% more tolerance to locate dimensions in coordinate systems, in addition, to provide additional tolerances through the use of maximum material condition. Errors in design also decreases with the correct application of GD&T which, consequently, reduce the cost of the product.

### Myth 3: GD&T is applied because the client asks

It is common for companies only worry about the application of GD & T after the collection or imposition of major customer. These companies, represented by their levels of direction, have no idea of the importance of GD&T to improve the quality of design and configuration of their products. Indeed, the lack of managerial knowledge about GD&T puts the company's management in a reactive, not proactive. Worse still, when the company decides on GD&T and therefore doesn't take its implementation. This is evidenced by the non-participation of managers in training executive of GD&T, people are not charged for the presence in the training and future application. This myth is very bad because the company is losing money and this is not being considered.

### Myth 4: GD&T is a matter of product engineering

Although the product engineering drawings who releases the product for the company, GD&T can not be considered only a responsibility of engineering. With the advancement of technologies and process control, in addition, the expertise of suppliers, it is virtually impossible to product engineering master all the content that should be considered during the application of GD&T. We should be clear that GD&T is a teamwork model of concurrent engineering. All areas should contribute to a better

specification of GD&T (marking drawings). In the new version of ISO 1101:2004, it is clear that GD&T should be specified as the functional requirements, however, manufacturing requirements and control also influence the application of GD & T.

### Myth 5: GD&T should be applied in a specific area

Some companies understand that the application of GD&T should be made only by a specialized team and dedicated. This is because the subject is very complex and people with less knowledge would take considerable time making the application of GD&T. While we respect this position, do not understand as a necessity. Good practice for application of GD&T recommends that it must be done by everyone in the organization who are involved in the design of the product, considering the engineers and designers of product engineering and other professionals in the areas of processes, quality and suppliers. This practice enhances the knowledge of some people and sub-optimizes the knowledge of the organization. In a short space seems to be a good solution, but in the long run this practice is being questioned.

### Myth 6: Vendors will strive to apply GD&T

It is sad to talk about it, but the truth is that with few exceptions, providers rarely take the initiative to apply GD & T in their products on their own, if there is a charge for its customers. The lack of knowledge about the benefits of GD & T encourages firms to disregard this methodology for the development of their products. The good news is that you already see a movement of suppliers to implement their own, regardless of the request of its customers. This I am already showing up in some companies, where I am working on, especially the largest providers, typically companies.

### Myth 7: GD&T Increases the cost of the product

Saying that GD&T would drive the cost of the product is the same as saying that the training disqualify people. It should be clear that the cost of the product is determined by the demands of customers and the way the company meets these requirements. Not the GD&T who says that tolerance should be 0.1 or 1 or yet to be made control of squareness, for example, is the need of functional performance that determines this. GD&T just consider this as a premise for marking designs. Whether to use GD&T these requirements must be considered. But when you use GD&T these requirements are met with the best and the lowest cost. In fact, a product of GD&T should be cheaper than a product without GD&T, because only with GD&T it will be optimized to meet these requirements and transform into dimensional and geometric specifications.

### Myth 8: GD&T makes it difficult to find suppliers

This myth has some truth when the company is limited

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to worry about the development of their suppliers. As already mentioned, GD&T does not flow naturally in most companies. This should be triggered. Companies that have GD&T as a strategic direction for development of its products also consider the involvement of suppliers in the capabilities of GD&T, either through participation in joint training, or even showing and / or suggesting that these vendors do training sessions with qualified professionals. Unfortunately, the situation in Brazil is still unfavorable to find good suppliers with deep knowledge of GD&T.

## **Myth 9: GD&T is only one set of standards**

Nothing worse than hearing that. Fortunately GD&T is supported by standards, we should be clear that the rules are made by people in society with interests and expertise on the subject to be standardized. The fact that GD&T standards are set for much help in its application and interpretation. Should be considered than in the Standards are many philosophies and fundamentals of design that there are hardly any books on design, process and control products. Many companies find that only the citation of the standard GD&T in the product design (which is mandatory), is sufficient, the rest happens naturally. In fact, the rules of GD&T (especially the family of the ASME Y14.5M) has much knowledge and experience of professionals around the world concerned with the subject.

## **Myth 10: GD&T is just another tool**

Just as GD&T is not only a standard, is not just a tool. GD&T is a whole philosophy of product design that considers, in addition to functional design, the process of manufacturing and assembly and form of control. There are several tools on the market quality (Quality Tools), we should not put GD&T in the same level. GD&T is more than a tool, its correct application can change the way they design a product. It is common among professionals involved in serious training for GD&T conclude that now they have a new reference design products. GD&T creates a new paradigm in product design. This should be considered, GD&T is not a tool, it is a philosophy supported by fundamentals, format (methodology) and various tools.

## **Myths related TRAINING**

### **Myth 11: I know GD&T**

This myth is caused by over-reliance on inadequate training programs. Training generates bad people who know that their skills in GD&T are inadequate, thus, do not criticize the skills of others, often ignoring training and skills. The worst is not what people do not know but what they think they know. Unfortunately, most people think they know GD&T is what is perpendicularity, or even its symbolism. Learn GD&T is to know its philosophy, its foundations, its application in any type of product. If people do not know well the fundamentals of GD&T they would never be secure they are talking about. They also call into disrepute the GD&T, so to be viewed several ways to specify and interpret. This is not

true, we have some different ways to specify (but are very close), but there are two ways to interpret a well-marked design.

### **Myth 12: You can learn GD&T in two days**

Most people receive only 16 hours of training, and assumes that this is enough. Two days may be sufficient to teach a person to read the drawings using GD&T, but not enough to teach a person to do the drawings and certainly not enough to make it fluent in GD&T. Fluency requires a minimum of 120 hours of interactive sessions in a room, with exercises and practical applications. Unfortunately, in Brazil many people who purchase training GD&T does not know what you're buying. This leads to prioritize short and cheap courses. In the end, all the investment is wasted, because the drawings do not accept incompetent markings. Fixed bad references lead the company and its suppliers to waste money, and cause the deterioration of relationships and delays in projects.

### **Myth 13: GD&T is learned in college**

It is very usual for people who take or took courses, for example, mechanical engineering, say they have learned or are learning GD&T in college. This is possible, but unlikely. The good learning GD&T occurs when the business is the company experiencing any use and impact of GD&T. Teaching GD&T for a person who is starting his career without ever has worked in a company in the areas of product manufacturing and / or control is very difficult, mainly because they lack practical experience to this work. The successful completion of courses in GD&T is with those professionals using drawings with GD&T and face many questions in their daily routine. In college professor does not have that focus or that concern. In addition, the college environment can not move designs of companies, which are essential to the practice of GD&T.

### **Myth 14: GD&T is learned in open courses**

Just as it is very difficult to train professionals in GD&T in schools, so do the courses in open mode. Proper training in GD&T requires a lot of practice after the field of law. This good practice should be made in the designs of the company and its customers and / or suppliers. Each design reflects a reality where they experienced the problems and difficulties of marking, interpretation and control of GD&T. As out of respect for property, these same designs can not move freely in the environment of open courses. Thus, the practice in real cases, is compromised, as well as their learning. In our view only the core course can be taught in the form of open courses.

### **Myth 15: Few people need to know GD&T**

This myth is very dangerous because some companies believe that having only one or two people trained in GD&T the company is already answered. This is wrong because, as GD&T is a design philosophy based on its own grounds, it is necessary that the

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entire workforce involved in the matter to is trained. This will enable greater participation in the discussion on the marking, interpretation and / or control of the product. The company must extend the training in GD&T for the entire workforce which involves engineering products, processes, quality, metrology, tool design and device fabrication, assembly and control, tooling, purchasing, technical and other areas that use technical drawings .

## **Myth 16: The management did not need to know about GD&T**

Currently few managers (directors and managers) have a good knowledge of GD&T. On the one hand this is accepted because that position no longer exists the need to work with the drawings. However, as GD&T is a philosophy of product design, well-executed, it is essential that these managers have minimal knowledge about "what is GD&T" and "because of GD&T". Many managers must be humble enough to attend a classroom, even to attend a course on Vision Board of GD&T. It is natural that the team learned that the manager dominates GD&T, it will take more care when using them. Thus, fewer errors occur. This is very important because it is almost impossible to find drawings with marking of GD&T with no errors.

## **Myth 17: We adopt a simple solution for training in GD&T**

In order to save money the company has home-made solutions to empower their workforce in GD&T. Often these people (internal multipliers) participate in courses in open mode and use the material illegally from that course to the internal multiplication. Besides this, they do not dominate the philosophy, the practice and the fundamentals of GD&T and, therefore, prepare people badly. These come with the illusion that they learned GD&T and start to make mistakes marking, interpretation and control. With this, the invisible costs increase and everyone starts to blame GD&T. The recommendation is that the company can not ignore a good training in GD&T, carried out by competent professionals, for their employees.

## **Myth 18: GD&T is learned by intranet / internet**

This myth is very common nowadays. With the advancement of non-classroom courses taken by internet or intranet, the company chooses to train their employees using this practice. For some courses this is a good solution, however, to GD&T we cannot say the same. As we don't learn how to play soccer through video games, we also do not learn GD&T courses only through internet adequately. This is because it is very important discussion and exercises of actual cases in the classroom. Both teachers and students learn a lot when using real cases of the company and this is impossible with courses in the discipline. Moreover, the Internet or intranet makes it difficult to experience in person where

questions and answers are made in person about all aspects of GD&T.

## **Myth 19: We can't realize the GD&T training cost-benefit**

Currently there is a major concern in assessing the return on investment in all courses. In our view, the training of GD&T offer a great opportunity to measure the return. In our experience with GD&T and the training we can say that this is one of the few courses that may have a high return on the first day of training. It is the only professional HR (training analyst) to identify where the greatest losses occurring for non-domain of GD&T are. As an example, we cite the case where there was an erroneous marking of GD&T and this triggered the construction of tooling and manufacturing control, the cost is easily accounted for. Furthermore, it also allows to evaluate the stresses caused by rework and delays in product development, as well as customer dissatisfaction before these events. The company that has a good competence in GD&T is very well regarded by its customers, this may account for new developments and new gains.

## **Myths related SPECIFICATION**

### **Myth 20: Standards of GD & T are ambiguous and confusing**

There is some truth in the myth, however this fact only occurs for those professionals who have had an inadequate training. Just as GD&T needs more time and effort to master it does not mean it is flawed, inadequate and not worth learning. Nor is it true that GD&T generates misinterpretation as designs are well marked and people dominate the subject.

### **Myth 21: Drawings using GD&T is time consuming**

Proponents of this myth want speed at any cost. Ironically, because they have no time to do the drawings correctly the first time, they have time (and money) to make revisions later. The clarity and precision of GD&T may require more time initially, but saves time in the future. Only when managers have a greater knowledge of GD&T can they be sure that this myth should be ignored.

### **Myth 22: Cartesian system is easier than Geometric System**

This myth, once again, derives from many professionals affection to coordinated system and the belief that this system is good because it's been for so long and all drawings were done in the past. The problem of using coordinated design is that only with it we cannot reach the level of precision demanded by technologies such as CAD / CAM and electronic gauges. GD&T currently meets these needs, working even better when designers use the concept of functional design. Actually it is not Cartesian system or geometric system, the four types of errors, they can

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only be covered when we use two systems together.

## **Myth 23: GD&T should be used only in critical elements**

This myth is correct regarding that some elements of number are not critical, the problem starts from the definition of what is a critical element and what is not critical. The limited use of GD&T can bring some benefit initially, but when the philosophy and rules of GD&T are applied to all elements of the part, and the whole process of product realization, the benefits of GD&T increases exponentially. Historically, this myth was supported by the version of ISO 1101:1983 which recommended the application of GD&T which was essential, that is, only functional elements, interchangeable and some other details. In review of the standard recommendation that has been withdrawn, the ASME never had this recommendation. In fact, any mechanical design that is inapplicable to GD&T is an incomplete design for not covering the four types of errors.

## **Myth 24: Preparation of design and GD&T are distinct**

The myth of making drawings now and marking with GD&T was later created by the need of saving time, and by the lack of knowledge of geometric tolerances. A drawing with dimensions lacking and insufficient definitions of tolerance, can produce artificially low estimates of cost or lead to produce parts manufacturing non-functional. The use of GD&T allows the product to be tested in the paper instead of being tested in a prototype. Companies that train their designers to test the role (Tolerance Stacks), and gives time for it, often eliminate the need for studies in several prototypes.

## **Myth 25: GD&T requires review of all the old drawings**

There is a controversy in the market for the conflict of a product that has designs without GD&T marking drawings living with the GD&T marking. Ideally, all product design is marked with GD&T. However, many current projects use old drawings (other projects) to communize parts. Since then, the conflict is established when these early drawings were not marked with GD&T. Good practice says to revise the labeling of these drawings since the old marking can interfere with the design of the new product. However, we must be careful when this drawing is having another application. The truth is that the use of GD&T, from a certain point in life does not require the company to review all the old drawings. This should be done very carefully and knowingly.

## **Myth 26: Standards of GD&T are all equal**

Although the philosophy of GD&T is the same for the two major standards in the world (family and family ASME ISO), the foundations, symbols, rules and ways to score and interpret drawings have some important differences that should be considered. For people with little knowledge of the

subject it seems the same, but for qualified professionals in both standards differences are significant. It is recommended special care in identifying which standard governs the marking of the GD&T analysis and this design can only be interpreted by this standard. We must consider the date of the Standard. For companies that adopt the ASME and have to adopt the ISO, or vice versa, some significant adjustments should be considered.

## **Myth 27: GD&T is synonymous of accuracy**

Who says this kind of thing does not understand GD&T. It's better to make it clear that GD&T has nothing to do with the value of the specified geometric tolerance. Looser or tighter tolerances are defined from the requirements of the project. In the analysis of functional design to evaluate whether a tolerance is tight or loose, that is sufficient to meet the requirement. Thus, we can apply in GD&T tolerances of thousandths (0.001 mm) and tolerances decimetres (100 mm). GD&T is not and can not be confused with tight tolerances.

## **Myth 28: The Application of GD&T requires use of software**

Although the use of software is useful in studies of functional design (tolerance stacks), the same can not be regarded as essential for the marking of GD&T. As can be constructed by hand control charts in CEP, we can also make studies of tolerance stacks without the use of software. We understand that the software is necessary, but their absence does not justify the application of GD&T especially when the interactions of translation and rotation occur in 2D. In the case of 3D, then yes, the software is essential.

## **Myth 29: GD&T does not require dimensional analysis**

Any marking of GD&T should be supported by a study of dimensional analysis, or more precisely the functional analysis. Unfortunately most of the markings are made without this consideration. We can be sure only if the values of dimensional and geometrical tolerances are appropriate when the project was submitted to the study of tolerance stacks. Otherwise, we are never sure if we specify the better tolerance (tolerance suitable for the product and process) for the project in focus.

## **Myth 30: GD&T applies in informal discussions**

Just as the doctor does not see the patient in parties, corridors etc, we should not discuss the marking of GD&T in an informal way, ie without systemic method. Many practitioners are unaware due to all the complexity of the GD&T marking, do this informally and without any concern for further study. This leads to erroneous markings that will generate future costs too. To dispel this myth we created the GD&T Data Sheet which is a formal document used to formalize the marking of GD&T in

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product design. When this document is stamped by the company and properly used, the markings erroneous GD&T reduces considerably, tending to zero.

## **Myth 31: The use of GD&T generates different specifications**

This myth is true when GD&T is applied or the ASME or the ISO. However, when competent professionals using the same standard and with people in the group with superior knowledge of product requirements, limitations of the process and forms of control, and following all the basics of the methodology, the markup should be as close as possible. Differences should occur only when the current standard permits the use of it or a control characteristic or another one, for example, can be replaced by concentric beat etc.. However, large differences are caused by people not suitable for the marking of GD&T.

## **Myth 32: Only the definition of reference is sufficient in GD&T**

Believing in this myth is a trap. The definition and use of references is one of the first steps of marking a drawing with GD & T. But this is only the beginning. We have no doubt that we have a gain when this occurs. However, the definition of reference should be understood as a necessary condition and not as a sufficient condition. When the company references in the park is losing all the potential of the methodology. This practice, though used by some companies is not the best practice, even recommendable.

## **Myths related MANUFACTURING**

### **Myth 33: The tools do not need GD&T**

This myth exists mainly because we are still in the process of implementation of GD&T drawings of products. If we still have many companies not applying GD&T correctly in their products, and collect them from the application of GD&T in tooling manufacturing and assembly. Since these tools are mechanical engineering and subject to the dimensional and geometric variations, GD&T applies. In these cases, you must have the product design as a reference for these markings.

### **Myth 34: The construction of the tooling with GD&T is complicated**

Again, the factor that defines the complexity for the construction of a particular product or tooling is GD&T, but their functional requirements. Many confuse complexity with the lack of knowledge of GD&T. Regardless of the use of GD&T, the tools should be built and meet the specifications of the product which in turn must meet the specifications of the client (your requirements). We must be sure that with the use of GD&T will make only a tooling design more consistent in terms of dimensional and geometric, which will surely have far fewer problems during their try-out.

### **Myth 35: GD&T hinders productivity**

This myth is linked to the use of tight tolerances and the highest number of controls. A good marking GD&T will only facilitate the manufacture and assembly or part due to have involved the process engineers, control, and suppliers from the time of identification of references. We can say that the other way around is true, or not to use GD&T is what really makes the production process, generating lots of rejections, rework, tighter tolerances, misinterpretation pass / fail due to lack of clear markings.

## **Myths related CONTROL**

### **Myth 36: Dimensional control and GD&T are synonymous**

Many people believe that to control the dimensional (size tolerance) and to the geometric control (tolerances of form, orientation and location) are the same thing. Therefore, if we know the dimensional system well (Cartesian), we have no difficulties in making the geometric control, especially if we have a CMM available or another equivalent equipment. This myth is sustained by those who do not want to spend time learning GD&T and despise all their pleas. GD&T requires a new conception of control. It is a new paradigm, and for this, one must acquire new knowledge, because knowledge of the Cartesian system is inadequate and incomplete.

### **Myth 37: GD&T allows the sum bonus of references**

This is one of the most dangerous myths when control of parts using GD&T with references in maximum material condition (MMC) or minimum material condition (LMC). People believe they can get by adding the references indiscriminately. Who knows GD&T in-depth know that this is only allowed if it is controlling only one element and not a set of elements. If we are controlling a coaxial element with the geometric feature of the real position, the bonus element reference can be added. If more than one element, first we must identify the direction of movement of the items checked. More than a myth is an error control parts in GD&T.

### **Myth 38: GD&T increases the number of control devices**

Who sets the number of control devices in the production process and the final evaluation of play is not the application of GD&T, but their functional requirements, resources available for production control and quality policy adopted by the company. The proper use of GD&T only facilitates the adoption part eliminating questions of interpretation, from the functional definition of landmarks. When you think of control we have in mind to reduce costs, but not the reduction that compromises the assessment of the artifact. We point out that with the application of GD&T it becomes the elaboration of the product control much easier.

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## Myth 39: GD&T increases the number of rejected parts

Who knows the philosophy and fundamentals of GD&T will never make that statement because it is exactly the opposite. The whole structure of GD&T is made for the company to maximize profits, taking full advantage of the available tolerance, that is, using as many pieces as possible, avoiding the rejection of good parts. If this does not occur there must be specification or interpretation errors. When applying GD&T we do it to increase the value of tolerance and never to decrease it. Doing this, it increases the probability of pursuing good parts.

## Myth 40: GD&T does not require control by CEP

As the application of dimensional tolerances applied to the size require the use of Statistical Process Control (not talking of Control Charts, but the statistical evidence), GD & T also requires statistical evidence for errors of form, orientation and location. Unfortunately, most companies are not adopting this practice, either because of ignorance of the reasons for CEP applied GD & T or knowledge of GD & T or by lack of CEP. The combination of CEP in GD & T with the use of control devices should be encouraged.

## Self-evaluation of the Myths in GD&T

	YES	NO
MYTH 1		
MYTH 2		
MYTH 3		
MYTH 4		
MYTH 5		
MYTH 6		
MYTH 7		
MYTH 8		
MYTH 9		
MYTH 10		

	YES	NO
MYTH 11		
MYTH 12		
MYTH 13		
MYTH 14		
MYTH 15		
MYTH 16		
MYTH 17		
MYTH 18		
MYTH 19		
MYTH 20		

	YES	NO
MYTH 21		
MYTH 22		
MYTH 23		
MYTH 24		
MYTH 25		
MYTH 26		
MYTH 27		
MYTH 28		
MYTH 29		
MYTH 30		

	YES	NO
MYTH 31		
MYTH 32		
MYTH 33		
MYTH 34		
MYTH 35		
MYTH 36		
MYTH 37		
MYTH 38		
MYTH 39		
MYTH 40		

### Self-evaluation of the Myths in GD&T

To eliminate the myths of GD&T quoted in this article, we recommend the company to develop a deeper understanding of the scope of GD&T, properly train its employees and allow sufficient time for the engineers and designers to create consistent designs. Management must also review their priorities and no longer value people by speed but by the quality, and also the use of maximum available tolerance. When the GD&T is truly learned, fully understood and properly used, myths and consequences will be eliminated.

We also recommend that the company make a self-assessment as is the current situation in relation to the myths presented. Use **YES** if the myth is the reality of this company and **NOT** if the myth is absent from the company's reality. Then see the code below to determine the IQ of GD&T of your business:

**Company Type I - Up to 10 NO:** The company has little or no evidence of application of GD&T in its products or products of its customers. Even with the same application is questioned.

**Company Type II - From 11 to 20 NO:** The company has shown some evidence of application of GD&T. However, there must be many disagreements about the marking, interpretation and control.

**Company Type III - From 21 to 30 NO:** The company shows some evidence of application of GD&T. However, there are still some disagreements on the marking, interpretation and control.

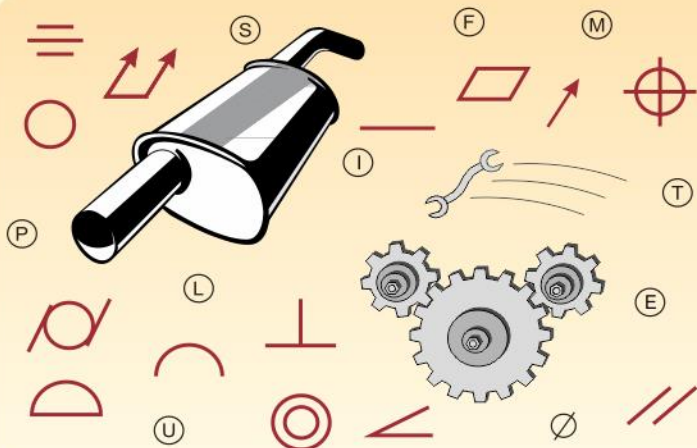
**Company Type IV - Over 31 NO:** The company shows much evidence of application of GD&T. There may be some disagreement as to the marking, interpretation and control, but the company knows how to resolve this issue.

Table - Types of Companies

		KNOWLEDGE		
		LOW	MIDDLE	HIGH
APPLICATION	HIGH	COMPANY TYPE II	COMPANY TYPE IV	COMPANY TYPE IV
	MIDDLE	COMPANY TYPE II	COMPANY TYPE III	COMPANY TYPE III
	LOW	COMPANY TYPE II	COMPANY TYPE II	COMPANY TYPE II



# What is GD&T?



It is a way to scale and tolerate a design considering the **Role, Relationship** and the **tolerances** of the elements of the piece, so that it can be produced economically.

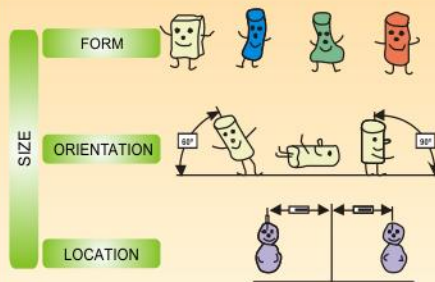
In general, it is a system of symbols and rules for the Practice of Design (GoodDrawingPractice) which provides the means to scale and to tolerate the elements of the part, ensuring standardized interpretations anywhere if you use it.

The **application of GD&T** involves the whole cycle of product development: Concept, Design, Prototype and Production.

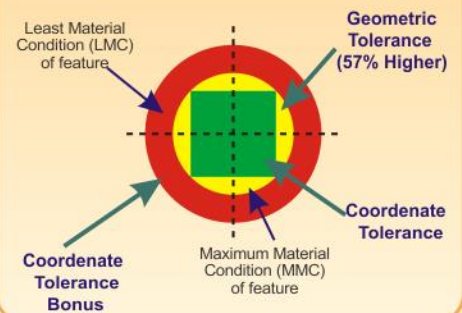
## PROJECT REQUIREMENTS PRODUCT



## DIMENSIONAL AND GEOMETRICAL VARIATION



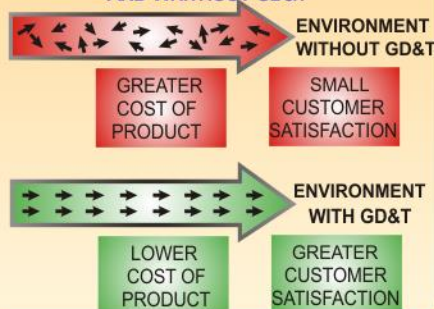
## COORDINATE AND GEOMETRIC TOLERANCE



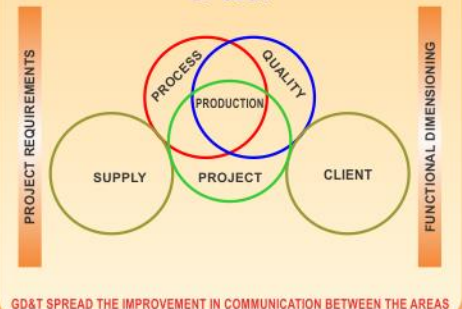
## KEY WORDS IN GD&T



## ENVIRONMENTS IN COMPARISON WITH AND WITHOUT GD&T



## FUNCTIONS INVOLVED IN IMPLEMENTATION OF GD&T



## MAIN GEOMETRIC TOLERANCE STANDARDS

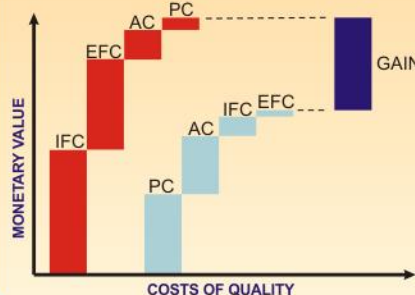
GD&T - GEOMETRIC DIMENSIONING AND TOLERANCING (ASME)  
**ASME Y14.5M:1994/2009**



GPS - GEOMETRICAL PRODUCT SPECIFICATIONS (ISO)  
**ISO 1101:1983/2004**



## GAINS IN THE APPLICATION OF GD&T



## SERVICES OFFERED IN GD&T

**GD&T-GEOMETRIC TOLERANCE**

**ASME Y14.5/ISO 1101**

**TRAINING AND CONSULTANCY:**

- STRUCTURE OF THE IMPLEMENTATION
- TRAINING OF PEOPLE
- FOLLOW THE SPECIFICATIONS

**SERVICE:**

- SPECIFICATIONS DRAWINGS
- FIXTURE PROJECT
- EVALUATION OF PARTS

Specializing in the segment Automotive and Auto Parts

Application of GD&T - Enhancing the Product with Reduced Costs

# Available Training for GD&T

**QPTG01**

**16 horas**

## **GD&T - Functional Specification for Manufacturing Processes**

Covers the concepts, fundamentals and methodology of the system of functional evaluation applicable where there needs to manufacture parts, such as machined parts. Establishes the relationship between the system of functional evaluation and the methodology of tolerance stacks showing that the similarity and difference between the systems.

**QPTG03**

**16 horas**

## **GD&T - Application of Isometric Drawings**

Discusses the application of GD&T drawings in 3D, considering all the concepts and fundamentals in the usual 2D drawings suitable for 3D design, but also the appropriateness of the symbols for this particular use.

**QPTG05**

**16 horas**

## **GD&T - Fixture and Gauge Control**

Covers the design of functional devices for control of parts in GD&T considering all the geometrical characteristics and variants of application as well as specified tolerances for the construction of geometric dimensions and gauges for the three material conditions (MMC, LMC, RFS) .

**QPTG07**

**40 horas**

## **GD&T – Project Specification Product - Advanced**

It complements the refined concepts and fundamentals for the application of GD&T, based on the ASME, with emphasis on specification of geometric features, reading, specification interpretation and matched control and dimensional evaluation of the actual location for more complex parts.

**QPTG09**

**16 horas**

## **GD&T – Drawings Reading and Interpreting - Fundamental**

Discusses the main concepts and foundations by reading and interpreting drawings with the application of GD&T, based on ASME and some basics of ISO, with emphasis on geometric interpretation of references and dimensional evaluation of the real position for simple parts.

**QPTG11**

**16 horas**

## **GD&T – Planning Control and Dimensional Geometric**

Covers the basic foundations and concepts that should be considered in the formulation and preparation of planning control and dimensional geometric product. Considers issues of selection of calibrators, measurement uncertainty, and probability of error, and especially the construction of a control plan for GD&T.

**QPTG02**

**16 horas**

## **GD&T - Application of Geometric Tolerancing in CEP**

Discusses the use of Statistical Process Control - CEP for parts with application of GD&T, considering the three material conditions (MMC, LMC, RFS) and also the analysis of stability and capability to errors in size, shape, orientation and location.

**QPTG04**

**8 horas**

## **GD&T - Application of Castings and Forgings**

It addresses key concepts and rationale for the application of GD&T in castings and forgings, considering their interrelations with the final stage of cuts (raw versus finished) and also the appropriateness of the symbols for this particular use.

**QPTG06**

**32 horas**

## **GD&T – Specification of Product Design - Fundamental**

Aborda os principais conceitos e fundamentos para leitura, interpretação e aplicação de GD&T, baseado na Norma ASME, com ênfase em especificação de referenciais geométricos, análise crítica e validação do desenho recebido do cliente e avaliação dimensional da posição real para peças mais simples.

**QPTG08**

**16 horas**

## **GD&T - Tools and Fixture Manufacturing**

Discusses the application of GD&T design fabrication tools (dies, molds, etc.) and mounting devices (sub-assemblies, assemblies, etc.) from the designs of existing products. Does the definition of geometrical benchmarks and geometrical tolerances, applicable to environmental construction tooling.

**QPTG10**

**24 horas**

## **GD&T – Drawings Reading and Interpreting - Advanced**

It complements the main concepts and foundations by reading and interpretation of GD&T, based on ASME and some basics of ISO, with the emphasis on geometric characteristics, matched control and review of the actual dimensional position for simple parts.

**QPTG12**

**24 horas**

## **GD&T – Practice Control Products - Advanced Application**

Addresses the practice of control of parts and products, considering the evaluation and validation of reference geometrical and geometrical features. It is a completely practical, and characteristics of a consultancy, but with the ingredients of a training. It is the combination of theory and practice.

# Available Training for GD&T

**QPTG13**

**40 horas**

## GD&T - Practice Specification Drawings - Advanced Application

Discusses the practice of marking of product design, recital is the definition of benchmarks, the choice of the geometric characteristics and determine the values of dimensional and geometrical tolerances. It is a completely practical, and characteristics of a consultancy, but with the ingredients of a training. It is the combination of theory and practice.

**QPTG14**

**24 horas**

## GD&T - Tolerance Stacks Fundamental

Covers the main concepts and fundamentals to determine the dimensional and geometric tolerances, considering the three systems of tolerance (Worst Case, RMS and Process Tolerance), including analysis of Cp / Cpk for simple parts.

**QPTG15**

**24 horas**

## GD&T - Tolerance Stacks Advanced

It complements the refined concepts and fundamentals to determine the dimensional and geometric tolerances, considering the three systems of tolerance (Worst Case, RMS and Process Tolerance), including analysis of Cp / Cpk for complex parts as well as Monte Carlo simulation.

**QPTG16**

**24 horas**

## GD&T - Verification and Control Dimensional and Geometric

Covers the basic foundations and concepts that should be considered in the verification and control dimensional and geometric product. It addresses each of the fourteen geometric characteristics separately and jointly. Reinforces the interpretation of the markings and the correct control of them.

**QPTG17**

**4 horas**

## GD&T – Overview Executive Leadership

Addresses the issue of GD&T in a language management, giving an overview of the main foundations and methodology, enhancing its applicability and potential. Allows executives from various areas of business visualize GD&T as an excellent initiative strategic product development.

**QPTG18**

**16 horas**

## GD&T/GPS - Comparison between ASME and ISO Standards

Addresses the comparison between ASME and ISO standards (differences and similarities), considering the main definitions and rules, conditions of material, geometrical, geometrical references and symbolism.

**QPTG19**

**32 horas**

## GPS – Geometric Product Specification ISO - Fundamental

Discusses the main concepts and foundations for reading, interpretation and application of GD&T, based on ISO, with emphasis on geometric specification references, review and validation of the design received from the client and evaluation dimensional position peel to simpler parts.

**QPTG20**

**40 horas**

## GPS – Geometric Product Specification ISO - Advanced

It complements the refined concepts and fundamentals for the application of GD&T, based on ISO, with emphasis on specification of geometric features, reading, specification interpretation and matched control and dimensional evaluation of the actual location for more complex parts.

**QPTG21**

**16 horas**

## Dimensional Tolerances and Surface Roughness

Discusses the application of dimensional tolerances (linear, angular and fit) for the errors in size analysis of mating parts of the application and interpretation of tolerances for surface roughness, including knowledge and use of major national and international the subject.

**QPTG22**

**24 horas**

## GD&T ASME Y14.5-2009

Discusses the main changes and improvements of the standard, presenting and comparing the new main foundations, concepts, symbols and implementation and its impact on product, process and control. We present the main differences and similarities with the standard of the previous version and also of the ISO.

**QPTG23**

**8 horas**

## PRS - Points of Reference System

Discusses the key concepts and practices to establish benchmarks, used by some automotive companies to reduce variations during the manufacturing and assembly of complex parts and assemblies through wrong interpretations and decisions, in addition to or substitution for simplification normative practices of GD & T.

## GD&T - GEOMÉTRIC TOLERANCING

ASME Y14.5 / ISO 1101

TRAINING AND CONSULTANCY:

STRUCTURE OF THE IMPLEMENTATION

TRAINING OF PERSONS

FOLLOW THE SPECIFICATIONS

SERVICE:

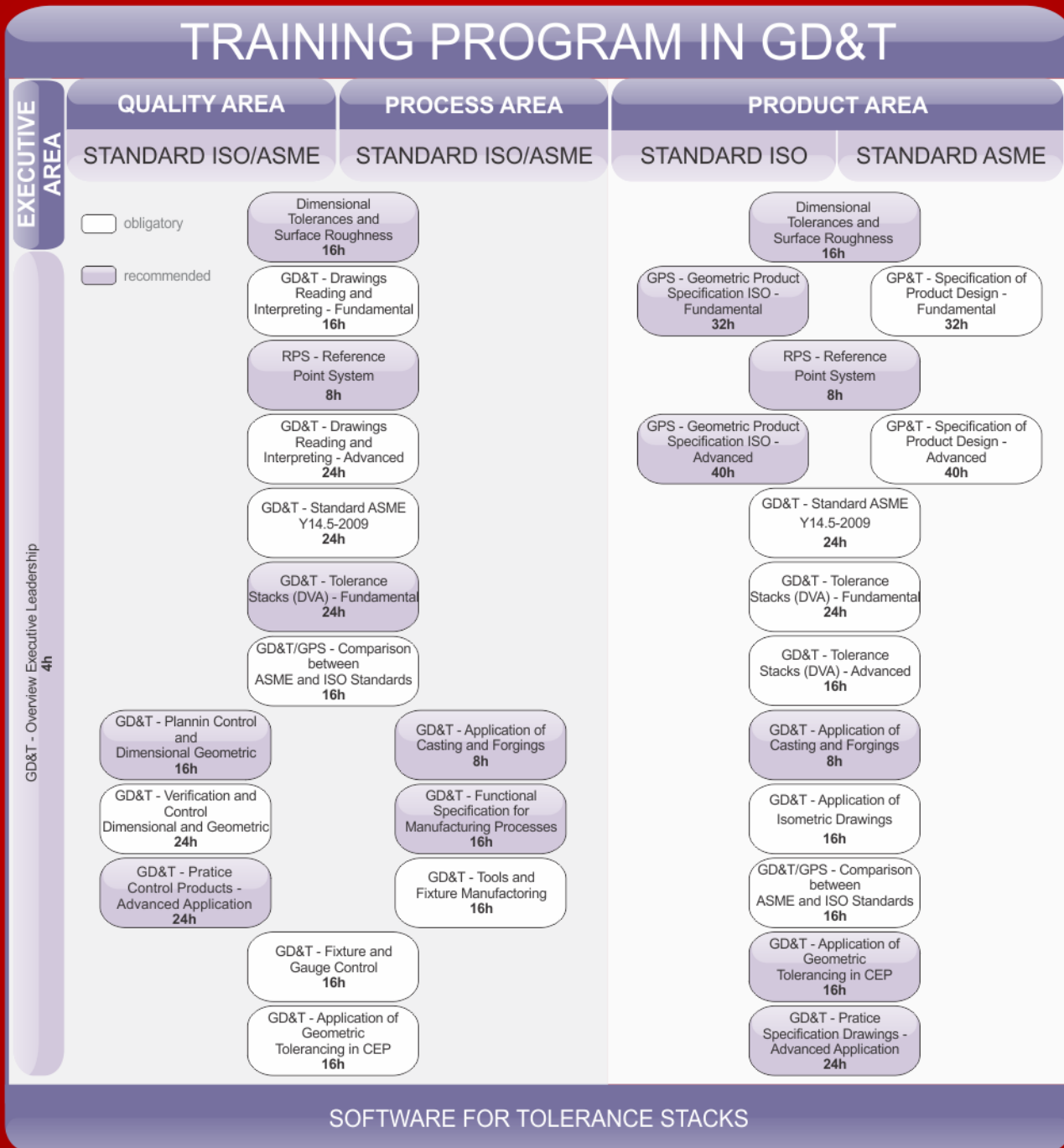
SPECIFICATIONS DRAWINGS

FIXTURE PROJECT

EVALUATION OF PARTS

# BECOME AN EXPERT PROFESSIONAL IN GD&T

The labor market is increasingly competitive, but at the same time, offering great opportunities for professionals. Identified as one of the opportunities the Implementation and Control GD&T - Geometric tolerances. However, we also realize that there is a great lack of professional training. Basso's & Associates is a pioneer in teaching GD&T in Brazil, operating in the market since 1989 and recognized by the main demands of this technique. We offer the "Training Program in GD&T" to the areas of Product, Process and Quality. After the compulsory programming service, the Participant shall be submitted at the end of the program, a conceptual and practical assessment and taking into account this evaluation, will receive a Certificate of Expertise in GD&T, which makes it a highly qualified professional and differential in labor market since the application of GD&T companies around the world, is a strategic initiative for the development of products.



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