

Slim-line ESP

Slim-line ESP Applications

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- Starting up idle wells
- Wells after WO
- Exploratory wells
- Wells with technical limitations due to:
 - Small drift diameter
 - Displacement of casing
 - Patched casings
- Operation in wells with dogleg severity of:
 - $4^{\circ}/10\text{ m}$ - during RIH
 - $0.25^{\circ}/10\text{ m}$ - at pump setting depth
- Drawdown in sidetrack wells for effective oil production
- Bypass systems (Y-tool) with slim ESPs for casings: $5\frac{3}{4}''$, $6\frac{5}{8}''$, $7''$, $9\frac{5}{8}''$
- ESP operation in highly deviated wells with zenith angle of 90° (horizontal wells)
- Dual ESP systems for multi-zone production (casings: $5\frac{3}{4}''$, $6\frac{5}{8}''$, $7''$, $9\frac{5}{8}''$)

Slim-line ESP Benefits and Features:

- Increased production from wells with small ID less than 3.9”;
- Increased production due to multi-zone operation;
- Production from wells when a slim ESP is a single solution: side-track wells;
- All are of Power Save™ design having the best efficiency possible for such small diameters;
- Available in three series: 217, 272 and 319 (max OD including cable 1.5”, 3.23” and 3.74”);
- Asynchronous Motor cannot be used due to low Efficiency and long length, Permanent Magnet of 319 series is used instead;
- For gassy applications multiphase pumps of 272, 319 series are available;
- Downhole sensor systems are 217 and 319 series;

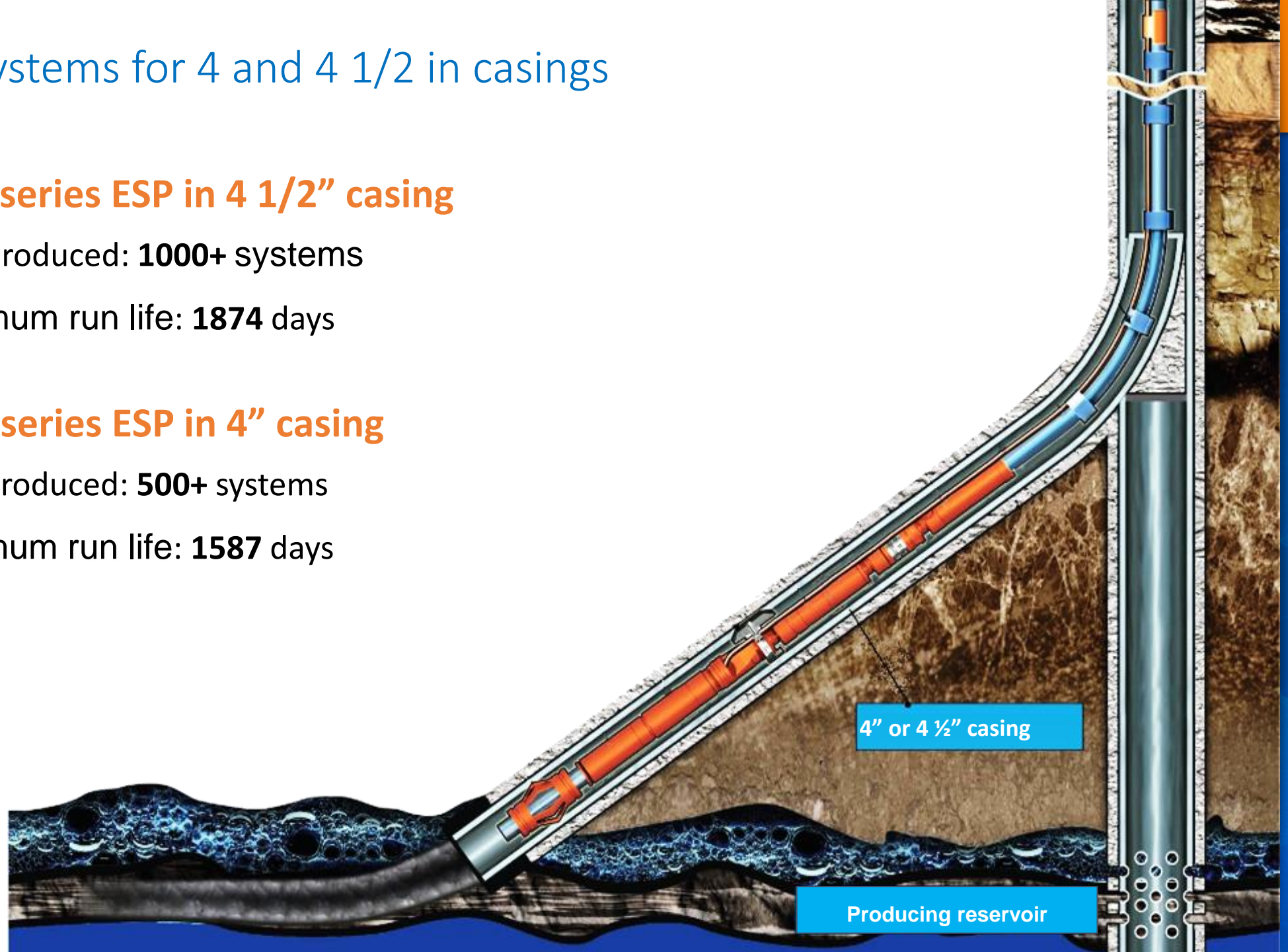
Slim-line ESP Systems for 4 and 4 1/2 in casings

B (319) series ESP in 4 1/2" casing

- Total produced: **1000+** systems
- Maximum run life: **1874** days

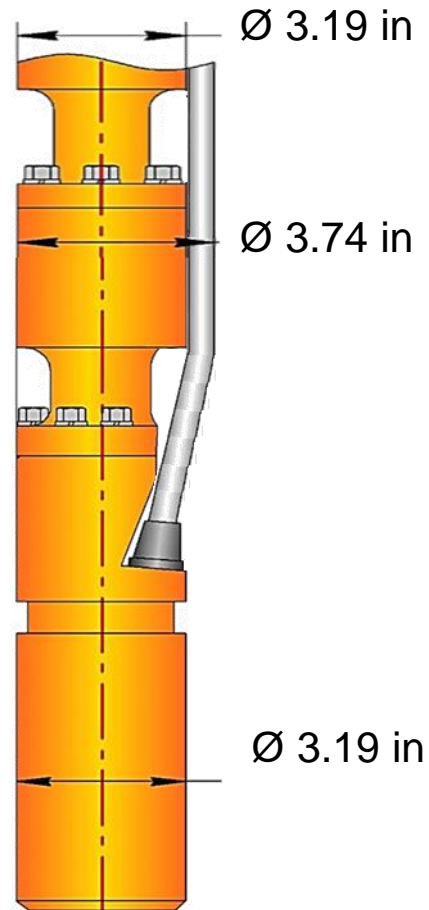
A (272) series ESP in 4" casing

- Total produced: **500+** systems
- Maximum run life: **1587** days



ESP system of NB (319) series

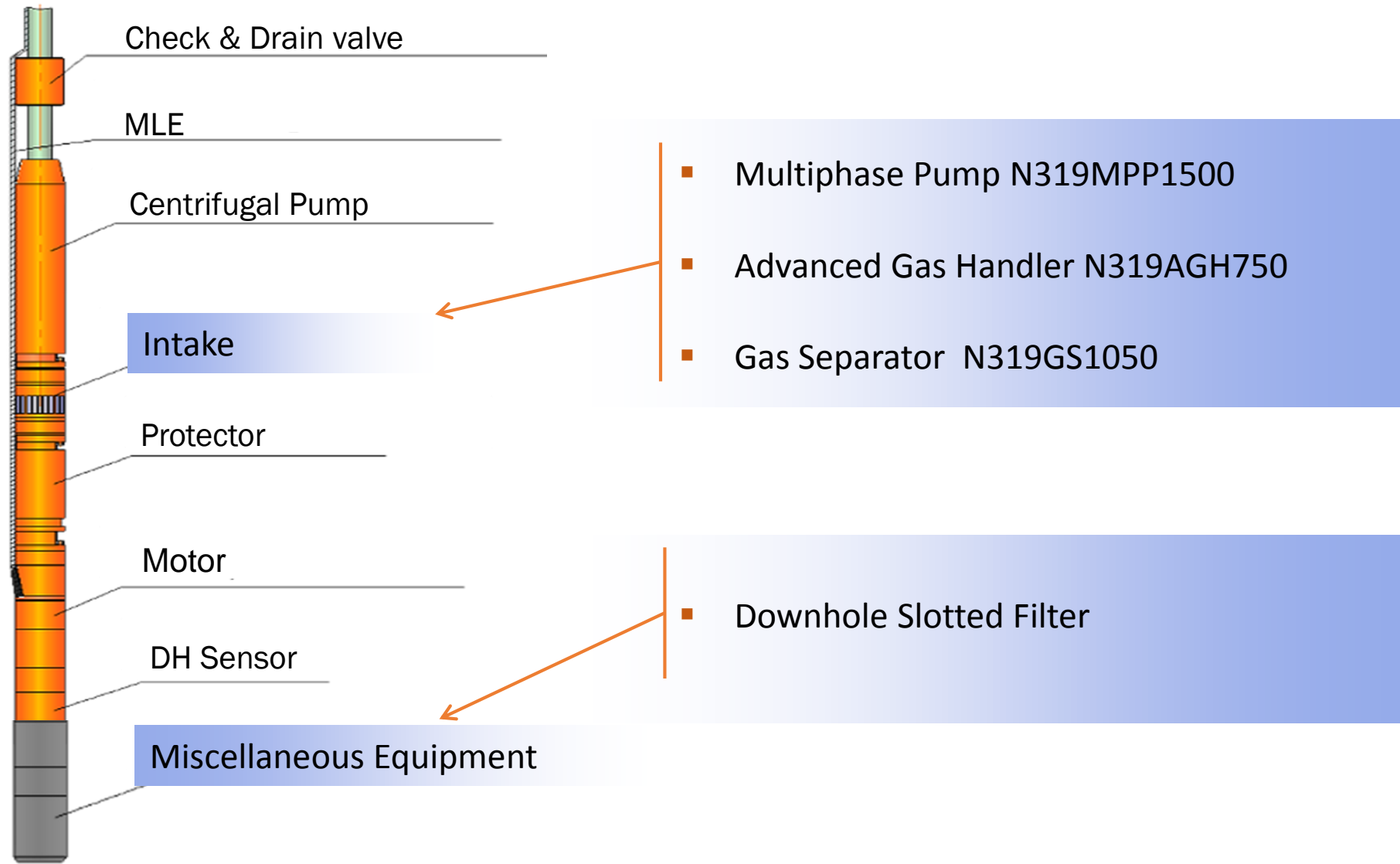
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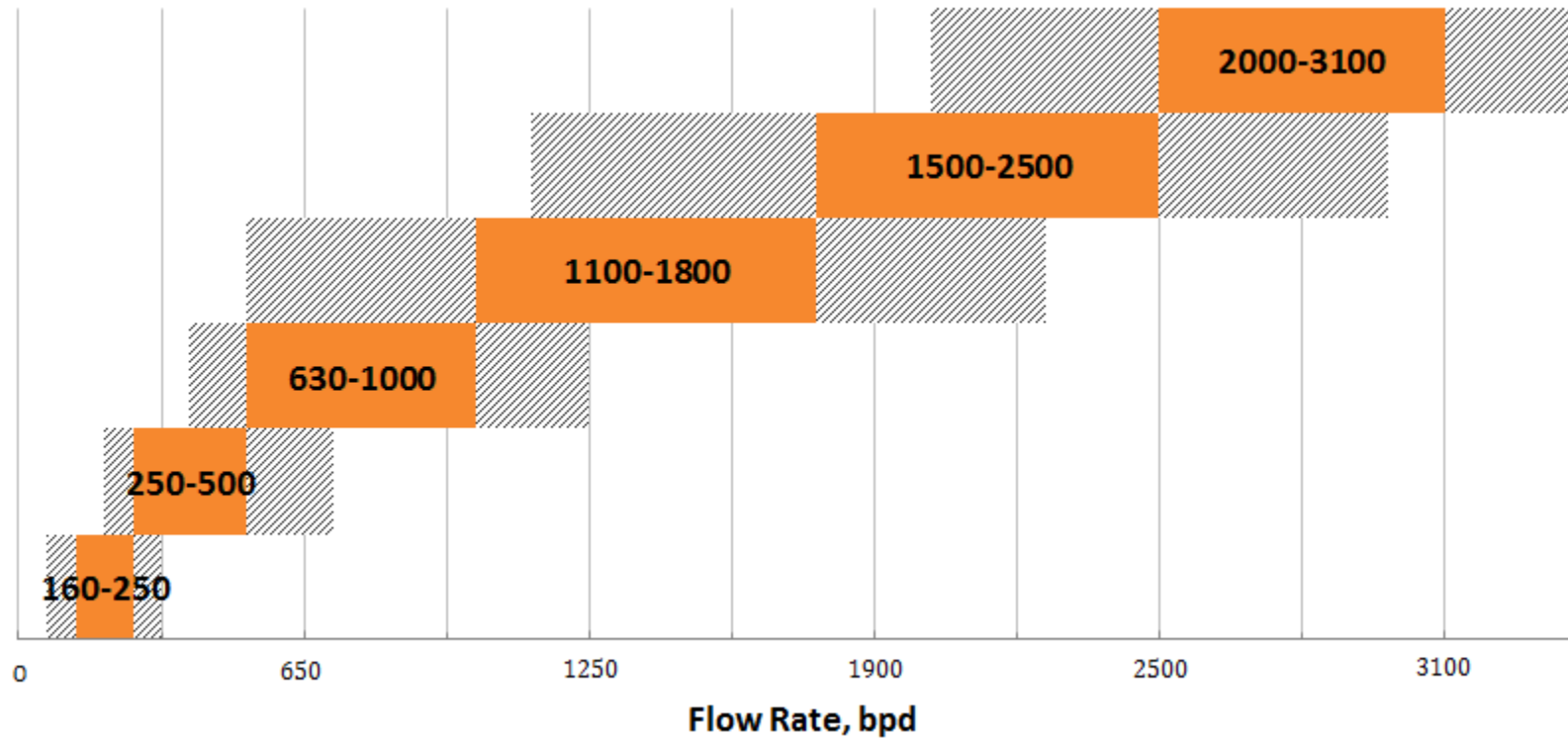
Series	319/B
Pump OD, in/mm	3.19/81
Motor OD, in/mm	3.19/81
Max OD of ESP system, in/mm	3.74/95
Drift Casing 4 ½" (15.1lb/ft), in/mm	3.83/97.1



Stage	Flow Rate, bpd	Rotation Speed, rpm	Eff, %
NB (160-250)H	160-250	3000 ÷ 6000	40
NBV (250-500)H	250-500	3000 ÷ 6000	52
NB (630-1000)H	630-1000	3000 ÷ 6000	63
NB (1100-1800)H	1100-1800	3000 ÷ 6000	64
NB (1500-2500)H	1500-2500	3000 ÷ 6000	68
NB (2000-3100)H	2000-3100	3000 ÷ 6000	70

Components of NB (319) series



Flow rate ranges of NB (319) series



-  - Nameplate Flow Rate
-  - Operating Flow Rate

Operating results of NB (319) series

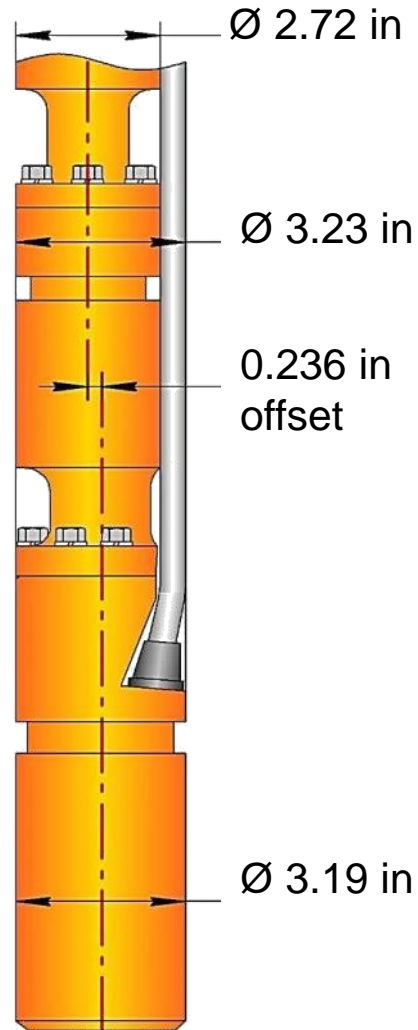
- Start of operation in 2008
- About 600 ESP units of 319 series were installed in Russia
- 97 ESP units of 319 series were installed in USA, Argentina, Colombia, Ecuador, Romania

Examples of operation:

Country	ESP	Run life, days	Condition
Russia	NB(630-1000)H	1321	Working
Russia	NB(1100-1800)H	922	Working
Russia	NBV(250-500)H	909	Working
Colombia	NB(1100-1800)H	1597	Working
Colombia	NB(1100-1800)H	1596	Working
Colombia	NB(1100-1800)H	1566	Working
Colombia	NB(630-1000)H	1370	Working

ESP system of NA (272) series

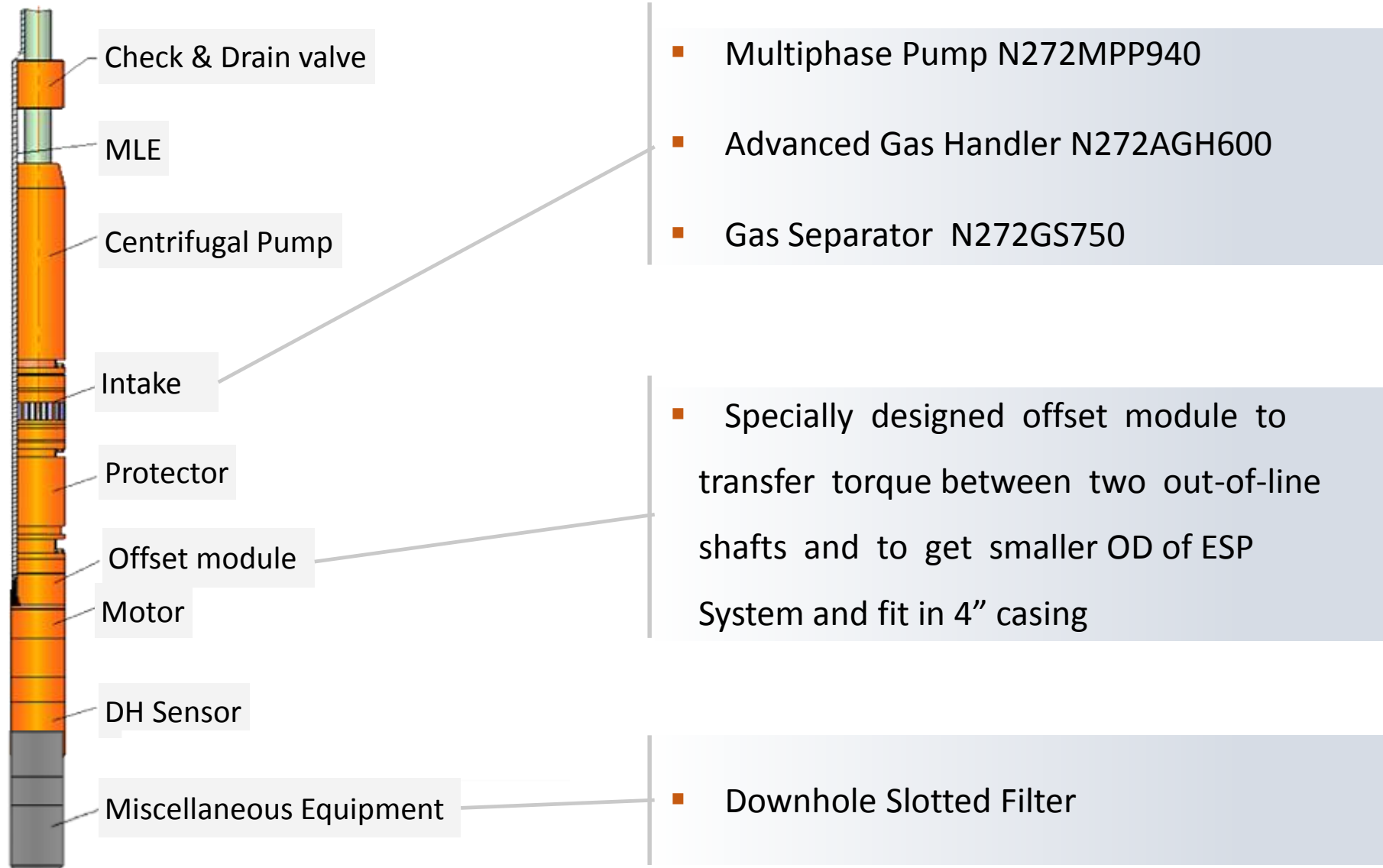
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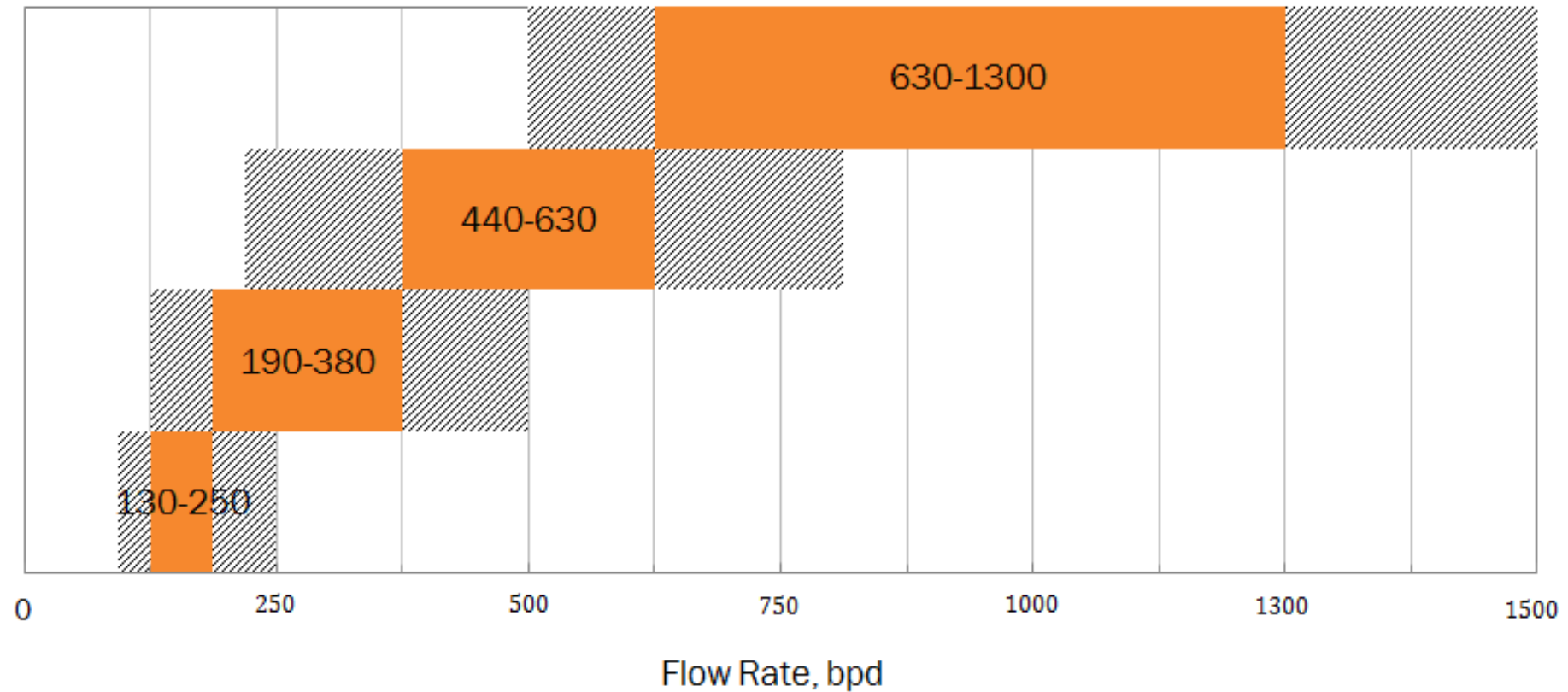
Series	272/A
Pump OD, in/mm	2.72/69
Motor OD, in/mm	3.19/81
Max OD of ESP system, in/mm	3.23/82
Drift Casing 4" (13.4 lb/ft), in/mm	3.34/84.8


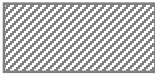
Stage	Flow Rate, bpd	Rotation Speed, rpm	Eff, %
NAV (130-250)H	130-250	3000 ÷ 6000	44
NAV (190-380)H	190-380	3000 ÷ 6000	48
NAV (440-630)H	440-630	3000 ÷ 6000	61
NAV (630-1300)H	630-1300	3000 ÷ 6000	58

Components of NA (272) series



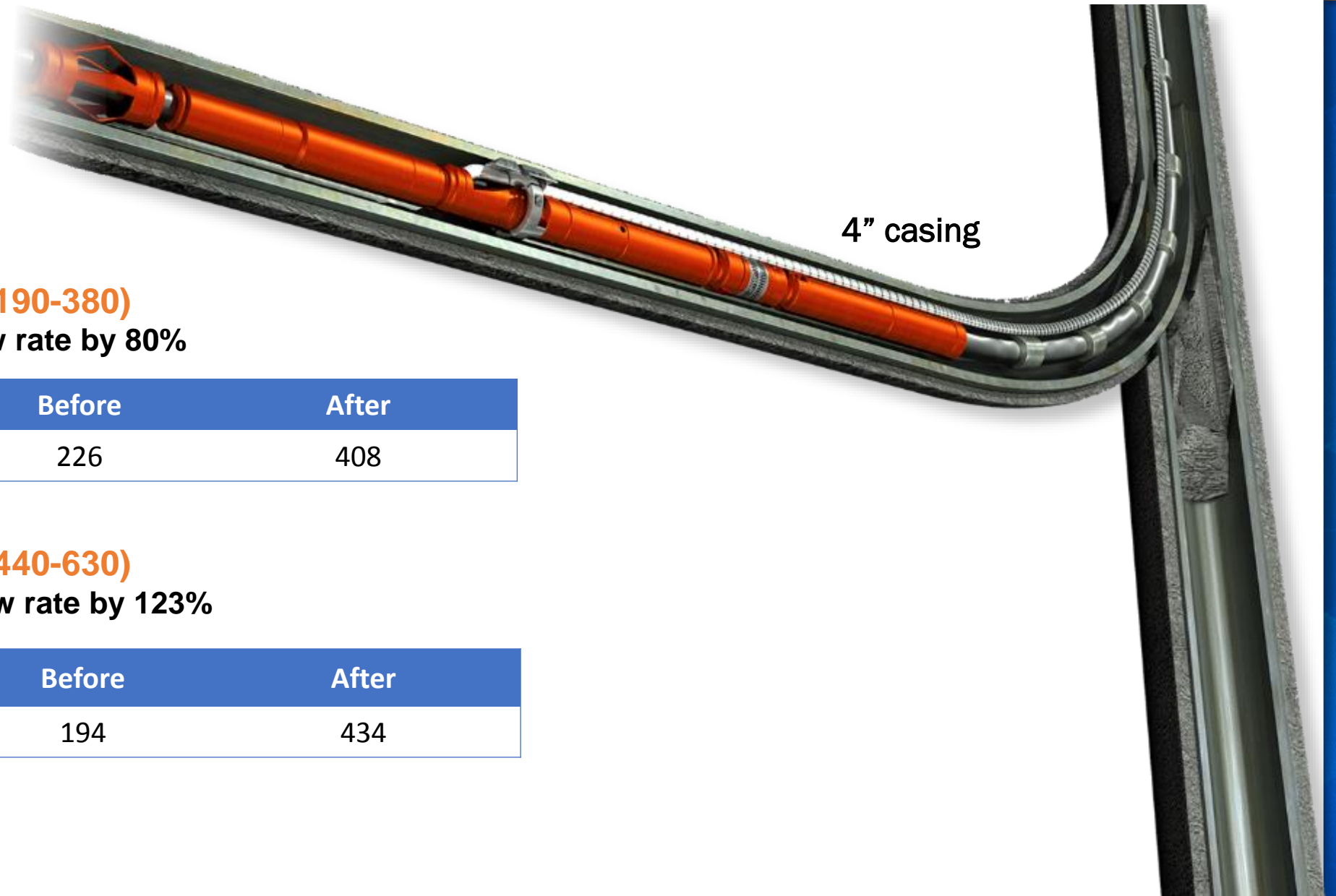
Flow rate ranges of NA (272) series



-  - Nameplate Flow Rate
-  - Operating Flow Rate

Slim-line ESP Systems in side-track wells In Russia

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Installation NAV(190-380)
Increasing the flow rate by 80%

Flow Rate	Before	After
Q, BPD	226	408

Installation NAV(440-630)
Increasing the flow rate by 123%

Flow Rate	Before	After
Q, BPD	194	434

Operating results of NA (272) series

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- Start of operation in 2011
- 500+ ESP units of 272 series were installed

Examples of operation:

Country	Oil Company	ESP	Run life, days	Condition
Russia	"TomskNeft"	NA(440-630)H	1587	Working
Russia	"TomskNeft"	NA(440-630)H	1143	Working
Russia	"SamotlorNefteGaz"	NAV(440-630)H	1075	Working
Russia	"Bashneft"	NA(630-1300H	833	Working
Russia	"Orenburgneft"	NAV(440-630)H	800	Working
Russia	"Orenburgneft"	NAV(440-630)H	655	Working

Heat resistance modifications of Novomet ESP System units

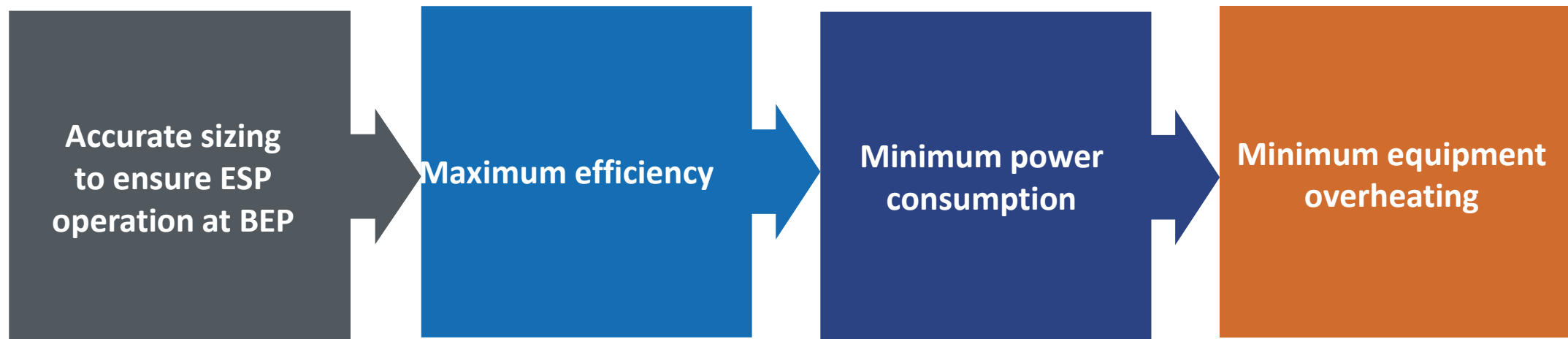


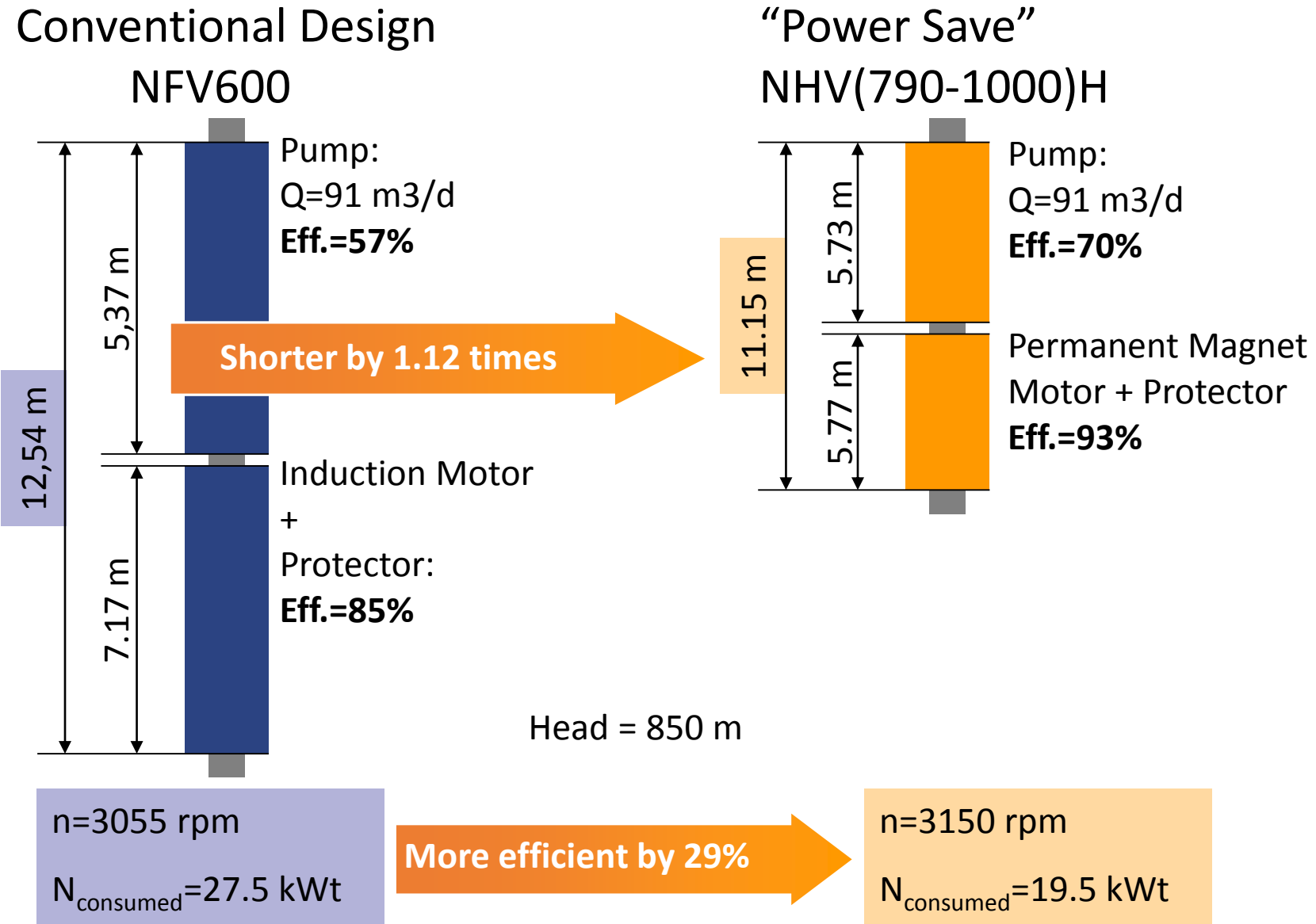
Heat resistance	Standard	High temperature HT		Ultra High Temperature UHT		Hyper High Temperature HHT	
Valves				338F (170°C)		482F (250°C)	
Pump		284F (140°C)		338F (170°C)		482F (250°C)	
Intake				338F (170°C)		482F (250°C)	
Gas separator				338F (170°C)		482F (250°C)	
Advanced Gas Handler				338F (170°C)		482F (250°C)	
Multiphase Pump				338F (170°C)		482F (250°C)	
Protector	248F (120°C)			338F (170°C)		482F (250°C)	
Motor Lead Extension	248F (120°C)	266F (130°C)	302F (150°C)	448F (230°C)			482F (250°C)
Electric Motor	248F (120°C)	284F (140°C)		320F (160°C)	356F (180°C)	392F (200°C)	482F (250°C)
Downhole Sensor System		302F (150°C)			356F (180°C)		
Filters against solids				338F (170°C)		482F (250°C)	
Scale Preventers				338F (170°C)		482F (250°C)	

Elements of integrated approach to Power Saving

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- Proper equipment sizing at Best Efficiency Point (BEP)
- “Power Save” pump
- Permanent Magnet Motor

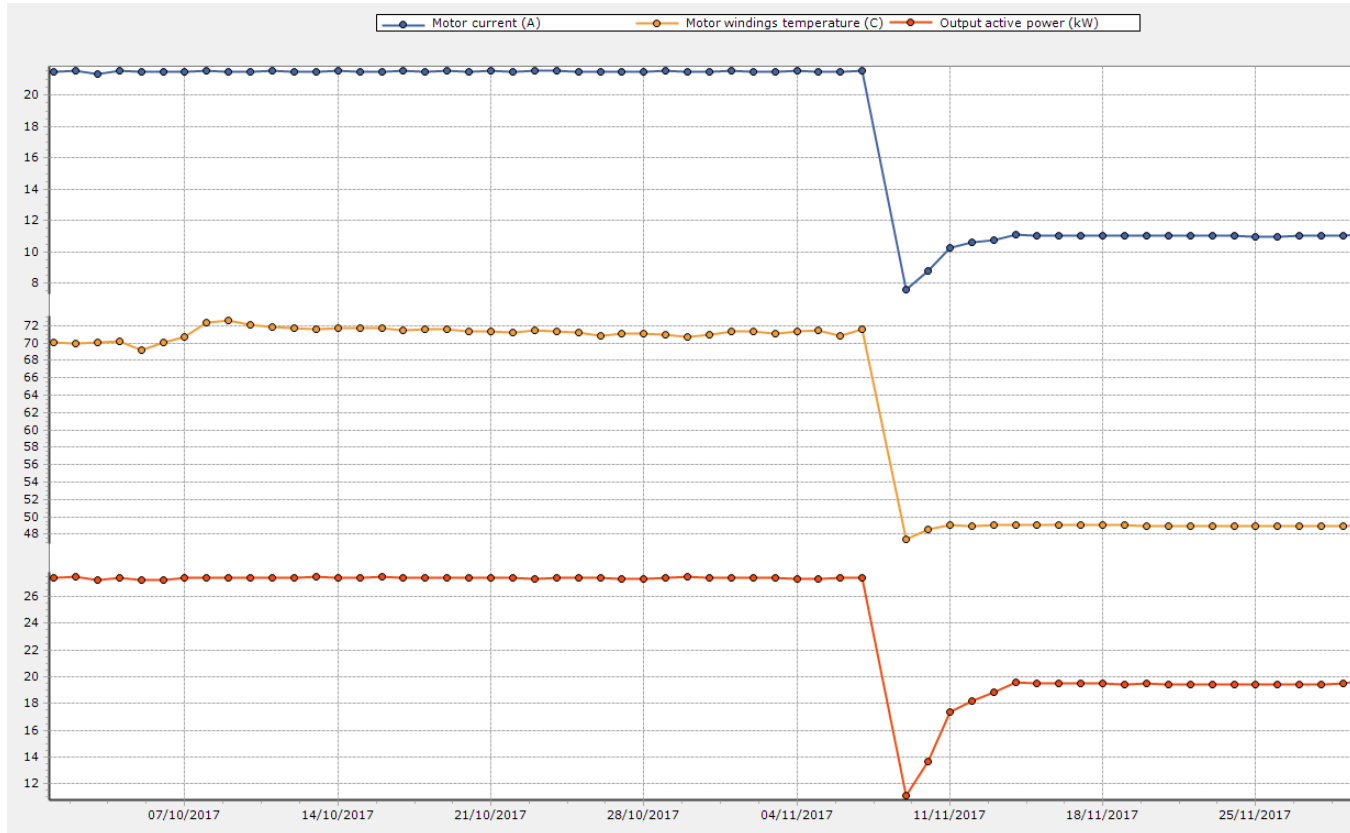




Case study #1, Romania

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- Operating current: 21.5A → 11.5A;
- Motor winding temperature: 71°C → 49°C;
- Active power consumed: 27.5kW → 19.5kW.



- Proved bench and field tests showed power consumption reduce up to 20-35% depends on sizing and well conditions

Novomet-Track

The remote monitoring
system of artificial lift



Thank you!