### **SIEMENS**



## SINAMICS PERFECT HARMONY GH180

The perfect harmony of performance and value

siemens.com/sinamics-perfect-harmony-gh180

### SINAMICS PERFECT HARMONY -

The drive of choice for high performance at a reasonable cost





According to energy authorities, industrial motors consume over a billion kilowatt hours of energy each year – fully 50 percent of the world's energy usage. System enhancements such as improved sizing and proper matching to load, more efficient drive trains, and adjustable speed drives will help drive energy usage down, according to experts. That means that the right drive can help you drive cost out of your operation by providing more precise and efficient control of motors, fans, pumps, and other devices.

Siemens drives, the best-selling medium-voltage AC drives in the world, deliver an impressive combination of benefits:

- Lower operating costs
- Precise process control
- Increased production efficiency
- Exceptional reliability
- Intuitive HMI

"If you haven't installed a variable-speed drive yet, you're letting thousands of dollars of energy costs eat away at your bottom line every month because of process inefficiencies."

The SINAMICS PERFECT HARMONY's outstanding record has made it the drive of choice for demanding applications that require the highest levels of reliability, precision, and longevity. Employed in applications ranging from power generation to oil and gas, water, marine, and paper production, the SINAMICS PERFECT HARMONY GH180 drive is a versatile performer that can help you significantly increase productivity, enhance energy efficiency, and reduce operating costs.



Siemens can provide a custom-engineered SINAMICS PERFECT HARMONY drive to maximize your process. We're the only company that offers drives from 225 to 85,000 kW. And with an installed base exceeding more than 2.2 million kW worldwide, the SINAMICS PERFECT HARMONY is a proven workhorse that can perform brilliantly for you, too.

#### A bright future built on a firm foundation

Since its introduction in 1994, the SINAMICS PERFECT HARMONY drive (formerly ROBICON) has revolutionized power conversion and continues to set industry standards for reliability and innovation. As power switching device technology advances and increases output voltage capability, Siemens improves each generation of the SINAMICS PERFECT HARMONY in three key areas: increased reliability and availability, increased efficiency, and a smaller drive footprint. Advances to our product line are made without "reinventing the wheel" like other drive manufacturers. We have maintained the SINAMICS PERFECT HARMONY's core topology and continue to advance its capability, ensuring lifecycle product support. By keeping the same topology, our customers see a reduction in maintenance and spare parts as well as an increase in quality and lower lifecycle costs. We improve our products by actively soliciting the input of our customers, and we look forward to counting you among them.

The SINAMICS PERFECT HARMONY of today represents an evolution founded on experience garnered from our huge installed base coupled with Siemens' unparalleled investments in R&D. As one of the largest companies in the world, Siemens provides confidence and financial stability in addition to exceptional technology.

## Designed for maximum versatility, efficiency, and reliability



#### Different by design

The SINAMICS PERFECT HARMONY drives are designed to withstand failures that would overwhelm conventional drive systems.

A traditional drive features up to five separate components, such as harmonic filter, power factor correction, transformer, power converter, and motor filter. The SINAMICS PERFECT HARMONY GH180 topology isolation transformer and power converter are the only major components required. The integrated system allows for quick, easy, and less expensive installations and startups – shortening your outages and process downtime to give you more project flexibility.

In the SINAMICS PERFECT HARMONY drives, a series of low-voltage cells are linked together to build the mediumvoltage power output of the drive system. This patented configuration delivers for you when it comes to ease of maintenance, power quality, and reliability. It also provides the basis for one of its most important advantages – increased availability through the advanced cell bypass option.

#### System performance

The SINAMICS PERFECT HARMONY GH180 exceeds 95 power factor at normal operating speeds without external power factor correction capacitors. It also provides more than 98 percent power converter efficiency.

#### Versatility

The proven technology of SINAMICS PERFECT HARMONY GH180 drives meets the needs of customers in almost any industry that employs motors, fans, or pumps. The SINAMICS PERFECT HARMONY GH180 drives can accept many different input voltages and can provide motor output voltages up to 11,000 volts, putting it in a class by itself.



#### Perfect for retrofits

When it comes to retrofits, the SINAMICS PERFECT HARMONY upholds its reputation as the world's most versatile medium-voltage drive.

The SINAMICS PERFECT HARMONY is compatible with your existing motor systems, regardless of age, brand, or volt-age/frequency – even synchronous motors can be upgraded.

#### System compatibility

You can be sure that the SINAMICS PERFECT HARMONY is compatible with your power system because it meets the most stringent IEEE 519 1992 requirements for current harmonic distortion. We meet those guidelines without filter or harmonic mitigation equipment – the SINAMICS PERFECT HARMONY design includes a transformer that employs phase shifting technology to eliminate harmonic distortion at the source.

#### Efficiency

The integrated SINAMICS PERFECT HARMONY maximizes efficiency in a number of critical areas. Because systems seldom require 100 percent power, the variable drive provides only the necessary power to the motor. As demands increase or decrease, the drive can respond with the precise power level needed.

One of the most inefficient power events occurs at motor start-up. Typically, a motor "slams" on – going from off to 100 percent with the flick of a switch.

By contrast, the "soft start" features of the SINAMICS PERFECT HARMONY decrease stresses that can limit the life of your equipment – gradually increasing power to smoothly initiate power output with full rated torque available during acceleration from zero speed, but without any current inrush into the motor. Additionally, overall design integration helps provide quick and reliable start-ups and allows the addition of power conversion redundancy. Pre-wiring reduces installation costs as well. It all adds up to give you a smaller, more efficient and reliable system.

## **Clean power input**

SINAMICS PERFECT HARMONY drives meet the most stringent IEEE-519-1992 requirements for voltage and current harmonic distortion. An integrated sinusoidal converter not only eliminates the need for harmonic filters, power factor correction capacitors or extra bus capacity; it also protects other online equipment from harmonic disturbances. Depending on the configuration, input waveform equivalents can range from 30- to 48-pulse rectifier, resulting in less than 3 percent total voltage distortion and less than 5 percent total current distortion.

To ensure very low line harmonics especially for drives in larger power ranges, the SINAMICS PERFECT HARMONY GH180 offers 30- to-48 pulse rectifiers which create lower line harmonics than the example of an 18-pulse drive shown on the top right.

#### **High-quality output**

No drive offers a higher quality waveform output than the SINAMICS PERFECT HARMONY. Its cell-based design accommodates any standard motor without requiring additional output or dv/dt filters – which can reduce efficiency and reliability – and it provides the lowest peak voltage to the motor windings. Together with the drive's inherently low harmonic content, these features extend motor life by protecting the motor insulation and preventing motor bearing failure.

#### **Environmental tolerance**

Only SINAMICS PERFECT HARMONY drives are engineered to operate reliably in environments with temperatures ranging from operating temperature  $5^{\circ}$ C to  $40^{\circ}$ C (up to  $50^{\circ}$ C on request).





Output waveforms at 100% speed



Output waveforms at 50% speed

## Maximized availability



Equivalent circuit of 5-cell SINAMICS PERFECT HARMONY drive with all cells in service • 6000 volts type (line to line)



Equivalent circuit of 5-cell SINAMICS PERFECT HARMONY drive with cell A4, A5 out of service • Unbalance after loss of A4, A5

(not acceptable)



Equivalent circuit of 5-cell SINAMICS PERFECT HARMONY drive with cell A4, A5 out of service • Neutral point shift: balance restored after loss of A4, A5 by adjusting angles. Maximum voltage = 80 % x 6000 V = 4800 V

#### Reliability

The reliability and availability of the SINAMICS PERFECT HARMONY drive is second to none due to sophisticated component selection and design. A combination of industryproven components, redundant bypass control technology, and hierarchical system of warnings brings you a drive of uncompromising prowess.

#### **Insulated Gate Bipolar Transistors**

Traction-grade Insulated Gate Bipolar Transistors (IGBTs) form the backbone of the SINAMICS PERFECT HARMONY drive. A proven power device across the industrial power control industry, IGBT technology has been in existence for more than a decade. The stability and availability of IGBTs give you reliable, long-term, lifecycle confidence. But that's just the start of our forward-thinking design.

#### Cell bypass

The SINAMICS PERFECT HARMONY GH180 drives are engineered to withstand failures that would overwhelm conventional drives because we've added options into the system. Our patented, cell-based configuration maximizes uptime and simplifies modifications.

Through a bypass control that is completely separated from each power cell, the SINAMICS PERFECT HARMONY GH180 ensures automatic bypass of a failed power cell in 250 milliseconds (less than 1/4 of a second).



## Get up and running fast





#### Control drive tool

- Provides Windows-based graphical user interface
- Has full functionality
- Same menu structure as keypad interface

#### Factory system test

You can be confident that the SINAMICS PERFECT HARMONY will get your process up and running because we have the ability to test every product as a complete system at full load – prior to delivery. At our factory, we test every transformer and power converter together to ensure performance meets precise specifications. In addition, factory testing allows accurate efficiency measurements. We also verify sequence of operation and protection to ensure that the SINAMICS PERFECT HARMONY system matches your needs.

#### Easy setup and control

- Easy-to-use high-function keypad on the door
- Touch-screen interface on door also available
- Auto-tune feature shortens start-up and guarantees operational efficiency
- Drive tool runs on PCs that can interface through the Ethernet ports that are included as standard
- Other protocols supported:
  - Modbus Plus™
  - DeviceNet Profile 12<sup>™</sup>
  - ControlNet<sup>™</sup>
  - PROFIBUS DP™
  - Other connectivity as required by the user



Siemens' service and support network is never more than a phone call away. Representatives are ready 24 hours a day, seven days a week, to assist you with immediate technical support geared to handle every phase of installation, start-up, maintenance, and troubleshooting. Our service team is available for you around the globe.

#### Our services include:

- Around-the-clock field service 24/7/365
- Preventive maintenance
- Training
- After-market spare parts
- Product refurbishment
- Upgrades
- Repairs and exchanges
- Specialty services (harmonic analysis studies, power quality studies, electrical system application, remote diagnostics, and more)

#### **Our commitment**

Siemens is proud of our reputation for long-term service of our products, including the SINAMICS PERFECT HARMONY drives. We are committed to providing complete lifecycle support. We never relinquish the responsibility for servicing our products to your full satisfaction, regardless of the age of the product. To extend the lifespan and increase the functionality of the drive, the Siemens refurbishment program gives you the opportunity to upgrade SINAMICS PERFECT HARMONY drives with new technology as it becomes available.

#### Local convenience

Because we have long provided on-site service for all of our customers, we have the extensive reach of a dedicated, global service force. Each of our service representatives are fully trained.

#### SINAMICS PERFECT HARMONY

#### In synch with your business goals

- Lower operating costs
- Precise process control
- Lower maintenance costs
- Increased production efficiency
- Exceptional reliability
- Intuitive HMI

# Technical specifications and dimension drawings

Frame Sizes A, B, C, D, E, F, G

General	
Power semiconductors	IGBTs; diodes
Line-side converter	30- to 48-pulse diode rectifier (standard)
Motor-side converter	Multi-level converter (PWM) with IGBT power modules
Drive control	Speed sensorless and closed-loop control, fully digital with signal processor
Drive quadrants	Driving: 2 directions of rotation (2 quadrants)
Potential separation: power section	Fiber-optic cable
Permissible humidity rating	Relative air humidity <95% non-condensing
Paint finish	RAL7035
Degree of protection – Standard – Optional	Acc. to DIN VDE 0470, IEC 60529, EN 60529 IP31 (air cooling) IP42 (air cooling)
Air-cooled	Forced-air cooling with integrated fans
Permissible ambient and cooling te	mperature
– In operation	+5 °C ~ +40 °C: Normal rating, +40 °C ~ +50 °C: Derating
– During storage	+5 °C ~ +40 °C
– During transport	−25 °C ~ +60 °C
Performance	
Accuracy	Open-loop vector control $\pm 0.5\%$ ; closed-loop vector control $\pm 0.1\%$
Power factor	>0.95 (within the whole speed range)

Overview of frame sizes A, B, C, D, E, F, G										
Framo	Cabinet length		Cabinet height		Cabinet depth		Blower cage height		Ventila-	
size	mm	inch	mm	inch	mm	inch	mm	inch	tion (m³/min)	
А	3657	144.0	2280	89.8	1250	49.3	468	18.4	249	
В	4730	186.2	2280	89.8	1250	49.3	468	18.4	392	
С	6145	242.0	2667	105	1300	51.2	468	18.4	850	
D	4703	194.3	2383	93.8	950	37.4	416	16.4	260	
E	5108	210.2	2383	93.8	1100	43.4	416	16.4	405	
F	8382	330.0	2540	100	1372	54.1	416	16.4	892	
G	8580	337.4	2921	115	1372	54.1	477	18.8	1046	





## Selection data for motor 6.0 kV

Selection data for motor voltage 6.0 kV									
Rated motor voltage (kV)	Current (A)	Type rating (kVA)	Shaft output (kW)	Shaft output (hp)	Order number (MLFB)	Weight (kg)	Frame size		
6	19	190	160	214	6SR4502-2[]A32-0[][]1	3039	А		
6	28	290	240	322	6SR4502-2[]A33-0[][]1	3221	А		
6	37	390	320	429	6SR4502-2[]A34-0[][]1	3312	А		
6	40	415	344	461	6SR4502-2[]A34-5[][]1	3403	А		
6	42	440	360	483	6SR4502-2[]B34-5[][]1	3439	А		
6	47	480	400	536	6SR4502-2[]B35-0[][]1	3530	А		
6	56	580	480	643	6SR4502-2[]B36-0[][]1	3621	А		
6	65	680	560	751	6SR4502-2[]B37-0[][]1	3803	А		
6	70	725	602	807	6SR4502-2[]B37-5[][]1	3893	А		
6	74	770	640	858	6SR4502-2[]C38-0[][]1	3984	А		
6	84	870	720	965	6SR4502-2[]C38-7[][]1	4075	А		
6	93	970	800	1072	6SR4502-2[]C41-0[][]1	4166	А		
6	100	1035	860	1152	6SR4502-2[]C41-1[][]1	4348	А		
6	102	1060	880	1180	6SR4502-2[]D41-1[][]1	4387	А		
6	116	1210	1000	1340	6SR4502-2[]D41-2[][]1	4569	А		
6	126	1310	1080	1448	6SR4502-2[]D41-4[][]1	4682	В		
6	140	1450	1203	1613	6SR4502-2[]D41-5[][]1	4796	В		
6	150	1560	1320	1769	6SR4502-2[]E41-6[][]1	5431	В		
6	159	1650	1400	1877	6SR4502-2[]E41-7[][]1	5597	В		
6	172	1790	1520	2038	6SR4502-2[]E41-8[][]1	5738	В		
6	181	1890	1600	2145	6SR4502-2[]E42-0[][]1	5902	В		
6	200	2075	1763	2363	6SR4502-2[]E42-2[][]1	6222	В		
6	204	2120	1800	2413	6SR4502-2[]F42-2[][]1	6297	В		
6	218	2260	1920	2574	6SR4502-2[]F42-4[][]1	6517	В		
6	227	2360	2000	2681	6SR4502-2[]F42-5[][]1	6655	В		
6	250	2590	2200	2949	6SR4502-2[]F42-7[][]1	7087	В		
6	260	2700	2292	3073	6SR4502-2[]F43-0[][]1	7433	В		
6	386	4010	3400	4558	6SR4502-2[]J44-2[][]1	9145	С		
6	408	4240	3600	4826	6SR4502-2[]J44-5[][]1	9590	С		
6	431	4480	3800	5094	6SR4502-2[]J44-7[][]1	9813	С		
6	454	4720	4000	5362	6SR4502-2[]J45-0[][]1	10,035	С		
6	476	4950	4200	5630	6SR4502-2[]J45-2[][]1	10,258	С		
6	499	5190	4400	5898	6SR4502-2[]J45-5[][]1	10,480	С		
6	522	5420	4600	6166	6SR4502-2[]K45-7[][]1	11,078	С		
6	544	5660	4800	6434	6SR4502-2[]K46-0[][]1	11,300	С		
6	550	5720	4849	6500	6SR4502-2[]K46-2[][]1	11,675	С		
6	590	6130	5200	6971	6SR4502-2[]K46-5[][]1	12,050	С		
6	635	6600	5600	7507	6SR4502-2[]K47-0[][]1	12,800	С		
6	660	6855	5818	7799	6SR4502-2[]K47-5[][]1	13,240	С		

## Selection data for motor 6.6 kV

Selection data for motor voltage 6.6 kV								
Rated motor voltage (kV)	Current (A)	Type rating (kVA)	Shaft output (kW)	Shaft output (hp)	Order number (MLFB)	Weight (kg)	Frame size	
6.6	17	190	160	214	6SR4502-2[]A32-0[][]1	3039	А	
6.6	25	290	240	322	6SR4502-2[]A33-0[][]1	3221	А	
6.6	34	390	320	429	6SR4502-2[]A34-0[][]1	3312	А	
6.6	40	455	378	507	6SR4502-2[]A35-0[][]1	3494	А	
6.6	42	480	400	536	6SR4502-2[]B35-0[][]1	3530	А	
6.6	51	580	480	643	6SR4502-2[]B36-0[][]1	3621	А	
6.6	59	680	560	751	6SR4502-2[]B37-0[][]1	3803	А	
6.6	63	730	600	804	6SR4502-2[]B37-5[][]1	3893	А	
6.6	68	770	640	858	6SR4502-2[]B38-0[][]1	3984	А	
6.6	70	800	662	887	6SR4502-2[]B38-7[][]1	4075	А	
6.6	76	870	720	965	6SR4502-2[]C38-7[][]1	4075	А	
6.6	85	970	800	1072	6SR4502-2[]C41-0[][]1	4166	А	
6.6	93	1060	880	1180	6SR4502-2[]C41-1[][]1	4348	А	
6.6	100	1140	946	1268	6SR4502-2[]C41-2[][]1	4530	А	
6.6	106	1210	1000	1340	6SR4502-2[]D41-2[][]1	4569	А	
6.6	114	1310	1080	1448	6SR4502-2[]D41-4[][]1	4682	В	
6.6	127	1450	1200	1609	6SR4502-2[]D41-5[][]1	4796	В	
6.6	140	1600	1324	1775	6SR4502-2[]D41-7[][]1	5348	В	
6.6	144	1650	1400	1877	6SR4502-2[]E41-7[][]1	5597	В	
6.6	157	1790	1520	2038	6SR4502-2[]E41-8[][]1	5738	В	
6.6	165	1890	1600	2145	6SR4502-2[]E42-0[][]1	5902	В	
6.6	186	2120	1800	2413	6SR4502-2[]E42-2[][]1	6222	В	
6.6	198	2260	1920	2574	6SR4502-2[]E42-4[][]1	6442	В	
6.6	200	2285	1939	2600	6SR4502-2[]E42-5[][]1	6580	В	
6.6	206	2360	2000	2681	6SR4502-2[]F42-5[][]1	6655	В	
6.6	227	2590	2200	2949	6SR4502-2[]F42-7[][]1	7087	В	
6.6	247	2830	2400	3217	6SR4502-2[]F43-0[][]1	7433	В	
6.6	260	2970	2521	3380	6SR4502-2[]F43-2[][]1	7877	В	
6.6	392	4480	3800	5094	6SR4502-2[]J44-7[][]1	9813	С	
6.6	412	4720	4000	5362	6SR4502-2[]J45-0[][]1	10,035	С	
6.6	433	4950	4200	5630	6SR4502-2[]J45-2[][]1	10,258	С	
6.6	454	5190	4400	5898	6SR4502-2[]J45-5[][]1	10,480	С	
6.6	474	5420	4600	6166	6SR4502-2[]J45-7[][]1	10,703	С	
6.6	495	5660	4800	6434	6SR4502-2[]J46-0[][]1	10,925	С	
6.6	500	5715	4849	6500	6SR4502-2[]J46-2[][]1	11,300	С	
6.6	516	5890	5000	6702	6SR4502-2[]K46-2[][]1	11,675	С	
6.6	536	6130	5200	6971	6SR4502-2[]K46-5[][]1	12,050	С	
6.6	577	6600	5600	7507	6SR4502-2[]K47-0[][]1	12,800	С	
6.6	619	7070	6000	8043	6SR4502-2[]K47-5[][]1	13,240	С	
6.6	660	7540	6400	8579	6584502-2[]K48-0[][]]	14 300	C	

## Selection data for motor 10.0 kV

Selection data for motor voltage 10.0 kV – 40 A – 140 A									
Rated motor voltage (kV)	Current (A)	Type rating (kVA)	Shaft output (kW)	Shaft output (hp)	Order number (MLFB)	Weight (kg)	Frame size		
10	20	340	280	375	6SR4502-5[]A33-5[][]1	3450	D		
10	22	390	320	429	6SR4502-5[]A34-0[][]1	3500	D		
10	25	440	360	483	6SR4502-5[]A34-5[][]1	3550	D		
10	28	480	400	536	6SR4502-5[]A35-0[][]1	3600	D		
10	31	540	448	601	6SR4502-5[]A35-6[][]1	3650	D		
10	34	580	480	643	6SR4502-5[]A36-0[][]1	3800	D		
10	36	620	512	686	6SR4502-5[]A36-4[][]1	3800	D		
10	39	680	560	751	6SR4502-5[]A37-0[][]1	3850	D		
10	40	690	573	768	6SR4502-5[]A37-5[][]1	3900	D		
10	42	730	600	804	6SR4502-5[]B37-5[][]1	3900	D		
10	45	770	640	858	6SR4502-5[]B38-0[][]1	4050	D		
10	50	870	720	965	6SR4502-5[]B38-7[][]1	4200	D		
10	56	970	800	1072	6SR4502-5[]B41-0[][]1	4400	D		
10	70	1210	1000	1340	6SR4502-5[]B41-2[][]1	4800	E		
10	84	1450	1200	1609	6SR4502-5[]C41-5[][]1	5200	E		
10	92	1600	1320	1769	6SR4502-5[]C41-6[][]1	5450	E		
10	98	1690	1400	1877	6SR4502-5[]C41-7[][]1	5650	E		
10	100	1730	1433	1921	6SR4502-5[]C41-8[][]1	5950	E		
10	106	1840	1520	2038	6SR4502-5[]D41-8[][]1	6000	E		
10	112	1930	1600	2145	6SR4502-5[]D42-0[][]1	6100	E		
10	126	2180	1800	2413	6SR4502-5[]D42-2[][]1	6500	E		
10	140	2420	2000	2681	6SR4502-5[]D42-5[][]1	6800	Е		





## Selection data for motor 10.0 kV

Selection data for motor voltage 10.0 kV – 315 A – 550 A									
Rated motor voltage (kV)	Current (A)	Type rating (kVA)	Shaft output (kW)	Shaft output (hp)	Order number (MLFB)	Weight (kg)	Frame size		
10	272	4720	4000	5362	6SR3501-5[]G45-0[][]1	10888	F		
10	286	4950	4200	5630	6SR3501-5[]G45-2[][]1	11142	F		
10	299	5190	4400	5898	6SR3501-5[]G45-5[][]1	11403	F		
10	313	5420	4600	6166	6SR3501-5[]G45-7[][]1	11649	F		
10	315	5455	4628	6204	6SR3501-5[]G46-0[][]1	11903	F		
10	327	5660	4800	6434	6SR3501-5[]H46-0[][]1	11999	F		
10	354	6130	5200	6971	6SR3501-5[]H46-5[][]1	12676	F		
10	375	6495	5510	7386	6SR3501-5[]H47-0[][]1	13352	F		
10	381	6600	5600	7507	6SR3501-5[]J47-0[][]1	13976	F		
10	408	7070	6000	8043	6SR3501-5[]J47-5[][]1	15386	G		
10	436	7540	6400	8579	6SR3501-5[]J48-0[][]1	16121	G		
10	463	8020	6800	9115	6SR3501-5[]J48-5[][]1	16636	G		
10	490	8490	7200	9651	6SR3501-5[]J48-7[][]1	17151	G		
10	500	8660	7346	9848	6SR3501-5[]J48-8[][]1	17984	G		
10	517	8960	7600	10,188	6SR3501-5[]M48-8[][]1	18104	G		
10	544	9430	8000	10,724	6SR3501-5[]M52-0[][]1	19600	G		



## Selection data for motor 11.0 kV

Selection data for motor voltage 11.0 kV									
Rated motor voltage (kV)	Current (A)	Type rating (kVA)	Shaft output (kW)	Shaft output (hp)	Order number (MLFB)	Weight (kg)	Frame size		
11	18	340	280	375	6SR4502-5[]A33-5[][]1	3450	D		
11	20	380	320	429	6SR4502-5[]A34-0[][]1	3500	D		
11	23	440	360	483	6SR4502-5[]A34-5[][]1	3550	D		
11	25	480	400	536	6SR4502-5[]A35-0[][]1	3600	D		
11	28	530	450	603	6SR4502-5[]A35-6[][]1	3650	D		
11	30	570	480	643	6SR4502-5[]A36-0[][]1	3800	D		
11	32	610	510	684	6SR4502-5[]A36-4[][]1	3800	D		
11	36	690	560	751	6SR4502-5[]A37-0[][]1	3850	D		
11	38	720	600	804	6SR4502-5[]A37-5[][]1	3900	D		
11	40	760	630	845	6SR4502-5[]A38-0[][]1	4050	D		
11	41	780	640	858	6SR4502-5[]B38-0[][]1	4050	D		
11	46	880	720	965	6SR4502-5[]B38-7[][]1	4200	D		
11	51	970	800	1072	6SR4502-5[]B41-0[][]1	4400	D		
11	63	1200	1000	1340	6SR4502-5[]B41-2[][]1	4800	E		
11	70	1330	1100	1475	6SR4502-5[]B41-3[][]1	5050	E		
11	76	1450	1200	1609	6SR4502-5[]C41-5[][]1	5200	E		
11	84	1600	1320	1769	6SR4502-5[]C41-6[][]1	5450	E		
11	89	1700	1400	1877	6SR4502-5[]C41-7[][]1	5650	E		
11	96	1830	1520	2038	6SR4502-5[]C41-8[][]1	5950	E		
11	100	1910	1580	2118	6SR4502-5[]C42-0[][]1	6050	E		
11	102	1940	1600	2145	6SR4502-5[]D42-0[][]1	6100	E		
11	114	2170	1800	2413	6SR4502-5[]D42-2[][]1	6500	E		
11	127	2420	2000	2681	6SR4502-5[]D42-5[][]1	6800	E		
11	140	2670	2200	2949	6SR4502-5[]D42-7[][]1	7080	E		

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