

FAILURE-TOLERANT 1 MW LIQUID COOLED CLUSTER

DESIGN OVERVIEW

1.2 MW+ NVIDIA DGX
SuperPOD

Data Center IT Load
1,152 kW per cluster

Redundancy
N+1 CDU for CDU-300;
2N CDU for CDU-1500;
Dual redundant cooling feeds
to every rack with automatic
valves

Cooling Heat Capture Ratio
72% Liquid (direct-to-chip);
28% Air (perimeter units)

Annualized PUE at 100% Load
< 1.2

Racks and Density
8 x 126 kW+ per rack
(computing);
8 x 14 kW per rack (network
and storage)

SUPERPOD FOR AI OPERATORS

Chilldyne's negative pressure liquid cooling reference designs tackle the cooling challenges of modern AI clusters with validated, proven, and documented infrastructure optimized for high-density deployments. This design focuses on 1 MW AI clusters using Chilldyne's patented leak-proof technology, specifically supporting NVIDIA's GB200 NVL72 platform with 126 kW per rack cooling.



5 x CF-CDU300 Cooling Distribution Units (CDUs)

Key Features

- Purpose-built negative pressure liquid cooling system optimized for high-density AI clusters
- Proven design using Chilldyne 300 kW CDUs with automatic switchover valves
- Modular architecture supporting NVIDIA GB200 NVL72 racks
- Redundant design for increased availability and concurrent maintainability
- Quick and easy deployment with lower total cost of ownership



ZERO-LEAK COOLING

Negative pressure technology



DIRECT-TO-CHIP

Energy efficient



FAIL-SAFE DESIGN

Resilient and redundant



QUICK DEPLOYMENT

Easy to install and maintain

NVIDIA SuperPOD REFERENCE DESIGN

System with N+1 300 kW CDUs*

- 99 LPM per rack at 34°C, providing 100 kW cooling per rack
- 2°C CDU approach @ 200 kW with 5°C margin

***2N 1.5 MW CDUs also available**

Pressure Drop Accounting

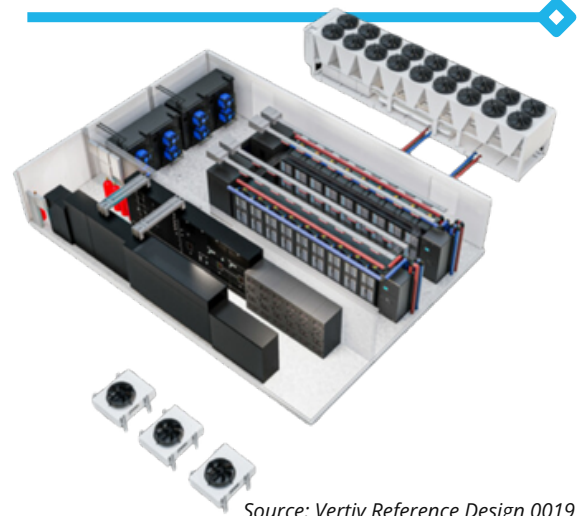
Component	Flow (lpm)	ΔP in Hg
Server	2.7	14.1
Rack Manifold	99	0.3
Manifold Connector	99	0.1
12 ft of 1.25-inch Tubing	99	0.3
Automatic Switchover Valve	198	0.1
28 ft of 2.5-inch Tubing	198	0.5
Total		15.4
Rack (subtotal)		0.4
CDU-Rack (Subtotal)		1

NVIDIA Specs for MGX rack

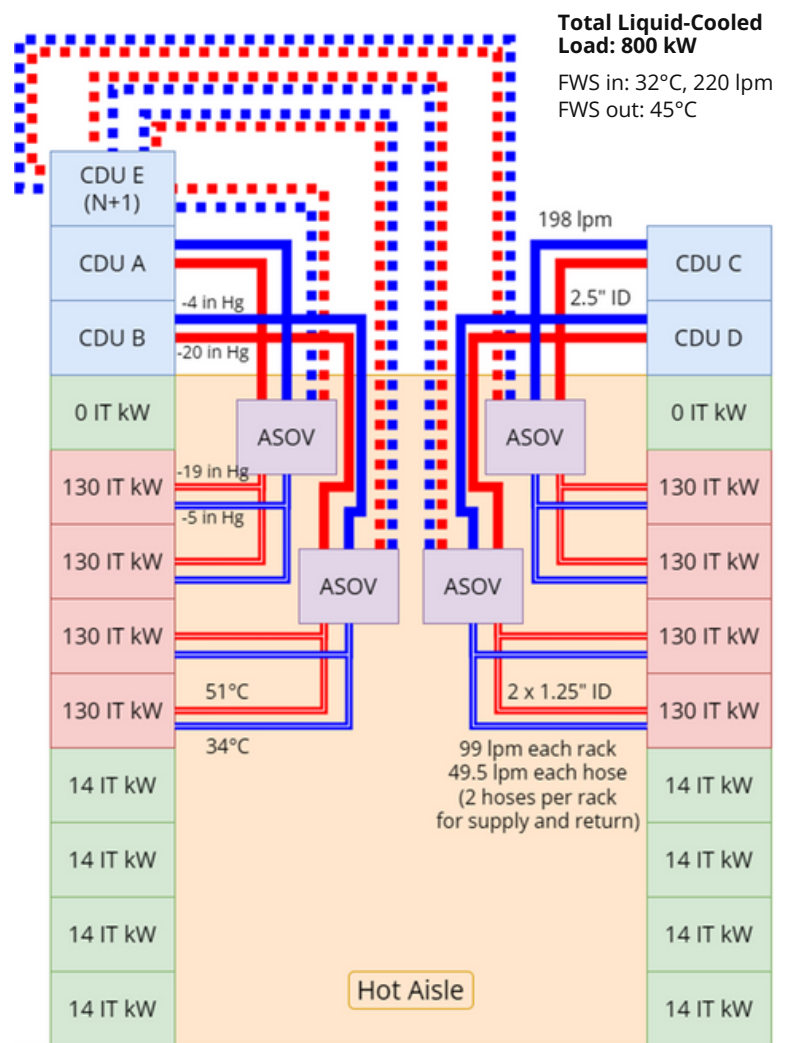
Inlet Temperature (°C)	Maximum Required Liquid Flow (lpm/kW)	Total Flow Rate (lpm)
25	0.5	57.5
30	0.6	69
35	0.7	80.5
40	0.9	103.5

Chilidyne Parts List per POD

- CDU-300 (#1000): 5 each
- Automatic Switchover Valves (#1711): 4 each



Source: Vertiv Reference Design 0019



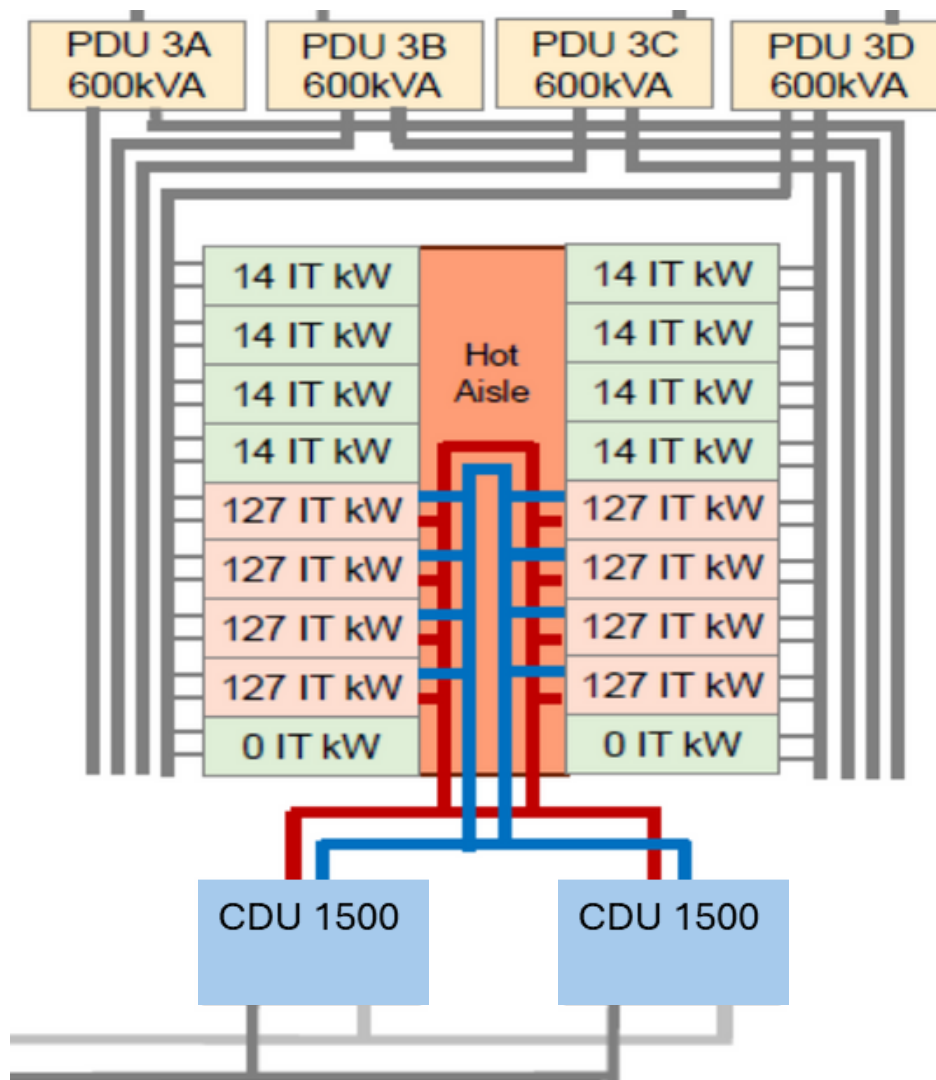
NVIDIA SuperPOD REFERENCE DESIGN

Data for underfloor application with N+1 1500 kW CDUs

- 103 LPM per rack at 40°C, providing 100 kW cooling per rack
- CDU approach 1°C @800 kW with 5°C margin

Advantages over positive pressure systems:

Chilidyne CDU-1500 offers positive pressure operation for compatibility with legacy systems plus negative pressure operation for better uptime and lower risk



Chilidyne Parts List per POD

- CDU-1500: 2 each
- Automatic Switchover Valves (#1711): 4 each

**Total Liquid-Cooled
Load: 816 kW**

Based on a system
layout from Vertiv

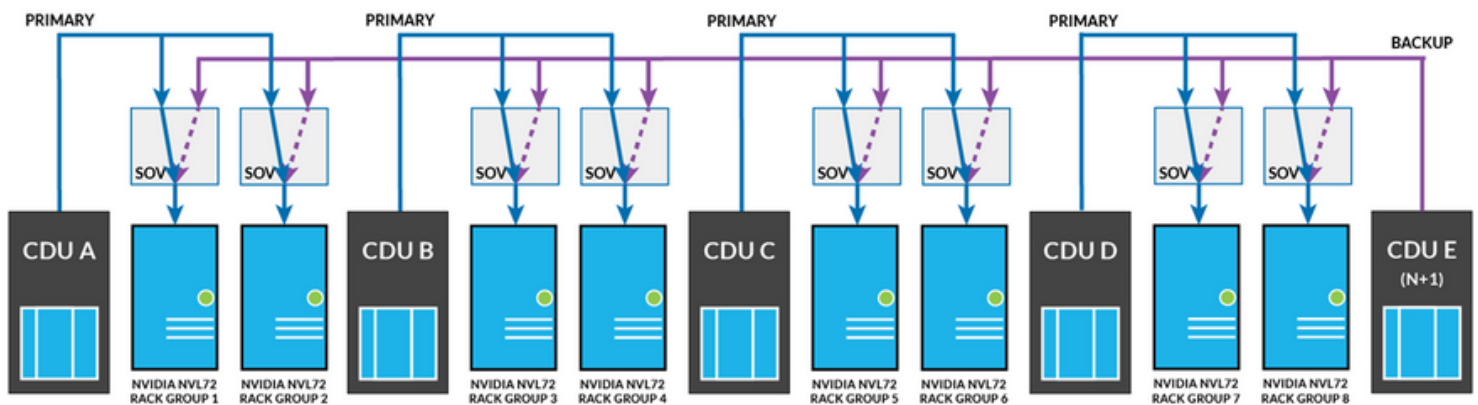
N+1 CDU REDUNDANCY: NVIDIA GB200 NVL72

MAXIMIZE UPTIME & REDUCE RISKS

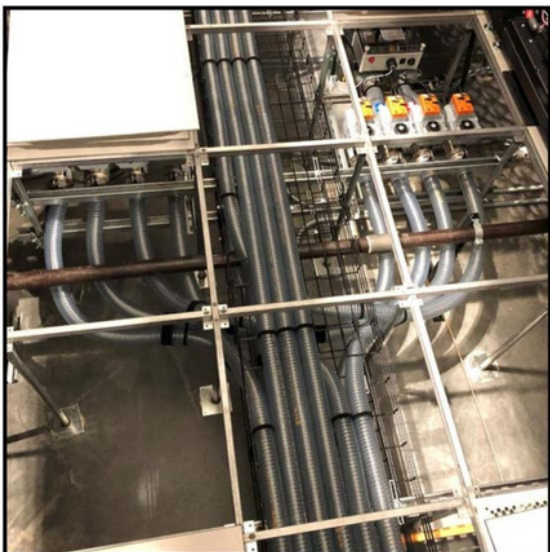
N+1 redundancy is a standard in resilience engineering that ensures continuous system operation even if a component fails. In Chilldyne's system:

- Multiple CDUs are deployed, with at least one extra unit beyond what's needed for normal operation
- Dual redundant cooling feeds to every rack with Automatic Switchover Valves
- If a CDU experiences an issue, Automatic Switchover Valves immediately redirect coolant flow from the backup CDU, ensuring uninterrupted cooling

Chilldyne's N+1 redundant design is an invaluable safeguard for your data center's cooling strategy. Superior fault isolation confines any cooling loop or CDU compromise to localized 2N racks, avoiding the total pod shutdown risk seen in positive pressure liquid cooling systems.



Layout: 5 CDUs, 8 racks (1-10 racks per cluster), N+1 setup for NVIDIA NVL72 cluster with CDU E as the primary backup. "SOV" denotes Automatic Switchover Valves that redirect coolant flow in case of a failure.



Switchover valves installed at Sandia National Labs

Automatic Switchover Valve Features

- **Smart Monitoring:** Actively checks temperature and flow rates, swiftly engaging a backup when necessary.
- **Network Compatibility:** Networked for monitoring and control, providing instant alerts and supporting a wide range of protocols.
- **Versatile Reset Options:** Conveniently resettable through a push button, power cycle, or remotely via network command.

HOW IT WORKS: SYSTEM ANATOMY

Chillydyne's innovative negative pressure technology creates a vacuum to circulate water by pulling it through the cooling system. This approach removes the need for costly, heavy-duty plumbing to the racks, ensures easy setup and upkeep, and eliminates leaks in a system with no single point of failure. This resilient and cost-effective solution outperforms alternative liquid cooling systems, delivering superior reliability at a lower total cost of ownership.

Compatible with both Chillydyne and NVIDIA-approved rack manifolds and cold plates.

1) Cooling Distribution Unit (CDU)

CDU-300 cools up to 300 kW of servers.
CDU-1500 cools up to 1.5 MW of servers.

2) Rack Manifold

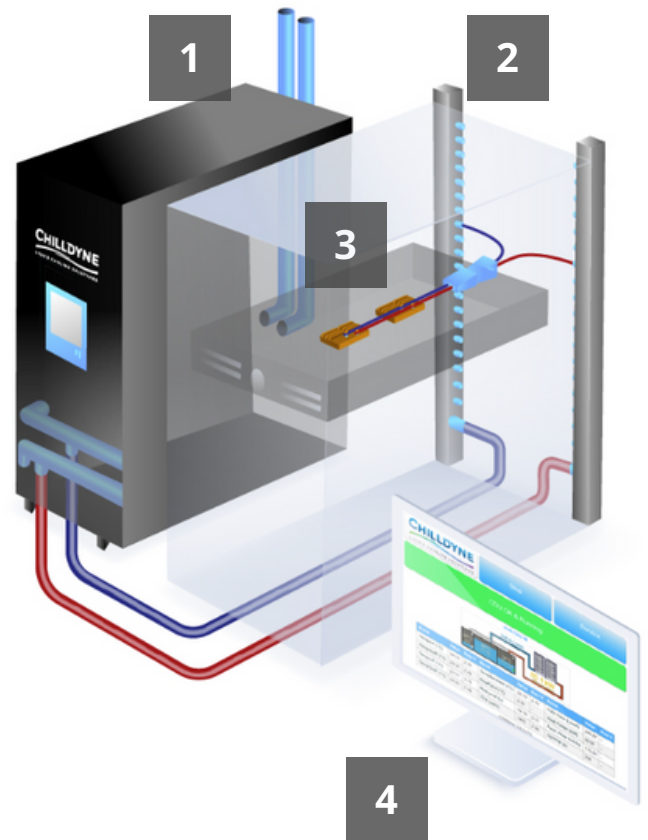
Delivers coolant to servers inside a standard server rack.

3) Cold Plates

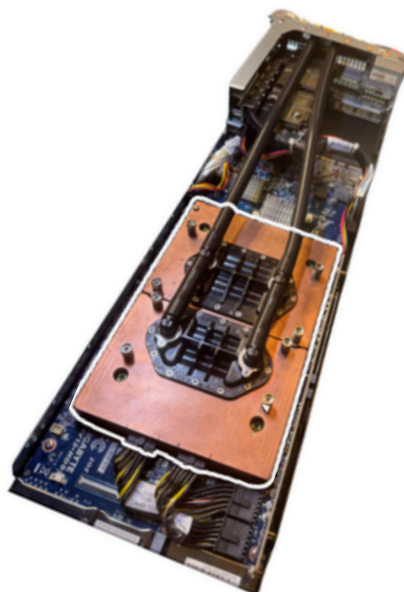
Mounted to processors to remove heat at the source.

4) Cool-Flo Software

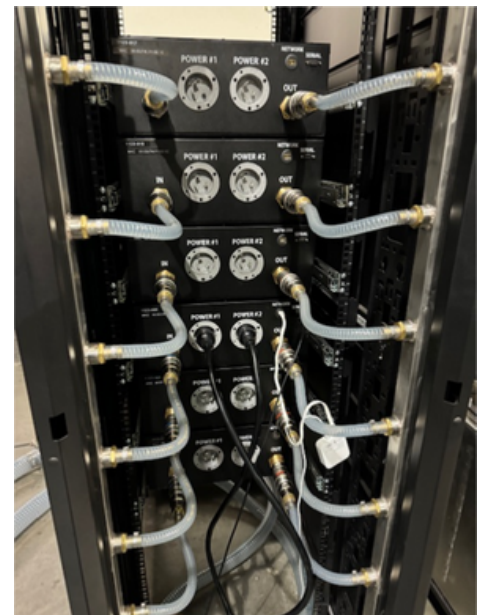
Remotely monitor and control the CDU via web, protocols, or DCIM/BMS integration.



CDU with negative pressure for leak-proof direct liquid cooling



NVIDIA GH200 cold plates



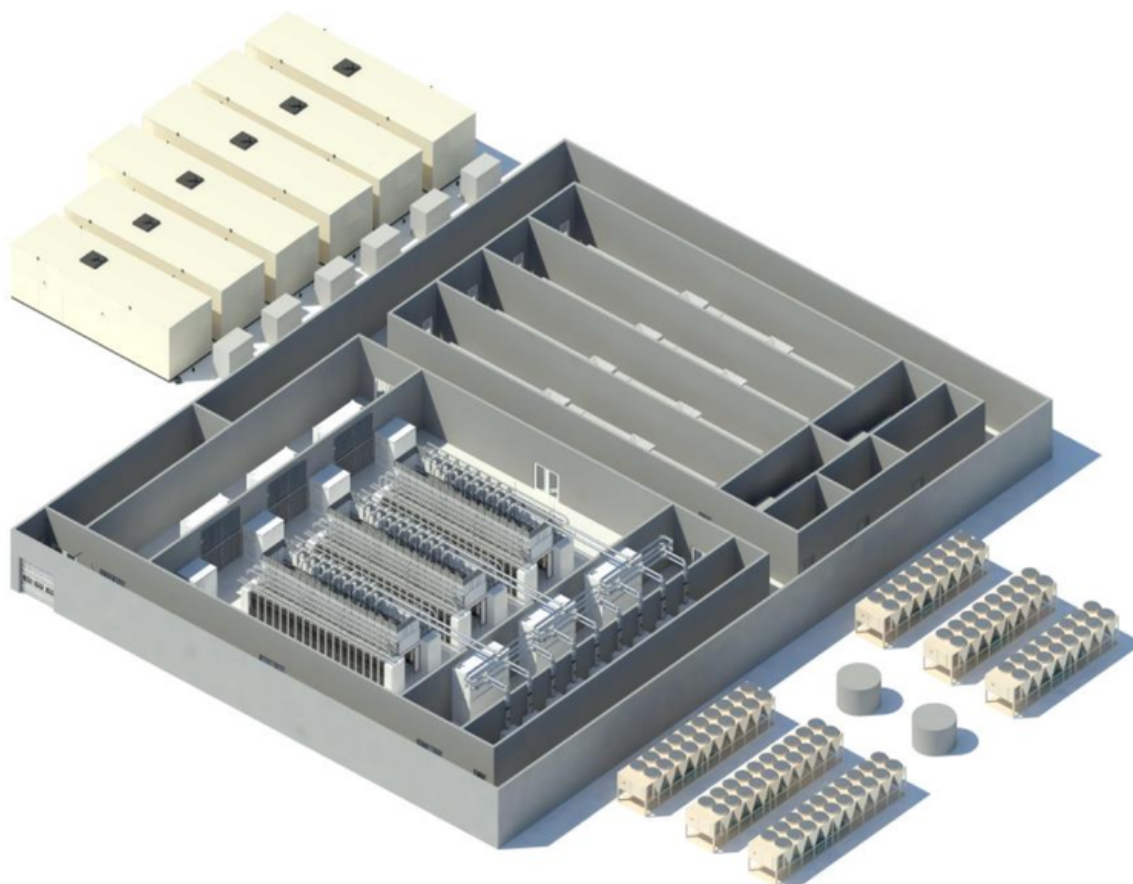
Rack manifolds

DESIGN DETAIL

- **Computing Racks:** 8 x 126+ kW total power per rack (100 kW+ liquid-cooled, 26 kW+ air-cooled)
- **Network/Storage:** 8 x 14 kW liquid-cooled racks
- **Total Air Cooling Load:** 320 kW (91 tons)
- **Cooling Requirements:** Cold aisle containment or rear-door heat exchanger required
- **Installation Options:** Liquid cooling available overhead or underfloor
- **CDU Power:** 208/380/415/480 V, 50/60 Hz, 3-phase

Power Requirements

- For power and air-cooling systems, refer to Vertiv Reference Design 0019.
- Also refer to Schneider Electric Reference Design 109.
- For two 1.5 MW CDUs in a 2N configuration, replace the positive pressure 1-1.5 MW CDU with the Chilldyne CDU1500.
- We recommend using a system with multiple smaller CDUs to minimize the “blast radius” to two racks in the event of downtime for repairs.

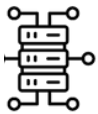


Source: Schneider Electric Reference Design 109

COOLING SOLUTIONS ACROSS INDUSTRIES

YOUR TRUSTED EXPERTS IN LIQUID COOLING TECHNOLOGY

With over a decade of experience, Chilldyne continues to pioneer data center cooling technology. From our first system deployment in 2012 to our first at-scale implementation in 2015, our advanced liquid cooling solutions are trusted by leading institutions and are featured in the list of TOP500 supercomputers. We deliver reliable, efficient, and scalable cooling solutions for a wide range of industries.



HPC



AI & ML



DATA
CENTERS



TELECOM



FINANCE &
BANKING



CLOUD
PROVIDERS



HYPER-
SCALERS



GOVT
(DOD & DOE)



ACADEMIC &
RESEARCH



The supercomputer at Sandia National Laboratories with the under-floor automatic switchover valves that enable the system's N+1 smart redundancy to maximize uptime.

**VIDEO DEMO:
WATCH OUR LEAK-PROOF
TECHNOLOGY IN ACTION**



U.S. DEPARTMENT OF
ENERGY

arpa-e
awardee



COOLERCHIPS



Chilldyne delivers reliable, leak-proof direct-to-chip (DTC) liquid cooling solutions. Our patented, fail-safe systems use advanced negative pressure technology and smart redundancy to prevent leaks and maximize uptime. Easy to install and maintain, Chilldyne delivers reliable, efficient, and sustainable liquid cooling systems that offer superior heat removal performance, significantly reducing carbon emissions, while minimizing environmental impact.

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