



TESTUDO Security Consultants Ltd
Middle East and North Africa (MENA)
Regional Office
P.O. Box 925256
11190 Amman
JORDAN

Tel / Fax: +962 6 566 45 52
Mobile: +962 (0)79 545 78 51
Mobile Intl: +49 (0)171 128 31 22
Thuraya: MSISDN +882 16 52 00 22 23
<http://www.testudo-security.com>

GUIDELINES FOR PROCUREMENT CHARACTERISTICS ON ARMoured VEHICLES

Since 2002, both Non Governmental Organisations (NGOs) and government agencies have trusted Testudo Security Consultants to advise them on their armoured vehicle procurement. They've trusted our expertise and experience gathered from conducting independent, diagnostic reports around the world. We've reviewed vehicle misuse and mechanical failure of all kinds. We know what to look for in an armoured vehicle, we know what delivers ballistic integrity, and we know which manufacturers produce what level of quality.

This report's information is independent advice gathered by Testudo's numerous inspections and reports. It fills a much needed knowledge gap and will safeguard you from less reputable suppliers and inadequate vehicles. We hope this reports gives you a clearer understanding of the different parts that make up an armoured vehicle and the different levels of protection and certification.

1.0 Introduction

Buying armoured vehicles is a difficult business. Buy cheap and the money saved is soon lost when unreliable vehicles breakdown and expensive upgrading is the only remedy. When you buy cheap you're buying ineffective components, and that can cost the ultimate price – lost lives.

An effective product performance evaluation requires sophisticated ballistic analysis. Yet we see many cases where the purchaser has no previous experience, and neither a security, military or police background. We regularly see customer loyalty to a make of vehicle and supplier regardless of quality and reputation. And lack of knowledge often means the latest, often critical, technological advances in ballistic security are overlooked. So while air filters or high altitude compensatory devices may seem irrelevant, installing the wrong make or failing to install what are relatively inexpensive items could lead to vehicle failure in a highly dangerous situation.

Organised armoured vehicle customers in comparison with individual purchasers, standardise their information, determine and compare alternatives, and often establish better decision criteria, undertaking analysis on performance against product not on price alone.

The following list is to provide clarification on the armouring levels and also the ballistic protection factor of a vehicle. The most common misunderstanding is the difference between armouring levels and quality.



2.0 Certification

An armoured vehicle manufacturer should produce certificates to verify it complies with the ballistic level of construction. Yet in the past, procurement officers and agencies have been misled by the two types of certificates issued: Certificate of Material and Certification of Vehicle Resistance Level.

2.1 Certificate of Materials (Components): This type of certificate is issued when a manufacturer's submitted sample of steel plates and ballistic glass window (i.e. the materials only) have passed testing by a Federal authorised institution. The institution will shoot three rounds in a 12cm triangle into the armour; the material cannot be penetrated in any way. On passing this test a certificate is awarded according to the level of testing, such as B6 (Ballistic Level 6). Some armoured vehicle manufacturers will arrange for glass and steel samples to be officially tested. The resulting certificate can then be issued in the name of the armouring company instead of the steel or glass manufacturer. This material certification can be misrepresented as a full vehicle test certificate. While it is a relatively straightforward procedure to successfully withstand a ballistic test carried out on a square of steel or glass on a test range, it is quite another challenge to integrate ballistic materials into a vehicle. Many obstacles have to be overcome such as the steel becoming weakened by overheating during welding, insufficient overlap between materials, poor coverage of difficult to reach areas (behind dashboard, inside door pillars, etc.). (See 2.5 Main components/alterations on armoured vehicles.)

2.2 Certification of Vehicle (Product): This certification is awarded when an armoured vehicle manufacturer's finished product has passed rigorous and strict testing by a Federal authorised institution. The finished vehicle is shot using different calibres of ammunition according to the protection level being tested against. Sometimes up to 580 rounds are fired against all vulnerable points, side and rear doors, front windscreen, side and rear glass windows, door and window frame overlaps, the roof segment at a 45 degree angle and the engine compartment. The vehicle is then tested against the simultaneous explosion of two DM51 hand grenades on top and underneath the vehicle. If there is even the slightest penetration of any kind the vehicle will fail the test. On passing the test the armouring manufacturer is issued a certificate of VR (Vehicle Resistance Level), such as VR6 described in the test above.

SPECIAL NOTE:

When a manufacturer can only present copies of the certificate of materials then the finished product has NEVER been tested and there's absolutely no guarantee that the vehicle will withstand an attack of any kind whether by small-arms fire or explosion from an Improvised Explosive Device (IED). So in the event of an attack from an AK47 assault rifle for instance, fragmentation from – or the complete bullet(s) – could enter the space between the door pillar and door or even the roof causing serious injuries or even fatalities. (See the ballistic chart at the end of this report.)



2.3 Vehicle Certification (Product)

The following is a brief explanation of ballistic testing on the end product by an independent federal institution.

1. The armoring manufacturer presents the finished product to the test centre. They have no influence as to which areas or how the vehicle is to be tested.
2. The strict testing criteria are conducted over a period of days. All information and data from these tests are recorded.
3. The vehicle is tested at different angles using various types of ammunition, where a particular area or part of the vehicle will be shot. Each time the testing authority will mark the area and then after the shot have been fired the area is inspected for signs of penetration. If the vehicle is penetrated then the product has failed the test.

Some vehicles have had to be resubmitted up to five times before being awarded the certificate. With such rigorous testing, it's in armoring company's financial and business interest to build a quality product and pass the test first time. And while testing costs are extremely expensive it ensures the product's ballistic integrity.

Certain governments will only buy from manufacturers with vehicle certification yet the United Nations agencies and other NGO agencies are well known to procure vehicles through a bidding process and award the contract to the cheapest supplier. This usually results in the vendor providing certificates of materials and not the vehicle being certified. Security is therefore compromised and while buying on price alone will save money, it may not save the human lives of those operating inside the vehicle.

2.4 The different levels of certification

There are different levels of certification, all differing depending on the level of ballistic integrity offered. Below are the most common levels for vehicles that are deployed for use in operations where the risk of attack is high.

Vehicle Resistant Level 6 (VR6)

A fully certified security armoured vehicle that has successfully passed the standards in all aspects of the threat level of Ballistic Level B6, including test by the following:

- 5.56 x 45mm (SS109)
- 5.45 x 39mm
- 7.62 x 51mm
- 7.62 x 39mm
- 2x DM51 hand grenades detonated simultaneously directly on top and underneath the vehicle



NATO Standardised Agreement 4569 LEVEL II (STANAG 2)

A fully certified security armoured vehicle that has successfully passed the standards in all aspects of the above threat level of Ballistic Level B6 and Military Standards, including test by the following:

- 7.62 x 39mm AP BZI (Armour Piercing)
- 7.62mm x 54R CT2M (Dragonov)

Vehicle Resistant Level 7 (VR7)

A fully certified security armoured vehicle that has successfully passed the standards in all aspects of the threat level of Ballistic Level B7, including test by the following:

- All the above calibres
- 7.62 x 51mm AP (Armour Piercing)

Note: Remember it is not the weapon but the type of bullet that causes the damage.



2.5 Main components/alterations on armoured vehicles

Chassis

The chassis bears the vehicle's weight so after adding armour to a vehicle it must be specifically re-engineered. The armouring materials generate much higher vehicle kerb weights, and if ignored or incorrectly adjusted will result in the main chassis fracturing.

Suspension

To support the increased weight and payload capacity of the vehicle, modifications are made to the suspension assembly, including up-rated/reinforced springs and coils, and the addition of heavy-duty shock absorbers and stabilisers.

Brakes

Due to the increased vehicle weight the brakes must be upgraded with different brake discs, pads/shoes and/or brake lines to ensure the vehicle can safely stop effectively under the additional weight. Standard or poor quality brakes will result in overheating, inadequate safety and high maintenance costs due to frequent renewal.

Doors/Pillars

Heavy duty and strengthened door hinges, doubling plates, door catches and other buffer systems are all fitted to compensate for the additional weight of the armour. Specially designed and constructed door hinges should replace the standard door during re-assembly in the production facility. Yet some manufacturers simply add a steel plate to the original door hinge – then claim it's reinforced!

Armour Plating

Armour plating is added to the vehicle to meet required ballistic levels. Yet some vehicles use a base unit that can't support the over-weight ration, such as the lightweight and weak chassis found on common mini-buses with CEN B6 armouring.

Opaque Armouring Materials (Steel)

Steel supply varies with demand and substitute supplies are sometimes introduced in the middle of production. Therefore, due to the change of the iron ore content and quality, steel suppliers are required to conduct ballistic testing on each batch. And controls by the armouring manufacturers must act as proof that the ballistic material stated is being built into all of the vehicles. Further tests are required on the Heat Affected Zones (HAZs), where welding brackets, nuts, bolts, rivets, screws and other secondary projectiles cause ballistic steel to become brittle and reduced making them potential penetration areas.

Transparent Armouring Materials (Glass)

On armoured vehicles the glass used is critical. The glass is specifically designed with extended edges and should ensure ballistic integrity while retaining good optical quality. Manufacturers that supply ballistic glass are subject to regular testing, and the better quality glass has higher resistance to stress factors when exposed to extreme (hot/cold, dry/humid) weather conditions.



Window / Door Frames

Certified vehicles have built in overlaps of ballistic steel that reinforce the danger areas where steel meets glass. These potential weak spots will have been rigorously tested during certification of the vehicle.

Ballistic Sealing

Professional manufacturers will install ballistic overlaps around the door frames and spall returns. And vulnerable areas – the dashboard, bulk head, firewall armouring and openings for normal vehicle functions (steering column, foot pedals and controls) – will all be safeguarded by testing during vehicle certification.

Engine Compartment Protection

Armouring manufacturers are obliged to armour the passenger compartment – a key safety cell. And the best manufacturers also build in as standard – or offer as additional precautions – additional armouring of side wings, vehicle bonnet, radiator grill protection, batteries and engine management system (ECU). Once again, these potential weak spots are tested during vehicle certification.

Fuel Tank Protection

Particular attention must be paid to the quality and type of protection for obvious reasons. There are three approaches to protecting fuel tanks:

- **Self-Sealing fuel tanks**

This involves enclosing the tank in a rubber-like material that, in the event of a puncture, will “flow” into the hole and reseal the tank.

- **Protected fuel tank**

The tank is protected by either armoured steel or ballistic fabric known as blast mats. While ballistic steel is rigid, a blast mat will absorb the energy by deforming inwards - away from the blast - and towards the tank. If the fuel tank is protected with a blast mat then, in the event of an attack, the mat will deform and possibly puncture the tank causing an explosion.

Note: Some vehicles' spare wheel is located beneath the vehicle floor. This presents a problem in the vehicles with dual fuel tanks because, when the second fuel tank is protected with steel, the space left is sometimes no longer enough to refit the spare wheel underneath the vehicle. Some manufacturers will therefore not protect the second fuel tank resulting in a lethal vulnerability.

- **EXPLOSAFE®**

This is especially important in gasoline models. EXPLOSAFE® treated tanks contain a honeycomb structure that prevents large pockets of vapours forming within the tank. Since there is no vapour, there is nothing to cause an explosion.



Electrical Wiring

Armouring manufacturers normally modify the vehicle by adding additional wiring channels for secondary batteries and window lifters. In some cases they also fit a second fuse box. Occasionally, because of the changes, the vehicle's manual becomes obsolete and you'll need circuit/wiring diagrams.

Warranty / After-Sales support

Many armouring manufacturers offer one or two-year warranty covers but fail to honour their obligation in the event of breakdown or problems. Others attempt to pass on the standard OEM warranty hoping that their armouring is never noticed by the local OEM dealer. Naturally, in the event of a problem, local dealerships declare the warranty null-and-void since the vehicle has been armoured. In the Middle East we've witnessed numerous first-hand arguments around this issue, some dragging on for six months or more. So we highly recommend you demand written proof from the armouring manufacturer that the local dealership agrees to cover the warranty in the event of vehicle faults.

We've also experienced poor after-sales support where an armoured vehicle manufacturer is reluctant to deploy technicians into theatre where the vehicle(s) are operating. And while some reported defects or claims can be decided by providing photographic evidence, on-site inspections by qualified technicians are often required to diagnose whether the problem is due to poor maintenance or misuse. So knowing which manufacturers offer what after-sales support is worth considering before you buy.

Covert appearance

To avoid drawing attention to the vehicle, its overall exterior appearance should retain the look of the standard model. The same goes for the interior, ensuring details such as exterior body panels are not obviously altered.

2.6 Base Vehicle (Donor Vehicle)

Original Equipment Manufacturers (OEM) such as Toyota, Mitsubishi, Nissan and Mercedes operate globally and every regional market is different. For example, the technical requirements of the Middle East (Gulf Specification) are different from Europe (EU Specification) or the United States (US Specification).

An armoured vehicle manufacturer must base the conversion on a vehicle with appropriate regional specifications. This is important for vehicle longevity – if an armoured vehicle is operating in the Middle East then it requires the heavier duty cooling and air conditioning systems that make up the Gulf Specification configuration.

The availability of spare parts must be considered if a vehicle fitted with one set of regional requirements is then operating in a different region

Some armoured vehicle manufacturers will use the cheapest possible base vehicle. This will reduce the overall cost of the complete armoured vehicle and give the illusion of value for money. The procurement agency must specify the region in which the armoured vehicle will be operated.



3.0 Summary

Threat level and vehicle selection

If you were looking to buy a mountain bike you'd want to assess its quality and investigate suppliers and manufacturers. With prices ranging from US\$150 to US\$15,000 you'd soon realise some are specifically built as mountain bikes to cope with the terrain and harsh conditions, others made to simply look like mountain bikes. In order for the bicycle manufacturers to sell their models cheaper than the better quality bikes they use low quality parts. And in very quick time these low quality bikes develop cracks, require constant repairs or simply fall apart.

The same analogy can be used for armoured vehicles. There are high quality armoured vehicles and low quality ones passed off as armoured vehicles. And you get what you pay for. Yet armoured vehicles cannot afford to be sub-standard. High risk areas require high quality vehicles, with vehicle certification not simply certification of the component materials.

We've all seen the dangers of operating in Iraq with the increased use of IED's, suicide bombers and more recently, Explosively Formed Penetrators (EFP). Yet many are of the opinion that, against these types of attacks, a vehicle will fail regardless of vehicle certification. And although standard VR6, STANAG II or VR7 are not designed to protect against these devices, there are people alive today who as vehicle occupants during such attacks can testify to the ballistic integrity of high quality, well-engineered armoured vehicles.

Therefore our recommendation for those operating in Iraq and Afghanistan, where the likelihood of attack is extremely high, is that the minimum level be VR6. While our highly recommended level is STANAG II, where ballistic glass is upgraded from the standard 39mm to 55mm, and the ballistic steel is increased throughout the vehicle and supplemented with composite spall lining material inside the enhanced ballistic steel protection. What's more, we always recommend you demand that the vehicle roof and floor armouring be made of ballistic steel with a minimum of 6mm, and not blast mats or Kevlar alone.

Testudo Security Consultants is often tasked by organisations to establish the quality, certification and suitability of armoured vehicle companies and their products.

Once a tender has been released, we inspect the production facilities and confirm the certification of the companies that have been short-listed for the contract and report our findings on each company. It is then the organisation, not us, who chooses which company is to be awarded the contract.

After the contract has been awarded we continue to support the organisation and inspect the vehicle(s) during the stages of armouring to ensure the quality and integrity of the vehicle meets the required standards. We provide the client with a written bi-weekly progress report and conduct the final inspection. We check all functions and controls and test drive the vehicle(s) prior to being accepted for receipt. As most procurement contracts are final payment prior to shipment, this ensures the quality of the vehicle(s) is maintained and the organisation receives the vehicles fully inspected, tested and ready for use.



ARMoured VEHICLE CLASSIFICATION AND RESISTANCE LEVEL

ARMOUR WEIGHT

PROTECTION LEVELS

LIGHT / CRIMINAL MEDIUM / TERRORIST HEAVY / MILITARY	AMMUNITION TYPE / CALIBRE	WEAPON TYPE	US NIJ	CEN 1063	NATO STANAG 4569	RUSSIA
LIGHT	.22 LR	Rifle	I	B1		
LIGHT	9 mm Para	Hand gun	IIA	B2		
LIGHT	.357 Magnum	Hand gun	II	B3		
LIGHT	.44 Magnum	Hand gun	IIIA	B4		
MEDIUM	5.56 X 45mm NATO SS109	Rifle		B6	Level 1	Class 3
MEDIUM	7.62 x 39mm	Rifle	III	B6		
MEDIUM	5.56 x 45mm NATO M193	Rifle	III	B6	Level 1	Class 3
MEDIUM	7.62 x 51mm NATO M80	Rifle	III	B6	Level 1	Class 3
MEDIUM	7.62 x 39mm BZ API	Rifle	IV		Level 2	Class 4
MEDIUM	7.62mm x 54R CT2M	Rifle	IV		Level 2	Class 4
HEAVY	7.62 x 51mm AP	Rifle	IV	B7		Class 5
HEAVY	7.62mm x 54R API B-32	Rifle	IV	B7		Class 5