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株洲力洲硬质合金有限公司



株洲力洲硬质合金有限公司  
ZHUZHOU LIZHOU CEMENTED CARBIDE CO.,LTD.

2010

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## 一、商标释义 Brand explanation

“力洲”商标是在中华人民共和国内注册商标，它是株洲力洲硬质合金有限公司出厂产品的名字，同时也是本公司全体员工辛勤工作、严格检验、努力孵化的结晶。

“力洲”商标的意义就是本公司的产品就象“力洲”商标的图案一样，自始至终表里如一、奋发向上、坚定不移地专业做好硬质合金模具毛坯及配套深加工一体的产品。

### Brand explanation

“LIZHOU” brand is a registered trade mark of P. R. China, it's the name of the product which is produced by Zhuzhou Lizhou Cemented Carbide Limited Company, the same time, it's also the product of our company's whole employees hard work, strictly test and hard hatch.

The meaning of “Lizhou”brand is same to the pattern of the “Lizhou”brand, all along try our best to produce the carbide mould roughcast and following the deep process product.

## 二、简介 Introduction

株洲力洲硬质合金有限公司是一家集钨钴冶炼、专业化开发和生产硬质合金模具毛坯的现代化企业。公司主要生产硬质合金拉伸模毛坯、冷镦模毛坯、板材毛坯、辊环及其各种异型耐磨件产品。

公司创立于 1993 年，现有员工 150 于人，其中本科以上学历 15 人、硕士学历 3 人、技术开发 20 于人，拥有自主技术开发专利 24 项以上。

公司拥有全资控股子公司株洲力洲精密模具有限公司，主要以本公司毛坯为基体进行深度加工成拉伸模具、冷镦冷冲模具、连续级进模具、冲剪模具。

公司拥有全资控股子公司株洲迪远硬质合金工业炉有限公司，主要为硬质合金生产厂家提供具有世界先进技术各种工业炉。

公司拥有国际先进水平的制造硬质合金模具材料的电脑程控还原炉、高温自动碳化炉、TPA 压力成型机、压力烧结炉等。



公司管理体系实行 IEP 管理，体系保证每一件产品都经过严格的检查，并在 2003 年 9 月通过了 ISO 9001:2000 国际质量体系认证。

2008 年度硬质合金毛坯生产能力突破 300 吨，拉伸模销量已经突破 100 吨，并远销美国、德国、西班牙、印度、韩国、日本、马来西亚等国，其外销产值突破 150 万美元。

我们擅长硬质合金模具毛坯的生产技术，特别是对大型制品和异型模具，最大硬质合金模具毛坯重量为 80 kg，生产技术更有独到之处。

我们的经营理是为硬质合金模具加工企业完美的技术解决方案、降低生产成本、提高工作效率。

公司秉承“诚信创新、共同发展”的企业文化，致力于发展成为中国最优秀的专业生产硬质合金模具材料及其配套成品模具企业。

Zhuzhou Lizhou Cemented Carbide Co. Ltd, is a modern enterprise, which integrates cobalt-tungsten smelting, and professional development and production of cemented carbide blank. Our company mainly produces carbide drawing die, heading die, carbide plate die, carbide roll and various special-shaped wear-resistant Products.

Our company was founded in 1993 and currently employs 150 people, including 15 bachelors, 3 masters, 20 technical engineers; possesses more than 24 independent technological patents.

Our company has wholly-owned subsidiary-Zhuzhou Lizhou Precision Mould Co., Ltd, mainly based the blanks of our company to process deeply for drawing dies, heading and punching dies, progressive dies, shearing dies.

Our company has wholly-owned subsidiary-Zhuzhou Diyuan Powder Metallurgy Furnace Co., Ltd, mainly provides all kinds of world advanced technical industrial furnace for carbide manufacturer.

Our company possesses international advanced level in the manufacture of cemented carbide mould materials, such as deoxidization furnace controlled by computer, high temperature automatic carbide furnace, TPA pressure forming machines, pressure sintering furnace and so on.

Our administration system implements IEP administration, the system ensures that every product to undergo rigorous inspection, and passed the ISO 9001:2000 international quality system certification in September 2003.

The production capacity of cemented carbide blank broke through 300 tons in 2008, the drawing die have reached a sale of 100 tons, and exported to the United States, Germany, Spain, India, South Korea, Japan, Malaysia and other countries, our exported output values exceeded 1.5 million U.S. Dollars.

We're expert in production techniques of cemented carbide blank, especially in large-scale products and shaped mould, maximum weight of carbide blanks is 80 KGs, production technology is more unique.

Our business philosophy is to provide perfect technology solution, to reduce production costs and enhance work efficiency for carbide die processing enterprises.



Our company inherits "sincerity, creativity, cooperation" corporate culture, dedicates to develop into Chinese the most excellent and professional enterprise of producing carbide die materials and supporting finished mould.

### 三、领导致辞 Leader oration

株洲力洲硬质合金有限公司成立十五年以来，我们创造了傲人的成绩。今天，力洲已在硬质合金产业中独树一帜。从钨和钴的氧化物到碳化钨及钴粉，从硬质合金模具毛坯再到各种精密模具，我们实现了产业的纵向一体化。“诚信创新，共同发展”是我们始终坚持的核心理念。

力洲的成功建立在诚信创新的基础之上。我们拥有一批高素质的硬质合金模具毛坯及各种精密模具研发团队，不断地创新技术和产品使我们的产品为客户提供了各种不同的解决方案。同时，我们坚信必能为您创造更多的价值。

展望未来，我们将一如既往，为实现力洲的企业文化而努力不懈，以满足客户需求为力洲的目标。致力于与全球各地的客户建立长期、稳定的商业伙伴关系。

在此，株洲力洲硬质合金有限公司感谢广大客户多年来的大力支持，我们将继续努力，为您提供更优质，更具竞争力的产品与最完善的服务！

总经理  
陈辽  
谨敬

#### Leader oration

Lizhou have obtained the great success in past fifteen years. Today Lizhou is a unique carbide manufacturer. We have integrated our carbide production process from Ammonium Para-Tungstate (APT) to tungsten carbide and to finished mold and die carbide tools. We believe this integration is necessary to realize our core values: integrity, innovation and mutual benefit.

Lizhou's success is built on basis of integrity and innovation. We are able to create solutions for our clients because through our company's development we acquired the high experienced staff who engaged in research of carbide blanks and precision moulds. We are confident LIZHOU can add value for you.

We will stay committed to our key business values and to leverage our accomplishments to achieve continue client satisfaction. LIZHOU is now in the position to reach out to every corner of the world building long-term business partnerships.

We sincerely appreciate the strong support of our client. We will endeavor to do our very best on preserving and enhancing our reputation, offering consistent good quality at competitive price and service to our clients.

Chairman:

## 四、拉伸模的主要特性 The main properties

本公司硬质合金拉伸模是由微晶的稀有难熔金属碳化物及以辅助金属高纯钴粉或其它金属粉末作粘结剂构成的.由于生产方法特殊,而且采用了国际上先进的低压炉烧结技术,这种合金不但保持碳化钨原有可贵的特性,而且其性能比普通硬质合金拉伸模提高 1/4; 同时由于有钴或其它金属作粘剂,又使其具有韧性。

Carbide drawing die of our Company are composed by microcrystalline rare refractory metal carbide and high-purity cobalt powder for auxiliary metal or other metal powder as the binder. As a result of special production methods, and use of international advanced low pressure sintering furnace, the alloy is not only to maintain the original valued properties of tungsten carbide, and its performance increased by 1 / 4 than ordinary drawing die ; At the same time, due to cobalt or other metal for cement, it become also tough.

### 主要特性 Main properties

#### 1、耐磨性高 Good wear resistance

硬质合金耐磨性很高,可以保证拉伸模在任何拉制用量下,都能长期工作,并保证制品的尺寸及精度。

##### 1、 Good wear resistance

Tungsten carbide possesses high wear resistance, which could guarantee long-term work of drawing die within any drawn amount and ensure the size and precision of products.

#### 2、抛光性优良 Excellent polishing

硬质合金具有良好的抛光性,能加工成镜面光的模孔,从而保证拉制金属表面的高质量。

##### 2、 Excellent polishing

Carbide has a good polishing, which can be processed die hole like mirror, thus ensuring high-quality of metal drawn surface.

#### 3、粘附性小 Small adhesion

在拉制过程中,拉伸模对被加工金属的粘附性小,从而提高拉伸模的耐用度,并能使加工材料获得高品质表面光洁度。

##### 3、 Small adhesion

In the drawing process, the drawing die keep little adhesion with metal processed, thereby enhancing the durability of drawing die, and make processing material to acquire high-quality gloss finish for surface.

#### 4、摩擦系数小 Small friction coefficient

在拉制过程中,摩擦阻力小,能大大降低电能损耗,大大提高工作效率

##### 4、 Small friction coefficient

In the drawing process, small frictional resistance can greatly reduce the power loss, thus enhancing efficiency.

#### 5、导热系数高 High coefficient of thermal conductivity

在拉制过程中产生的热量能很好的传导出。

##### 5、 High coefficient of thermal conductivity

In the drawing process, heat can be conducted away very well.

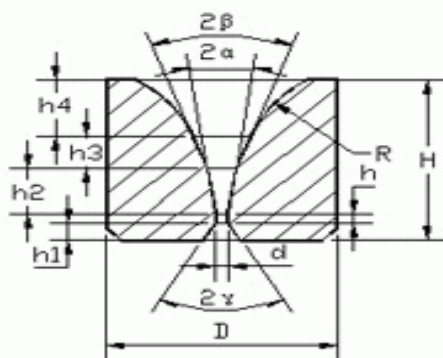
## 6、抗腐蚀性好 Good corrosion resistance

抗腐蚀性好，这一特性在湿式润滑拉伸时，尤其是在酸性润滑拉伸时，更为优越。

## 6、 Good corrosion resistance

Good corrosion resistance, the property is in the wet lubricated stretch, especially in the acidic lubricated stretch, to become more superior.

## 五、拉伸模各个部位名称和作用 The names and roles of different parts for carbide drawing die blanks



D- 模坯外径	h-定径区长度
H- 模坯高度	h1- 出口区长度
h-工作孔径	h2- 工作区长度
2β-入口锥度	h3- 润滑区长度
2α-工作锥度	h4-入口区长度
2γ-出口锥度	R-入口区弧度

D- The outer diameter of die blank

h-The length of sizing district

H-The height of die blank

h1-The length of exit area

h- The working aperture

h2-The length of work area

2β-The cone angle of entrance

h3-The length of lubrication area

2α-The the cone angle of work

h4- The length of entrance area

2γ- The cone angle of exit

R-Radian of entrance area

硬质合金拉丝模坯各部位的作用

硬质合金拉丝模孔各部的形状和尺寸，取决于拉制金属的成分、性能及尺寸，压缩率大小，润滑、拉制条件以及对制品的要求等。

The roles of different parts for carbide drawing die blanks

The shape and size of different parts for carbide drawing die, depended on the drawn metal components, performance and size, the size of compression ratio, lubrication, drawn conditions and requirements of products.

## 入口区

入口区至工作区均为圆弧过渡，利于拉制材料进入工作区，而不致被模孔棱缘所擦伤。

## Entrance area

Entrance area to work area are designed for arc transition in favor of material drawn into the work area, and will not be grazed by rhombus edge of die hole

## 润滑锥角

润滑区是储存润滑剂，从而使被拉制材料得到润滑，利于拉制过程的顺利进行。

在拉丝模扩孔时，靠润滑区来加大工作区。润滑区的高度一般为模坯总高度  $H$  的 0.25 倍。

## The cone angle of lubrication

Lubrication area is the storage of lubricants, so that the materials drawn can be lubricated, in favor of the smooth progress of the drawing process. It's by means of lubrication area to enlarge the work area when drawing die ream hole. The height of lubrication zone is 0.25 times than total height of blank.

## 工作区

金属拉伸的塑性变形区，即金属材料通过这个区，直径由大变小，拉制管材时，使管壁变薄或管径变小。工作区的长度，随拉制材料、直径和润滑情况而有不同，其选择原则是：

## Work area

Plastic deformed area of metal stretch, that is, metallic materials is through the area, diameter will range from big to small; tube wall becomes thin or tube diameter gets small when drawing tube. The length of the work area will be different according to drawn material, diameter and lubrication. The principle of their choice is as below:

- 1、拉制软金属线材时应较拉制硬金属线材短
- 2、拉制小直径线材时应较干式润滑拉伸短
- 3、湿式润滑拉伸时应较干式润滑拉伸短；正常的情况，工作区的长度为定径区直径  $d$  的 1.0-1.4 倍

1、Drawing soft metal wire should be shorter than the hard metal wire.

2、Stretching small diameter wire should be shorter than dry lubrication stretch.

3、Wet lubrication stretch should be shorter than dry lubrication, In normal cases, the length of the work zone is 1.0-1.4 times than the diameter of sizing district.

## 工作锥角

在拉制钢材时工作锥角较小，而拉制有色金属及其合金时，工作锥角应较大。其选择原则是：

## The cone angle of work

The cone angle of work is smaller when drawing steel and the cone angle should be larger when drawing non-ferrous metals and their alloys. The principle of their choice is as following:

- 1、 压缩率愈小，工作锥角应愈小
- 2、 拉制材料愈硬，工作锥角应愈小
- 3、 拉制小直径材料时，工作锥角应较大直径材料小。

- 1、 Smaller compression ratio, smaller cone angle of work
- 2、 Harder drawn materials, smaller cone angle of work
- 3、 Drawn small-diameter material, the cone angle should be larger.

### 定径区 Sizing district

拉伸制品通过定径区得到最终尺寸，定径区的长度  $h$  视拉制材料的硬度，截面积大小和润滑情况而有不同。符合下列要求：

Stretching product will define the final size through the sizing district; the length  $h$  of sizing district is different according to the hardness of drawn material, the size of cross-sectional area and lubrication. Meeting the below requirements:

$h$  过长，在拉制过程中会使摩擦力增加，模具温度升高，影响模具寿命。同时，也会增加拉应力，拉伸时，断线率就会增高，电力消耗也增大。

If " $h$ " is too long, the friction will increase in the drawing process and mold temperature rise, thus the die life is impacted. At the same time, it will also raise stretch stress, the rate of broken wire will be increased and power consumption is also increasing in the stretching process.

若  $h$  过小，在拉伸过程中，工作锥度发生变化时，会影响拉制品尺寸。拉制材料不同，定径区的长度也不同。

If " $h$ " is too small, it will affect the size of drawing products in the stretching process when the working taper change. Different drawing materials, the length of the sizing district are also different.

一般拉制软金属材料的定径区较拉制硬金属材料的短；拉制大直径材料的定径区较拉制小直径材料的短（拉制线材和棒材时，其长度一般为内孔的 0.3-0.5 倍）；湿式润滑拉制的定径区较干式润滑拉制的短。

The sizing district of stretching soft metal materials is generally shorter than hard metal material; the sizing district of drawing large-diameter material is shorter than

small-diameter material (stretching wire and rod, its length is generally 0.3-0.5 times of inner hole); the sizing district of wet lubrication drawn is shorter than dry lubrication

#### 出口区 Exit area

拉制材料离开模孔最后通过的部分，但出口区不宜过短，否则出口端容易破裂。出口区的长度  $h_1$  应为模坯  $H$  高度的 0.12-0.20 倍

It's the last passed area for drawing material leaving die-hole, but exit zone should not be too short, otherwise it's easy to rupture the exit zone. The length " $h_1$ " of exit zone should be as 0.12-0.20 times as the height of blanks " $H$ ".

#### 出口锥角 The cone angle of exit

保证被拉制金属不致擦伤定径区出口处以及被拉制出来的成品或半成品。因为无特殊要求，拉制粗线和中号线材时，出口锥角一般为  $60^\circ$ ，拉制细线时，则宜用较大的出口锥角  $90^\circ$  或  $75^\circ$ ，也有采用半球形状。

It ensures that the drawn metal will not scratch the exit of sizing district and the stretched finished or semi-finished product, because there are no special requirements. Drawn thick and medium wires, the cone angle of exit is generally  $60^\circ$ ; stretched small wires, it should be taken larger cone angle  $90^\circ$  or  $75^\circ$ , also taken hemispheric shape.

## 六、国内牌号物理机械性能和国内牌号用途推荐 Physical and mechanical properties sheet for domestic grade and Application recommended for home's grade

### 1、国内牌号物理机械性能 Physical and mechanical properties sheet for domestic grade

牌 号	机械性能				物理性能		
	硬度 HRA	抗弯强度 N/mm <sup>2</sup>	抗压强度 N/mm <sup>2</sup>	弹性模量 KN/mm <sup>2</sup>	密度 g/cm <sup>3</sup>	导热率 cal/cm.sec.°C	线膨胀系数 10 <sup>-6</sup> /°C
YG3X	91.5	1300	6100	680-690	15.0-15.4	0.80	4.6
YG6X	91.0	1560	5460	630-640	14.8-15.1	0.72	5.0
YG6A	91.5	1680	5400	630-640	14.9-15.2	0.69	5.0
LL10	90.5	2000	5100	600-610	14.6-14.9	0.65	5.1
LL20	90.0	1840	5100	540-600	14.5-14.7	0.76	5.0
LL10.2	91.5	1900	4200	570-580	14.2-14.6	0.54	5.4
YG3	91.0	1400	5800	680-690	15.0-15.4	0.88	4.6

YG6		1670			14.7-15.1		
LD30	89.5	2200	5200	630-640	14.8-15.0	0.80	5.0
YG8M	89.5	1720	4900	610-620	14.7-14.8	0.70	5.1
YG8		1840			14.6-14.9		
LD20	89.0	2300	4800	600-610	14.7-14.9	0.75	5.2
YG8N							
YG11	88.0	2000	4500	580-590	14.1-14.5	0.67	5.5
YG15		2300			13.9-14.2		
LD10	86.5	2750	3800	560-570	14.0-14.2	0.59	6.3
YG18	86.0	2500	4500	520-530	13.6-13.9	0.51	6.4

## 2、国内牌号用途推荐 Application recommended for home's grade

牌号

用途推荐表 application recommended sheet

- 优异的耐磨性。适于应力不大的条件下,拉制直径 2mm 以下的钢丝、有色金属丝有合金线材,尤其拉伸直径在
- YG3X 0.6mm 以下的金属细丝效果最佳。Excellent wear resistance. It's suitable for under the stress not big condition, stretch diameter in 2 millimeters following small-gauge wires, non-ferrous metal and alloy wire rod, stretches 0.6 millimeter below metal filament to be best especially.
- 优良的耐磨性。适于应力较大的条件下拉制直径 10mm 以下的钢丝、有色金属丝及其合金线材、棒材和 10mm
- YG6X 以下合金管材。With very high wearable properties. It's suitable for under the stress of big condition, stretch diameter in 10 millimeters following wire, non-ferrous metal and alloy wire rod.
- YG6A 耐磨性高于 YG6X。适于应力较大的条件下拉制直径 10mm 以下的钢丝、有色金属丝及其合金线材、棒材和 10mm 以下合金管材。Its wearable property is higher than YG6X. It's suitable for under the stress of big condition, stretch diameter in 10 millimeters following wire, non-ferrous metal and alloy wire rod.
- LL10 该牌号专门设计用于拉伸模的合金,通用性好,用于不锈钢、高碳钢及其有色金属,的中、高速拉拔。  
The grade specialized in the alloy of drawing die, good commonality. It's used for drawing medium and high speed stainless steel, high-carbon steel and non-ferrous metal.
- LL20 通用性较好,用于中、高碳钢的中、高速拉拔,以及直径 40mm 以下的黑、有色金属棒材、管材的拉拔。  
Good commonality, it's used for drawing medium and high speed medium and high-carbon steel, and  $d \leq 40$ mm ferrous and non-ferrous metal.

- LL10.2 耐磨性高、使用强度高。适用于拉制直径（1.5-10）mm 的钢丝、钨丝、钼等硬质材料的高速拉丝拉拔，以及表面光洁要求很高的有色金属管材、棒材的拉制。Excellent wearable and toughness. It's suitable for express drawing D=1.5-10mm steel wire, tungsten wire and molybdenum, and drawing non-ferrous tube, bar for high-quality Surface polish.
- YG3 耐磨性次于 YG3X，使用强度和冲击韧性中等。适用于应力不大的条件下，拉制直径 6mm 以下的钢、有色金属及其合金线材、棒材。Wear resistance is worse than YG3X, use intensity and resilience medium. It's suitable for under the stress of not big condition, stretch diameter in 6 millimeters following wire, non-ferrous metal and alloy wire rod.
- YG6 耐磨性较好，使用强度和冲击韧性中等。适用于应力不大的条件下，拉制直径 20mm 以下的钢、有色金属及其合金线材、棒材；也适于拉伸直径在 10mm 以下的合金管材。With very high wearable properties, use intensity and resilience is medium. Mainly used for drawing  $d \leq 20.0$  mm wires, non-ferrous metal and alloy wire rod;  $d \leq 10.0$  mm alloy tubes.
- LD30 强度高，其硬度、耐磨性明显高于 YG8。适用于应力不大的条件下，拉制直径 50mm 以下的钢丝、有色金属丝及其合金线材、棒材；With excellent intensity, hardness and wear resistance is obviously higher than YG8. For drawing  $d \leq 50.0$  mm wires, non-ferrous metal and alloy wire rod under the stress of not big condition.
- YG8M 耐磨性良好，使用强度及其冲击韧性较高于 YG6X。适用于应力很大的条件下，拉制直径 50mm 以下的钢、有色金属及其合金线材、棒材；也适于拉伸直径在 35mm 以下的合金管材。With excellent wear resistance, hardness and toughness is better than YG6X. For drawing  $d \leq 50.0$  mm wires, non-ferrous metal and alloy wire rod under the stress of big condition; and  $d \leq 35.0$  mm alloy tubes.
- LD20 耐磨性较低，使用强度及其冲击韧性较高。适用于应力较大的条件下，拉制直径 60mm 以下的钢、有色金属丝其合金线材、棒材；也适于拉伸直径在 40mm 以下的合金管材。With lower wearable properties, higher intensity and toughness. For drawing  $d \leq 60.0$  mm wires, non-ferrous metal and alloy wire rod under the stress of big condition.
- YG11 耐磨性低，使用强度及其冲击韧性较高。适用于应力很大和压缩率大的情况下拉制管、棒。
- LD10 With lower wearable properties, high intensity and toughness. For drawing tubes, rod under the stress of big condition and compression ratio.
- YG15 耐磨性略低于 YG15，使用强度及其冲击韧性略高于 YG15。适用于应力很大和压缩率大的情况下拉制管、棒。



Wearable property is a little lower YG15, intensity and toughness is a little higher than YG15. For drawing tubes, rod under the stress of big condition and compression ratio.

在使用本公司硬质模具时,就根据拉制材料的性能、拉制类别,正确合理地选择硬质合金牌号,对于拉制作业的顺利进行,具有极其重要的意义,所以,请使用者按下表合理地选择硬质合金牌号。如有疑问,可向本公司进行咨询。

When using the carbide drawing dies of our company, please choose the Grade according to the drawing way and properties of the drawing material. It's important to the drawing work. So, please choose the carbide grade as per upper list. If you have any question, please don't hesitate to inquiry us.

## 七、拉伸模出口牌号物理机械性能表及其用途推荐 Physical and mechanical properties sheet and recommended application for exported grade of drawing die

### 1、出口牌号物理物械性能表 Physical and mechanical properties sheet for exported grade

Grade	Mechanical Properties				Physical Properties		
	Hardness	Bending Strength	Compression Strength	Modulus	Density	Thermal conductivity	Thermal Expansion conductivity
	HRA	N/mm <sup>2</sup>	N/mm <sup>2</sup>	KN/mm <sup>2</sup>	g/cm <sup>3</sup>	cal/cm.sec.°C	10 <sup>-6</sup> /°C
LZ10.0	91.5	1300	6100	680-690	15.0-15.4	0.80	4.6
LZ10.1	91.0	1560	5460	630-640	14.8-15.1	0.72	5.0
LZ10.2	91.5	1900	4200	570-580	14.2-14.6	0.54	5.4
LZ10.3	91.5	1680	5400	630-640	14.9-15.2	0.69	5.0
LZ10.4	90.5	2000	5100	600-610	14.6-14.9	0.65	5.1
LZ10.5	90.0	1840	5100	540-600	14.5-14.7	0.76	5.0
LZ05	91.0	1400	5800	680-690	15.0-15.4	0.88	4.6
LZ10	89.5	1670	5200	630-640	14.7-15.1	0.80	5.0
LZ15	89.5	1720	4900	610-620	14.7-14.8	0.70	5.1
LZ20	89.0	1840	4800	600-610	14.6-14.9	0.75	5.2
LZ25	88.0	2000	4500	580-590	14.1-14.5	0.67	5.5
LZ30	86.5	2300	3800	560-570	13.9-14.2	0.59	6.3

LZ50      86.0      2500      4500      520-530      13.6-13.9      0.51      6.4

When using the carbide drawing dies of our company, please choose the Grade according to the drawing way and properties of the drawing material, it's important to the drawing work. So, please choose the carbide grade as per upper list. If you have any question, please ask our company.

## 2、出口牌号用途推荐 Application recommended for exported grade

牌号	用途推荐表 application recommended sheet
LZ10.0	优异的耐磨性。适于应力不大的条件下,拉制直径 2mm 以下的钢丝、有色金属丝有合金线材,尤其拉伸直径在 0.6mm 以下的金属细丝效果最佳。Excellent wearable properties. It's suitable for under the stress not big condition, stretch diameter in 2 millimeters following small-gauge wires, non-ferrous metal and alloy wire rod, stretches 0.6 millimeter below metal filament to be best especially.
LZ10.1	优良的耐磨性。适于应力较大的条件下拉制直径 10mm 以下的钢丝、有色金属丝及其合金线材、棒材和 10mm 以下的合金管材。Excellent wearable properties. It's suitable for under the stress of big condition, stretch diameter in 10 millimeters following small-gauge wires, non-ferrous metal and alloy wire rod, and drawing $\leq$ 10mm alloy tube.
LZ10.2	耐磨性高、使用强度高; 适用于拉制直径 (1.5-10) mm 的钢丝、钨丝、钼等硬质材料的高速拉丝拉拔, 以及表面光洁要求很高的有色金属管材、棒材的拉制。Excellent wearable and toughness. It's suitable for express drawing $D=1.5-10$ mm steel wire, tungsten wire and molybdenum, and drawing non-ferrous tube, bar for high-quality surface polish.
LZ10.3	耐磨性高于 LZ10.1。适于应力较大的条件下拉制直径 10mm 以下的钢丝、有色金属丝及其合金线材、棒材和 10mm 以下的钢丝、有色金属丝及其合金管材。Wearable properties is better than LZ10.1, it's suitable for under the stress of big condition, stretch diameter in 10 millimeters following wires, non-ferrous metal and alloy wire rod.
LZ10.4	该牌号专门设计用于拉伸模的合金, 通用性好, 用于不锈钢、高碳钢及其有色属, 的中、高速拉拔。 The grade specialized in designing for alloy of drawing dies, good commonality, used for medium and high speed drawing stainless steel, high-carbon steel and non-ferrous.
LZ10.5	通用性较好, 用于中、高碳钢的中、高速拉拔, 以及直径 40mm 以下的黑、有色金属棒材、管材的拉拔。 Good universality, it's used for drawing medium and high speed medium and high-carbon steel, and $d \leq 40$ mm ferrous and non-ferrous metal.
LZ05	耐磨性次于 LZ10.0, 使用强度和冲击韧性中等; 适用于应力不大的条件下, 拉制直径 6mm 以下的钢丝、有

- 色金属丝及其合金线材、棒材。Wearable properties is worse than LZ10.0, intensity and toughness is medium; It's suitable for under the stress not big condition, stretch diameter in 6 millimeters following wires, non-ferrous metal and alloy wire rod
- LZ10 耐磨性较好, 适用强度使用强度和冲击韧性中等; 适用于应力不大的条件下, 拉制直径 20mm 以下的钢丝、有色金属丝及其合金线材、棒材; 也适于拉伸直径在 10mm 以下的合金管材。With good wear-resistance, intensity and toughness is medium; For drawing  $d \leq 20$ mm steel wires, non-ferrous wire, bar under small stress; and  $d \leq 10$ mm alloy tubes.
- 强度较高, 其硬度、耐磨性明显高于 LZ20, 适用于应力不大的条件下, 拉制直径 50mm 以下的钢、有色金属及其合金线材、棒材; High intensity, hardness and wear resistance is obviously higher than LZ20. For drawing  $d \leq 50$ mm wires, non-ferrous and alloy bar under the stress of small condition.
- LZ15 耐磨性良好, 使用强度及其冲击韧性较高于 LZ10.1; 适用于应力很大的条件下, 拉制直径 50mm 以下的钢、有色金属及其合金线材、棒材; 也适于拉伸直径在 35mm 以下的合金管材。With good wearable resistance, intensity and toughness is higher LZ10.1 under the stress of big condition.
- LZ20 耐磨性较低, 使用强度及其冲击韧性较高; 适用于应力较大的条件下, 拉制直径 60mm 以下的钢、有色金属及其合金线材、棒材; 也适于拉伸直径在 40mm 以下的合金管材。With lower wearable resistance, higher intensity and toughness; For drawing  $d \leq 60$ mm wires, non-ferrous, bar; and  $d \leq 40$ mm alloy tubes.
- LZ25 耐磨性低, 使用强度及其冲击韧性较高; 适用于应力很大和压缩率大的情况下拉制管、棒。With lower wearable resistance, higher intensity and toughness; it's suitable to stretch tube and bar under the big stress and compression ratio.
- LZ30 耐磨性略低于 LZ30, 使用强度及其冲击韧性略高于 LZ30; 适用于应力很大和压缩率大的情况下拉制管、棒。Wearable property is a little lower LZ30, intensity and toughness higher than LZ30; it's suitable to stretch tube and bar under the big stress and compression ratio.

## 八、拉伸模坯型号规格表示 Drawing dies type and size

拉伸模坯型号由型号类别、外径、高度、压缩角、内孔参数、其它尺寸或角度等 6 个代号组成。Drawing dies type is consist of item type, OD, height, compress angle and ID parameter

示例 example:

**S11 — 008    06   12    — 1.2 — X**

- ① ② ③ ④ ⑤ ⑥

①: 拉伸模坯型号类别代号。

The Symbol of drawing dies' model.

②: 拉伸模坯外径代号, 用三位数字表示, 单位为mm: 不足三位, 则前面加“0”填位。

Symbol of drawing dies' OD, expressed by three digitally number, the unit is in mm, if the number is short of three digits, add "0" in the front to fill in it

③: 拉伸模坯高度代号, 用两位数字表示, 单位为mm: 不足两位, 则前面加“0”填位。

Symbol of drawing dies' height, expressed by two digitally number, the unit is in mm, if the number is short of two digits, add "0" in the front to fill in it

④: 拉伸模坯压缩角代号, 用两位数字表示, 单位为 $^{\circ}$ : 如没有压缩角, 则用“00”表示。

Symbol of drawing dies' compress angle, expressed by two digitally number, the unit is in " $^{\circ}$ ": if have no compress angle, expressed by "00".

⑤: 拉伸模坯内孔代号: Symbol of drawing dies' ID

圆形内孔用内径尺寸  $d$  表示, 单位为mm; 当内径尺寸不大于 1 mm时取两位整数, 当内径尺寸大于 1 mm时取一位整数;

Round inner hole is expressed by ID size "d", the unit is in mm; when ID size is less than 1mm, use two digitally integer, when ID size is lager than 1mm, use one digitally integer.

四边形内孔用孔长  $a$  × 孔宽  $b$  表示, 单位为mm, 取一位小数位;

Quadrangle inner hole is expressed by hole length × hole width, the unit is in mm, use one digitally.

六边形内孔用内切圆尺寸  $s$  表示, 单位为mm, 取一位小数位。

Hexagon inner hole is expressed by inscribed circle' size "s", the unit is mm, use one digitally.

⑥: 金属线材模坯其它尺寸或角度值与标准型号的不同区别。X 是由很多不同字母、数据、单位符号等组成, X 具体表示意思如下:

⑥The difference is between other dimensions or angle value of metal wire blanks and standard type. X consists of a lot of different letter, data and unit. Symbol X's specific meaning as follows:

F-表示拉丝模外径为负公差: Express outer diameter of drawing die to be minus tolerance

H-表示拉丝模高度与标准型号不一致: Express the disagreement between the height of drawing die and standard type's

D-表示拉丝模外径与标准型号不一致: Express the disagreement between the OD of drawing die and standard type's

R-表示拉丝模入口区、润滑区与标准型号不一致: Express the disagreement between entrance and lubrication area of drawing die and standard type's

r-表示拉丝模出口角与标准型号不一致: Express the disagreement between exit angle of drawing die and standard type's

E-表示拉丝模型号类似于 E 系列； Express the type of drawing die to be similar with E series

HB-表示拉丝模与原 LH 型号相同，并 $\alpha$ 角不同； Express the same between the model of drawing die and original LH's, yet the difference of angle  $\alpha$ .

HA-表示拉丝模定径区高度比标准型号要高； Express the height of sizing district is higher standard type

AB-表示拉丝模为 LH 型号中转来，主要是 D、H 有变化 Express the type is arise from LH's one, mainly D&H changed

H-表示拉丝模为 LH 型号中转来； Express the type is arise from LH's one

2.5°-表示拉丝模外圆带 2.5°的锥度角； Express outside round of drawing die with cone angle of 2.5 degree

A-表示拉丝模 $\alpha$ 角不同； Express the angle  $\alpha$  of drawing die is different

**30 型、30-A 型、30-A 型**

**S30 — 008 06 12 — 1.2 — X**

①            ② ③ ④            ⑤            ⑥

Type 30, type 30-A, type 30-A

①: 拉伸模坯型号类别代号

Symbol of drawing dies model.

②: 拉伸模坯内径代号，用两位数字表示，单位为mm：不足两位，则前面加“0”填位。

Symbol of drawing dies' ID, expressed by two digitally number, the unit is in mm, if the number is short of two digits, add "0" in the front to fill in it

③: 拉伸模坯高度代号，用两位数字表示，单位为mm：不足两位，则前面加“0”填位。

Symbol of drawing dies' height, expressed by two digitally number, the unit is in mm, if the number is short of two digits, add "0" in the front to fill in it

④: 拉伸模坯外径压缩角代号，用两位数字表示，取整数，单位为 °。

Symbol of drawing dies OD compress angle, expressed by two digitally number, the unit is in "°" .

⑤: 拉伸模坯外径代号：

Symbol of drawing dies OD:

⑥:金属线材模坯其它尺寸或角度值与标准型号的不同区别。X 是由很多不同字母、数据、单位符号等组成，X 具体表示意思如下：

⑥The difference is between other dimensions or angle value of metal wire blanks and standard type. X consists of a lot of different letter, data and unit symbol, X's specific meaning as follows:

F-表示拉丝模外径为负公差； Means outer diameter of drawing die to be minus tolerance

H-表示拉丝模高度与标准型号不一致； Means the disagreement between the height of drawing die and standard type's

D-表示拉丝模外径与标准型号不一致； Means the disagreement between the OD of drawing die and standard type's

R-表示拉丝模入口区、润滑区与标准型号不一致； Means the disagreement between entrance and lubrication area of drawing die and standard type's

r-表示拉丝模出口角与标准型号不一致； Means the disagreement between exit angle of drawing die and standard type's

E-表示拉丝模型号类似于 E 系列； Means the type of drawing die to be similar with E series

HB-表示拉丝模与原 LH 型号相同，并 $\alpha$ 角不同； Means the same between the model of drawing die and original LH's, yet the difference of  $\alpha$  angle.

HA-表示拉丝模定径区高度比标准型号要高； Means the height of sizing district is higher standard type

AB-表示拉丝模为 LH 型号中转来，主要是 D、H 有变化； Means the type is arise from LH's one, mainly D&H changed

H-表示拉丝模为 LH 型号中转来； Means the type is arise from LH's one

2.5°-表示拉丝模外圆带 2.5°的锥度角； Means outer round of drawing die with cone angle of 2.5 degree

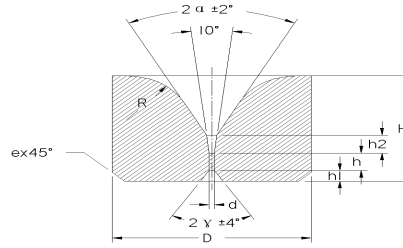
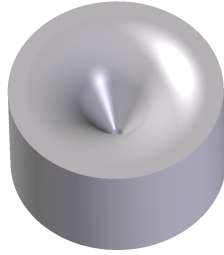
A-表示拉丝模 $\alpha$ 角不同； Means the angle  $\alpha$  of drawing die is different

30-AB 型仍然采用原型号。

Type 30-AB still adapts original type.

## 九、黑色金属线材拉伸模坯型号 The type of drawing die for drawing ferrous metal wire

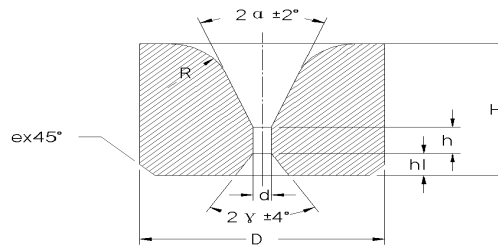
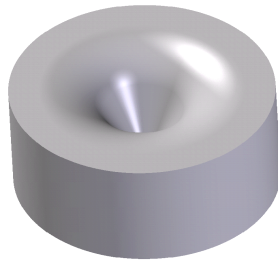
1、S01 型 拉制黑色金属线材模坯 Carbide drawing die for drawing ferrous metal wire



新型号 New Type	原型号 Old Type	Dimension (mm) 基本尺寸					Reference dimension(mm) 参考尺寸			
		D	H	d	2α	2γ	h	h <sub>1</sub>	h <sub>2</sub>	R
S01-0060440-0.8	S01-0.8	6	4	0.2	40°	60°	0.8	0.6	0.8	1.5
S01-0080640-1.0	S01-1.0	8	6	0.2	40°	60°	1.0	0.6	1.0	2.5

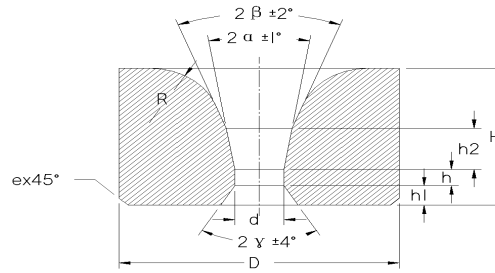
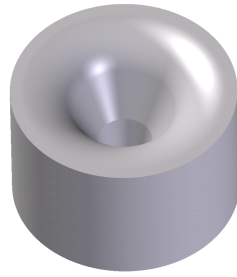
## 2、S10 型 拉制黑色金属线材模坯 Type S10 Carbide drawing die for drawing ferrous metal wires

### Type S10



新型号 New Type	原型号 Old Type	Dimension (mm) 基本尺寸					Reference dimension(mm) 参考尺寸			
		D	H	d	2α	2γ	h	h <sub>1</sub>	R	e
S10-0060440-0.3	S10-0.3	6	4	0.3	40°	60°	0.6	0.8	1.5	0.5
S10-0060440-0.4	S10-0.4	6	4	0.4	40°	60°	0.6	0.8	1.5	0.5
S10-0060440-0.6	S10-0.6	6	4	0.6	40°	60°	0.8	0.8	1.5	0.5
S10-0060440-0.7	S10-0.7	6	4	0.7	40°	60°	0.9	0.8	1.5	0.5
S10-0060440-0.8	S10-0.8	6	4	0.8	40°	60°	1.0	0.8	1.5	0.5
S10-0080640-0.3	LS10-0.3-8	8	6	0.3	40°	60°	0.2	1.0	2.0	0.5
S10-0080640-0.4	LS10-0.4-8	8	6	0.4	40°	60°	0.4	1.0	2.0	0.5
S10-0080640-0.6	LS10-0.6-8	8	6	0.6	40°	60°	0.6	1.0	2.0	0.5
S10-0080640-0.8	LS10-0.8-8	8	6	0.8	40°	60°	0.8	1.0	2.0	0.5
S10-0080640-1.0		8	6	1.0	40°	60°	1.0	0.6	2.5	0.5

### 3、S11 型 拉制黑色金属线材模坯 Type S11 Carbide drawing die for drawing ferrous metal wires



新型号 New Type	原型号 Old Type	Dimension (mm) 基本尺寸						Reference dimension(mm) 参考尺寸				
		D	H	d	2α	2β	2γ	h	h <sub>1</sub>	h <sub>2</sub>	R	e
S11-0080612-0.3	S11-0.3	8	6	0.3	12°	40°	60°	0.3	1.0	1.2	2.0	0.5
S11-0080612-0.4	S11-0.4	8	6	0.4	12°	40°	60°	0.3	1.0	1.2	2.0	0.5
S11-0080616-0.5		8	6	0.5	16°	40°	60°	0.3	1.0	1.5	2.0	0.5
S11-0080612-0.6	S11-0.6	8	6	0.6	12°	40°	60°	0.4	1.0	1.4	2.0	0.5
S11-0080616-0.7		8	6	0.7	16°	40°	60°	0.5	1.0	1.7	2.0	0.5
S11-0080616-0.8	12-0.8	8	6	0.8	16°	40°	60°	0.6	1.0	1.8	2.0	0.5
S11-0080612-0.9		8	6	0.9	12°	40°	60°	0.6	1.0	1.8	2.0	0.5
S11-0080612-1.0	S11-1.0	8	6	1.0	12°	40°	60°	0.6	1.0	1.8	2.0	0.5
S11-0080610-1.1		8	6	1.1	10°	40°	60°	0.5	1.0	2.0	2.0	0.5
S11-0080610-1.2	11-1.2	8	6	1.2	10°	40°	60°	0.6	1.0	2.0	2.0	0.5
S11-0080610-1.4		8	6	1.4	10°	40°	60°	0.6	1.0	2.0	2.0	0.5
S11-0080610-1.6		8	6	1.6	10°	40°	60°	0.6	1.0	2.0	2.0	0.5
S11-0110816-0.7D		11	8	0.7	16°	40°	60°	0.6	1.2	2.0	4.0	1.0
S11-0110816-0.85D		11	8	0.85	16°	40°	60°	0.6	1.2	2.0	4.0	1.0
S11-0110816-0.9D		11	8	0.9	16°	40°	60°	0.6	1.2	2.0	4.0	1.0
S11-0110816-1.1D		11	8	1.1	16	40°	60°	0.8	1.2	1.2	4.0	1.0
S11-0110816-0.4D		11.5	8	0.4	16	40°	65°	0.4	1.2	2.0	4.0	1.0
S11-0110816-0.6D		11.5	8	0.6	16	40°	65°	0.4	1.2	2.0	4.0	1.0
S11-0110816-0.8D		11.5	8	0.8	16	40°	65°	0.6	1.2	2.0	4.0	1.0
S11-0110816-1.0D		11.5	8	1.0	16	40°	65°	0.8	1.2	2.0	4.0	1.0
S11-0110816-1.3D		11.5	8	1.3	16	40°	65°	0.8	1.2	2.0	4.0	1.0
S11-0110816-1.6D		11.5	8	1.6	16	40°	65°	1.0	1.2	2.0	4.0	1.0
S11-0110816-1.8D		11.5	8	1.8	16	40°	65°	1.2	1.2	2.0	4.0	1.0
S11-0110816-2.0D		11.5	8	2.0	16	40°	65°	1.2	1.2	2.0	4.0	1.0
S11-0121014-0.4	LS11-0.4-12H	12	10	0.4	14°	40°	90°	0.4	1.2	2.0	6.8	1.0
S11-0121014-0.6	LS11-0.6-12H	12	10	0.6	14°	40°	90°	0.6	1.2	2.0	6.5	1.0
S11-0121016-0.35α	LS11-0.35α	12	10	0.35	16	40°	60°	2.3	1.2	2.0	4.0	1.0
S11-0121016-0.4α	LS11-0.4α	12	10	0.4	16	40°	60°	2.3	1.2	2.0	4.0	1.0



S11-0121016-0.5α	LS11-0.5α	12	10	0.5	16	40°	60°	2.3	1.2	2.0	4.0	1.0
S11-0121016-0.6α	LS11-0.6α	12	10	0.6	16	40°	60°	2.4	1.2	2.0	4.0	1.0
S11-0120914-0.4α	LH11-0.4-12α	12	9	0.4	10°	40°	60°	0.6	1.2	2.0	4.0	1.0
S11-0120914-0.6α	LH11-0.6-12α	12	9	0.6	10°	40°	60°	0.6	1.2	2.0	4.0	1.0
S11-0121014-0.8	LS11-0.8-12H	12	10	0.8	14°	40°	90°	0.8	1.2	2.0	6.3	1.0
S11-0121014-1.0	LS11-1.0-12H	12	10	1.0	14°	40°	90°	0.8	1.2	2.0	6.1	1.0
S11-0121016-1.2	LS11-1.2-12H	12	10	1.2	16°	40°	90°	1.0	1.2	2.0	5.6	1.0
S11-0121016-1.4	LS11-1.4-12H	12	10	1.4	16°	40°	90°	1.0	1.2	2.0	5.4	1.0
S11-0121016-1.6	LS11-1.6-12H	12	10	1.6	16°	40°	90°	1.2	1.2	2.0	5.2	1.0
S11-0121016-1.8	LS11-1.8-12H	12	10	1.8	16°	40°	90°	1.2	1.2	2.0	5.1	1.0
S11-0121016-2.0	LS11-2.0-12H	12	10	2.0	16°	40°	90°	1.2	1.2	2.0	5.0	1.0
S11-0121016-2.3	LS11-2.3-12H	12	10	2.3	16°	40°	90°	1.2	1.2	2.0	4.8	1.0
S11-0131014-0.4	LS11-0.4-13F	13	10	0.4	14°	40°	60°	0.3	1.2	2.0	3.0	1.0
S11-0131012-0.4	LS11-0.4-13E	13	10	0.4	12°	42°	60°	0.3	1.2	2.0	3.0	1.0
S11-0131018-0.4	LS11-0.4-13	13	10	0.4	18°	40°	60°	0.3	1.2	2.0	3.0	1.0
S11-0131014-0.5		13	10	0.5	14°	40°	60°	0.4	1.2	2.0	4.0	1.0
S11-0131014-0.6	LS11-0.6-13F	13	10	0.6	14°	40°	60°	0.4	1.2	2.2	3.0	1.0
S11-0131012-0.6	LS11-0.6-13E	13	10	0.6	12°	42°	60°	0.4	1.2	2.2	3.0	1.0
S11-0131018-0.6	LS11-0.6-13	13	10	0.6	18°	40°	60°	0.4	1.2	2.2	3.0	1.0
S11-0131014-0.7	LS11-0.7-13F	13	10	0.7	14°	40°	60°	0.6	1.2	2.5	3.0	1.0
S11-0131012-0.7	LS11-0.7-13E	13	10	0.7	12°	42°	60°	0.6	1.2	2.2	3.0	1.0
S11-0131014-0.8	LS11-0.8-13F	13	10	0.8	14°	40°	60°	0.6	1.2	2.5	3.0	1.0
S11-0131012-0.8	LS11-0.8-13E	13	10	0.8	12°	42°	60°	0.6	1.2	2.5	3.0	1.0
S11-0131018-0.8	LS11-0.8-13	13	10	0.8	18°	40°	60°	0.6	1.2	2.5	3.0	1.0
S11-0151314-0.8	LS11-0.8-15H	15	13	0.8	14°	40°	90°	0.6	1.5	2.0	8.8	1.2
S11-0131012-0.9	LS11-0.9-13E	13	10	0.9	12°	42°	60°	0.7	1.2	2.5	3.0	1.0
S11-0131018-0.9	LS11-0.9-13	13	10	0.9	18°	40°	60°	0.7	1.2	2.5	3.0	1.0
S11-0131014-1.0	LS11-1.0-13F	13	10	1.0	14°	40°	60°	0.7	1.2	3.0	3.0	1.0
S11-0131012-1.0	LS11-1.0-13E	13	10	1.0	12°	42°	60°	0.7	1.2	3.0	3.0	1.0
S11-0131018-1.0	LS11-1.0-13	13	10	1.0	18°	40°	60°	0.7	1.2	3.0	3.0	1.0
S11-0131014-1.1	LS11-1.1-13F	13	10	1.1	14°	40°	60°	1.0	1.2	3.0	3.0	1.0
S11-0131012-1.1	LS11-1.1-13E	13	10	1.1	12°	42°	60°	1.0	1.2	3.0	3.0	1.0
S11-0131018-1.1	LS11-1.1-13	13	10	1.1	18°	40°	60°	1.0	1.2	3.0	3.0	1.0
S11-0131014-1.3	LS11-1.3-13F	13	10	1.3	14°	40°	60°	1.3	1.2	3.0	3.0	1.0
S11-0131018-1.3	LS11-1.3	13	10	1.3	18°	40°	60°	1.0	1.2	3.0	3.0	1.0
S11-0131018-1.5		13	10	1.5	18°	40°	60°	1.1	1.2	3.0	3.0	1.0
S11-0131014-1.6	LS11-1.6-13F	13	10	1.6	14°	40°	60°	1.1	1.2	3.0	3.0	1.0
S11-0131018-1.6	LS11-1.6	13	10	1.6	18°	40°	60°	1.1	1.2	3.0	3.0	1.0
S11-0131018-1.7		13	10	1.7	18°	40°	60°	1.2	1.2	4.0	4.0	1.0
S11-0131016-1.8	S11-1.8	13	10	1.8	16°	40°	60°	1.2	1.2	3.5	4.0	1.0
S11-0131018-1.8	LS11-1.8	13	10	1.8	18°	40°	60°	1.2	1.2	4.0	4.0	1.0
S11-0131018-1.9		13	10	1.9	18°	40°	60°	1.2	1.2	4.0	4.0	1.0

S11-0131016-2.0	LS11-2.0-13F	13	10	2.0	16°	40°	60°	1.2	1.2	4.0	4.0	1.0
S11-0131018-2.0	LS11-2.0	13	10	2.0	18°	40°	60°	1.2	1.2	4.0	4.0	1.0
S11-0131018-2.1		13	10	2.1	18°	40°	60°	1.4	1.2	4.0	4.0	1.0
S11-0131018-2.2		13	10	2.2	18°	40°	60°	1.4	1.2	4.0	4.0	1.0
S11-0131016-2.3	LS11-2.3-13F	13	10	2.3	16°	40°	60°	1.4	1.2	4.0	4.0	1.0
S11-0131016-2.4		13	10	2.4	16°	40°	60°	1.2	1.2	3.5	4.0	1.0
S11-0131016-2.5		13	10	2.5	16°	40°	60°	1.2	1.2	3.5	4.0	1.0
S11-0131016-2.6	S11-2.6	13	10	2.6	16°	40°	60°	1.2	2.0	3.5	3.0	1.0
S11-0151314-0.4	LS11-0.4-15H	15	13	0.4	14°	40°	90°	0.4	1.5	2.0	9.1	1.2
S11-0151314-0.6	LS11-0.6-15H	15	13	0.6	14°	40°	90°	0.6	1.5	2.0	9.0	1.2
S11-0151314-1.0	LS11-1.0-15H	15	13	1.0	14°	40°	90°	0.8	1.5	2.0	8.6	1.2
S11-0151316-1.3	LS11-1.3-15H	15	13	1.3	16°	40°	90°	1.0	1.5	2.0	8.2	1.2
S11-0151316-1.6	LS11-1.6-15H	15	13	1.3	16°	40°	90°	1.3	1.5	2.0	8.0	1.2
S11-0151316-1.8	LS11-1.8-15H	15	13	1.8	16°	40°	90°	1.3	1.5	2.0	7.8	1.2
S11-0151316-2.0	LS11-2.0-15H	15	13	2.0	16°	40°	90°	1.3	1.5	2.0	7.6	1.2
S11-0151316-2.3	LS11-2.3-15H	15	13	2.3	16°	40°	90°	1.3	1.5	2.0	7.4	1.2
S11-0151220-2.4D H		15.5	12.8	2.4	20	40°	75°	2.2	1.5	5.0	10.0	1
S11-0151316-2.8	LS11-2.8-15H	15	13	2.8	16°	40°	90°	1.5	1.5	2.0	7.0	1.2
S11-0161316-0.3	S11-0.3-16	16	13	0.3	16°	45°	60°	0.2	1.5	4.0	5.0	1.0
S11-0161316-0.4	S11-0.4-16	16	13	0.4	16°	45°	60°	0.2	1.5	4.0	5.0	1.0
S11-0161316-0.5		16	13	0.5	16°	45°	60°	0.3	1.5	4.0	5.0	1.0
S11-0161316-0.6	S11-0.6-16	16	13	0.6	16°	45°	60°	0.3	1.5	4.0	5.0	1.0
S11-0161316-0.7		16	13	0.7	16°	45°	60°	0.3	1.5	4.0	5.0	1.0
S11-0161316-0.8	S11-0.8-16	16	13	0.8	16°	45°	60°	0.4	1.5	4.0	5.0	1.0
S11-0161316-0.9		16	13	0.9	16°	45°	60°	0.4	1.5	4.0	5.0	1.0
S11-0161316-1.0	S11-1.0-16	16	13	1.0	16°	45°	60°	0.5	1.5	4.0	5.0	1.0
S11-0161316-1.1		16	13	1.1	16°	45°	60°	0.5	1.5	4.0	5.0	1.0
S11-0161316-1.2	S11-1.2-16	16	13	1.2	16°	45°	60°	0.6	1.5	4.0	5.0	1.0
S11-0161316-1.3	S11-1.3-16	16	13	1.3	16°	45°	60°	0.6	1.5	4.0	5.0	1.0
S11-0161316-1.4		16	13	1.4	16°	45°	60°	0.7	1.5	4.0	5.0	1.0
S11-0161316-1.5		16	13	1.5	16°	45°	60°	0.7	1.5	4.0	5.0	1.0
S11-0161316-1.6	S11-1.6-16	16	13	1.6	16°	45°	60°	0.8	1.5	4.0	5.0	1.0
S11-0161316-1.7		16	13	1.7	16°	45°	60°	0.8	1.5	4.0	5.0	1.0
S11-0161316-1.8	S11-1.8-16	16	13	1.8	16°	45°	60°	0.9	1.5	4.0	5.0	1.0
S11-0161316-1.9		16	13	1.9	16°	45°	60°	0.9	1.5	4.0	5.0	1.0
S11-0161316-2.0	S11-2.0-16	16	13	2.0	16°	45°	60°	1.0	1.5	4.0	5.0	1.0
S11-0161316-2.1		16	13	2.1	16°	45°	60°	1.0	1.5	4.0	5.0	1.0
S11-0161316-2.2		16	13	2.2	16°	45°	60°	1.0	1.5	4.0	5.0	1.0
S11-0161316-2.3	S11-2.3-16	16	13	2.3	16°	45°	60°	1.1	1.5	4.0	5.0	1.0
S11-0161316-2.4		16	13	2.4	16°	45°	60°	1.2	1.5	4.0	5.0	1.0
S11-0161316-2.5		16	13	2.5	16°	45°	60°	1.2	1.5	4.0	5.0	1.0

S11-0161316-2.6		16	13	2.6	16°	45°	60°	1.3	1.5	4.0	5.0	1.0
S11-0161316-2.7		16	13	2.7	16°	45°	60°	1.3	1.5	4.0	5.0	1.0
S11-0161316-2.8	S11-2.8-16	16	13	2.8	16°	45°	60°	1.4	1.5	4.0	5.0	1.0
S11-0161316-3.0	S11-3.0-16	16	13	3.0	16°	45°	60°	1.4	1.5	4.0	5.0	1.0
S11-0161318-3.2		16	13	3.2	18°	45°	60°	1.4	1.5	5.0	4.0	1.0
S11-0161418-0.4	LS11-0.4-16	16	14	0.4	18°	40°	60°	0.3	1.5	4.0	4.0	1.0
S11-0161418-0.6	LS11-0.6-16	16	14	0.6	18°	40°	60°	0.4	1.5	4.0	4.0	1.0
S11-0161418-0.8	LS11-0.8-16	16	14	0.8	18°	40°	60°	0.6	1.5	4.0	4.0	1.0
S11-0161418-0.9	LS11-0.9-16	16	14	0.9	18°	40°	60°	0.6	1.5	4.0	4.0	1.0
S11-0161418-1.0	LS11-1.0-16	16	14	1.0	18°	40°	60°	1.0	1.5	4.0	4.0	1.0
S11-0161418-1.3	LS11-1.3-16	16	14	1.3	18°	40°	60°	1.2	1.5	4.0	4.0	1.0
S11-0161418-1.6	LS11-1.6-16	16	14	1.6	18°	40°	60°	1.2	1.5	4.0	4.0	1.0
S11-0161418-1.8	LS11-1.8-16	16	14	1.8	18°	40°	60°	1.2	1.5	4.0	4.0	1.0
S11-0161418-2.0	LS11-2.0-16	16	14	2.0	18°	40°	60°	1.2	1.5	4.0	4.0	1.0
S11-0161418-2.3	LS11-2.3-16	16	14	2.3	18°	40°	60°	1.4	1.5	4.0	4.0	1.0
S11-0161418-2.5	LS11-2.5-16	16	14	2.5	18°	40°	60°	1.4	1.5	4.0	4.0	1.0
S11-0161418-2.6	LS11-2.6	16	14	2.6	18°	40°	60°	1.4	1.5	4.0	4.0	1.0
S11-0161418-2.8	LS11-2.8	16	14	2.8	18°	40°	60°	1.4	1.5	4.0	4.0	1.0
S11-0181516-1.5		17.9	15	1.5	16	40°	75°	1.5	2.0	5.0	6.0	1.5
S11-0181516-1.8		17.9	15	1.8	16	40°	75°	1.5	2.0	5.0	6.0	1.5
S11-0181516-2.0		17.9	15	2.0	16	40°	75°	1.5	2.0	5.0	6.0	1.5
S11-0181516-2.3		17.9	15	2.3	16	40°	75°	1.5	2.0	5.0	6.0	1.5
S11-0181516-2.5		17.9	15	2.5	16	40°	75°	1.5	2.0	5.0	6.0	1.5
S11-0181516-2.8		17.9	15	2.8	16	40°	75°	2.0	2.0	5.0	6.0	1.5
S11-0181518-2.8		18	15	2.8	18	40°	60°	6.7	2.0	5.5	3.0	1.0
S11-0181516-3.0		17.9	15	3.0	16	40°	75°	2.0	2.0	5.0	6.0	1.5
S11-0181518-4.5		18	15	4.5	18	40°	60°	6.7	2.0	5.5	3.0	1.0
S11-0181520-1.5D		17.9	15	1.5	20	40°	75°	2.2	2.0	-	10.0	1.5
S11-0181520-1.8D		17.9	15	1.8	20	40°	75°	2.2	2.0	-	10.0	1.5
S11-0181520-1.5D		18	15	1.5	20	40°	75°	2.2	2.0	-	10.0	1.5
S11-0181520-2.3D		18	15	2.3	20	40°	75°	2.2	2.0	-	10.0	1.5
S11-0181520-2.5D		18	15	2.5	20	40°	75°	2.2	2.0	-	10.0	1.5
S11-0181520-2.8D		18	15	2.8	20	40°	75°	3.0	2.0	-	10.0	1.5
S11-0181520-3.0D		18	15	3	20	40°	75°	3.0	2.0	-	10.0	1.5
S11-0181520-3.3D		18	15	3.3	20	40°	75°	3.0	2.0	-	10.0	1.5
S11-0181520-3.6D		18	15	3.6-	20	40°	75°	3.0	2.0	-	10.0	1.5
S11-0181520-3.8D		18	15	3.8	20	40°	75°	3.0	2.0	-	10.0	1.5
S11-0181520-4.2D		18	15	4.2	20	40°	75°	3.5	2.0	-	10.0	1.5
S11-0181520-4.7D		18	15	4.7	20	40°	75°	3.5	2.0	-	10.0	1.5
S11-0181520-5.2D		18	15	5.2	20	40°	75°	3.5	2.0	-	10.0	1.5
S11-0181520-5.7D		18	15	5.7	20	40°	75°	3.5	2.0	-	10.0	1.5
S11-0191618-1.8		19	16	1.8	18	40°	75°	2.0	2.5	5.0	8.1	1.5
S11-0191618-2.0		19	16	2.0	18	40°	75°	2.0	2.5	5.0	8.1	1.5

S11-0191618-2.3	LS11-2.3-19H	19	16	2.3	18°	40°	75°	1.2	2.5	6.0	9.6	1.5
S11-0191618-2.5	LS11-2.5-19H	19	16	2.5	18°	40°	75°	1.3	2.5	6.0	9.7	1.5
S11-0191616-2.8	LS11-2.8-19H	19	16	2.8	16°	40°	75°	1.4	2.5	6.0	9.8	1.5
S11-0191618-3.0	LS11-3.0-19H	19	16	3.0	18°	40°	75°	1.4	2.5	6.0	9.6	1.5
S11-0191616-3.3		19	16	3.3	16°	40°	75°	2.0	2.5	5.0	8.0	1.5
S11-0191616-3.6		19	16	3.6	16°	40°	75°	2.0	2.5	5.0	8.1	1.5
S11-0191616-3.8	LS11-3.8-19H	19	16	3.8	16°	40°	75°	1.7	2.5	6.0	9.0	1.5
S11-0191616-4.2		19	16	4.2	16°	40°	75°	2.0	2.5	5.0	8.2	1.5
S11-0191616-4.7		19	16	4.7	16°	40°	75°	2.0	2.5	5.0	8.5	1.5
S11-0191616-5.2	LS11-5.2-19H	19	16	5.2	16°	40°	75°	2.0	2.5	6.0	8.1	1.5
S11-0191616-5.6	LS11-5.6-19H	19	16	5.6	16°	40°	75°	2.0	2.5	6.0	8.0	1.5
S11-0191616-5.9	LS11-5.9-19H	19	16	5.9	16°	40°	75°	2.0	2.5	6.0	7.9	1.5
S11-0201716-1.4	LS11-1.4-20H	20	17	1.4	16°	40°	75°	1.1	2.5	6.0	10.1	1.5
S11-0201716-1.6	LS11-1.6-20H	20	17	1.6	16°	40°	75°	1.2	2.5	6.0	10.0	1.5
S11-0201716-1.8	LS11-1.8-20H	20	17	1.8	16°	40°	75°	1.2	2.5	6.0	10.0	1.5
S11-0201718-1.8	LS11-1.8-20F	20	17	1.8	18°	40°	60°	2.3	2.5	6.0	5.0	1.2
S11-0201718-1.9		20	17	1.9	18°	40°	60°	2.3	2.5	6.0	3.0	1.2
S11-0201716-2.0	LS11-2.0-20H	20	17	2.0	16°	40°	75°	1.5	2.5	6.0	10.0	1.5
S11-0201718-2.0	LS11-2.0-20F	20	17	2.0	18°	40°	60°	2.3	2.5	6.0	5.0	1.2
S11-0201718-2.1	S11-2.1-20	20	17	2.1	18°	40°	60°	2.3	2.5	6.0	3.0	1.2
S11-0201718-2.2		20	17	2.2	18°	40°	60°	2.3	2.5	6.0	4.0	1.2
S11-0201710-2.3	LS11-2.3-20HB	20	17	2.3	10°	40°	75°	3.0	2.5	6.0	10.0	1.5
S11-0201716-2.3	LS11-2.3-20H	20	17	2.3	16°	40°	75°	1.2	2.5	6.0	9.7	1.5
S11-0201718-2.3	LS11-2.3-20F	20	17	2.3	18°	40°	60°	2.3	2.5	6.0	5.0	1.2
S11-0201718-2.4		20	17	2.4	18°	40°	60°	2.3	2.5	7.0	5.0	1.2
S11-0201710-2.5	LS11-2.5-20HB	20	17	2.5	10°	40°	75°	3.0	2.5	6.0	10.0	1.5
S11-0201716-2.5	LS11-2.5-20H	20	17	2.5	16°	40°	75°	1.3	2.5	6.0	9.6	1.5
S11-0201718-2.5	LS11-2.5-20F	20	17	2.5	18°	40°	60°	2.3	2.5	7.0	5.0	1.2
S11-0201718-2.6		20	17	2.6	18°	40°	60°	2.3	2.5	7.0	5.0	1.2
S11-0201718-2.7		20	17	2.7	18°	40°	60°	2.3	2.5	7.0	5.0	1.2
S11-0201716-2.8	LS11-2.8-20HA	20	17	2.8	16°	40°	75°	1.5	2.5	6.0	9.8	1.5
S11-0201718-2.8	LS11-2.8-20F	20	17	2.8	18°	40°	60°	2.3	2.5	7.0	5.0	1.2
S11-0201718-3.0	LS11-3.0-20F	20	17	3.0	18°	40°	60°	2.3	2.5	7.0	5.0	1.2
S11-0201716-3.3	LS11-3.3-20HA	20	17	3.3	16°	40°	75°	1.5	2.5	6.0	9.6	1.5
S11-0201718-3.3	LS11-3.3-20F	20	17	3.3	18°	40°	60°	2.3	2.5	7.0	5.0	1.2
S11-0201718-3.5	LS11-3.5-20F	20	17	3.5	18°	40°	60°	2.3	2.5	7.0	5.0	1.2
S11-0201718-3.8	LS11-3.8-20F	20	17	3.8	18°	40°	60°	2.3	2.5	7.0	5.0	1.2
S11-0201718-4.0	LS11-4.0-20F	20	17	4.0	18°	40°	60°	2.4	2.5	7.0	5.0	1.2
S11-0201718-4.2	LS11-4.2-20F	20	17	4.2	18°	40°	60°	2.5	2.5	7.0	5.0	1.2
S11-0201718-4.5	LS11-4.5-20F	20	17	4.5	18°	40°	60°	2.5	2.5	7.0	5.0	1.2
S11-0201718-4.7	LS11-4.7-20F	20	17	4.7	18°	40°	60°	2.6	2.5	7.0	5.0	1.2
S11-0201718-5.0		20	17	5.0	18°	40°	60°	2.6	2.5	7.0	5.0	1.2
S11-0201718-5.2	LS11-5.2-20F	20	17	5.2	18°	40°	60°	2.6	2.5	7.0	5.0	1.2

S11-0201718-5.5	LS11-5.5-20F	20	17	5.5	18°	40°	60°	2.6	2.5	7.0	5.0	1.2
S11-0201716-5.7	LS11-5.7-20H	20	17	5.7	16°	40°	75°	2.0	2.5	6.0	8.0	1.5
S11-0201718-5.7	LS11-5.7-20F	20	17	5.7	18°	40°	60°	2.6	2.5	7.0	5.0	1.2
S11-0201718-6.0	LS11-6.0-20F	20	17	6.0	18°	40°	60°	2.6	2.5	7.0	5.0	1.2
S11-0211718-1.6	LS11-1.6-21F	21	17	1.6	18°	40°	60°	1.2	2.5	6.0	5.0	1.2
S11-0211718-1.8	LS11-1.8-21F	21	17	1.8	18°	40°	60°	1.2	2.5	6.0	5.0	1.2
S11-0211718-2.0	LS11-2.0-21F	21	17	2.0	18°	40°	60°	1.2	2.5	6.0	5.0	1.2
S11-0211718-2.3	LS11-2.3-21F	21	17	2.3	18°	40°	60°	1.4	2.5	6.0	5.0	1.2
S11-0211718-2.5	LS11-2.5-21F	21	17	2.5	18°	40°	60°	1.4	2.5	6.0	5.0	1.2
S11-0211718-2.8	LS11-2.8-21F	21	17	2.8	18°	40°	60°	1.4	2.5	6.0	5.0	1.2
S11-0211718-3.0	LS11-3.0-21F	21	17	3.0	18°	40°	60°	1.4	2.5	6.0	5.0	1.2
S11-0211718-3.3	LS11-3.3-21F	21	17	3.3	18°	40°	60°	1.5	2.5	7.0	5.0	1.2
S11-0211718-3.5	LS11-3.5-21F	21	17	3.5	18°	40°	60°	1.5	2.5	7.0	5.0	1.2
S11-0211718-3.8	LS11-3.8-21F	21	17	3.8	18°	40°	60°	1.6	2.5	7.0	5.0	1.2
S11-0211718-4.0	LS11-4.0-21F	21	17	4.0	18°	40°	60°	1.7	2.5	7.0	5.0	1.2
S11-0211718-4.2	LS11-4.2-21F	21	17	4.2	18°	40°	60°	1.8	2.5	7.0	5.0	1.2
S11-0211718-4.5	LS11-4.5-21F	21	17	4.5	18°	40°	60°	1.8	2.5	7.0	5.0	1.2
S11-0211718-4.7	LS11-4.7-21F	21	17	4.7	18°	40°	60°	1.8	2.5	7.0	5.0	1.2
S11-0211718-4.9	LS11-4.9-21F	21	17	4.9	18°	40°	60°	1.9	2.5	7.0	5.0	1.2
S11-0211718-5.2	LS11-5.2-21F	21	17	5.2	18°	40°	60°	2.0	2.5	8.0	5.0	1.2
S11-0211718-5.5	LS11-5.5-21F	21	17	5.5	18°	40°	60°	2.5	2.5	8.0	5.0	1.2
S11-0211718-5.7	LS11-5.7-21F	21	17	5.7	18°	40°	60°	3.0	2.5	8.0	5.0	1.2
S11-0221818-1.5	S11-1.5-22	22	18	1.5	18°	40°	60°	1.2	2.5	6.0	5.0	1.2
S11-0221818-1.6	LS11-1.6-22F	22	18	1.6	18°	40°	60°	1.4	2.5	5.0	5.0	1.2
S11-0221818-1.7	S11-1.7-22	22	18	1.7	18°	40°	60°	1.2	2.5	6.0	5.0	1.2
S11-0221818-1.7	11-1.7-22	22	18	1.7	18°	40°	60°	1.2	2.5	6.0	5.0	1.2
S11-0221818-1.8	LS11-1.8-22F	22	18	1.8	18°	40°	60°	1.4	2.5	5.0	5.0	1.2
S11-0221818-1.8	11-1.8-22	22	18	1.8	18°	40°	60°	1.2	2.5	6.0	5.0	1.2
S11-0221818-1.9	S11-1.9-22	22	18	1.9	18°	40°	60°	1.2	2.5	6.0	5.0	1.2
S11-0221818-2.0	LS11-2.0-22F	22	18	2.0	18°	40°	60°	1.4	2.5	5.0	5.0	1.2
S11-0221818-2.1		22	18	2.1	18°	40°	60°	1.2	2.5	6.0	5.0	1.2
S11-0221818-2.2		22	18	2.2	18°	40°	60°	1.2	2.5	6.0	5.0	1.2
S11-0221818-2.3	LS11-2.3-22F	22	18	2.3	18°	40°	60°	1.4	2.5	5.0	5.0	1.2
S11-0221818-2.4		22	18	2.4	18°	40°	60°	1.4	2.5	5.5	5.0	1.2
S11-0221818-2.5	LS11-2.5-22F	22	18	2.5	18°	40°	60°	1.4	2.5	5.0	5.0	1.2
S11-0201716-2.5	LS11-6.3-22H	22	18	6.3	20°	40°	75°	2.2	2.5	6.0	8.0	1.5
S11-0221818-2.6		22	18	2.6	18°	40°	60°	1.4	2.5	5.5	5.0	1.2
S11-0221818-2.7		22	18	2.7	18°	40°	60°	1.4	2.5	6.5	5.0	1.2
S11-0221818-2.8	LS11-2.8-22F	22	18	2.8	18°	40°	60°	1.4	2.5	7.0	5.0	1.2
S11-0221818-2.9		22	18	2.9	18°	40°	60°	1.4	2.5	5.5	5.0	1.2
S11-0221818-3.0	LS11-3.0-22F	22	18	3.0	18°	40°	60°	1.4	2.5	7.0	5.0	1.2
S11-0221818-3.1	LS11-3.1-22F	22	18	3.1	18°	40°	60°	1.8	2.5	7.0	5.0	1.2
S11-0221818-3.3	LS11-3.3-22F	22	18	3.3	18°	40°	60°	1.8	2.5	7.0	5.0	1.2

S11-0221818-3.5	LS11-3.5-22F	22	18	3.5	18°	40°	60°	1.8	2.5	7.0	5.0	1.2
S11-0221818-3.7		22	18	3.7	18°	40°	60°	1.8	2.5	7.0	5.0	1.2
S11-0221818-3.8	LS11-3.8-22F	22	18	3.8	18°	40°	60°	1.8	2.5	7.0	5.0	1.2
S11-0221818-4.0	LS11-4.0-22F	22	18	4.0	18°	40°	60°	1.8	2.5	7.0	5.0	1.2
S11-0221818-4.2	LS11-4.2-22F	22	18	4.2	18°	40°	60°	2.2	2.5	7.0	5.0	1.2
S11-0221818-4.5	LS11-4.5-22F	22	18	4.5	18°	40°	60°	2.2	2.5	7.0	5.0	1.2
S11-0221818-4.7	LS11-4.7-22F	22	18	4.7	18°	40°	60°	2.2	2.5	7.0	5.0	1.2
S11-0221818-5.0	LS11-5.0-22F	22	18	5.0	18°	40°	60°	2.6	2.5	7.0	5.0	1.2
S11-0221818-5.2	LS11-5.2	22	18	5.2	18°	40°	60°	2.0	2.5	6.0	5.0	1.2
S11-0221818-5.4	S11-5.4	22	18	5.4	18°	40°	60°	2.0	2.5	7.0	5.0	1.2
S11-0221814-5.5	LS11-5.5	22	18	5.5	14°	40°	60°	2.7	2.5	7.5	5.0	1.2
S11-0221818-5.7	LS11-5.7-22F	22	18	5.7	18°	40°	60°	2.6	2.5	7.0	5.0	1.2
S11-0221818-6.0	LS11-6.0-22F	22	18	6.0	18°	40°	60°	2.6	2.5	7.0	5.0	1.2
S11-0251718-6.0	LZ25-6	25	17	6.0	18°	70°	70°	1.5	3.0	6.0	2.5	2.0
S11-0251718-7.0	LZ25-7	25	17	7.0	18°	70°	70°	1.5	3.0	6.0	2.5	2.0
S11-0251718-8.0	LZ25-8	25	17	8.0	18°	70°	70°	1.5	3.0	6.0	2.5	2.0
S11-0302018-9.0	LZ30-09	30	20	9.0	18°	70°	70°	1.5	3.0	6.0	2.5	2.0
S11-0302018-10.0	LZ30-10	30	20	10.0	18°	70°	70°	1.5	3.0	6.0	2.5	2.0

#### 4、S11(改进型号)拉制黑色金属线材模坯 S11(improved type) carbide drawing die for drawing metal wire

新型号 New Type	原型号 Old Type	Dimension (mm) 基本尺寸					Reference dimension(mm) 参考尺寸					
		D	H	d	2 $\alpha$	2 $\gamma$	h	h <sub>1</sub>	h <sub>2</sub>	R	e	
S11-0131316-1.8-2.5°		13	13	1.8	16°	60°	1.5	1.5	4.0	8.0	1.0	
S11-0131316-2.0-2.5°		13	13	2.0	16°	60°	1.5	1.5	4.0	8.0	1.0	
S11-0131316-2.3-2.5°		13	13	2.3	16°	60°	1.5	1.5	4.0	8.0	1.0	
S11-0131316-2.6-2.5°		13	13	2.6	16°	60°	1.5	1.5	4.0	8.0	1.0	
S11-0131316-3.0-2.5°		13	13	3.0	16°	60°	1.5	1.5	4.0	8.0	1.0	
S11-0131316-3.2-2.5°		13	13	3.2	16°	60°	1.5	1.5	4.0	8.0	1.0	
S11-0131316-3.7-2.5°		13	13	3.7	16°	60°	2.0	1.5	4.0	8.0	1.0	
S11-0131316-4.2-2.5°		13	13	4.2	16°	60°	2.0	1.5	4.0	8.0	1.0	
S11-0131316-4.7-2.5°		13	13	4.7	16°	60°	2.0	1.5	4.0	8.0	1.0	
S11-0131316-5.2-2.5°		13	13	5.2	16°	60°	2.0	1.5	4.0	8.0	1.0	
S11-0161516-5.5-2.5°		16	15	5.5	16°	60°	2.0	1.5	4.0	8.0	1.0	
S11-0161516-6.0-2.5°		16	15	6.0	16°	60°	3.0	1.5	5.0	10.0	1.0	
S11-0161518-6.8-2.5°		16	15	6.8	16°	60°	3.0	1.5	5.0	10.0	1.0	
S11-0161618-7.8-2.5°		16	16	7.8	16°	60°	3.0	1.5	5.0	10.0	1.0	