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Developing a Mobile Cart for Datacenter Fluid Servicing



NOVEMBER 9-10, 2021

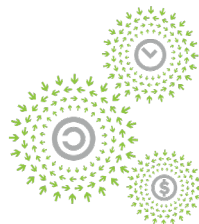
CE (Cooling Environments)

Developing a Mobile Cart for Datacenter Fluid Servicing

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Motivation

Datacenter Need

- As datacenters switch to liquid-cooling from air-cooling, easy-to-use infrastructure must be considered to ensure operator readiness to maintain and service fluids.

Presentation & Whitepaper Goal

- To give guidance to datacenter operators and providers on approaches and considerations to fill, refresh, discharge and otherwise service liquid cooled racks.

Solution

- A mobile cart to charge or discharge cooling fluid from a rack or other liquid cooled chassis as well as rinse it with water and dry with air or nitrogen to prepare for storage/shipment.



RACK & POWER



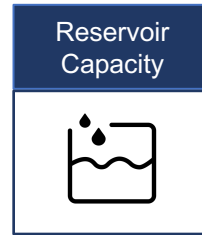
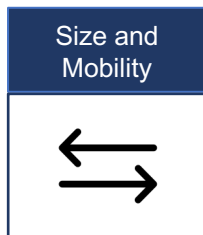
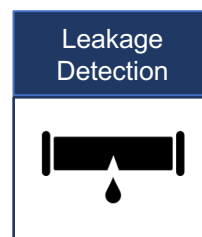
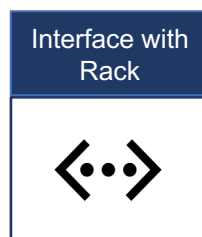
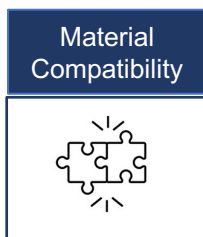
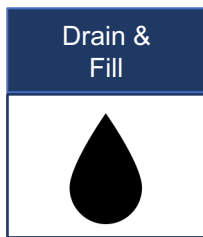
Mobile fluid-servicing cart by generic cabinet

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Datacenter Requirements

Key considerations



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Key Cart Capabilities

Flush

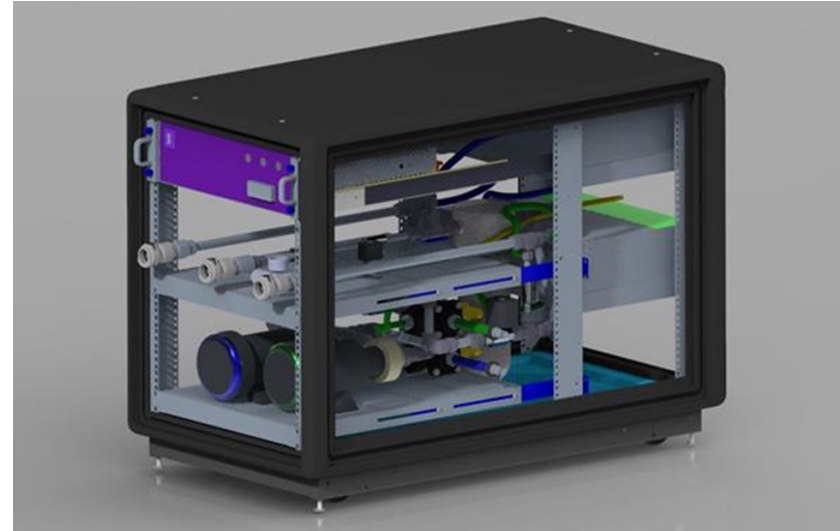
- Rinsing a liquid-cooled rack or cold-plate with a rinse-fluid. Used to clean the fluid loop of contaminants or old cooling fluid.

Charge

- Filling a liquid-cooled rack or cold-plate with new cooling fluid.

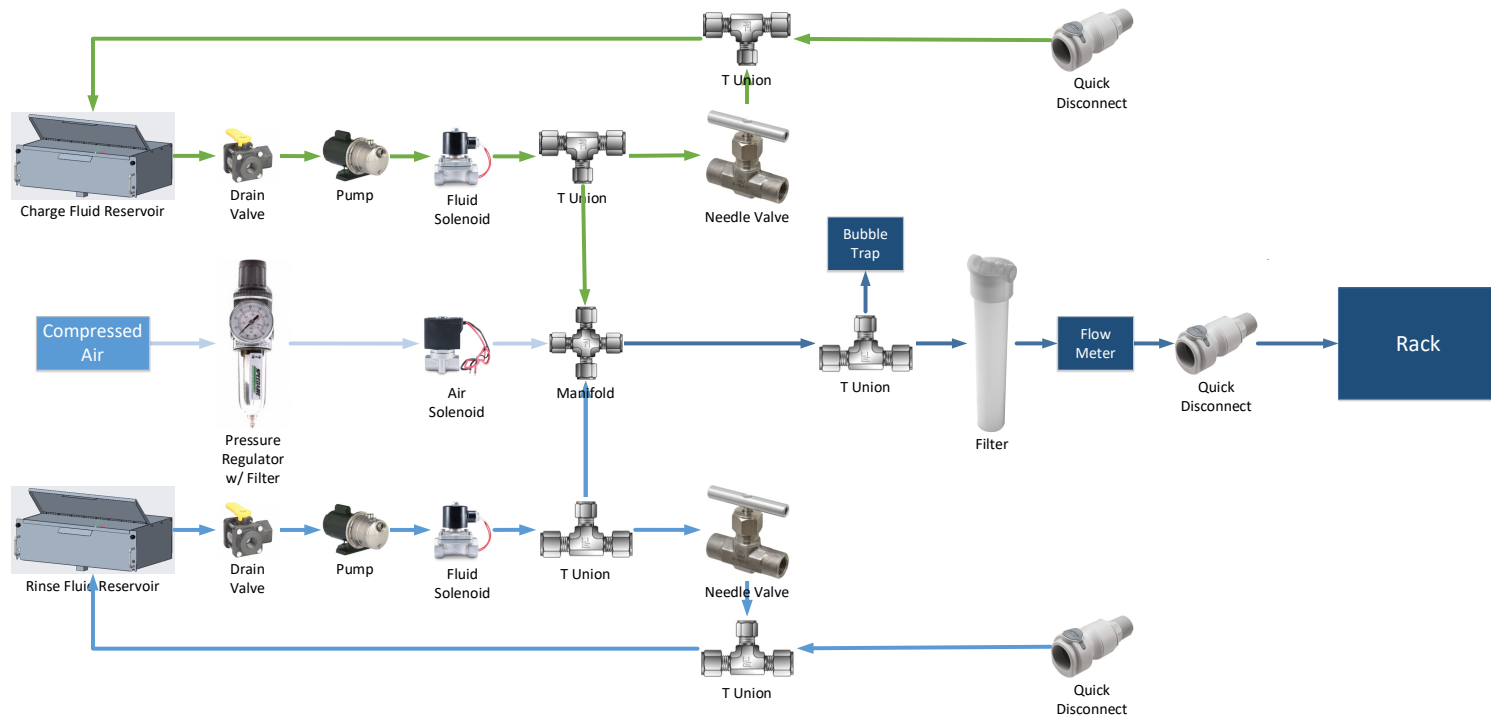
Purge and Dry

- Pushing out all fluid from a liquid-cooled rack or cold-plate with air or nitrogen. This can also be used to dry the fluid loop.



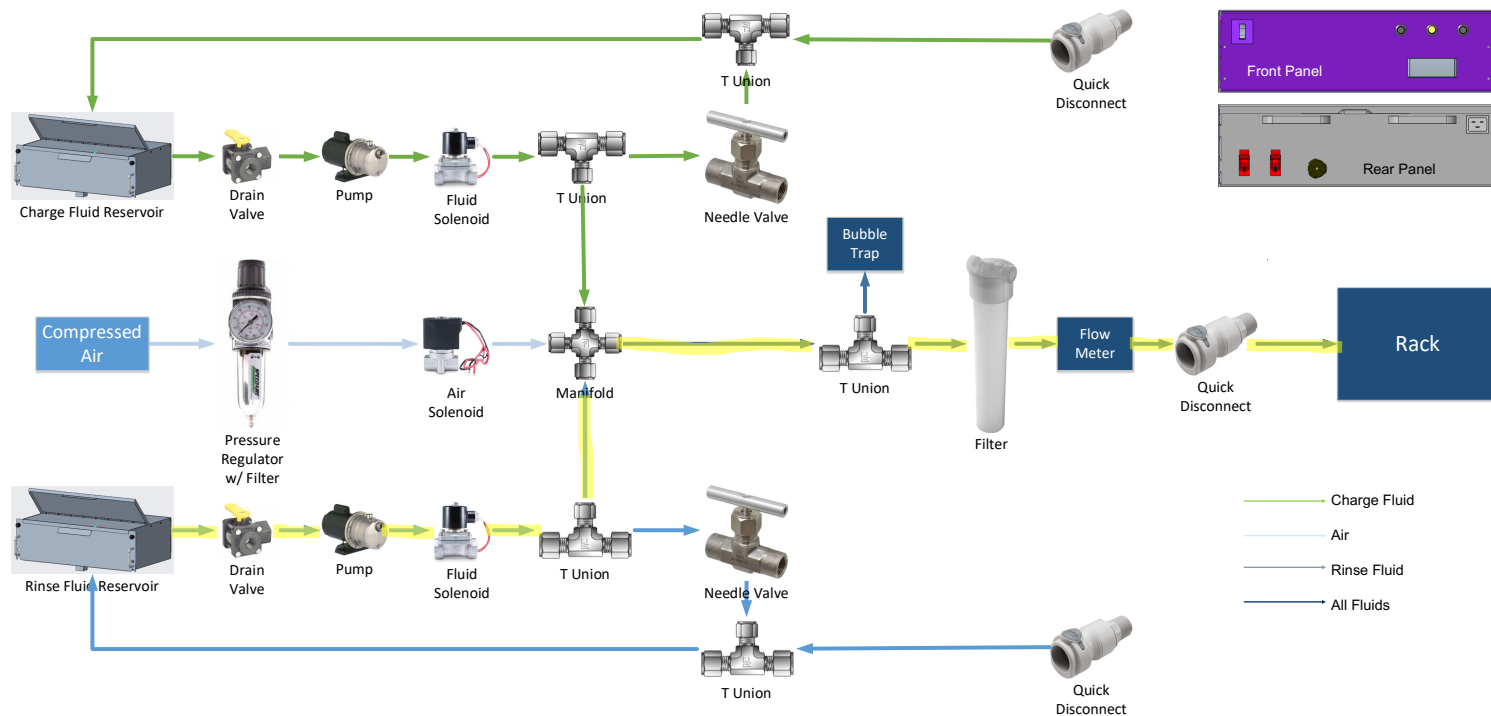
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Cart Piping Diagram



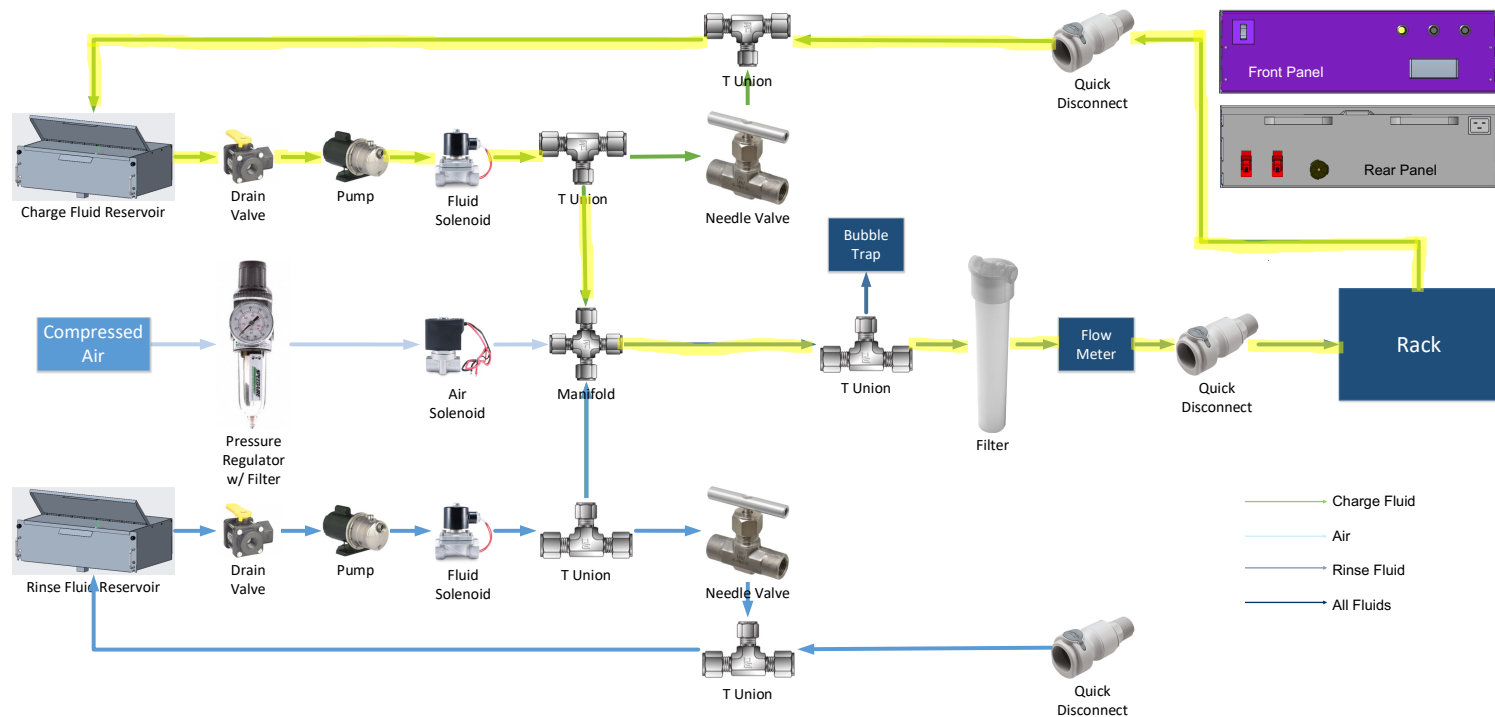
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Flush Cycle



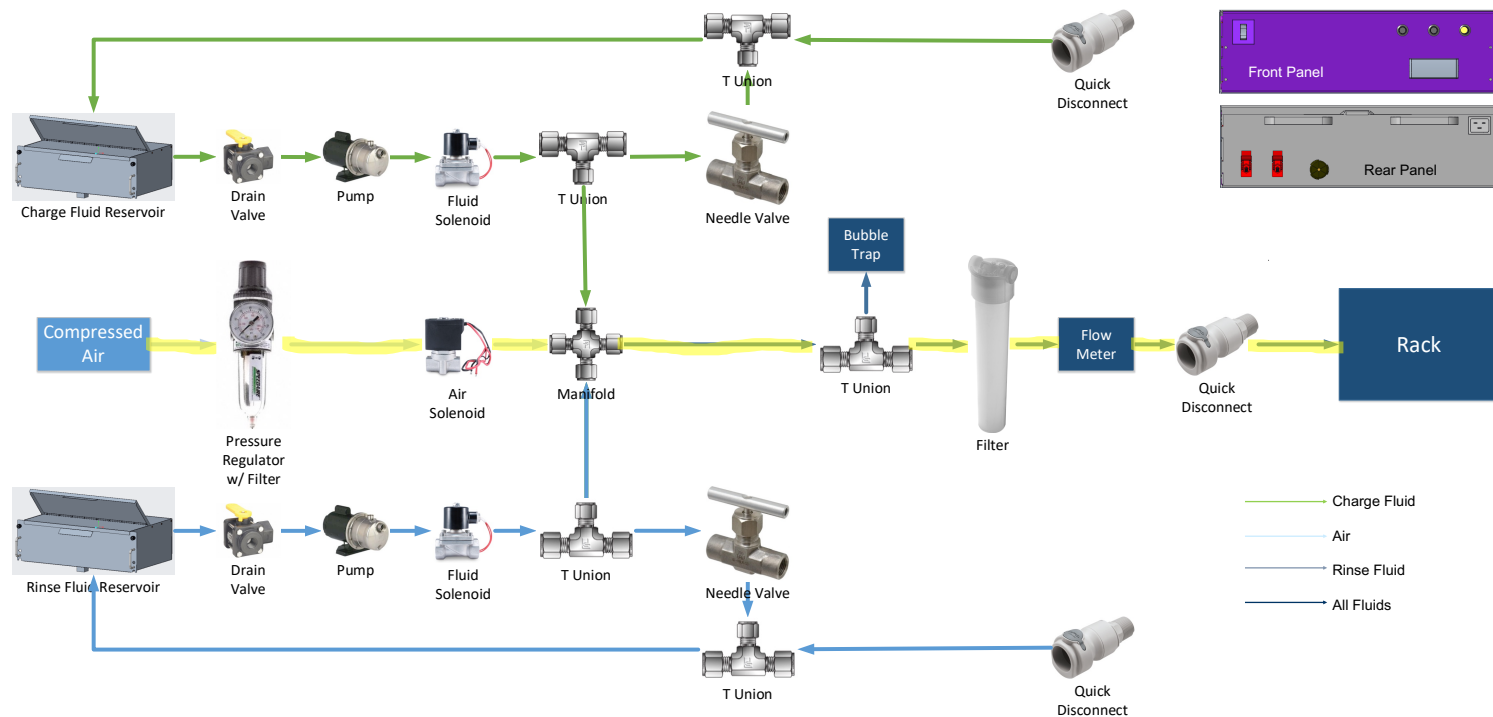
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Charge Cycle



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Purge & Dry Cycle



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Highlighted Design Considerations

Pressure Rating
& Material
Compatibility

Performance

Size & Mobility

Drip
Containment &
Detection

Control &
Usability

Table 2
MAXIMUM ALLOWABLE WORKING PRESSURE TABLES
316 or 304 STAINLESS STEEL (Seamless)

Wall Thickness	0.010	0.012	0.014	0.016	0.018	0.020	0.022	0.024	0.026	0.028	0.030	0.032	0.034	0.036	0.038	0.040	0.042	0.044	0.046	0.048	0.050	0.052	0.054	0.056	0.058	0.060	0.062	0.064	0.066	0.068	0.070	0.072	0.074	0.076	0.078	0.080	0.082	0.084	0.086	0.088	0.090	0.092	0.094	0.096	0.098	0.100	0.102	0.104	0.106	0.108	0.110	0.112	0.114	0.116	0.118	0.120	0.122	0.124	0.126	0.128	0.130	0.132	0.134	0.136	0.138	0.140	0.142	0.144	0.146	0.148	0.150	0.152	0.154	0.156	0.158	0.160	0.162	0.164	0.166	0.168	0.170	0.172	0.174	0.176	0.178	0.180	0.182	0.184	0.186	0.188	0.190	0.192	0.194	0.196	0.198	0.200	0.202	0.204	0.206	0.208	0.210	0.212	0.214	0.216	0.218	0.220	0.222	0.224	0.226	0.228	0.230	0.232	0.234	0.236	0.238	0.240	0.242	0.244	0.246	0.248	0.250	0.252	0.254	0.256	0.258	0.260	0.262	0.264	0.266	0.268	0.270	0.272	0.274	0.276	0.278	0.280	0.282	0.284	0.286	0.288	0.290	0.292	0.294	0.296	0.298	0.300	0.302	0.304	0.306	0.308	0.310	0.312	0.314	0.316	0.318	0.320	0.322	0.324	0.326	0.328	0.330	0.332	0.334	0.336	0.338	0.340	0.342	0.344	0.346	0.348	0.350	0.352	0.354	0.356	0.358	0.360	0.362	0.364	0.366	0.368	0.370	0.372	0.374	0.376	0.378	0.380	0.382	0.384	0.386	0.388	0.390	0.392	0.394	0.396	0.398	0.400	0.402	0.404	0.406	0.408	0.410	0.412	0.414	0.416	0.418	0.420	0.422	0.424	0.426	0.428	0.430	0.432	0.434	0.436	0.438	0.440	0.442	0.444	0.446	0.448	0.450	0.452	0.454	0.456	0.458	0.460	0.462	0.464	0.466	0.468	0.470	0.472	0.474	0.476	0.478	0.480	0.482	0.484	0.486	0.488	0.490	0.492	0.494	0.496	0.498	0.500	0.502	0.504	0.506	0.508	0.510	0.512	0.514	0.516	0.518	0.520	0.522	0.524	0.526	0.528	0.530	0.532	0.534	0.536	0.538	0.540	0.542	0.544	0.546	0.548	0.550	0.552	0.554	0.556	0.558	0.560	0.562	0.564	0.566	0.568	0.570	0.572	0.574	0.576	0.578	0.580	0.582	0.584	0.586	0.588	0.590	0.592	0.594	0.596	0.598	0.600	0.602	0.604	0.606	0.608	0.610	0.612	0.614	0.616	0.618	0.620	0.622	0.624	0.626	0.628	0.630	0.632	0.634	0.636	0.638	0.640	0.642	0.644	0.646	0.648	0.650	0.652	0.654	0.656	0.658	0.660	0.662	0.664	0.666	0.668	0.670	0.672	0.674	0.676	0.678	0.680	0.682	0.684	0.686	0.688	0.690	0.692	0.694	0.696	0.698	0.700	0.702	0.704	0.706	0.708	0.710	0.712	0.714	0.716	0.718	0.720	0.722	0.724	0.726	0.728	0.730	0.732	0.734	0.736	0.738	0.740	0.742	0.744	0.746	0.748	0.750	0.752	0.754	0.756	0.758	0.760	0.762	0.764	0.766	0.768	0.770	0.772	0.774	0.776	0.778	0.780	0.782	0.784	0.786	0.788	0.790	0.792	0.794	0.796	0.798	0.800	0.802	0.804	0.806	0.808	0.810	0.812	0.814	0.816	0.818	0.820	0.822	0.824	0.826	0.828	0.830	0.832	0.834	0.836	0.838	0.840	0.842	0.844	0.846	0.848	0.850	0.852	0.854	0.856	0.858	0.860	0.862	0.864	0.866	0.868	0.870	0.872	0.874	0.876	0.878	0.880	0.882	0.884	0.886	0.888	0.890	0.892	0.894	0.896	0.898	0.900	0.902	0.904	0.906	0.908	0.910	0.912	0.914	0.916	0.918	0.920	0.922	0.924	0.926	0.928	0.930	0.932	0.934	0.936	0.938	0.940	0.942	0.944	0.946	0.948	0.950	0.952	0.954	0.956	0.958	0.960	0.962	0.964	0.966	0.968	0.970	0.972	0.974	0.976	0.978	0.980	0.982	0.984	0.986	0.988	0.990	0.992	0.994	0.996	0.998	1.000	1.002	1.004	1.006	1.008	1.010	1.012	1.014	1.016	1.018	1.020	1.022	1.024	1.026	1.028	1.030	1.032	1.034	1.036	1.038	1.040	1.042	1.044	1.046	1.048	1.050	1.052	1.054	1.056	1.058	1.060	1.062	1.064	1.066	1.068	1.070	1.072	1.074	1.076	1.078	1.080	1.082	1.084	1.086	1.088	1.090	1.092	1.094	1.096	1.098	1.100	1.102	1.104	1.106	1.108	1.110	1.112	1.114	1.116	1.118	1.120	1.122	1.124	1.126	1.128	1.130	1.132	1.134	1.136	1.138	1.140	1.142	1.144	1.146	1.148	1.150	1.152	1.154	1.156	1.158	1.160	1.162	1.164	1.166	1.168	1.170	1.172	1.174	1.176	1.178	1.180	1.182	1.184	1.186	1.188	1.190	1.192	1.194	1.196	1.198	1.200	1.202	1.204	1.206	1.208	1.210	1.212	1.214	1.216	1.218	1.220	1.222	1.224	1.226	1.228	1.230	1.232	1.234	1.236	1.238	1.240	1.242	1.244	1.246	1.248	1.250	1.252	1.254	1.256	1.258	1.260	1.262	1.264	1.266	1.268	1.270	1.272	1.274	1.276	1.278	1.280	1.282	1.284	1.286	1.288	1.290	1.292	1.294	1.296	1.298	1.300	1.302	1.304	1.306	1.308	1.310	1.312	1.314	1.316	1.318	1.320	1.322	1.324	1.326	1.328	1.330	1.332	1.334	1.336	1.338	1.340	1.342	1.344	1.346	1.348	1.350	1.352	1.354	1.356	1.358	1.360	1.362	1.364	1.366	1.368	1.370	1.372	1.374	1.376	1.378	1.380	1.382	1.384	1.386	1.388	1.390	1.392	1.394	1.396	1.398	1.400	1.402	1.404	1.406	1.408	1.410	1.412	1.414	1.416	1.418	1.420	1.422	1.424	1.426	1.428	1.430	1.432	1.434	1.436	1.438	1.440	1.442	1.444	1.446	1.448	1.450	1.452	1.454	1.456	1.458	1.460	1.462	1.464	1.466	1.468	1.470	1.472	1.474	1.476	1.478	1.480	1.482	1.484	1.486	1.488	1.490	1.492	1.494	1.496	1.498	1.500	1.502	1.504	1.506	1.508	1.510	1.512	1.514	1.516	1.518	1.520	1.522	1.524	1.526	1.528	1.530	1.532	1.534	1.536	1.538	1.540	1.542	1.544	1.546	1.548	1.550	1.552	1.554	1.556	1.558	1.560	1.562	1.564	1.566	1.568	1.570	1.572	1.574	1.576	1.578	1.580	1.582	1.584	1.586	1.588	1.590	1.592	1.594	1.596	1.598	1.600	1.602	1.604	1.606	1.608	1.610	1.612	1.614	1.616	1.618	1.620	1.622	1.624	1.626	1.628	1.630	1.632	1.634	1.636	1.638	1.640	1.642	1.644	1.646	1.648	1.650	1.652	1.654	1.656	1.658	1.660	1.662	1.664	1.666	1.668	1.670	1.672	1.674	1.676	1.678	1.680	1.682	1.684	1.686	1.688	1.690	1.692	1.694	1.696	1.698	1.700	1.702	1.704	1.706	1.708	1.710	1.712	1.714	1.716	1.718	1.720	1.722	1.724	1.726	1.728	1.730	1.732	1.734	1.736	1.738	1.740	1.742	1.744	1.746	1.748	1.750	1.752	1.754	1.756	1.758	1.760	1.762	1.764	1.766	1.768	1.770	1.772	1.774	1.776	1.778	1.780	1.782	1.784	1.786	1.788	1.790	1.792	1.794	1.796	1.798	1.800	1.802	1.804	1.806	1.808	1.810	1.812	1.814	1.816	1.818	1.820	1.822	1.824	1.826	1.828	1.830	1.832	1.834	1.836	1.838	1.840	1.842	1.844	1.846	1.848	1.850	1.852	1.854	1.856	1.858	1.860	1.862	1.864	1.866	1.868	1.870	1.872	1.874	1.876	1.878	1.880	1.882	1.884	1.886	1.888	1.890	1.892	1.894	1.896	1.898	1.900	1.902	1.904	1.906	1.908	1.910	1.912	1.914	1.916	1.918	1.920	1.922	1.924	1.926	1.928	1.930	1.932	1.934	1.936	1.938	1.940	1.942	1.944	1.946	1.948	1.950	1.952	1.954	1.956	1.958	1.960	1.962	1.964	1.966	1.968	1.970	1.972	1.974	1.976	1.978	1.980	1.982	1.984	1.986	1.988	1.990	1.992	1.994	1.996	1.998	2.000	2.002	2.004	2.006	2.008	2.010	2.012	2.014	2.016	2.018	2.020	2.022	2.024	2.026	2.028	2.030	2.032	2.034	2.036	2.038	2.040	2.042	2.044	2.046	2.048	2.050	2.052	2.054	2.056	2.058	2.060	2.062	2.064	2.066	2.068	2.070	2.072	2.074	2.076	2.078	2.080	2.082	2.084	2.086	2.088	2.090	2.092	2.094	2.096	2.098	2.100	2.102	2.104	2.106	2.108	2.110	2.112	2.114	2.116	2.118	2.120	2.122	2.124	2.126	2.128	2.130	2.132	2.134	2.136	2.138	2.140	2.142	2.144	2.146	2.148	2.150	2.152	2.154	2.156	2.158	2.160	2.162	2.164	2.166	2.168	2.170	2.172	2.174	2.176	2.178	2.180	2.182	2.184	2.186	2.188	2.190	2.192	2.194	2.196	2.198	2.200	2.202	2.204	2.206	2.208	2.210	2.212	2.214	2.216	2.218	2.220	2.222	2.224	2.226	2.228	2.230	2.232	2.234	2.236	2.238	2.240	2.242	2.244	2.246	2.248	2.250	2.252	2.254	2.256	2.258	2.260	2.262	2.264	2.266	2.268	2.270	2.272	2.274	2.276	2.278	2.280	2.282	2.284	2.286	2.288	2.290	2.292	2.294	2.296	2.298	2.300	2.302	2.304	2.306	2.308	2.310	2.312	2.314	2.316	2.318	2.320	2.322	2.324	2.326	2.328	2.330	2.332	2.334	2.336	2.338	2.340	2.342	2.344	2.346	2.348	2.350	2.352	2.354	2.356	2.358	2.360	2.362	2.364	2.366	2.368	2.370	2.372	2.374	2.376	2.378	2.380	2.382	2.384	2.386	2.388	2.390	2.392	2.394	2.396	2.398	2.400	2.402	2.404	2.406	2.408	2.410	2.412	2.414	2.416	
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NOVEMBER 9-10, 2021