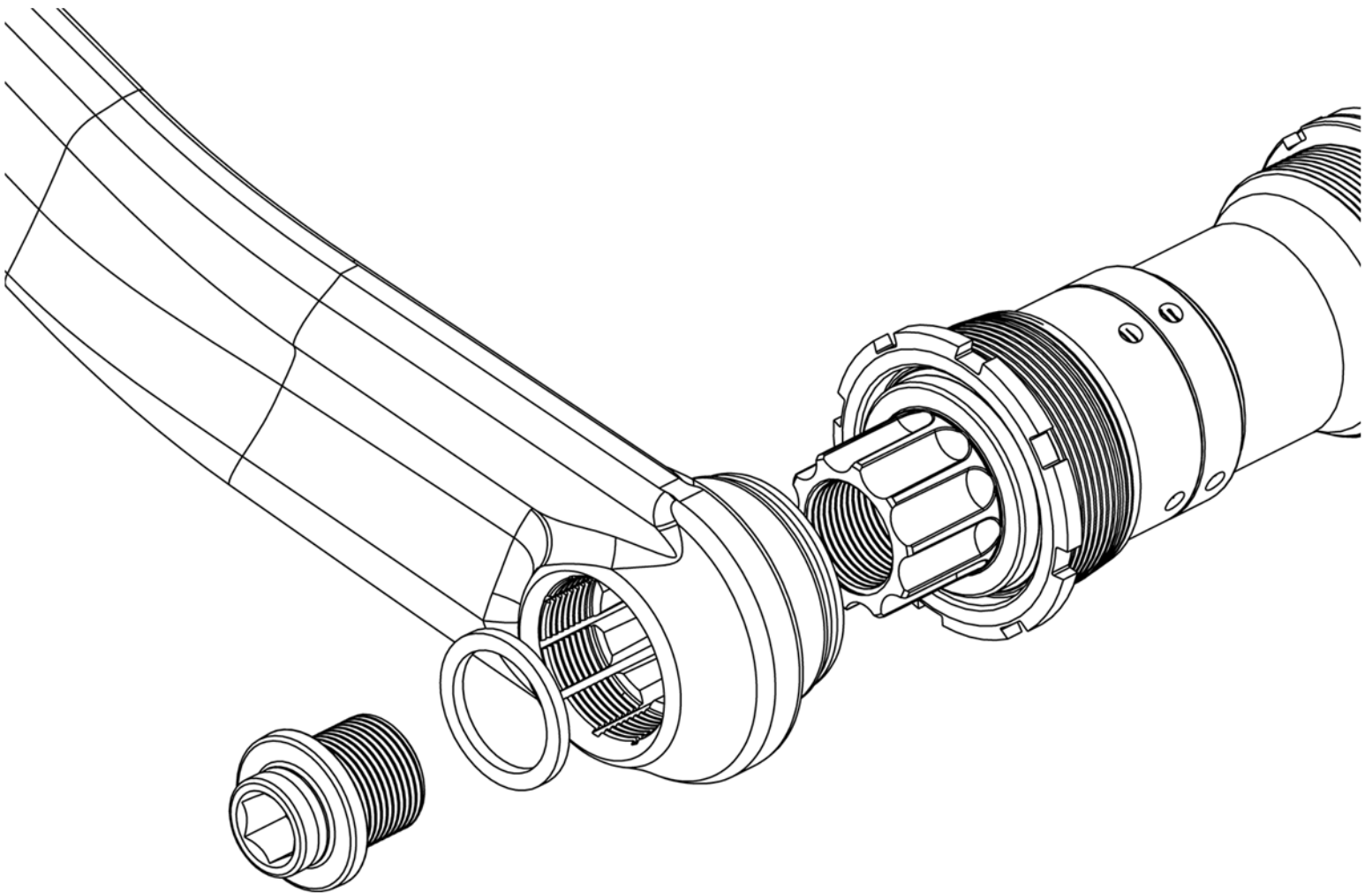




# The International Spline Interface Standard





REVISIONS

REV	DATE	BY	COMMENTS
A	17-Aug-00	G. Smith	Release.
B	19-Oct-00	G. Smith	Skipped a revision to catch up with drawings.
C	30-Oct-00	G. Smith	Added frame centerline clarification in Sec 1.2.1. Added suggested press-fit numbers for aluminum alloy cranks in Sec 3.1.2. Added note to grease the interface between the crank and spindle in Sec 3.1.2. Added diameter symbols for male shoulder diameter and spline major diameter on drawing sheet one. Added diameter symbols for female shoulder ID on drawing sheet two. Changed minimum spline length in crank to 18.5mm from 19.0mm on drawing sheet two. Added thread depth, chamfer dimensions, and flag note three for crank on drawing sheet three.
D	23-Mar-01	G. Smith	Increased flute minor diameter by 0.02mm. Changed spline tolerance scheme on drawing sheets one and two. Added crank thread depth and washer thickness tolerances on drawing sheet three. Added bolt length requirements on drawing sheet three. Added drawing sheets six and seven showing use of master gages. Modified text in Sec 3.1.3, Attachment Bolt discussion. Changed all references from Master Gages to Reference Tooling.



## 1. Overview

### 1.1. Background

The International Spline Interface Standard (ISIS Drive) was conceived and executed for the following two reasons:

1. To create a common bottom bracket/crankset interface that can be freely shared within the industry. Currently the industry is fragmented and non-standardized with regard to the bottom bracket/crankset interface. This standard seeks to eliminate this problem and thus allow the easy and fully compatible exchange of parts among manufacturers.
2. To eliminate or greatly reduce the current problems associated with bottom bracket and crankset interfaces. These problems include incompatibility, lack of crankset position control, insufficient interface strength, and difficulty in determining interface compatibility/conformance.

This standard consists of two parts: one governing the interface between the crank and bottom bracket spindle, the other describing a set of standard spindle lengths. The interface portion defines the ISIS Drive interface geometry, insertion depth and control, and attachment bolt specifications. The spindle length section defines the relationship between the bottom bracket and the frame centerline for different standard spindle lengths, thus ensuring the correct position of the crankset relative to the frame centerline.

### 1.2. Definitions

#### 1.2.1. Frame Centerline

The frame centerline is defined as the plane running through the middle of the bottom bracket shell and perpendicular to the bottom bracket spindle axis. For the purposes of this document it is assumed this plane coincides with the plane defined by the bicycle frame and dropouts.

#### 1.2.2. Chainline

Chainline measures the relationship of the front chainrings to the frame centerline. The chainline of a crankset has a major effect on the shifting performance of the front derailleur, and thus must be controlled and measured accurately and consistently. Following are the methods of measuring chainline for the different types of cranksets in the context of this standard. Sheet five of the standard drawings graphically define the following chainline measurements.



#### 1.2.2.1. Single Chainring Cranksets:

Chainline is measured as the distance from the frame centerline to the center of the tooth of the single chainring.

#### 1.2.2.2. Double Chainring Cranksets:

Chainline is measured as follows:  $A$  = the distance from the frame centerline to the crank stop shoulder,  $C_{avg}$  = the average of the distances from the crank stop shoulder to the center of the tooth of the inner and outer chainrings. The chainline is then the sum of these two measurements,  $A + C_{avg}$  (see drawing sheet five).

#### 1.2.2.3. Triple Chainring Cranksets:

Chainline is measured as the distance from the frame centerline to the center of the tooth of the middle chainring.

## 2. Design Overview and Advantages

This new interface was designed to eliminate or greatly reduce the problems with current bottom bracket/crankset interfaces. These problems are identified below with the new interface's design features following.

### 2.1. Current Interface Limitations

#### 2.1.1. No "Standard"

There is currently no "one" standard that defines the geometry and interface relationship between the crankarm and bottom bracket spindle. This results in compatibility problems among manufacturers and has severely limited the ability of bicycle manufacturers and the general public to freely choose among bottom brackets and cranksets across companies.

#### 2.1.2. Structural Capability

The use of bicycles in extreme conditions has clearly demonstrated the limited structural capability of the tapered square interface. Common failures of this interface include spindle strength, crank arm interface deformation, and low impact strength and fatigue life of both the spindle and crankarm.

#### 2.1.3. Insertion Depth/Chainline



Chainrings and front derailleurs have evolved to produce exceptional and reliable shifting performance under all types of riding conditions. Unfortunately the degree of shifting performance is greatly influenced by very small differences in chainline. Only in recent years have some square bottom brackets utilized a chainline control stop for the drive-side crankarm. This has certainly been a step in the right direction, but problems still occur with Q-factor and insertion depth for the non-drive crankarm. Further, only a few companies currently produce bottom brackets with this drive-side chainline control stop, thus limiting the compatible bottom bracket choices available to consumers and manufacturers.

#### 2.1.4. Design/Manufacturing Differences

As mentioned above, no one standard exists for the bottom bracket interface geometry. Thus, it is impossible for manufacturers to produce bottom brackets and cranksets that are freely interchangeable, each manufacturer following a different standard or no standard at all. Further, there is no reference tooling available for checking the conformance of any bottom bracket to a known reference, so it becomes difficult to ensure that manufacturer A's bottom bracket is interchangeable with manufacturer B's bottom bracket. These manufacturing differences produce nothing but confusion for bottom bracket and crankset manufacturers, customers, and users.

### 2.2. ISIS Drive Features

#### 2.2.1. One Open Standard

This standard, by definition, eliminates the compatibility problems among manufacturers by disclosing a free, common interface for all companies and individuals to produce parts to.

#### 2.2.2. Structural Capability

When used with appropriately engineered materials, a spline system to transfer load between the crankset and bottom bracket greatly increases the strength and durability of the bottom bracket/crankset interface. The ISIS Drive interface also includes additional support structures to stabilize the crankarm relative to the spindle. This standard recognizes the different requirements of spindle materials and riding conditions and therefore includes two different attachment bolt sizes so engineers can choose the optimum bolt size for their specific application.

#### 2.2.3. Insertion Depth/Chainline Control



A critical component of the interface standard is the use of a crank stop shoulder on the bottom bracket spindle to ensure consistent axial crankarm location. These stop shoulders are the datums from which the entire interface standard is derived.

#### 2.2.4. Standard Reference Tooling

Parts manufactured to this standard may be checked with precision reference tooling to ensure they meet the standard requirements. Two types of reference tools are available through the standard home page ([www.isisdrive.com](http://www.isisdrive.com)), one a GO/NO-GO gage for checking ISIS Drive bottom bracket spindles, the other an “Ideal Spindle” reference gage. It is critically important that all manufacturers producing parts to this standard use the reference tooling in their quality procedures. The standard committee will maintain a list of companies who have purchased the reference tools and proven their products conform to this standard. This Compatibility List will be available on the standard home page. The Compatibility List’s purpose is to ease the introduction of the standard by providing a resource of companies that manufacture parts conforming to the standard and are therefore compatible with each other.

### 3. Part A – Bottom Bracket Spindle/Crankarm Interface

The ISIS Drive interface may be easily produced using a variety of manufacturing methods. The spindle may be machined or formed; the crankarm may be broached or broached and coined. Major and minor diameters of the interface were chosen to conform to as much existing tooling as possible, including current crank forging dies, fixing bolts, and removal tools. The interface was purposely designed not to be compatible with any other known interface. This was done to ensure that non-ISIS Drive parts could not be forced onto the ISIS Drive interface.

#### 3.1. Geometry Description

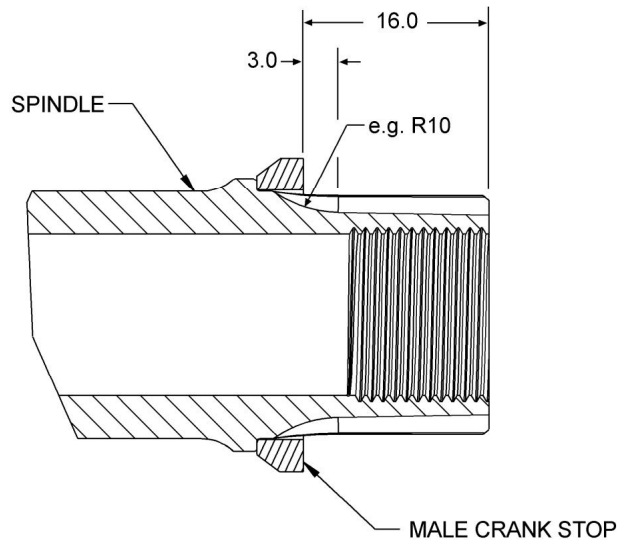
##### 3.1.1. Bottom Bracket Spindle

Sheet one of the standard drawings graphically describes the spindle interface geometry.

The spindle is a constant outer diameter shaft with 10 evenly spaced flutes machined or forged into each end. The flute cuts themselves are 6mm in diameter and inclined at a 1° angle to the spindle axis. In addition to the tapered flutes, a hard stop is positioned 16mm from the end of the spindle on

both sides of the bottom bracket. The spindle is symmetric relative to the bottom bracket shell centerline.

It is noted on the drawing that the 3.000mm sweep-out distance of the flute cuts use a 3.0mm minimum radius. These dimensions are requirements if the male crank-stop shoulder is integrally formed with the spindle. An alternative to this design is the use of a separate pressed-on crank-stop. If the pressed-on shoulder configuration is used for the male crank-stop then the 3.000mm sweep-out dimension refers to the pressed-on crank stop rather than the stop shoulder integrally formed with the spindle. This allows the flute terminating sweep-out to extend along a greater distance, thus decreasing the stress concentration present at the flute termination and possibly improving workability. Figure 1 illustrates an example of this alternative configuration.



**Figure 1. Alternative spindle flute sweep-out configuration.**

Spindle bearing assemblies are not part of this standard.

### 3.1.2. Crankarm

Sheet two of the standard drawings graphically describes the crankarm interface geometry.

The crank interface maintains a constant minor diameter bore of 17.90-18.10mm and a constant major diameter of 22.0-22.4mm. The tapered profile of the crank interface exactly matches that of the spindle (1° inclined angle relative to the spindle axis) with 2 exceptions: the constant major and



minor diameters found in the crank interface as just described, and the offset of the gage lines to produce the required amount of press-fit between the parts. The crankarm spline may be created using several manufacturing methods but the simplest and quickest is through a broaching or broaching and coining operation.

As mentioned above, the interface requires a certain amount of press-fit between the crankarm and spindle. The magnitude of press-fit is defined as the distance between the female shoulder on the crankarm and the male shoulder on the spindle when the crankarm is pressed onto the spindle by hand. The shown 4.000 gage-line dimension for section B-B produces a nominal press-fit of 5.0mm. Note that the distance between the gage-lines remains constant for both the spindle and crankarm.

Each manufacturer must determine the allowable magnitude of the press-fit for their specific crankarm. However, to avoid problems with the crankarm loosening and ensure accurate crankset location, it is recommended that the crankarm “bottom out” against the male shoulder of the spindle prior to reaching the full installation torque specified by the manufacturer. When aluminum alloys are used for the crankarm, a press-fit between 3.0 – 6.0mm has been found to produce the best results.

The interface was designed to be thoroughly greased between the crankarm and spindle.

### 3.1.3. Attachment Bolt

This standard recognizes the different requirements of spindle materials and riding conditions and therefore includes two different attachment bolt sizes so engineers can choose the optimum bolt size for their specific application. The larger of the two bolt sizes uses an M15x1 bolt while the smaller size uses an M12x1 bolt. With all else being equal, the M12 bolt will create a stronger spindle due to the increased wall thickness through the spline area. Both sizes require a minimum thread depth of 12mm in the spindle.

To maintain compatibility among parts with different threads, the attachment bolt should be supplied with the bottom bracket. Drawing sheet three depicts standard dimensions for the crank bolt interface to ensure compatibility between bolts and cranks. The use of a washer between the bolt head and crankarm is required to prevent excessive deformation of the crankarm. The outside diameter of the bolt head itself may fall within a fairly wide range, but the length should fall the dimensions specified. Further, when a washer is used, the smooth side of the washer is best placed against the crankarm to prevent the washer from shearing through softer crank materials. A note of





caution: it is highly recommended that the length of threads in the spindle combined with the bolt length itself make it impossible for the bolt to “bottom-out” in the spindle if a washer is not used. This is to prevent possible damage to the spindle in the event of mis-installation.

### 3.2. Standard Reference Tools

Standard reference tooling is available through the ISIS Drive web page ([www.isisdrive.com](http://www.isisdrive.com)). This reference tooling allows for the quick and easy determination of whether a crankarm and bottom bracket spindle meet the ISIS Drive geometry requirements. The tools can therefore be used to ensure that parts are manufactured correctly and are interchangeable with each other. All manufacturers of ISIS Drive parts are strongly urged to use these reference tools in their quality procedures.

The ISIS Drive web page contains a list of companies that have purchased reference tooling and proven they can produce products that are compatible with the standard geometry. These companies are then given the right to use the ISIS Drive mark on their products, thus providing assurance that their products conform to the ISIS Drive geometry. Use of the ISIS Drive mark in no way guarantees structural integrity of components, only geometric compatibility with the ISIS Drive standard. Companies who wish to be included in the Compatibility List can find information about reference tool purchasing, part geometry validation, and ISIS Drive trademark licensing on the ISIS Drive web page ([www.isisdrive.com](http://www.isisdrive.com)). Trademark licensing and legal issues are also discussed in Section 5 of this document.

## 4. Part B – Positional Relationships

In order for the insertion depth/chainline control feature of this standard to be effective, dimensions for spindle lengths and distance from spindle crank-stop to frame centerline must be defined. This section defines these dimensions for a set of standard spindle lengths and therefore ensures the consistent location of the crankarm from the frame centerline for a given spindle length. Sheet four of the standard drawings defines these dimensions.

### 4.1. Spindle Lengths

Four standard spindle lengths are currently defined in this standard. The lengths and their recommended purposes are shown in Table 1 below. All spindles are symmetric relative to the bottom bracket shell centerline. The spindle designation refers to the nominal distance between the crank-stops; add 32mm to the spindle designation for the nominal overall spindle length.



**Table 1. Standard spindle designations, lengths, and recommended purposes.**

<u>Spindle Designation</u>	<u>Spindle Length</u>	<u>Recommended Purpose</u>
76	108mm	Narrow Mountain, Double Road
81	113mm	Standard Mountain
86	118mm	Wide Mountain, Triple Road
96	128mm	Downhill Specific

These spindle lengths were chosen for the following reasons:

- With the exception of the downhill bottom bracket, each spindle length difference is a multiple of 5mm, or 2.5mm on each side. This allows a single crankset to produce two different chainlines, differing by 2.5mm, simply through the use of a different bottom bracket.
- The 10mm difference between a 76 and 86 spindle is sufficient to allow one crankset to perform the function of either a road double or road triple simply by adding a chainring and switching spindles.
- The 15mm difference (7.5mm on each side) between the 81 and 96 spindles is roughly the same distance as typically exists between a middle and large chainring on a mountain bike crankset. When using some chain-guides, downhill bicycles require a large chainring be placed in the middle chainring position. To allow clearance between the bicycle frame and large chainring, this wider spindle places a crankset further from the frame centerline such that the middle chainring position ends up where the large chainring would normally be. Note that even with the many possibilities of downhill chain-guide set-ups, this spindle is still symmetric about the bottom bracket shell centerline.

#### 4.2. Information Disclosure Recommendations

Disclosure of the following specifications is recommended to allow users to make informed decisions when choosing among cranksets and bottom brackets:

- Recommended bottom bracket spindle designation for a given chainline.
- Distance from the frame centerline to the inside of each chainring.
- ‘I’ Factor.
- ‘Q’ Factor.

#### 5. Trademark Licensing and Legal Issues

ISIS Drive and the ISIS Drive logo are pending trademarks in the United States of America. Manufacturers wishing make ISIS Drive compatible products and use the ISIS Drive mark may do so after completing the following:



- Purchasing reference tools for their product and agreeing to actively use these tools as part of their quality procedures.
- Providing at least one sample of their product to the ISIS Drive standard committee that conforms to the geometry requirements set forth in this standard.
- Agreeing to and signing the license agreement that then gives them the legal right to use the ISIS Drive mark on the certified product.

A copy of the license agreement may be obtained by contacting the ISIS Drive committee through the ISIS Drive web site ([www.isisdrive.com](http://www.isisdrive.com)). Please note that this license entails no fees or royalties, but simply requires that the ISIS Drive mark be used only on products conforming to the ISIS Drive geometry and indemnifies the ISIS Drive standard committee, its members and companies, from any liability arising from the ISIS Drive geometry as used in the product.

The ISIS Drive standard discloses geometry only. Each company manufacturing parts to this standard is responsible for their own engineering to ensure their products are safe for use in their intended application. This standard makes no claims as to strength or safety of products manufactured to conform to the ISIS Drive geometry. Geometry alone has no strength until associated with a material and manufacturing process. The ISIS Drive standard discloses no information regarding appropriate materials for use with the geometry; this is left to the engineers associated with manufacturers producing ISIS Drive products.

## 6. Contact Information

Further information regarding this standard as well as updates to the standard and ISIS Drive artwork may be obtained from the ISIS Drive web page:

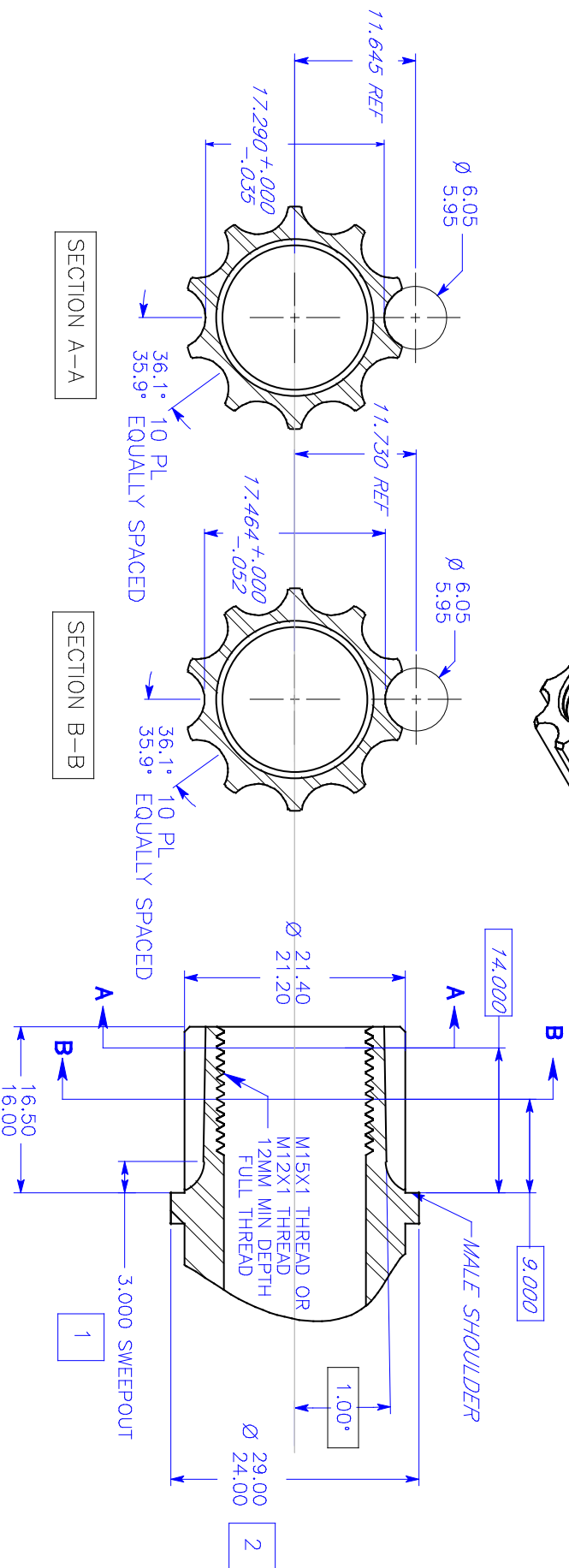
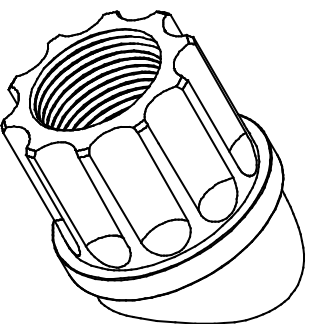
**[www.isisdrive.com](http://www.isisdrive.com)**

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[WWW.ISISDRIVE.COM](http://WWW.ISISDRIVE.COM) FOR DETAILS AND UPDATES

REVOLUTIONS		
REV.	DATE	CHANGES
A	9/5/00	CHANGES ITALICS, PRE LOAD WORDING, GAUGE LINES ALL RELATIVE TO STOP
B	9/12/00	NO CHANGE
C	10/16/00	INCREASE FLUTE MINOR Ø 0.02MM, BOX DIMSTO LOCATEGAGE PLANES
D	2/3/01	



2. MALE SHOULDER MUST SUPPORT FULL BOLT PRELOAD WHEN CRANK IS INSTALLED AND IN USE (MIN 7000 LBF (31137N, 31777 KGF) OF AXIAL LOAD SUGGESTED)

1. MIN 3MM RADIUS ON SWEEPOUT. SEE STANDARD DOCUMENT 3.1.1 FOR DETAILS

NOTES:

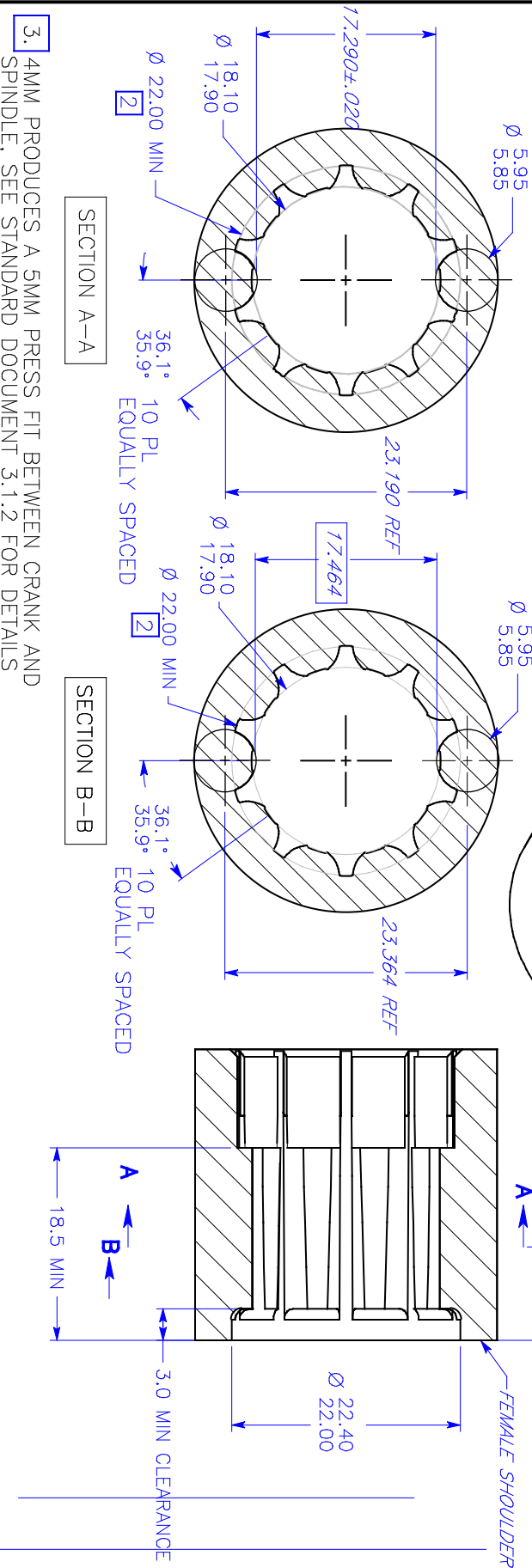
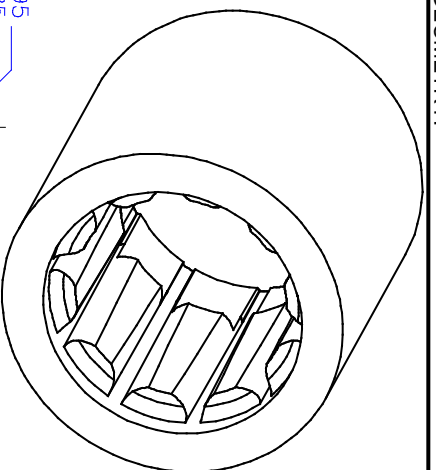
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4.0/30MM		REMOVE ALL BURRS	
ALL DIMENSIONS AFTER FINISHING			
		DATE	NAME
		10-16-00	MOROURKE
DATE	DATE	DATE	DATE
APPROVED	DATE	DATE	DATE
RELEASED	DATE	DATE	DATE
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REV D		SHEET	1 of 7

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[WWW.ISISDRIVE.COM](http://WWW.ISISDRIVE.COM) FOR DETAILS AND UPDATES

REVISONS		
REV.	DATE	CHANGES
A	9/5/00	CHANGE FLUTE CUT DIAMETER. FIX NOTE 2. ADD 'EQUALLY SPACED'.
B	9/12/00	REGENERATE PROFILES TO REFLECT 5.90 NOMINAL CRANK FLUTES
C	10/10/00	18.5MM MIN FLUTE DEPTH FROM 19MM
D	3/15/01	BOXDIM CHANGES TO GAUGE PLANE LOCATIONS, INCREASE FLUTE MINOR Ø .02MM, CHANGES IN ITALICS



- 4MM PRODUCES A 5MM PRESS FIT BETWEEN CRANK AND SPINDLE, SEE STANDARD DOCUMENT 3.1.2 FOR DETAILS
- ROOT FILLETS MAY BE ADDED BUT MUST NOT INTRUDE WITHIN THE 21.4MM SPINDLE MAJOR DIAMETER
- 2 DEGREE INCLUDED ANGLE THROUGH TAPER.

NOTES:

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS IN MILLIMETERS  
 EDGE BREAK R 0.100/0.30MM  
 ALL DIAMETERS CONCENTRIC TO SPINDLE/BEARING RACES  
 ±0.30MM  
 REMOVE ALL BURRS  
 ALL DIMENSIONS AFTER FINISHING



**ISIS DRIVE**

**CRANK**

DRAWN	DATE	NAME	REV
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CHECKED	DATE		
APPROVED	DATE		
RELEASED	DATE		

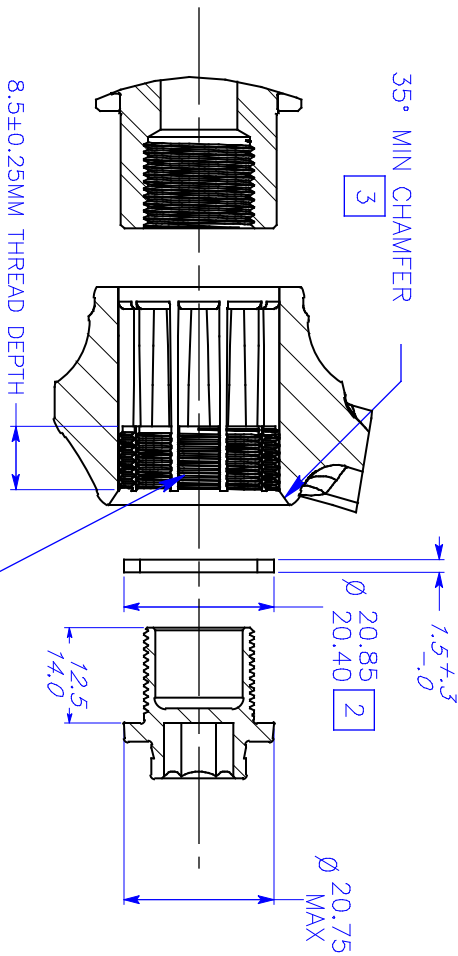
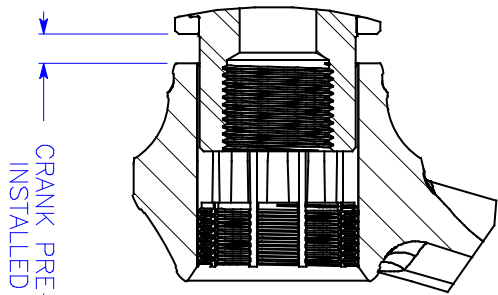
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REV.	DATE	CHANGES
A	9/5/00	CHANGES IN ITALICS
B	9/12/00	NO CHANGES
C	10/16/00	ADDED MIN CHAMFER, WASHER THICKNESS, FIXED PROFILE, ADDED 8.5MM THREAD DEPTH
D	3/15/01	REMOVE NOTE 1, ADD DIMS TO BOLT LENGTH, TOLERANCE CRANK THREAD DEPTH AND WASHER THICKNESS



- CHAMFER REQUIRED IF CRANK EXTENDS BEYOND 8.5MM THREAD DEPTH TO INSURE CLEARANCE FOR PLASTIC BOLT CAP.
- USE OF A STEEL WASHER BETWEEN THE BOLT HEAD AND CRANK IS REQUIRED TO AVOID EXCESSIVE DEFORMATION OF THE CRANK. SEE STANDARD DOCUMENT SECTION 3.1.3.

NOTES:

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS IN MILLIMETERS  
 EDGE BREAK R 0.100, 30MM  
 ALL DIAMETERS CONCENTRIC TO SPINDLE BEARING RACES  
 ±0.30MM  
 REMOVE ALL BURRS  
 ALL DIMENSIONS AFTER FINISHING



**ISIS DRIVE**

**CRANK AND BOLT**

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MOROURKE	10-16-00	
CHECKED	DATE	
APPROVED	DATE	
RELEASED	DATE	
SIZE	SCALE	SHEET
A	1:1	3 OF 7

REV **D**

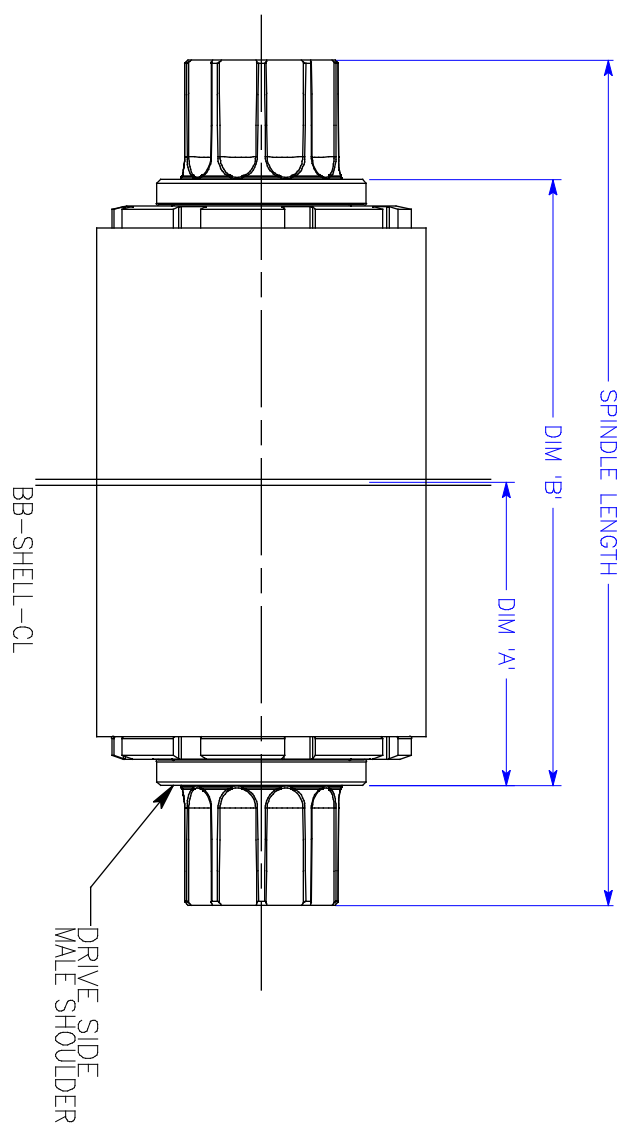
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WWW.ISISDRIVE.COM FOR DETAILS AND UPDATES

REVISIONS	
REV.	DATE
A	9/5/00
B	9/12/00
C	10/16/00
D	3/15/01

SPINDLE DESIGNATION	SPINDLE LENGTH	DIM 'A'	DIM 'B'
76	108	38.00 – 38.50	75.50 – 77.00
81	113	40.50 – 41.00	80.50 – 82.00
86	118	43.00 – 43.50	85.50 – 87.00
96	128	48.00 – 48.50	95.50 – 97.00



UNLESS OTHERWISE SPECIFIED:

- DIMENSIONS IN MILLIMETERS
- EDGE BREAK R 0.100, 3.0MM
- ALL DIMETERS CONCENTRIC
- ALL DIMETERS TOLERANCING RADCS ±0.30 MM
- REMOVE ALL BURRS
- ALL DIMENSIONS AFTER FINISHING



**ISIS DRIVE**

**BB DESIGNATION**

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CHECKED	DATE	
APPROVED	DATE	
RELEASED	DATE	
SIZE	SCALE	SHEET
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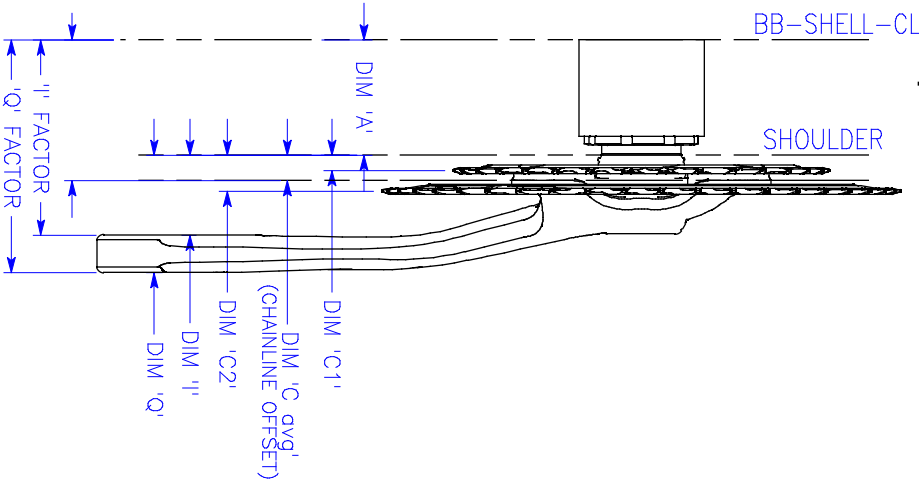
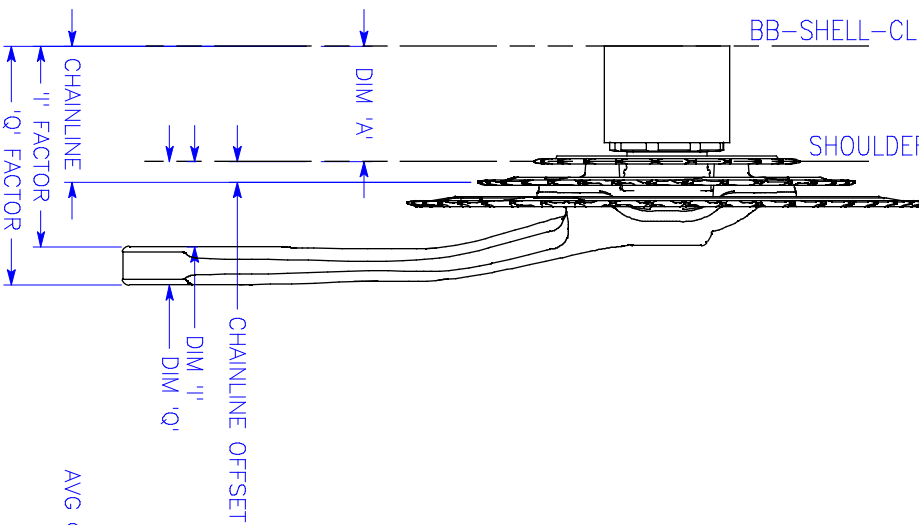
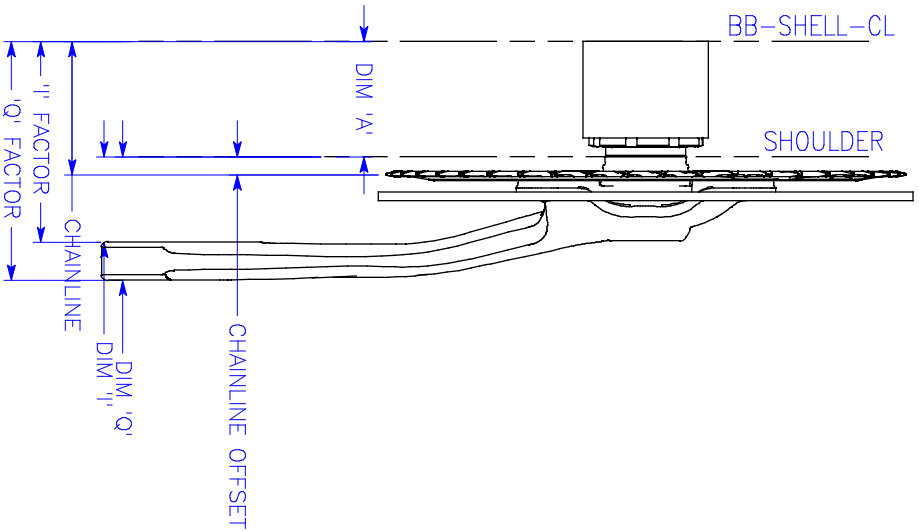
NOTES:

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WWW.ISISDRIVE.COM FOR DETAILS AND UPDATES

REVISIONS		
REV.	DATE	CHANGES
A	9/5/00	CHANGES IN ITALICS
B	9/12/00	NO CHANGE
C	10/16/00	NO CHANGE
D	3/15/01	NO CHANGE



1. SEE SECTION 1.2.2 FOR DETAILS REGARDING CHAINLINE

NOTES:

UNLESS OTHERWISE SPECIFIED:			
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REMOVE ALL BURRS		CHECKED: DATE:	
ALL DIMENSIONS AFTER FINISHING		APPROVED: DATE:	
RELEASED: DATE:		SIZE: A SCALE: 1:4 SHEET: 5 OF 7	
		REV: <b>D</b>	



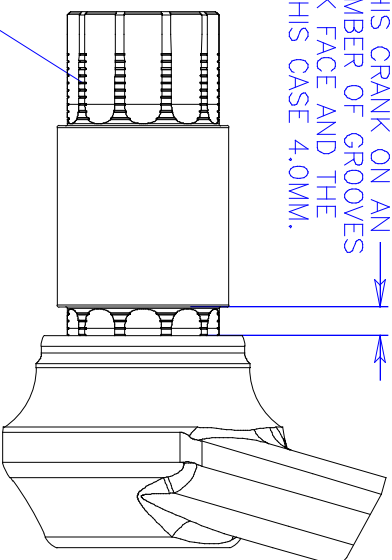
THE INFORMATION CONTAINED HEREIN IS INTENDED TO BE PUBLIC DOMAIN, HOWEVER, CHANGES TO THE SPECIFICATIONS CONTAINED HEREIN MAY BE PERFORMED ONLY BY THE ISSUER OF THIS PRINT. PRODUCT NOT IN COMPLIANCE TO THE SPECIFICATIONS CONTAINED HEREIN WILL BE CONSIDERED INCOMPATIBLE WITH THIS STANDARDIZED DESIGN.

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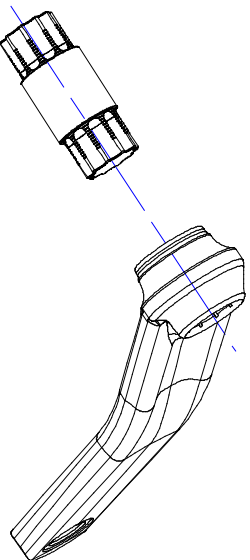
REVISIONS		
REV.	DATE	CHANGES
D	3/20/01	RELEASE

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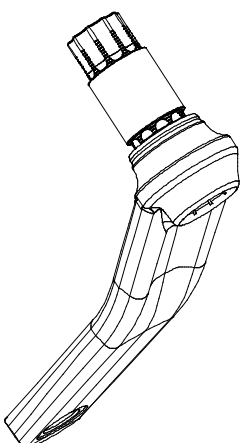
AMOUNT OF PRELOAD FOR THIS CRANK ON AN IDEAL SPINDLE EQUALS THE NUMBER OF GROOVES SHOWING BETWEEN THE CRANK FACE AND THE SPINDLE MALE SHOULDER, IN THIS CASE 4.0MM.



GROOVES ARE SPACED 1.0MM APART PAST THE IDEAL SPINDLE CRANK STOP PLANE.



SCALE: 0.5  
INSTALLING THE GAUGE INTO A CRANK USE LIGHT FINGER PRESSURE ONLY



SCALE: 0.5  
IDEAL SPINDLE INSTALLED INTO CRANK

1.

NOTES:

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS IN MILLIMETERS  
EDGE BREAK R 0.100, 30MM  
ALL DIAMETERS CONCENTRIC TO SPINDLE BEARING RACES 40.30 MM  
REMOVE ALL BURRS  
ALL DIMENSIONS AFTER FINISHING



**ISIS DRIVE**

**IDEAL SPINDLE USE**

DRAWN MOROURKE	DATE 10-1-6-00	NAME	
CHECKED	DATE	PN	
APPROVED	DATE	REV	D
RELEASED	DATE	SIZE	A
		SCALE	1:1
		SHEET	6 OF 7

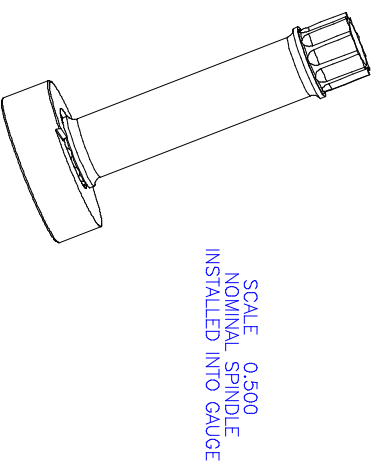
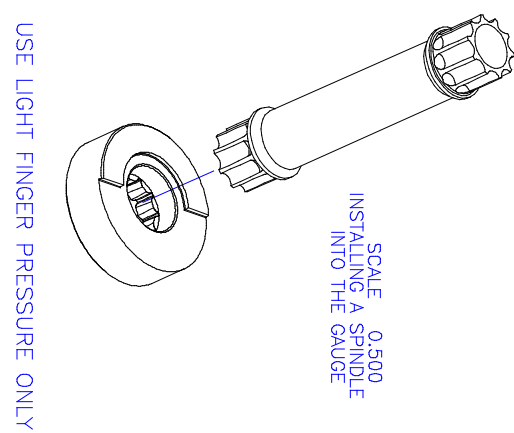
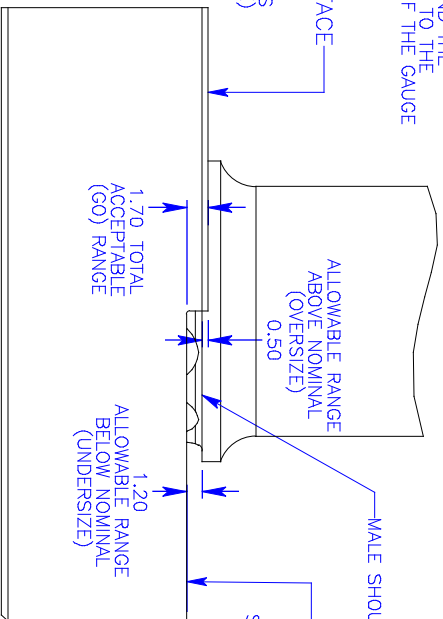
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REV.	DATE	CHANGES
D	3/20/01	RELEASE

THIS VIEW SHOWS A NOMINAL (IDEAL) SPINDLE INSTALLED INTO THE GAUGE AND THE RESULTING OFFSETS TO THE TWO NO-GO PLANES OF THE GAUGE



UNLESS OTHERWISE SPECIFIED:

**ISIS DRIVE**

DRAWN		DATE		NAME	
MOROURKE		10-16-00		SPINDLE GAUGE USE	
CHECKED		DATE		PN	
APPROVED		DATE		REV	
RELEASED		DATE		D	

DIMENSIONS IN MILLIMETERS					
EDGE BREAK R 0.100/0.30MM					
ALL DIAMETERS CONCENTRIC TO SPINDLE BEARING RACES ±0.30 MM					
REMOVE ALL BURRS					
ALL DIMENSIONS AFTER FINISHING					
SCALE	1.25:1	SHEET	7	OF	7

1.  
NOTES: