

**EXIDE  
INDUSTRIAL**

**EXIDE**

# TBS OPzS

TUBULAR BATTERIES IN  
TRANSPARENT CONTAINERS



**EXIDE**  
**LEADER**  
**IN STORAGE POWER**



One of the largest lead acid battery manufacturers in the world, Exide Industries Limited, has led the way in bringing the best and latest battery technology into India. Formerly known as Chloride India Limited, it traces its heritage to Chloride plc. UK, the pioneers of commercially produced batteries.

In South & South East Asia, Exide is the largest battery maker by far with the widest range of Tubular, Planté, Gel Tubular VRLA, Pasted Plate and AGM VRLA batteries. Technology, innovation, quality and a country-wide service network sets it apart from the competition.

**Some key features are :**

- 9 factories strategically located across the country
- The only company in India to manufacture batteries from 2.5 Ah to 20,400 Ah
- Collaborations with Shin Kobe and Furukawa of Japan, East Penn Manufacturing USA
- Subsidiaries in Singapore, UK and Sri Lanka
- Fast growing exports, currently to 18 countries in 5 continents
- R&D Centre, set up in 1976, is counted among the premium battery research facilities in the world and is approved by the Dept. of science and technology, Govt. of India as an independent test laboratory
- Certified with ISO 9001 and ISO 14001



*We have received ISO 14001 Certificate in recognition of our eco-friendly production process.*



*Recognition of our pursuit of quality was achieved when we were awarded the ISO 9001.*

**The Solutions Company**

The wide ranging expertise and over six decades of experience enable Exide to offer customers much more than the product. We guide the buyer from selecting the right battery for a particular application to final erection and commissioning. In addition we offer assured life long services. We are partners who provide complete storage power solutions.



Exide TBS/OPzS

## Unique Design

- Transparent SAN Container.
- Proprietary Torr Tubular plates, cast at 100 bar high pressure in imported Hadi machine.
- Less than 3% antimony alloy in positive plate and lead calcium alloy in negative plate.
- Microporous and resin based separators with polyester mat backbone and smaller average pore diameters.
- Plastic encapsulated bolt-on terminals with brass inserts.
- Large electrolyte volume.
- Microporous Ceramic Vent Plugs.
- Insulated intercell copper connectors.

## Superior Features

- Easy monitoring. Better cosmetics.
- Robust. Best battery for arduous condition. Suitable for frequent discharges and high ambient temperature. Long life.
- Minimal maintenance. Topping up frequency once in 12-18 months.
- High temperature stability. Higher mechanical strength. Low electrical resistance. High porosity. No penetration shorts. Long trouble free operation.
- No Pillar corrosion. Resistant to wear and tear.
- Excellent thermal management.
- Arrests acid fume and electrolyte spillage.
- Safe. No accidental short circuit. Corrosion resistant. Higher conductivity.



15 years  
design  
life



100-3200Ah



Block / single cell



Tubular plate



Recyclable



Low maintenance



# SPECIAL DESIGN FEATURES



*Positive Spine*

## Spine

The Positive Plate of Exide TBS/OPzS is of Tubular type. The spine diameter is in excess of 3mm. This gives the battery longer life and high electrical efficiency. The raw material for the Spine is Lead-Antimony alloy with Antimony content 1.6-2.5%. Lower Antimony ensures low water loss and less topping up (topping up frequency is between 12 and 18 months) This cuts down the maintenance considerably. The alloy is suitably dosed with copper and selenium which helps in achieving low anodic corrosion rate.

The Törr Tubular spines are cast at 100 Bar pressure on specially imported HADI Machines which makes the plates further corrosion resistant.



*Negative Plate*

## Negative Plate

The Exide TBS/OPzS negative plate is flat pasted type. These plates with special alloy and innovative plate design accommodate more active material, thereby increasing cyclic performance and battery life.



*Separator*

## Separator

The Separators used are imported microporous synthetic separators. They have :

- High temperature stability, mechanical strength, low electrical resistance, high porosity and low acid displacement for greater efficiency
- Small average pore diameters to prevent penetration shorts
- The inherent stability of the separator in the battery makes sure no harmful substances are generated



*Gauntlet*

## Gauntlet

To hold the positive active material, Exide TBS/OPzS batteries uses high quality gauntlets manufactured in-house. The gauntlets are specially designed to improve active material retention and consistent output.

The Exide TBS/OPzS gauntlet is made of high quality cloth to increase burst strength, thereby bolstering the positive plate life even in the most arduous applications.

## SPECIAL DESIGN FEATURES



*Transparent SAN  
Container and Lid*



*Plastic encapsulated  
bolt-on terminals*



*Microporous Ceramic Vent Plug*



*Insulated Intercell connectors*

### The Container

The container is made of Styrene Acrylo Nitrile (SAN) polymer which is Transparent in nature. The advantages are as under :

- It enables easy visual monitoring and provides improved aesthetics
- The container material is strong and inert to acid
- The tall tower type design has a lower footprint

### Plastic Encapsulated Bolt-on Terminals

High end bolt-on terminals are provided with Brass inserts to provide better electrical performance

- Terminals have unique double layered protection with a special bonding agent to prevent failure of batteries through crevice corrosion
- The design is such that battery accessories like Connector, Take off etc. are easy to replace
- Bolt-on technology prevents wear and tear of the terminals. This was unavoidable in weld-on terminals

### Vent Plug

The domed vent plugs are made of special grade ceramic. The benefits are as under :

- The ceramic Dome Vent Plug helps in retaining acid inside the cell by efficiently arresting acid fumes
- The innovative vent plug is also very effective in arresting electrolyte spillage, which in turn helps to reduce the top-up frequency

### Insulated Connector

- The global quality insulated connector protects it from acid attack
- The insulation protects operators from electric shocks
- Maintains close contact between the terminals for better conductivity. This also avoids DC shorts.

# A SUPERIOR TECHNOLOGY



Exide TBS/OPzS, branded as Törrsafe, is the new addition in its Tubular range. It comes in transparent SAN Container in line with the latest international practices. Exide TBS/OPzS range essentially packs the time tested and robust tubular plate design in a transparent polymer cell box and matching lids. The cells are designed to conform international specification DIN 40736 and BIS standard 1651:2013.

- **Easy monitoring** : The cells are housed in transparent SAN container making it user friendly and easy to monitor
- **Minimum maintenance** : The topping up frequency for Exide TBS/OPzS cells is once in 12-18 months
- **Low foot print** : The tall tower type design has a much lower foot print than the conventional system

- **Robust** : The cells are manufactured with Exide's Törr tubular design making it extremely robust and suitable for harsh environment like high ambient temperature and frequent discharges
- **Plastic encapsulated bolt-on terminals**: The corrosion-resistant bolt-on terminals with brass insert provide better electrical performance and resistance to wear and tear of terminals
- **Insulated intercell connectors** : They offer better conductivity. The insulation protects the connector from acid attack and electric shock
- **Reliable** : They are extremely reliable for standby float applications
- **Long life** : Expected service life is 15 years in standby float application at 27°C

# APPLICATION



- Power Plants
- Substations
- Signalling

- UPS Systems
- Telecommunications
- Process Industries

- Solar Photovoltaic Systems
- Control & Instrumentation
- Emergency lighting

- Petrochemicals & Refineries
- Oil & Gas Pipelines
- Refineries



# SPECIFICATION

## Technical Data for Exide OPzS/TBS Cells

Nomenclature	C10 Capacity upto 1.80 Vpc	Charging Current		Total Minimum Input during Initial Charging (Ah)	Weight +/- 5% (KG)		Approx Qty of acid 1.220 sp. gr. (Litres)	Overall Cell Dimensions			Cell Centre (mm)	Trickle Charge Current (mA)	
		Starting Rate (A)	Finishing Rate (A)		Dry	Acid Filled		L+/-3 (mm)	W+/-3 (mm)	H+/-5 (mm)		Min	Max
OPzS / 2TBS100	100	12	6	500	8.7	14.7	4.9	103	206	430	112	100	400
OPzS / 2TBS120	120	14	7	600	9.3	15.0	4.7	103	206	430	112	120	480
OPzS / 3TBS150	150	18	9	750	10.5	15.9	4.4	103	206	430	112	150	600
OPzS / 3TBS180	180	22	11	900	10.5	15.9	4.4	103	206	430	112	180	720
OPzS / 4TBS200	200	24	12	1000	14.0	18.8	4.0	103	206	430	112	200	800
OPzS / 4TBS240	240	29	14	1200	14.4	19.2	3.9	103	206	430	112	240	960
OPzS / 4TBS300	300	36	18	1500	19.8	31.0	9.2	145	206	546	153	300	1200
OPzS / 5TBS375	375	45	23	1875	22.5	33.2	8.8	145	206	546	153	375	1500
OPzS / 6TBS400	400	48	24	2000	25.0	35.3	8.4	145	206	546	153	400	1600
OPzS / 6TBS450	450	54	27	2250	25.8	35.9	8.3	145	206	546	153	450	1800
OPzS / 5TBS500	500	60	30	2500	30.1	45.2	12.4	145	206	721	153	500	2000
OPzS / 5TBS550	550	66	33	2750	31.0	45.9	12.2	145	206	721	153	550	2200
OPzS / 6TBS600	600	72	36	3000	34.3	48.6	11.7	145	206	721	153	600	2400
OPzS / 6TBS650	650	78	39	3250	35.4	49.4	11.5	145	206	721	153	650	2600
OPzS / 6TBS700	700	84	42	3500	40.8	66.9	21.4	210	233	721	220	700	2800
OPzS / 7TBS800	800	96	48	4000	45.6	70.9	20.7	210	233	721	220	800	3200
OPzS / 8TBS900	900	108	54	4500	49.1	73.5	20.0	210	233	721	220	900	3600
OPzS / 9TBS1000	1000	120	60	5000	53.3	77.0	19.4	210	233	721	220	1000	4000
OPzS / 10TBS1100	1100	132	66	5500	57.4	80.2	18.7	210	233	721	220	1100	4400
OPzS / 9TBS1200	1200	144	72	6000	65.5	104.5	32.0	210	275	871	220	1200	4800
OPzS / 10TBS1325	1325	159	80	6625	70.1	106.2	29.6	210	275	871	220	1325	5300
OPzS / 11TBS1450	1450	174	87	7250	77.6	112.6	28.7	210	275	871	220	1450	5800
OPzS / 12TBS1500	1500	180	90	7500	81.5	115.8	28.1	210	275	871	220	1500	6000
OPzS / 12TBS1600	1600	192	96	8000	84.0	117.9	27.8	210	275	871	220	1600	6400
OPzS / 13TBS1700	1700	204	102	8500	96.0	148.3	42.9	214	399	847	220	1700	6800
OPzS / 14TBS1850	1850	222	111	9250	102.0	153.4	42.1	214	399	847	220	1850	7400
OPzS / 15TBS1975	1975	237	119	9875	105.5	155.8	41.2	214	399	847	220	1975	7900
OPzS / 16TBS2000	2000	240	120	10000	107.4	157.0	40.7	214	399	847	220	2000	8000
OPzS / 16TBS2100	2100	252	126	10500	110.7	160.0	40.4	214	399	847	220	2100	8400
OPzS / 17TBS2200	2200	264	132	11000	116.8	165.0	39.5	214	399	847	220	2200	8800
OPzS / 18TBS2400	2400	288	144	12000	131.5	193.4	50.7	212	487	847	220	2400	9600
OPzS / 20TBS2500	2500	300	150	12500	140.7	200.8	49.3	212	487	847	220	2500	10000
OPzS / 20TBS2600	2600	312	156	13000	145.0	204.8	49.0	212	487	847	220	2600	10400
OPzS / 22TBS2900	2900	348	174	14500	158.5	231.8	60.1	212	576	847	220	2900	11600
OPzS / 24TBS3000	3000	360	180	15000	164.9	236.5	58.7	212	576	847	220	3000	12000
OPzS / 24TBS3200	3200	384	192	16000	170.0	241.2	58.4	212	576	847	220	3200	12800

Cell	Terminal Pairs
OPzS/TBS 100 to 650	1
OPzS/TBS 700 to 1600	2
OPzS/TBS 1700 to 2200	3
OPzS/TBS 2400 to 3200	4

### Recommended float voltage :

Temperature	Float Voltage
<5°C	2.25 ± 0.02 vpc
5°C - 19°C	2.24 ± 0.02 vpc
20°C - 35°C	2.23 ± 0.02 vpc
36°C - 45°C	2.22 ± 0.02 vpc

### Initial Charging

- The filling in specific gravity of electrolyte for OPzS/TBS cells is  $1.220 \pm 0.005$  at 27°C
- The rest period after the initial acid filling is 12-24 hours
- The initial charging current:
  - Starting Rate** : 12% of C<sub>10</sub> capacity
  - Finishing Rate** : 6% of C<sub>10</sub> capacity
- Total minimum Ah input is 5 times of C<sub>10</sub> capacity
- The specific gravity of electrolyte of a fully charged cells is  $1.240 \pm 0.005$  at 27°C

**TABLE:1**  
**ecv = 1.70 v**  
**DISCHARGE DATA**

Type of Cell	C10 Capacity (Ah)	Discharge Current (A) at 27°C												
		15'	30'	45'	1h	2h	3h	4h	5h	6h	7h	8h	9h	10h
OPzS/TBS 100	100	102	78	62	52	34	26	21	18	16	15	13	12	11
OPzS/TBS 120	120	122	93	75	62	41	31	25	22	19	18	16	15	13
OPzS/TBS 150	150	153	116	93	78	51	39	31	27	24	22	20	18	16
OPzS/TBS 180	180	184	140	112	93	61	47	38	32	29	26	24	22	19
OPzS/TBS 200	200	204	155	124	103	68	52	42	36	32	29	26	24	21
OPzS/TBS 240	240	245	186	149	124	82	62	50	43	39	35	32	29	26
OPzS/TBS 300	300	288	230	187	155	102	78	63	54	48	44	39	36	32
OPzS/TBS 375	375	360	287	233	194	128	97	78	67	60	55	49	45	40
OPzS/TBS 400	400	384	307	249	207	136	103	84	72	64	59	53	48	43
OPzS/TBS 450	450	432	345	280	233	153	116	94	81	73	66	59	54	48
OPzS/TBS 500	500	439	355	311	258	170	129	104	90	81	73	66	60	54
OPzS/TBS 550	550	483	391	342	284	187	142	115	99	89	81	72	67	59
OPzS/TBS 600	600	527	426	373	310	204	155	125	108	97	88	79	73	64
OPzS/TBS 650	650	571	462	405	336	221	168	136	117	105	95	85	79	70
OPzS/TBS 700	700	615	497	436	362	239	181	146	126	113	103	92	85	75
OPzS/TBS 800	800	703	568	498	413	273	207	167	144	129	117	105	97	86
OPzS/TBS 900	900	791	639	560	465	307	233	188	162	145	132	118	109	97
OPzS/TBS 1000	1000	816	710	622	517	341	259	209	180	161	147	131	121	107
OPzS/TBS 1100	1100	846	775	685	568	375	285	230	198	177	161	144	133	118
OPzS/TBS 1200	1200	923	845	747	620	409	310	251	216	193	176	158	145	129
OPzS/TBS 1325	1325	1019	933	825	685	451	343	277	238	214	194	174	160	142
OPzS/TBS 1450	1450	1115	1021	902	749	494	375	303	261	234	213	190	175	156
OPzS/TBS 1500	1500	1154	1056	934	775	511	388	313	270	242	220	197	181	161
OPzS/TBS 1600	1600	1231	1127	996	827	545	414	334	288	258	235	210	193	172
OPzS/TBS 1700	1700	1308	1197	1058	879	579	440	355	305	274	249	223	206	182
OPzS/TBS 1850	1850	1423	1303	1151	956	630	479	387	332	298	271	243	224	198
OPzS/TBS 1975	1975	1519	1391	1229	1021	673	511	413	355	318	290	259	239	212
OPzS/TBS 2000	2000	1538	1408	1245	1034	681	517	418	359	322	293	263	242	215
OPzS/TBS 2100	2100	1615	1479	1307	1085	716	543	439	377	338	308	276	254	225
OPzS/TBS 2200	2200	1692	1549	1369	1137	750	569	460	395	355	323	289	266	236
OPzS/TBS 2400	2400	1846	1690	1494	1240	818	621	502	431	387	352	315	290	258
OPzS/TBS 2500	2500	1923	1761	1556	1292	852	647	522	449	403	367	328	302	268
OPzS/TBS 2600	2600	2000	1831	1618	1344	886	673	543	467	419	381	341	314	279
OPzS/TBS 2900	2900	2231	2042	1805	1499	988	750	606	521	467	425	381	351	311
OPzS/TBS 3000	3000	2308	2113	1867	1550	1022	776	627	539	483	440	394	363	322
OPzS/TBS 3200	3200	2462	2254	1992	1654	1090	828	669	575	516	469	420	387	343



# TABLE: 2

ecv = 1.75 v

## DISCHARGE DATA

Type of Cell	C10 Capacity (Ah)	Discharge Current (A) at 27°C												
		15'	30'	45'	1h	2h	3h	4h	5h	6h	7h	8h	9h	10h
OPzS/TBS 100	100	84	70	57	50	33	25	21	18	16	14	13	12	10
OPzS/TBS 120	120	101	85	68	60	40	31	24	21	19	17	16	14	12
OPzS/TBS 150	150	126	106	85	75	50	38	31	27	24	22	19	18	15
OPzS/TBS 180	180	151	127	102	90	60	46	37	32	29	26	23	22	19
OPzS/TBS 200	200	168	141	113	100	67	51	41	35	32	29	26	24	21
OPzS/TBS 240	240	202	169	136	120	80	61	49	42	38	35	31	29	25
OPzS/TBS 300	300	252	208	170	150	100	76	62	53	48	43	39	36	31
OPzS/TBS 375	375	315	260	213	188	125	95	77	66	60	54	49	45	39
OPzS/TBS 400	400	336	278	227	200	133	102	82	71	64	58	52	48	41
OPzS/TBS 450	450	378	313	255	225	150	114	93	80	72	65	58	54	46
OPzS/TBS 500	500	380	316	283	250	167	127	103	88	79	72	65	60	52
OPzS/TBS 550	550	418	348	312	275	183	140	113	97	87	80	71	66	57
OPzS/TBS 600	600	456	380	340	300	200	153	124	106	95	87	78	72	62
OPzS/TBS 650	650	494	411	368	325	217	165	134	115	103	94	84	78	67
OPzS/TBS 700	700	532	443	397	350	233	178	144	124	111	101	91	84	72
OPzS/TBS 800	800	608	506	453	400	267	203	165	141	127	116	104	96	82
OPzS/TBS 900	900	684	570	510	450	300	229	185	159	143	130	117	108	93
OPzS/TBS 1000	1000	714	633	567	500	333	254	206	177	159	145	130	120	103
OPzS/TBS 1100	1100	733	696	624	550	367	280	227	195	175	159	143	132	113
OPzS/TBS 1200	1200	750	702	632	553	400	305	247	212	191	174	156	144	124
OPzS/TBS 1325	1325	828	775	697	611	442	337	273	234	211	192	172	159	137
OPzS/TBS 1450	1450	906	848	763	668	483	369	299	256	231	210	188	174	149
OPzS/TBS 1500	1500	938	877	789	691	500	381	309	265	238	217	195	180	155
OPzS/TBS 1600	1600	1000	936	842	737	533	407	329	283	254	232	208	192	165
OPzS/TBS 1700	1700	1063	994	895	783	567	432	350	301	270	246	221	204	175
OPzS/TBS 1850	1850	1156	1082	974	853	617	470	381	327	294	268	240	222	191
OPzS/TBS 1975	1975	1234	1155	1039	910	658	502	407	349	314	286	256	237	204
OPzS/TBS 2000	2000	1250	1170	1053	922	667	508	412	354	318	290	260	240	206
OPzS/TBS 2100	2100	1313	1228	1105	968	700	534	432	371	334	304	273	252	216
OPzS/TBS 2200	2200	1375	1287	1158	1014	733	559	453	389	350	319	286	264	227
OPzS/TBS 2400	2400	1500	1404	1263	1106	800	610	494	424	382	348	312	288	247
OPzS/TBS 2500	2500	1563	1462	1316	1152	833	635	515	442	397	362	325	300	258
OPzS/TBS 2600	2600	1625	1520	1368	1198	867	661	535	460	413	377	338	312	268
OPzS/TBS 2900	2900	1813	1696	1526	1336	967	737	597	513	461	420	377	348	299
OPzS/TBS 3000	3000	1875	1754	1579	1382	1000	763	618	531	477	435	390	360	309
OPzS/TBS 3200	3200	2000	1871	1684	1475	1067	813	659	566	509	464	416	384	330

# TABLE: 3

**ecv = 1.80 v**  
**DISCHARGE DATA**

Type of Cell	C10 Capacity (Ah)	Discharge Current (A) at 27°C												
		15'	30'	45'	1h	2h	3h	4h	5h	6h	7h	8h	9h	10h
OPzS/TBS 100	100	80	64	50	43	30	24	20	17	15	14	13	12	10
OPzS/TBS 120	120	96	77	60	52	36	28	23	20	18	17	15	14	12
OPzS/TBS 150	150	120	96	75	65	45	35	29	25	23	21	19	17	15
OPzS/TBS 180	180	144	115	90	78	55	43	35	30	28	25	23	21	18
OPzS/TBS 200	200	160	128	100	86	61	47	39	34	31	28	25	23	20
OPzS/TBS 240	240	192	154	120	104	73	57	47	41	37	33	30	28	24
OPzS/TBS 300	300	231	185	150	130	91	71	59	51	46	41	38	35	30
OPzS/TBS 375	375	265	231	188	162	114	89	73	63	57	52	47	43	38
OPzS/TBS 400	400	283	247	200	173	121	95	78	68	61	55	50	46	40
OPzS/TBS 450	450	318	278	225	195	136	106	88	76	69	62	56	52	45
OPzS/TBS 500	500	318	275	250	216	152	118	98	84	76	69	63	58	50
OPzS/TBS 550	550	350	302	275	238	167	130	108	93	84	76	69	63	55
OPzS/TBS 600	600	382	330	300	259	182	142	117	101	92	83	75	69	60
OPzS/TBS 650	650	414	357	325	281	197	154	127	110	99	90	81	75	65
OPzS/TBS 700	700	424	383	350	303	212	165	137	118	107	97	88	81	70
OPzS/TBS 800	800	508	437	400	346	243	189	157	135	122	110	100	92	80
OPzS/TBS 900	900	571	492	450	389	273	213	176	152	138	124	113	104	90
OPzS/TBS 1000	1000	625	546	500	432	303	236	196	169	153	138	125	115	100
OPzS/TBS 1100	1100	647	564	550	476	334	260	215	186	168	152	138	127	110
OPzS/TBS 1200	1200	659	615	600	519	364	284	235	203	183	166	150	138	120
OPzS/TBS 1325	1325	678	657	616	573	402	313	259	224	203	183	166	153	133
OPzS/TBS 1450	1450	742	719	674	627	440	343	284	245	222	200	181	167	145
OPzS/TBS 1500	1500	767	744	698	649	455	354	294	253	229	207	188	173	150
OPzS/TBS 1600	1600	818	793	744	692	485	378	313	270	245	221	200	185	160
OPzS/TBS 1700	1700	870	843	791	735	516	402	333	287	260	235	213	196	170
OPzS/TBS 1850	1850	946	917	860	800	561	437	362	313	283	256	231	213	185
OPzS/TBS 1975	1975	1010	979	919	854	599	467	387	334	302	273	247	228	198
OPzS/TBS 2000	2000	1023	992	930	865	606	473	392	338	306	276	250	231	200
OPzS/TBS 2100	2100	1074	1041	977	908	637	496	411	355	321	290	263	242	210
OPzS/TBS 2200	2200	1125	1091	1023	951	667	520	431	372	336	304	275	254	220
OPzS/TBS 2400	2400	1228	1190	1116	1038	728	567	470	405	367	331	300	277	240
OPzS/TBS 2500	2500	1279	1239	1163	1081	758	591	489	422	382	345	313	288	250
OPzS/TBS 2600	2600	1330	1289	1209	1124	788	614	509	439	398	359	325	300	260
OPzS/TBS 2900	2900	1483	1438	1349	1254	879	685	568	490	443	401	363	335	290
OPzS/TBS 3000	3000	1535	1487	1395	1297	910	709	587	507	459	414	375	346	300
OPzS/TBS 3200	3200	1637	1587	1488	1383	970	756	626	541	489	442	400	369	320



# TABLE: 4

ecv = 1.83 v

## DISCHARGE DATA

Type of Cell	C10 Capacity (Ah)	Discharge Current (A) at 27°C												
		15'	30'	45'	1h	2h	3h	4h	5h	6h	7h	8h	9h	10h
OPzS/TBS 100	100	70	56	50	43	26	21	18	16	14	12	12	11	10
OPzS/TBS 120	120	85	67	60	52	31	25	22	19	16	15	14	13	12
OPzS/TBS 150	150	106	83	75	65	39	31	27	23	21	19	17	16	15
OPzS/TBS 180	180	127	100	90	78	47	38	32	28	25	22	21	19	17
OPzS/TBS 200	200	141	111	100	87	52	42	36	31	27	25	23	22	19
OPzS/TBS 240	240	169	133	120	104	62	50	43	37	33	30	28	26	23
OPzS/TBS 300	300	211	167	150	130	78	63	54	47	41	37	35	32	29
OPzS/TBS 375	375	236	208	188	163	97	79	67	58	52	47	43	40	36
OPzS/TBS 400	400	252	222	200	174	104	84	72	62	55	50	46	43	39
OPzS/TBS 450	450	283	250	225	196	117	94	81	70	62	56	52	49	44
OPzS/TBS 500	500	259	278	250	217	130	105	90	78	69	62	58	54	49
OPzS/TBS 550	550	285	306	275	239	143	115	99	85	76	68	64	59	53
OPzS/TBS 600	600	311	333	300	261	156	126	108	93	82	75	69	65	58
OPzS/TBS 650	650	337	361	325	283	169	136	117	101	89	81	75	70	63
OPzS/TBS 700	700	363	389	350	305	182	147	126	109	96	87	81	75	68
OPzS/TBS 800	800	415	444	364	313	208	168	144	124	110	99	93	86	78
OPzS/TBS 900	900	466	500	409	352	234	189	162	140	124	112	104	97	87
OPzS/TBS 1000	1000	518	556	455	391	260	210	180	155	137	124	116	108	97
OPzS/TBS 1100	1100	524	611	500	430	286	231	198	171	151	137	127	119	107
OPzS/TBS 1200	1200	545	545	545	451	312	252	216	186	165	149	139	129	117
OPzS/TBS 1325	1325	552	552	552	498	344	278	238	206	182	165	153	143	129
OPzS/TBS 1450	1450	604	604	604	545	377	304	260	225	199	180	168	156	141
OPzS/TBS 1500	1500	625	667	667	564	390	315	269	233	206	186	174	162	146
OPzS/TBS 1600	1600	667	667	667	602	416	336	287	248	220	199	185	173	155
OPzS/TBS 1700	1700	708	708	708	639	442	357	305	264	234	211	197	183	165
OPzS/TBS 1850	1850	771	771	771	695	481	388	332	287	254	230	214	199	180
OPzS/TBS 1975	1975	823	823	823	742	513	415	355	306	271	245	228	213	192
OPzS/TBS 2000	2000	833	875	875	752	520	420	359	310	275	248	231	216	194
OPzS/TBS 2100	2100	875	875	875	789	546	441	377	326	289	261	243	226	204
OPzS/TBS 2200	2200	917	917	917	827	572	462	395	341	302	273	255	237	214
OPzS/TBS 2400	2400	1000	1000	1000	902	624	504	431	372	330	298	278	259	233
OPzS/TBS 2500	2500	1042	1083	1083	940	650	525	449	388	344	311	289	270	243
OPzS/TBS 2600	2600	1083	1083	1083	977	676	546	467	403	357	323	301	280	252
OPzS/TBS 2900	2900	1208	1208	1208	1090	753	609	521	450	399	360	335	313	282
OPzS/TBS 3000	3000	1250	1333	1333	1128	779	630	539	466	412	373	347	323	291
OPzS/TBS 3200	3200	1333	1333	1333	1203	831	672	575	497	440	398	370	345	311

# TABLE:5

**ecv = 1.87 v**  
**DISCHARGE DATA**

Type of Cell	C10 Capacity (Ah)	Discharge Current (A) at 27°C												
		15'	30'	45'	1h	2h	3h	4h	5h	6h	7h	8h	9h	10h
OPzS/TBS 100	100	58	48	42	38	27	21	18	15	14	13	11	11	9
OPzS/TBS 120	120	70	57	50	45	32	26	22	18	17	15	14	13	11
OPzS/TBS 150	150	87	71	63	57	40	32	27	23	21	19	17	16	14
OPzS/TBS 180	180	105	86	75	68	48	38	32	28	25	23	20	20	17
OPzS/TBS 200	200	117	95	83	76	53	43	36	31	28	25	23	22	19
OPzS/TBS 240	240	140	114	100	91	64	51	43	37	34	30	27	26	22
OPzS/TBS 300	300	143	136	120	111	81	63	47	41	36	33	31	29	28
TBS/OPzS 375	375	179	170	150	138	101	79	58	51	45	41	39	37	35
TBS/OPzS 400	400	190	182	160	148	108	84	62	55	48	44	42	39	37
OPzS/TBS 450	450	214	205	180	166	121	95	70	61	54	49	47	44	42
OPzS/TBS 500	500	196	196	196	156	128	103	85	74	66	60	53	51	47
OPzS/TBS 550	550	215	215	215	172	140	113	93	81	73	65	59	56	51
OPzS/TBS 600	600	235	235	235	188	153	124	102	89	79	71	64	61	56
OPzS/TBS 650	650	254	254	254	203	166	134	110	96	86	77	69	66	60
OPzS/TBS 700	700	274	274	274	219	179	144	119	103	92	83	74	71	65
OPzS/TBS 800	800	313	313	313	250	204	165	136	118	106	95	85	82	74
OPzS/TBS 900	900	352	352	352	281	230	186	153	133	119	107	96	92	84
OPzS/TBS 1000	1000	391	391	391	313	255	206	169	148	132	119	106	102	93
OPzS/TBS 1100	1100	431	431	431	344	270	227	186	162	145	131	117	112	102
OPzS/TBS 1200	1200	375	375	375	375	294	235	203	177	158	143	128	122	112
OPzS/TBS 1325	1325	414	414	414	414	325	260	225	196	175	158	141	135	123
OPzS/TBS 1450	1450	453	453	453	453	355	284	246	214	191	173	154	148	135
OPzS/TBS 1500	1500	469	469	469	469	368	294	254	222	198	179	160	153	140
OPzS/TBS 1600	1600	500	500	500	500	392	314	271	236	211	190	170	163	149
OPzS/TBS 1700	1700	531	531	531	531	417	333	288	251	224	202	181	173	158
OPzS/TBS 1850	1850	578	578	578	578	453	363	314	273	244	220	197	189	172
OPzS/TBS 1975	1975	617	617	617	617	484	387	335	292	261	235	210	202	184
OPzS/TBS 2000	2000	625	625	625	625	490	392	339	295	264	238	213	204	186
OPzS/TBS 2100	2100	656	656	656	656	515	412	356	310	277	250	223	214	195
OPzS/TBS 2200	2200	688	688	688	688	539	431	373	325	290	262	234	224	205
OPzS/TBS 2400	2400	750	750	750	750	588	471	407	355	317	286	255	245	223
OPzS/TBS 2500	2500	781	781	781	781	613	490	424	369	330	298	266	255	233
OPzS/TBS 2600	2600	813	813	813	813	637	510	441	384	343	310	277	265	242
OPzS/TBS 2900	2900	906	906	906	906	711	569	492	428	383	345	309	296	270
OPzS/TBS 3000	3000	938	938	938	938	735	588	508	443	396	357	319	306	279
OPzS/TBS 3200	3200	1000	1000	1000	1000	784	627	542	473	422	381	340	327	298



# TABLE: 6

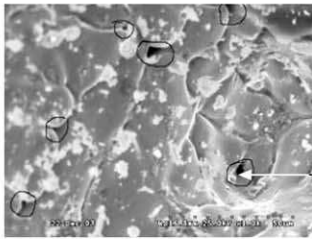
**ecv = 1.90 v****DISCHARGE DATA**

Type of Cell	C10 Capacity (Ah)	Discharge Current (A) at 27°C												
		15'	30'	45'	1h	2h	3h	4h	5h	6h	7h	8h	9h	10h
OPzS/TBS 100	100	46	42	36	33	21	18	16	14	12	11	10	10	9
OPzS/TBS 120	120	55	51	44	40	26	21	19	16	14	13	13	12	11
OPzS/TBS 150	150	68	63	55	50	32	27	23	20	18	16	16	15	14
OPzS/TBS 180	180	82	76	65	60	38	32	28	25	21	20	19	18	17
OPzS/TBS 200	200	91	84	73	67	43	36	31	27	24	22	21	20	19
OPzS/TBS 240	240	110	101	87	80	51	43	37	33	29	26	25	24	22
OPzS/TBS 300	300	109	109	107	95	64	54	47	41	36	33	31	29	28
OPzS/TBS 375	375	136	136	134	119	80	67	58	51	45	41	39	37	35
OPzS/TBS 400	400	145	163	143	127	85	71	62	55	48	44	42	39	37
OPzS/TBS 450	450	164	164	161	143	96	80	70	61	54	49	47	44	42
OPzS/TBS 500	500	157	173	173	136	107	89	78	68	60	55	52	49	46
OPzS/TBS 550	550	173	173	173	149	117	98	85	75	66	60	57	54	51
OPzS/TBS 600	600	189	204	204	163	128	107	93	82	71	65	63	59	56
OPzS/TBS 650	650	204	204	204	176	139	116	101	89	77	71	68	64	60
OPzS/TBS 700	700	220	220	220	190	149	125	109	96	83	76	73	69	65
OPzS/TBS 800	800	252	252	252	217	171	143	124	109	95	87	84	78	74
OPzS/TBS 900	900	283	283	283	244	192	161	140	123	107	98	94	88	83
OPzS/TBS 1000	1000	314	314	314	271	213	179	155	137	119	109	104	98	93
OPzS/TBS 1100	1100	346	346	346	299	234	196	171	150	131	120	115	108	102
OPzS/TBS 1200	1200	288	288	288	288	256	214	186	164	143	131	125	118	111
OPzS/TBS 1325	1325	318	318	318	318	282	237	206	181	158	144	138	130	123
OPzS/TBS 1450	1450	348	348	348	348	309	259	225	198	173	158	151	142	134
OPzS/TBS 1500	1500	360	384	384	384	320	268	233	205	179	164	157	147	139
OPzS/TBS 1600	1600	384	384	384	384	341	286	248	219	191	174	167	157	148
OPzS/TBS 1700	1700	408	408	408	408	362	304	264	232	202	185	177	167	158
OPzS/TBS 1850	1850	444	444	444	444	394	330	287	253	220	202	193	181	172
OPzS/TBS 1975	1975	474	474	474	474	421	353	307	270	235	215	206	194	183
OPzS/TBS 2000	2000	480	504	504	504	426	357	311	273	238	218	209	196	185
OPzS/TBS 2100	2100	504	504	504	504	448	375	326	287	250	229	219	206	195
OPzS/TBS 2200	2200	528	528	528	528	469	393	342	301	262	240	230	216	204
OPzS/TBS 2400	2400	576	576	576	576	512	429	373	328	286	262	251	235	223
OPzS/TBS 2500	2500	600	624	624	624	533	446	388	342	298	273	261	245	232
OPzS/TBS 2600	2600	624	624	624	624	554	464	404	355	310	283	271	255	241
OPzS/TBS 2900	2900	695	695	695	695	618	518	450	396	345	316	303	284	269
OPzS/TBS 3000	3000	719	767	767	767	639	536	466	410	357	327	313	294	278
OPzS/TBS 3200	3200	767	767	767	767	682	571	497	437	381	349	334	314	297



# TECHNOLOGY

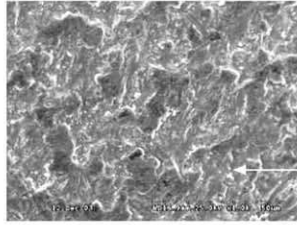
### 1. Gravity Casting (SEM Picture of plate)



Big voids  
Non uniform  
micro  
hardness

Machine Cost : Rs. 50,000/-

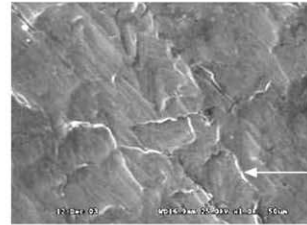
### 2. Low Pressure Casting (10 Bar) (SEM Picture of plate)



Small voids  
very low  
micro  
hardness

Machine Cost : Rs. 2 lakhs

### 3. High Pressure "HADI" Casting (100 Bar) used by EXIDE (SEM Picture of plate)



No voids  
Uniform  
micro  
hardness

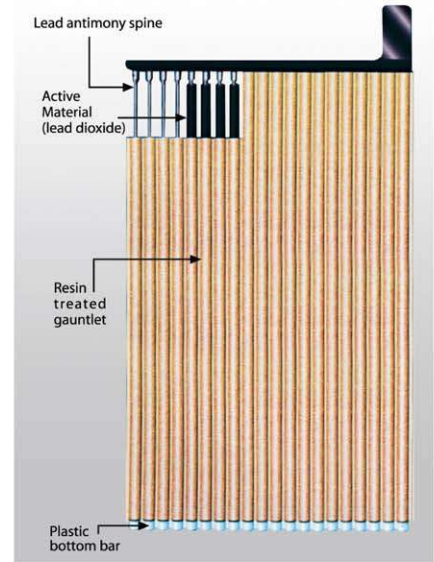
Machine Cost : Rs. 2.5 crore

While all tubular Batteries behave similarly in the beginning, the strength of their guts and their life, especially in heavy duties, is decided by the way their spines are cast.

There are three standard casting practices : 1. Gravity Casting 2. Low Pressure Casting 3. High Pressure "HADI" Casting

Exide TBS/OPzS Batteries have the spines or the positive plate support made by High Pressure "HADI" Casting Process (100 Bar operating pressure) which can protect the lead plate support from anodic corrosion. The Scanning Electron Microscope (SEM) study reveals the weakness of the plate support made by other processes.

Both the low pressure casting and the gravity casting which is used for flat plate manufacturing process show inconsistency in the grain orientation. This can lead to failure by the process known as creep which happens when the plate grows in the charging cycle. Moreover these two casting processes generate casting with open pores. The corrosion process penetrates in the cross section of the plate and leads to early failure compared to the situation where the corrosion is limited to the surface.



Tubular Plate and its various components

### Product Comparison by Scanning Electron Microscope Study\*

Properties	Gravity Casting	Low Pressure Casting (10 Bar)	High Pressure Casting (100 Bar) with HADI machine used by Exide
Micro hardness (Vicker hardness HV)	Micro hardness is very low compared to the other two types varying from 17.5 to 18.2	Micro hardness is not uniform varying from 21.5 to 28.4	Uniform micro hardness of 24.3 throughout the sample
Grain size	Inconsistent grain size	Combination of coarse and fine	Consistent
Grain orientation	Random orientation	Random orientation	Grains are oriented in single direction
Surface condition	Voids are seen and bigger than low pressure casting	Voids are seen (Small black spots)	No voids

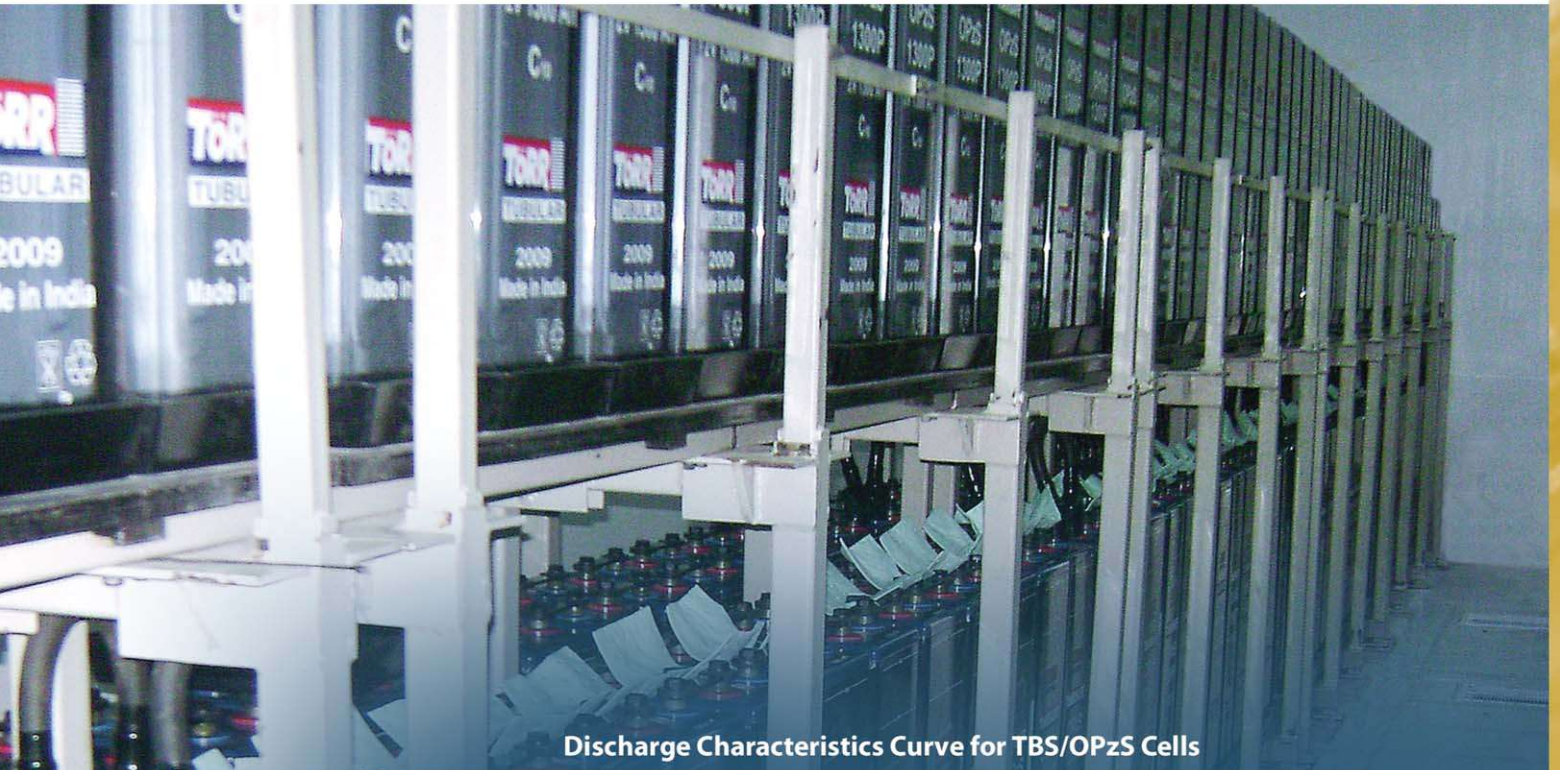
Insist on "HADI" Bar High pressure Casting Tubular for long life Standby Batteries

\*Basis CECRI Report

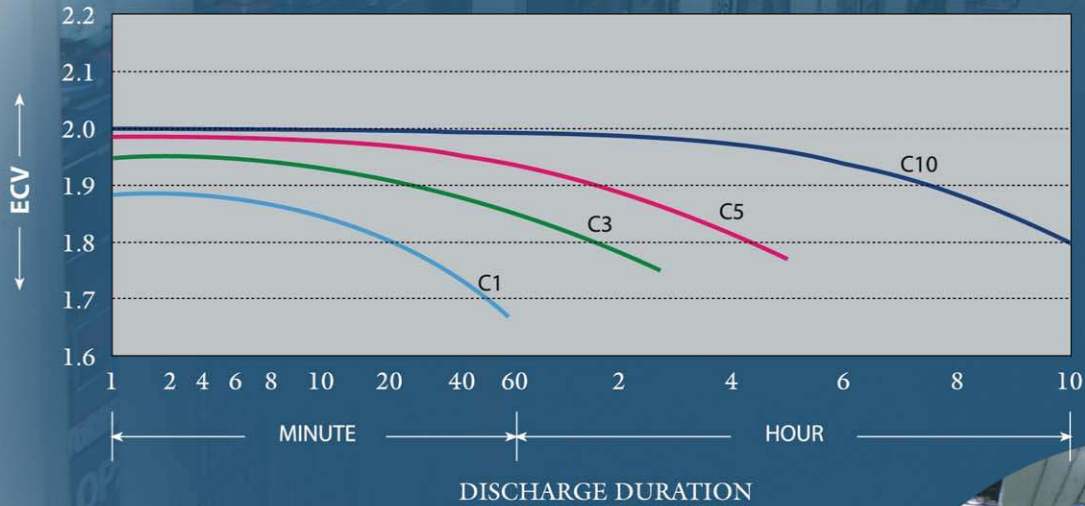




**Discharge Characteristics & Low Maintenance Feature**



**Discharge Characteristics Curve for TBS/OPzS Cells**



**Comparative Water Loss study data**

	Positive Spine Alloy	Negative Grid Alloy	Rate of water loss on float per Ah/Cell/21 days at 50°C, 2.4 V/Cell
Till late '80	9% Sb	5% Sb	1.10 gms.
Post '90	5% Sb	2.5% Sb	0.55 gms.
Exide TBS/OPzS	2.5% Sb	0.1% Ca 0.3% Sn	0.18 gms.



## PAN INDIA PRESENCE

NORTH	EAST	WEST	SOUTH
<b>Regional Office</b> New Delhi  <b>Branch Office</b> Ghaziabad Lucknow Varanasi  <b>Factory</b> Bawal Roorkee Hardwar	<b>Head Office</b> Kolkata  <b>Corporate Marketing Office</b> Entally  <b>Regional Office</b> Entally  <b>Branch Office</b> Siliguri Guwahati Jamshedpur Patna  <b>Factory</b> Haldia Shamnagar R&D Centre Kolkata  <b>Central Service</b> Shamnagar	<b>Regional Office</b> Mumbai  <b>Branch Office</b> Ahmedabad Baroda Nagpur Pune  <b>Factory</b> Chinchwad Ahmednagar Taloja	<b>Regional Office</b> Chennai  <b>Branch Office</b> Bangalore Hyderabad Coimbatore Cochin  <b>Factory</b> Hosur  <b>Central Service</b> Hosur

### Advantage TBS/OPzS

- |                       |  |
|-----------------------|--|
| ✓ Easy monitoring     | ✓ Plastic encapsulated bolt-on terminals |
| ✓ Minimum maintenance | ✓ Insulated intercell connectors         |
| ✓ Low foot print      | ✓ Reliable                               |
| ✓ Robust              | ✓ Long life                              |

Exide is the largest Power Storage Solutions Company in South and South Asia. Exide is the only company in India which has the experience, knowledge, product range, technology and nation wide service network to provide appropriate selection of battery under varying service conditions, in-time supply, correct installation, proper maintenance and timely disposal plus replacement of batteries. Continuous innovations enable Exide to provide storage energy solutions to its customers.

# EXIDE

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Caps Micrographics/TBS/OPzS/2k/11/03/2015