

Designed-to-application bits increase performance

NEW EFFICIENCIES IN ROLLER cone bit performance are being achieved with the new Security DBS X Series bit designs.

In one notable case, an operator in Texas realized cumulative savings of more than \$180,000 in two wells where X Series bits were used.

One 7½-in. XS™73 bit drilled 1,241 ft in 72.5 hr, for a cost per foot of \$9.63.

The new X Series brings together the latest roller cone technological advances, from bearing systems to hardfacing. X Series bits incorporate advanced innovations and improvements in application-specific designs so they consistently outperform offsets.

With the new X Series, Security DBS combines these advanced technologies to deliver custom-designed roller cone bits, organizing design functions at the customer interface, and delivering prototype bits quickly.

The company offers a large menu of diamond technology that enables the roller cone bits to be designed specifically for a customer's particular formation and application.

The X Series extends the choices for roller cone bit design, allowing various combinations of diamond enhancements and cutting structure concepts within a single bit.

The result is innovative designs that are

tact surface for higher load capacity.

The bearing system, composed of the bearing, seal and lubrication/pressure compensation system, incorporates a thicker thrust flange that provides both an additional radial load surface and better cone retention.

In addition, for larger sizes, new floating bushings reduce heat generation and resist galling.

Security DBS also altered the manufacturing process to achieve better surface finish and dimensional consistency, which is especially important in protecting the seal.

Security DBS has developed an integrated sealing and lubricating system that features a proprietary low friction seal, increased grease reservoir volume and a unitized reservoir cap and diaphragm.

In addition, a relief valve has been incorporated into the system to ensure pressure compensation for extended life performance.

Overall, the seal, diaphragm and pressure relief valves work synergistically so that downhole pressures and internal pressures are regulated and should not adversely affect the sealing system.

In an East Texas field application in which X Series bits were designed and introduced through the company's new processes, seal effectiveness rates have consistently improved from the 70% range to 90% seal effectiveness.

Figure 1: Limestone County, Tex

Well	No of bits	Interval	ROP	\$/ft
Competitor Bradley A-5	4	2,565	11.9	13.43
X Series Bradley A-6	3	2,585	12.7	11.60
X Series Bradley A-7	3	2,574	13.6	10.95

For example, in one Limestone County, Tex well program (Figure 1), X Series designs drilled greater footage at faster ROP than offset bits, reducing cost per foot from \$13.43 to \$10.95. In addition, 4 competitor bits were required in the offset well compared to just 3 X Series bits in each of two other wells.

ADVANCED TECHNOLOGIES

Security DBS, a product service line of Halliburton Energy Services, has been at the forefront of improvements in materials and in understanding design characteristics that have resulted in better roller cone bit designs.

Now, improved bearing precision, increased bearing load capacity, and longer lasting seals have significantly extended bit life.

Advances in diamond technology and better wear properties of tungsten carbide have extended roller cone bit application to harder, more difficult lithologies.

And new software allows bit designers to correlate formation lithology to bit design for optimum bit selection.

tailor-made to match particular drilling conditions.

In many cases, X Series bit performance has been substantially better than comparable offsets, including longer bit life as a function of design integrity.

Longer intervals are possible with X Series bits. In one Freestone County, Tex well, X Series bits drilled up to twice the footage of comparable competitor designs.

BEARINGS

X Series bits also exhibit significantly longer seal life as a result of a redesigned bearing system.

Instead of building technology upon an existing system, Security DBS designed a new bearing system taking advantage of today's materials and metallurgy and manufacturing know-how.

The entire system was revamped, producing a simpler and more robust bearing system with significantly more con-

Figure 2: Post run analyses

	Pre X Series	Post X Series
Seals effective	38	18
Seals failed	10	1
Total bits	48	19
% seals effective	79.10%	94.70%
% seals failed	20.80%	5.30%
Average hr to SF	65.1 hr	93 hr

In the case history example, comprehensive, detailed post run analyses identified both the strengths and weaknesses of the existing bit product line, providing a baseline upon which to measure current and future bit performance.

Detailed physical analyses of the vari-

Figure 3: Panola County, Tex

Well	No of bits	ROP	\$/ft
Competitor Floyd #17	4	10.1	14.04
Competitor Floyd #14	4	11.0	14.25
X Series Crenshaw 1-8	3	14.0	11.23
X Series Crenshaw 1-10	3	13.5	11.12

ous formations helped develop a better understanding of how to effectively drill them.

Customers involved Security DBS early in the planning process, and could see their bit design developments on a computer screen before the bits were built.

Utilizing Security DBS' GeoMechanics proprietary drilling analysis program, the Applications Design Engineer was able to "tweak" existing cutting structures, matching them to the redesigned bearing/seal systems with greater efficacy.

Based on these results, design and material changes were made which resulted in the improved seal effectiveness rates.

TOUGHER TEETH

Working with suppliers of tungsten carbide inserts and hard facing, Security DBS has also developed more wear-resistant materials for its cutting structures, especially for the critical gauge area.

In addition, X Series premium steel tooth bits feature the company's patented CLAW tooth combination of innovative internal tooth design and Diamond Tech 2000 hard facing.

The premium tooth design offers consistently faster ROP and extended cutting structure life, such that these steel tooth bits are replacing insert bits in several areas.

Performance improvements with the introduction of the X Series in Panola County, Tex wells bear out the advantages of the new technology.

Where competitor designs required 4

bits per interval drilled, only 3 X Series bits were required to drill comparable intervals, achieving faster penetration rates and consistently reducing cost per foot.

In these case histories, introduction of the X Series through Design at the Customer Interface allowed direct, local interaction with customers and development of accurate and timely response to their needs.

By including customers in the process, Security DBS Application Design Engineers heard first hand what their objectives and concerns were, minimizing

Figure 4: Panola County 1

	In	Out	Ftg	Hr	ROP
X Series	7835	8755	920	67.00	13.73
Offsets	7918	8728	810	89.50	9.05
	8074	8909	835	99.50	8.39
	8200	8865	665	55.50	11.98
	7864	8946	1082	96.50	11.21
	7925	8560	635	74.50	8.52
	7986	8768	782	80.50	9.71
	7829	8880	1051	101.00	10.41
	7831	8551	720	75.00	9.60

any misperception of what problems existed.

This hands-on approach resulted in design changes that addressed specific issues in the area.

Resulting design improvements have yielded dramatic savings from fewer rig-days per well, rigs freed for other opportunities, and more efficient, safer drilling.

In the first Panola County well, a 7¹/₈-in. XS 71 drilled 920 ft in 67 hr for an ROP of 13.73 ft/hr.

Comparable offsets drilled slightly more footage at 1082 and 1051, but at slower

penetration rates and significantly more hours. Similarly, in the second Panola County well, the X Series bits outperformed all other competitor bits, achieving greater footage at faster penetration rates.

By utilizing a Rapid Prototyping concept, Security DBS reduced lead-times and allowed testing, evaluation, and modification in a much shorter period of time.

The resulting X Series bits have consistently demonstrated substantial performance improvement throughout Texas field applications.

Beyond technological innovation, X Series is the culmination of the company's CASCADE business process, which puts experienced design personnel side-by-side with the customer.

It equips them with the most sophisticated drilling analysis software available, and facilitates rapid response to their requests through streamlined manufacture and delivery.

More than placing design engineers in the field, Security DBS reorganized the entire roller cone product line to become more responsive to customer needs.

That means providing leading technology and leading innovations in all aspects of bit design.

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MEETING CUSTOMER NEEDS THROUGH TRAINING SOLUTIONS

TECHNICAL

- Well Control (IWCF/IADC/MMS)(Deepwater)
- Stuck Pipe Prevention
- Training to Reduce Unscheduled Events
- Murchison Drilling Practices
- Advanced Pre-Spud/Drill-the-Well-on-Paper (DWOP)

SAFETY

- Target Safety . Safety Focus
- Dropped Objects Prevention . Safety Leadership

LEADERSHIP

- Outdoor Adventure Challenge (ROPES)
- Leadership Skills

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Randy Smith Training Schools
 Lafayette . Houston . Jackson . Bogota . Montrose
 337.235.4493
 www.RandySmith.com
 CourseInfo@RandySmith.com