Willard Batteries®

THE POWER OF TECHNOLOGY

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WILLARD® BATTERIES

Rooted in the hearts of South Africans, **Willard® Batteries** combines technology and a quest for perfection to bring you a battery of unrivalled standing.

Our **Willard®** product range is manufactured in Port Elizabeth. With a presence in SA since the 1920s, local production started in 1954. Today, the factory still reflects the true South African spirit of combining imported state-of-the-art technology with solid South African ingenuity and know-how.

Over the years, **Willard® Batteries** has built a strong track record of service excellence and has maintained the core attributes of the brand that has helped define it: its values, its culture and the long-term relationships it has built with its customers. In the future, **Willard® Batteries** is looking to continue to build and live its brand legacy as it strengthens its bonds with both its suppliers and its customers.

DEFINITIONS OF AUTOMOTIVE BATTERIES

VENTED (FLOODED) BATTERY

This is the most common of automotive battery types. This type of battery has a cover with one or more openings through which gas generated by the battery may escape. The battery has “free” electrolyte which means that the acid moves freely within the battery.

SEALED MAINTENANCE FREE BATTERY (SMF)

Some specifications use the term “maintenance free” to describe a battery that has a water loss below a certain level. SMF batteries are flooded batteries that have a mechanism for water to condensate and return to the battery.

ENHANCED FLOODED BATTERY (EFB)

Enhanced Flooded Batteries were developed for use in stop-start vehicles. EFB’s are specifically designed for stop-start loads, where the battery has to crank the engine several times more, due to frequent stop events, and must have enough capacity to run vehicle loads while the engine is not running.

VALVE REGULATED (VRLA)

A battery that is closed under normal conditions and has an arrangement that only allows gas to escape if the internal pressure exceeds a predetermined value. In this type of battery, the electrolyte is immobilised. This mean that the acid is held in either a gel or a glass mat structure.

A. AGM (Absorbed Glass Mat) is a special design glass mat designed to wick the battery electrolyte between the battery plates. If the battery is broken, no free liquid can leak out.

B. Gel Cell batteries contain a silica type gel that the battery electrolyte is suspended in; this thick paste like material allows electrons to flow between plates but will not leak from the battery if the case is broken.

The valve regulated battery is often called a sealed battery because no addition of electrolyte or water is possible.

DEFINITIONS OF AUTOMOTIVE BATTERIES

TERMINOLOGY

1. Capacity: is the ability of a fully charged battery to deliver a specific quantity of electricity (current in amperes) over a definite period of time in minutes or hours.

2. Reserve Capacity: (Cr, n) (Minutes) is the time in minutes a fully charged battery will supply 25 ampere continuously before the voltage falls to 10,5 volts. This rating represents the time in minutes which a fully charged battery would continue to supply the average (25 ampere) should the Alternator fail.

3. Cold Cranking Performance: (CCA) is the cold temperature discharge (-18°C) that a fully charged battery can supply current in ampere over a predetermined period before the voltage drops below a specified end-point. The various standards are as follows:

BATTERY RATINGS - ABBREVIATIONS

SANS
South African National Standard
1.4 volts per cell (or 8.4 volts on a 12 volt battery) after 60 seconds

SAE (BCI)
Society of Automotive Engineers
1.2 volt per cell (7.2 volts on a 12 volt battery) after 30 seconds

BATTERY PERFORMANCE

Optimum performance

Fanbelt drives alternator.

13.8V - 14.3V
Alternator generates power.
Voltage regulator turns the valve.

Battery acts as storage tank.

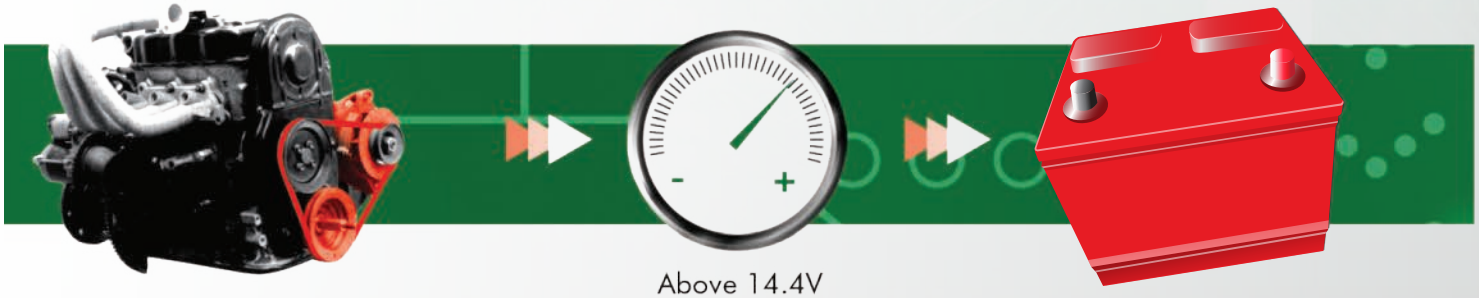
Malfunctions in the system

Fanbelt slips.

Below 13.8V
Alternator fails to generate sufficient power.
Voltage regulator set too low.

Battery runs down.

Or the opposite



Everything is operating normally.
The alternator generates power.

Above 14.4V
But the regulator releases too much power into the battery.

The battery overheats and malfunctions

BATTERY TEST PROCEDURE

Perform Test – Use Battery Diagnostic Tester

- Out of Vehicle Test
  - Select Battery Type
    - Regular
    - Gel
    - AGM
  - Select Battery Standard for SAE
    - CCA
    - EN
    - IEC
    - SAE
    - DIN
  - Select Battery Rating
    - Battery performs test:
  - Battery Test Results

Decision	Interpretation
GOOD BATTERY	Return the battery to service.
GOOD RECHARGE	Fully charge the battery and return it to service.
CHARGE & RETEST	Fully charge the battery and retest. Failure to fully charge the battery before retesting may cause inaccurate results. If **CHARGE & RETEST** appears again after you fully charge the battery, replace the battery.
REPLACE BATTERY	Replace the battery and retest. A **REPLACE BATTERY** result may also mean a poor connection between the battery cables and the battery. After disconnecting the battery cables, retest the battery using the out-of-vehicle test before replacing it.
BAD CELL REPLACE	Replace the battery.

  - Test Messages
    - Conditions that prevent proper testing:
    - Refer to Operating Manual.

- Perform in Vehicle - Test if required
  - Starter System Test
  - Charging System Test
    - Use Battery Diagnostic Tester.
    - Refer to operating manual for decision and interpretation of results.

VOLTAGE	CAPACITY	STATE OF CHARGE (S.O.C)	RESULTS
12.8 V	100%	Charged	Good Battery
12.6 V	100%	Charged	Good Battery
12.4 V	75%	Discharged	Charge & Retest
12.2 V	50%	Discharged	Charge & Retest
12 V	25%	Over Discharged	Charge & Retest
11.8 V	0%	Over Discharged	Charge & Retest

POST ABUSE INDICATORS

Look out for the following signs:

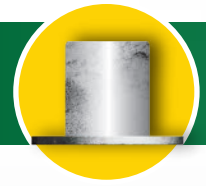
Perfect post.

Excessive force - Over tightening of post clamp.

Melted post - Caused from arc or short.

Bent post - Caused from excessive force and over tightening.

Indented post - Caused from over tightening of post clamp resulting in a poor connection.



Corroded post - Excessive corrosion resulting in post damage.

Chipped post - Caused from reverse connectivity.

NOTE: In the event of any signs of abuse, the warranty will be null and void.

BATTERY REMOVAL & FITTING CHART

Follow the steps below:

The negative(-) terminal must be connected to the ground cable.

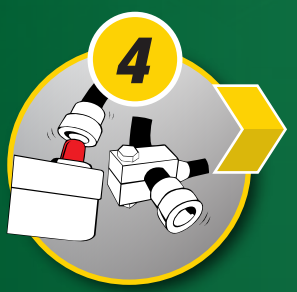
The chassis of all modern cars are earthed to the negative of the battery.

Disconnect the negative(-) cable first to prevent sparks/damage caused by accidental short circuiting.

Second, disconnect the positive (+) cable.
Remove the battery hold-downs.
Remove the battery from the vehicle.

Inspect and clean all corrosion from the battery tray, hold-downs and clamps using clean water.

Replace items damaged by excessive corrosion.
Neutralise and wash severely corroded components.
Use a solution of Bicarbonate of Soda mixed with warm water (10grams, or 1 tablespoon, to 1 litre of water).



Use a post cleaner to clean post and clamp.

Carefully place the new battery into the battery tray.

Ensure the battery terminals are in the same position in relation to the earth cable, to ensure correct polarity.

Replace battery hold-downs. Secure hold-down nuts tightly.

Reverse the connection procedure.

First connect the positive.
Second connect the negative cable.
Ensure cable connections are tight.
Coat the terminals with petroleum jelly.
Do not use grease which may contain metal additives.

Installation complete.
Start vehicle.

Caution: Certain vehicles such as BMW, Mercedes Benz and Audi, require that a slave battery or alternative electrical supply be connected before removing and installing a new battery:

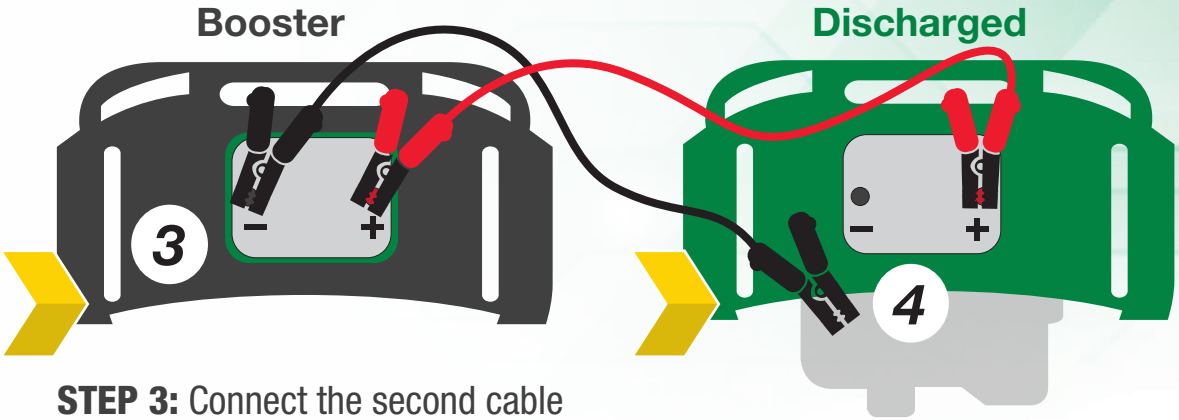
- Damage to the vehicle's electronic management system.
- Loss of all electronic management system coding for radios, windows, seats etc.

JUMP START GUIDE

When connecting the booster cables. In both cars, set handbrakes; turn off all switches, and place gear selector in Neutral or Park position.

STEP 1: Connect one cable to the positive (+) post of the discharged battery.

STEP 2: Connect other end of the same cable to the positive (+) post of the booster battery.



STEP 3: Connect the second cable to the negative (-) post of the booster battery.

STEP 4: Make final connection of the second cable on engine block or chassis of stalled vehicle

Ensure all booster cable connections are secure.

The engine of the stalled vehicle may now be cranked

STEP 5: To remove cables, reverse this exact procedure.

BATTERY CARE & MAINTENANCE

For a battery to remain in good working order, it should be maintained in a fully charged state by the vehicle's charging system. Where a battery is used as a means of alternative power, it is generally charged by means of an independent charger or rectifier which supplies controlled direct current (DC). An independent charger is also used to charge motor batteries that have become discharged due to faulty alternators, charging systems or if left unused for prolonged periods. If the following hints are adhered to, a battery will provide extended and trouble-free service.

WHAT TO DO

- Store batteries in a clean and dry area (in order to prevent deterioration).
- Store batteries in a fully charged state. (12V Battery above 12.6V).
- Ensure a correct polarity connection when recharging and fitting.
- Follow proper recharging schedules to prevent overcharging. Ensure charging is conducted in a well ventilated area.
- Ensure that the battery is always clean and dry, with the terminals coated with petroleum jelly (Vaseline) or proprietary terminal protectors. Do not use greases which may contain metal additives.
- NB: Practice stock rotation and use a first-in, first-out system at all times.
- Always wear protective clothing when working with batteries.

WHAT NOT TO DO

- Do not store batteries in a discharged state.
- Do not test batteries by shorting across terminal posts with wire, spanners, etc.
- Do not allow open flames or sparks near a battery as it could explode (batteries give off flammable gases).
- Do not use a single spanner to use loosen or tighten the terminal clamp as this could damage to post lid seal. Use a spanner to the nut and a second spanner to the bolt.
- Do not use the starter motor to propel the vehicle or leave the vehicle parked with accessories switched on for extended periods.
- Do not lean over a battery when charging or testing.
- Do not put any metal objects on top of a battery.

BATTERY SAFETY TIPS

SULPHURIC ACID (SULPHURIC ACID EMERGENCY PROCEDURES)

- Skin contact: Immediately drench the affected area with clean water and remove any contaminated clothing. If any soreness or irritation persists seek medical advice.
- Eye contact: Immediately wash out the eyes with clean water until initial burning subsides. Do not use eye drops but do seek prompt medical attention.
- Ingestion: DO NOT induce vomiting but make patient drink as much water or milk as possible, followed by milk of magnesia, beaten eggs or vegetable oil and seek immediate medical attention.
- Spillage: Small spillages can be quite simply dealt with by rinsing away with plent of water and neutralising using Bicarbonate of Soda mixed with water (10 grams Bicarb to 1 litre water).
- Burns: Apply a dry sterile dressing and seek medical attention.

SULPHURIC ACID HANDLING TIPS

Sulphuric acid (H_2SO_4) is contained in batteries. Battery acid is a poisonous and corrosive liquid, which will cause burns and irritation to the skin and eyes. Take precautions when charging as sulphuric acid is given off in a fine mist.

- Always handle batteries with care and keep upright.
- Disposal: Suitably labelled, acid resistant containers should be used for transporting, neutralising and disposal of sulphuric acid.
- Use eye protection and protective clothing where there is any risk of acid splashing or spillage.
- Keep, charge, check and test batteries in a well ventilated area.
- Do not place tools or conductive objects on top of batteries.
- Before using a battery charger consult manufacturer's literature.
- Remember to switch the charger off before connecting or disconnecting the battery.

EMISSION OF GASES

Hydrogen and oxygen can be generated and emitted. An explosive atmosphere is created if the concentration of hydrogen in air exceeds 4%.

BATTERY SAFETY TIPS

- Keep, fill, charge, check and test batteries in a well ventilated area.
- Avoid sources of ignition close to batteries. In particular: No smoking. No naked flames. Switch off current before making or breaking electrical connection. Avoid sparks caused by accidental short circuits.

EMERGENCY PROCEDURE FOR TREATING ELECTRIC SHOCKS

- Electric Shock: Immediate action is essential in cases of severe electrical shock as the nerves controlling breathing and heart action may be affected. Do not delay treatment by calling for a doctor; this should be done quickly if help is available or when the casualty recovers.
- Make sure it is safe to approach casualty. If the casualty is not clear of the electric source, switch off the power. If this is not possible, attempt to separate the casualty from the conductor using a dry, insulating object (wood, rubber, brick, thickly folded newspaper, cardboard) and try to push or pull the casualty clear of contact. Do not touch casualty with bare hands.
- Apply artificial respiration if necessary. Seek medical attention thereafter.
- Explosion: Seek any necessary medical attention and remember that sulphuric acid may have been ejected.

ELECTRICAL ENERGY HANDLING TIPS

Electrical energy can be supplied from batteries and charging equipment.

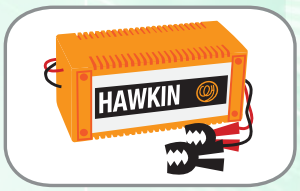
* Burns may occur from the heating effect of tools and conductive objects in contact with live battery terminals or conductors. In addition, sparks and molten metal may be ejected and co bustible materials, notably the gaseous fumes, ignited to cause potentially lethal explosions.

* It is possible to receive a severe electric shock from charging equipment and from a number of batteries connected in series i.e. five or more 12 volt batteries (+60 volt nominal).

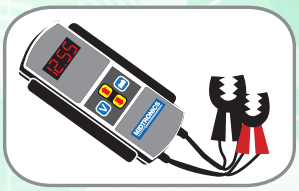
- Before using conductive tools on a battery, remove metallic personal adornments from the hands and wrists.
- Before working on a vehicle's electrical system, blow across the terminals and the vent holes to disperse any fumes and disconnect the battery where there is any risk of accidental short circuits. Always disconnect the earth terminal from a battery first and connect it last to prevent short circuiting.
- Use eye protection and protective clothing where there is any risk of acid splashing or spillage.

BATTERY BAY SETUP

TEST & CHARGE EQUIPMENT REQUIRED:



Battery Charger



Battery Analyser

Work Bench

Eye Protection

Acid Proof Overall

Safety Shoes

Apron

Safety Gloves

SAFETY EQUIPMENT:

TOOLS:

Terminal Cleaner

Battery Connectors

Jumper Cables

Booster Pack

Required Spanners/ Size 10 and 13

Shifting Spanner

Hack Saw

RELATED ACCESSORIES:

Battery Hold Downs

J-Bolts

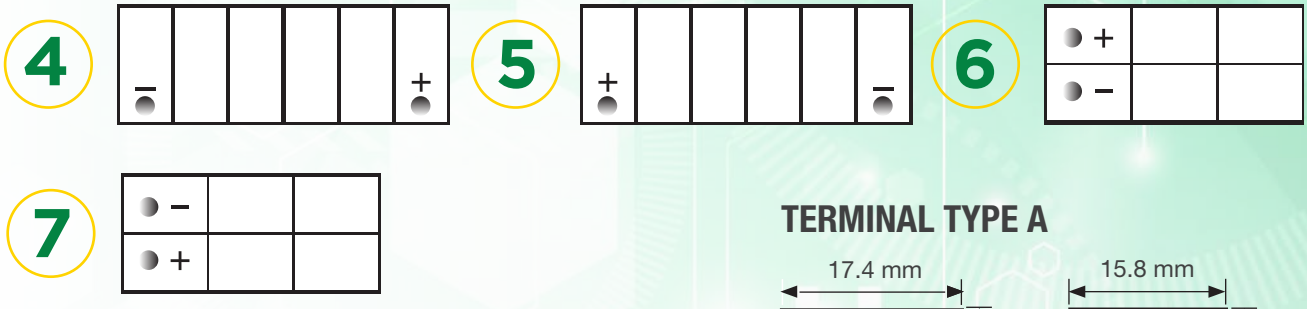
Positive & Negative Cable

Positive & Negative Terminal Clamps

Battery Trays

BATTERY LAYOUT

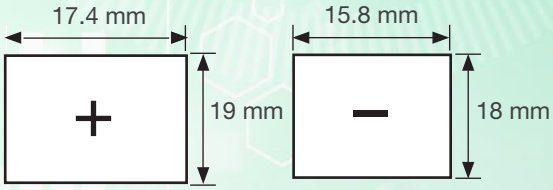
12 VOLT CELL LAYOUT



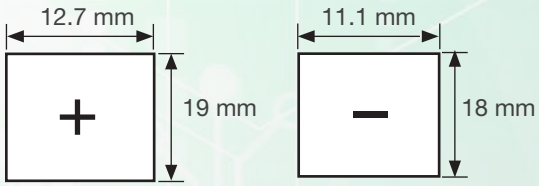
SPECIAL FEATURES

1. One piece DIN type cover
2. One piece flat top cover
3. Single cell lids with exposed connectors
4. Polypropylene container
5. With handles
6. 9mm Clip on side hold-downs optional
7. With clip on shoulders

TERMINAL TYPE A

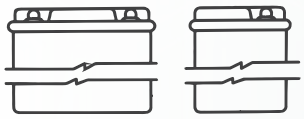


TERMINAL TYPE B



CONTAINER HOLD-DOWNS

B0



No bottom hold-downs

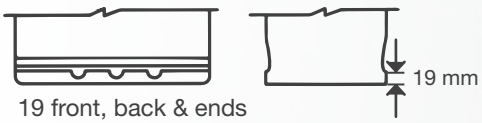
B1

10.5 front, back & ends

B3

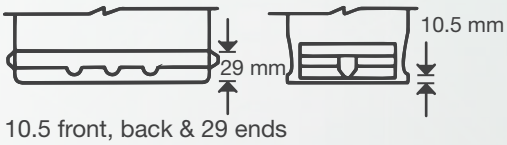
10.5 front, back & ends

B4



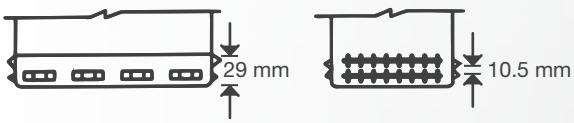
19 front, back & ends

B5



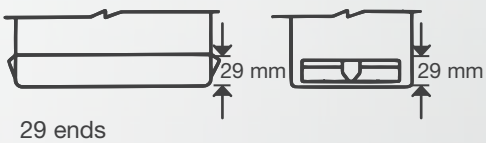
10.5 front, back & 29 ends

B13



19 & 10.5 front & back, 29 & 10.5 ends

B6



29 ends

EXAMPLE: B5. 2. 4
(10.5 FRONT & BACK & 29 ENDS)

B5 = Container Hold-down
2 = One piece flat top cover
4 = Polypropylene

BATTERY SPECIFICATION SHEET

SABMA Number	Willard Cover	20 Hr Capacity Ah	Reserve Capacity Minutes	SANS CCA Amps	DIN CCA Amps	SAE CCA Amps	IEC CCA Amps	Max length mm	Overall width mm	Overall height mm	Cell layout	Terminal layout	Container hold down	Special feature
Light														
610	Flat	50	77	255	220	370	360	255	173	204	5	A	B5	2,4
610	SMF	50	77	255	220	370	360	255	173	212	5	A	B5	2,4
611	SMF	50	77	255	220	370	360	255	173	212	4	A	B5	2,4
612	CV	45	69	220	190	325	310	208	175	190	4	A	B3	1,4
615	Flat	35	52	170	150	270	252	200	134	225	5	B	B0	
616	Flat	35	52	170	150	270	252	200	134	225	4	B	B0	
618	CV,Euro	36	50	190	165	285	270	208	175	175	4	A	B3G	1,4
619	SMF	36	50	190	165	285	270	208	175	175	4	A	B3	1,4
619	CV,Euro	36	50	190	165	285	270	208	175	175	4	A	B3	1,4
621	SMF	55	85	290	250	415	410	255	173	212	4	A	B5	2,4
621	Flat	45	69	216	189	323	310	255	173	204	4	A	B6	2,4
622	SMF	55	85	290	250	415	410	255	173	212	5	A	B5	2,4
622	Flat	45	69	216	189	323	310	255	173	204	5	A	B5	2,4
629	SMF	43	62	240	205	345	335	242	175	175	4	A	B13	1,4
630	Flat	36	50	200	170	295	280	241	134	203	5	A	B6	2,4
631	Flat	36	50	200	170	295	280	241	134	203	4	A	B6	2,4
634	Flat	45	62	250	215	360	355	241	134	203	5	A	B6	2,4
635	SMF	43	62	240	205	345	335	242	175	175	5	A	B13	1,4
636	CV	45	62	250	215	360	355	241	134	203	4	A	B6	2,4
638	SMF	70	109	345	295	480	485	255	173	212	5	A	B5	2,4
638	Flat	50	82	290	250	413	410	255	173	205	5	A	B5	2,4
639	SMF	70	109	345	295	480	485	255	173	212	4	A	B5	2,4
639	Flat	50	82	290	250	413	410	255	173	205	4	A	B5	2,4
643	SMF	55	90	280	240	400	395	242	175	190	5	A	B3	1,4
643	CV	50	80	253	219	368	360	242	175	190	5	A	B3	1,4
646	CV, Euro	55	90	280	240	400	395	242	175	190	4	A	B3	1,4
646	CV	50	80	253	219	368	360	242	175	190	4	A	B3	1,4
647	SMF	60	91	325	280	460	460	278	175	175	4	A	B4	1,4,5
649	Flat	65	97	320	260	450	450	230	171	225	4	A	B0	2,4
650	Flat	80	125	400	340	550	565	307	173	220	5	A	B0	2,4
650S	Flat	80	125	400	340	550	565	307	173	220	4	A	B0	2,4
651	SMF	60	91	325	280	460	460	278	175	175	4	A	B3	1,4,5
652	SMF	70	106	355	305	495	500	278	175	190	4	A	B3	1,4,5
652	CV	65	102	341	293	476	480	278	175	190	4	A	B3	1,4,6
654	CV	80	127	425	365	585	600	355	175	175	4	A	B3	1,4,5
657	SMF	70	110	400	340	550	564	278	175	190	5	A	B3	1,4,5

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657	CV	70	110	356	305	494	500	278	175	190	5	A	B3	1,4,6
658	CV	90	164	460	395	630	650	355	175	190	4	A	B3	1,4,5
659	Euro	80				650		307	175	175	5	A	B3	
660	Euro	110				900		393	175	190	4	A	B3	
668	CV, Euro	80	135	430	370	590	610	315	175	190	4	A	B3	1,4,5
669	CV, Euro	80	135	430	370	590	610	315	175	190	5	A	B3	1,4,5
						Heavy Duty								
671	Flat	90	136	440	375	600	615	345	175	226	5	A	B0	2,4,5
671	SMF	100	170	479	410	650	670	345	175	226	5	A	B0	2,4,5
671	SMF	105	180	525	450	710	740	345	175	226	5	A	B0	2,4,5
674	Flat	90	136	440	375	600	615	345	175	226	4	A	B0	2,4,5
674 C	SMF	105				800		330	172	238	4	A	B01	
674 CS	SMF	105				800		330	172	238	4	Threaded Post	B01	
675	SMF	110	155	510	435	690	715	345	175	277	5	A	B0	2,4,5
680/3	SMF	120	216	545	465	735	765	510	190	240	6	A	B0	2,4,5, S1
680/3	Flat	120	216	545	465	735	765	510	190	240	6	A	B0	2,4,5, S1
681/2	SMF	120	216	545	465	735	765	510	190	240	7	A	B0	2,4,5, S1
681/2	Flat	120	216	545	465	735	765	510	190	240	7	A	B0	2,4,5, S1
685	Flat	120	225	605	515	810	860	510	190	214	6	A	B0	2,4,5
685	SMF	120	225	605	515	810	860	510	190	214	6	A	B0	2,4,5
687	SMF	210	450	1050	900	1300	1400	515	275	248	6	A	B0	5
687	Flat	210	450	1050	900	1300	1400	515	275	248	6	A	B0	5
688	Flat	210	450	1050	900	1300	1400	515	275	248	7	A	B0	5
688	SMF	210	450	1050	900	1300	1400	515	275	248	7	A	B0	5
689	Flat	140	265	690	590	925	975	512	224	230	6	A	B0	2,4,5, S1
689	SMF	140	265	690	590	925	975	512	224	230	6	A	B0	2,4,5, S1
690	Flat	140	265	690	590	925	975	512	224	230	7	A	B0	2,4,5
692	Flat	165	331	755	645	1005	1065	512	224	230	6	A	B0	2,4,5
692	SMF	165	331	755	645	1005	1065	512	224	230	6	A	B0	2,4,5
695	Flat	240				1400		518	274	242	6	A	B0	
696	SMF	180	360	870	745	1140	1220	512	224	230	6	A	B0	2,4,5
722	CV	50	75	255	220	370	360	255	173	208	5	A	B0	2,4,5
738	CV	70	109	345	295	480	485	255	173	208	5	A	B0	2,4,5
774 CV	CV	90	136	400	330	550	560	345	175	226	4	A	B0	2,4,5
791	Flat	90	136	400	330	550	560	345	175	264	4	A		
791	SMF	105	180	525	450	710	740	345	175	264	4	A		

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